A Collection of Telephone Tales

© 2019

written by Herbert Schwarz of Vienna, Austria, European Union
Member of Telephone Collector's International
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Dedicated to the memory of my beloved parents, Dr. Erich G. K. Schwarz, Ph.D. (atomic physicist, University of California), whose untimely death at the early age of 49 left a big hole in my life, and my mother, Mrs. Emily M. Schwarz, who passed away at the age of 92 in 2015, and whose love I will always miss – may they rest in peace.

Thanks & Acknowledgements

First and foremost, I wish to express my gratitude to the members of the TCI Board of Directors for their support in getting this collection published.

I wish to express my sincerest thanks to the following companies and persons for their permission to use copyrighted material on a royalty-free basis:

Deutsche Telecom AG & Mr. T. Ollendorf
Federation of Austrian Unions, Mr. P. Autengruber & Mrs. M. Huber
The Kapsch Group of Austria & Mrs. K. Riedl

Likewise, I wish to express my thanks to the following individuals and private organizations for their permission to use copyrighted material on a royalty-free basis, resp. for their support, moral or otherwise:

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Dr. M. Schanz of Austria, E.U.
Mr. P. D. Wills of Telephone Collector's International, USA

Thanks are also in order to several anonymous sources from within A1 Telecom Austria for the pictures they supplied for the tales "Outside Plant in Vienna & Austria," "Inside the Viennese Toll MDF," "The Demise of Electromechanical Switching" and "A Brief Explanation of Secret Party-Line Service in Austria." It's a sad fact of life that I have lost contact with these folks and no longer recall their names; they were ***very*** pleasant folks to deal with and were quite willing to help out.

However, thanks *are not* appropriate to management personnel at A1 Telecom Austria – they deserve a huge Bronx Cheer for flatly refusing my request for royalty-free use of copyrighted material – all the way up to the CEO, who didn't deign to stoop so low as to bother replying to a three page letter I sent him back in February of 2013 - but, of course, I didn't *really* expect that such an *exalted* personage would want to communicate with a *lowly* telephone collector, historian & researcher. Granted: my letter may never have reached him, possibly having failed what I call the "flunky test."

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Personally, I'd have been quite happy to let readers print out their own copy of this collection… fact of the matter, though, is that some of the individuals, companies and/or other organizations who were kind enough to grant me royalty-free use of some of their copyrighted material requested that their material not be printable. So, I only had two choices: to do without the material and accept the fact that this collection would be less informative, or else comply with the request and use the materials concerned. I found the latter option to be the lesser of two evils.

I am, however, making three of the tales in this collection available in printable form, since they're intended for use as reference material.

Disclaimer

While every possible precaution has been taken to only include verifiable and historically correct information in this collection of telephone tales, the same is published on an "as is" basis. This means that I cannot guarantee 100 percent accuracy, despite in-depth research, and readers must keep this in mind – especially if they intend to write their own articles based upon information provided herein or if they intend to quote from this work.

The How & Why of This Collection

This collection started out in life as a single tale, entitled "Manhole Adventures," which was roughly 30 pages long. In the course of writing it, I found that it might be of interest if I were to include additional information on related subjects (now where have I heard *that* before?).

Thus, this single tale expanded into one with 5 appendixes, whereby each appendix wound up being almost as long as the original tale. Since these appendixes were viable as separate tales, they were expanded upon and given their own titles. A table of contents was added at this point.

By no means was this the end of things, because I then found that there were many other subjects on which I had, at one time or the other, intended to write something for inclusion in Singing Wires or Switcher's Quarterly; such things found their place here, so as to save very much valuable space in our cherished Journals (besides which, it simply isn't possible to condense any of the tales to achieve the circa 2,000 word limit which the Singing Wires Editorial Board requests).

Readers will notice that I "occasionally" stray off-topic; this happens whenever I feel that the additional information is important enough to want to include it, but not important (or long) enough to make a separate tale. This was another good reason for not publishing the collection piecemeal in SW & SQ – the articles in the Journals are always clearly on-topic.

I also discovered that constantly referring to myself as "the author" or "he" really isn't my cup of tea at all, and thus I began *re-writing* things after having reached page 175 … however, there are a very few tales which I have written in the third person.

Of course, it would have theoretically been possible to print this collection and then attempt to sell it, but after having seen the sad fate a similar enterprise met with, and taking into account that I am by no means a professional writer or photographer (both of which are painfully obvious), publishing these tales on the internet appears to be the only method by which a large readership can be reached. Aside from this, giving this collection away saves me from paying royalties for the use of copyrighted material … that is to say that I wrote copyright holders that I was going to publish this collection free of charge and requested free use of copyrighted material, since I was not after any material gain. Most were happy with this arrangement.

Truly – if anyone would had told me a few years ago that I'd be writing such a collection, I'd have said **they** were crazy; today, **I'm** the one who was crazy enough to actually have gone and done so.

I refer to the Austrian Telco entity by various names, such as the Administration of Posts and Telegraphs, Telecom Austria, A1 Telecom Austria, &c, throughout this collection; this is because I always used the proper term for the time in question. All the same, I have taken the liberty of writing the German-language "Telekom" as "Telecom."

Although the 850+ illustrations in this collection are designated by the word "figure," followed by one or more digits, the attending texts don't usually refer to the illustrations by their figure number; their primary purpose is to properly attribute copyright(s).

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The opinions expressed herein are *solely* my own, and under no circumstances represent those of any other member(s) of Telephone Collector's International, either collectively or individually, nor those of the TCI Board of Directors or those of the Editorial Board, nor those of anyone else connected with this collection in any way.

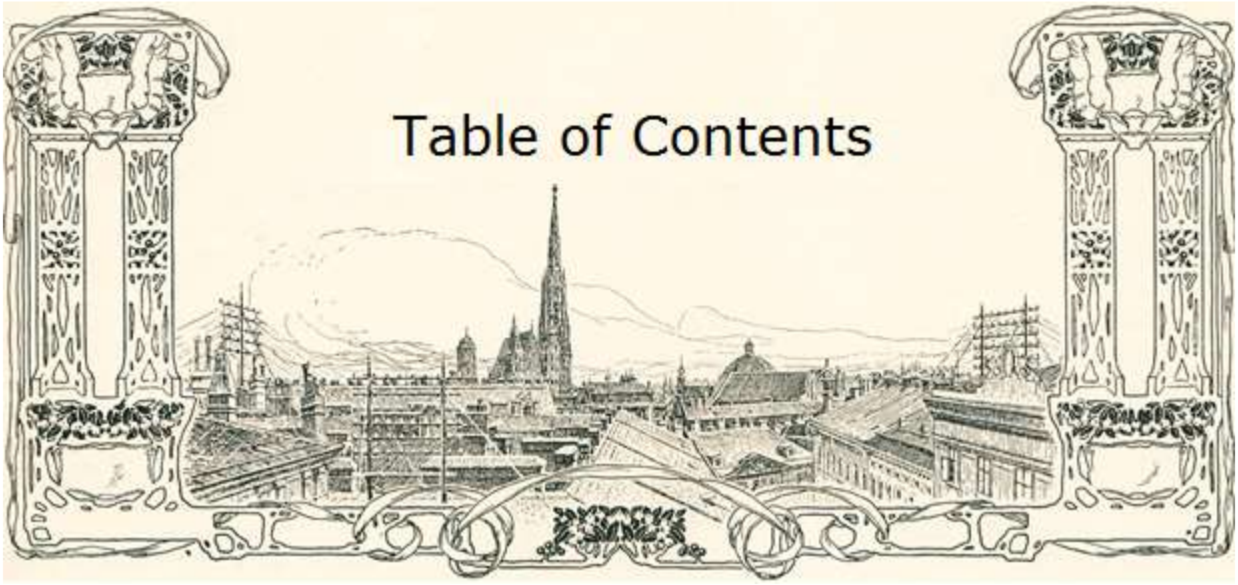
BTW – for many a year I was told that I had an American accent when speaking German, and in later years often heard that I had a German accent when speaking English… I can only hope that my written English isn't all that stilted, convoluted or backwards and that what I have written is intelligible. If not – sorry.

Despite having received a few kind, very well-meant offers from people who were willing to take on the arduous task of proofreading this collection, I didn't take anyone up on the offer, so that any typos, fluffs, missing, misspelled or superfluous words, &c. are my own fault.

All trademarks are the sole property of the respective trademark holders/owners and are only used in an illustrative manner within this collection.

P.S. – I am not, nor ever was, an accomplished typist, because my "pinkies" are too short to be able to type in the ten-finger system. I typed the nearly 121,000 words of this collection using no more than two to three fingers in sum (which is one reason why it took so long to finish this collection).

Herbert Schwarz
Vienna, Austria, European Union – April, 2019



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Manhole Adventures

It was back around the year 2000 that Telecom Austria was engaged in a minor rearrangement of their buried cable plant in an outlying district of Vienna. The small cable pulls and the splicing of the same took place within 3 days, from a Friday morning until Sunday afternoon; I had originally intended to only watch and document the cable splicer's work *above* ground, since the chance of anyone from Telecom Austria allowing me to actually climb down into a manhole was virtually nil – they're quite afraid that one might come to some sort of harm down there – but after having had a total of three longer chats with the project manager, in the course of which I was able to impress him with my knowledge of the various types of telephone cables and splicing methods previously used (all the way back to the time of the Austro-Hungarian Empire, which fell apart in November, 1918), he kindly allowed me to enter two adjacent manholes while cable splicing, &c. was in progress.

The guy was even kind enough to give me photocopies of plans for the manholes involved in the cable pulls (for obvious reasons, it doesn't seem politic to publish these – Telecom Austria may possibly consider them to contain privileged info).

While it might have been interesting to see how polyethylene-insulated cables (P.I.C.) are spliced, Telecom Austria laid in lead-sheathed, armored cable (600 pairs) with wires individually insulated with single, overlapping paper ribbons … the type of cable the use of which has long been discontinued in most other parts of the world, but which Telecom Austria still favors in many cases.

Some notes on the work documented in this tale and on the types of cable used are in order before beginning with the photographs … the rearrangement consisted of pulling in a new piece of cable between two manholes, and also pulling in a piece of cable between one of these manholes and a nearby splicing trench.

One of the cables would normally have been unprotected, lead-sheathed cable because the stretch between the two manholes is fully ducted with 3 millimeter thick, plastic conduits of 110 millimeters diameter, but Telecom Austria apparently didn't have a length of suitable cable on hand, because they pulled in a piece of armored cable (the type which is normally buried directly in the earth) instead. The second cable needed to be suitable for direct burial anyway.

Both new cables were of what is known as "unit stranded" construction (as opposed to building the cable by laying the pairs (or quads) up in concentric layers), with 25 spiral four quads (50 pairs) to the unit. Cable quads can be built by one of two methods: per Dieselhorst-Martin (used on toll cables to lower crosstalk) or as spiral four quads. In spiral four quads, the four wires comprising the quad are twisted together in a wholly symmetrical fashion, with two diagonal wires of each quad forming one pair and the remaining two wires forming the second pair. Local outside plant cables can run up to 1800 pairs (not counting spares); the common wire gauges encountered in local cable plant are roughly equivalent to between 20 and 24 AWG.

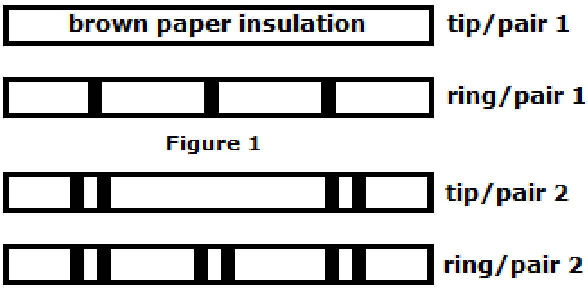

Figure 1

The individual wires are not color-coded; rather, the four wires of each spiral four quad are coded in the following manner: tip of pair 1 has no rings printed on the brown paper insulation, ring of pair 1 has single rings (roughly 1 millimeter wide) in dark blue or black printed on the paper insulation at intervals of 16 millimeters. Tip of pair 2 has double rings, with 1 millimeter spacing between rings, spaced at intervals of 30 millimeters, and ring of pair 2 has double rings, with 1 millimeter spacing between rings, spaced at intervals of 13 millimeters. This wire coding became the standard for spiral four quad cables circa 1935 and remains so to this day. In some earlier cables with spiral four quads, tip of pair 1 had red colored paper insulation without any rings.

One spiral four quad in each unit or layer is different in that the stripes are of red color (tracer quad); the quads are counted out from 1 to 25, beginning with this tracer in unit stranded cables. Whether the successive quads are counted out in a clockwise (or counter-clockwise) manner depends upon which end of the cable one is looking at – the rule is that one counts them counter-clockwise when looking at the end of the cable distant from the exchange. In the same manner, one of the units is held together with a binder of red strings or plastic ribbons, while all other units have binders of white strings (or ribbons) and the counting rule is the same as above.

Readers might be wondering why on earth Telecom Austria would bother with paper-insulated cable in the 21st century? I used to ask myself the same question, and when I was talking to the manager I asked him. It appears that the chief reason lies in the fact that lead-sheathed cable with paper-insulated wires is a whole lot less expensive (and also slightly smaller in outside diameter) than P.I.C. Another reason is the relatively low electrostatic capacity, besides which it was claimed that, should water enter the cable, the paper insulation would swell up and thus form a sort of plug, which would dam the water and prevent its spread throughout the cable (the alternative is to use P.I.C. with petroleum jelly filling, commonly known as icky-PIC).

Sorry, it just isn't so – the paper actually acts as a wick and, in fact, helps the water to spread through a cable fast … I can recall several instances in which hundreds of yards of paper-insulated cable were replaced after manholes became flooded.

The manner in which the individual wires were spliced together, and how the splices were insulated, has undergone great changes over time; in this tale, I will be concentrating on the methods employed during the timeframe 1938 thru 2000, as used on local cable plant.

During the era of the German Reichspost in Austria (1938-1945), the stripped wires were inserted into small-diameter, copper sleeves of oval shape. The copper sleeves were crimped with a special tool and the splices protected by sleeves made of thin cardboard. On cables of upwards of 100 pairs, the sleeves intended for the "tip" wire were sequentially numbered in order to make locating individual pairs at a later date easier (this method was discontinued in Austria around 1940, when copper began to become scarce due to the war effort).

The Reichspost also had a unique and purely mechanical machine for splicing the four wires of a quad at a same time. This machine stripped the paper insulation off the wires, cut them to length, uniformly twisted the bare wires and cut the excess length off.

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At the time when cable manufacturers no longer received any consignments of copper from the Ministry of War (circa 1942), they had to rely on aluminum wire for the manufacture of telephone and telegraph cables.

Splicing aluminum wires to each other (or worse yet, aluminum to copper) created some serious headaches which weren't easy to overcome. In the end, it was found that the bare aluminum wires could be twisted together without too great a danger that they might break – since the aluminum wires had to be slightly larger in diameter than their copper counterparts in order to have the same resistance – but that the resistance of such joints was high due to the fact that aluminum immediately forms a non-conductive oxide skin when exposed to the air … so the splicing method included welding the tips of the two wires together by melting them with a slim, hot oxyacetylene flame, so that a small blob of metal was formed at the tip of the splice.

For a number of reasons, copper to aluminum splices were really difficult; it's almost impossible to solder aluminum (due to its oxide skin), the contact surface of the splice would fall prey to dissimilar metal corrosion if not soldered, and worst of all: the two metals have widely different melting points, so that the blowtorch method was as much out of the question as simply twisting the wires together, or trying to solder them. What to do in this case?

The Reichspost came up with an unusual method: they took roughly 3" long pieces of aluminum wire of the proper diameters, deposited a layer of copper on the entire length of the wires by electrolysis and then stripped the copper plating from one-half the length with an acid-etch method (it would've been easier to just deposit copper on half the length of the aluminum wire and have done with it, but the above is how it's explained in a 1933 Reichspost textbook). The bare aluminum ends of these splicing wires were spliced to the aluminum wires by twisting them together and treating with a small blowtorch as described. The copper wires were tightly wrapped around the copper-plated ends of the splicing wires and these joints soldered. The splice thus formed was then protected with a thin cardboard sleeve.

Outside plant in Vienna suffered great damage during the Allied bombing raids of 1944 and 1945 – approximately 9,600 breaks in cables were counted in May, 1945. While, in most cases, the work of re-splicing the cables themselves didn't present that much of a problem, obtaining the cardboard sleeves used as insulation was next to impossible. The ideal solution was to use PVC spaghetti as insulation – it was to be had, it was cheap and was therefore used on a great number of splices. In the end, PVC turned out to be anything *but* ideal, since it gave off chlorine when heated (during the process of soldering the lead splice case closed); chlorine and free hydrogen in the air gave hydrochloric acid, which attacked the copper and formed copper chloride … in other words: instant corrosion on many otherwise perfect splices. Because of this blunder, quite a number of splices had to be re-worked within a few years, once again using thin cardboard sleeves as insulation.

As an aside: sheet lead for making splice cases wasn't readily available for the first few years after the end of WWII, and neither was scrap iron suitable for casting protective outer splice cases, so cable splices were simply placed in wooden boxes and the boxes filled with pitch … not *really* service-friendly in any sense of the word.

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Figure 2

The cases of splices inside manholes are usually made of one or more pieces of pre-formed lead; they're left without further protection and remain filled with air. The cases of splices which are to be buried in the soil receive protection in the form of an outer splice case; this case used to be made out of cast iron (as may be seen to the left here) – nowadays they're made of hard, yellow plastic. The airspace between the two splice cases used to be filled up with bitumen, while today polyurethane foam is used. In the instance of toll cables, the lead splice case was oftentimes filled with a special wax, in order to limit possible water ingress to a single cable length.

It was circa 1966 that the Austrian PTT began using Picabond® splices (manufactured by TYCO®) for splicing telephone cables … and Picabond® splice material was, under certain circumstances, still in use in the year 2000. The TYCO® Picabond® was a milestone on the way to better splices, because they were more uniform in quality and of lower resistance than handmade ones, and because the insulation was better – the splices had a layer of Mylar® film attached to the outside, but sometimes the Mylar® would come loose over time.

However, it was still tedious work to splice large cables together, and 3M® offered an even better solution around 1970: their "modular splicing system" MS^{2}®, which allows up to 2x25 pairs to be spliced in one fell swoop – this type is still in use today on outside cable plant.

I apologize for the quality of the photographs in this tale – they are scans of paper prints made from negatives; the camera used was a rather simple one, with a fixed focus, and no longer completely light-tight. Thus, some of the photos are overexposed, some underexposed, some show a halo due to light leakage and some show scratches.

Figure 3

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The lower photograph on the preceding page shows a large reel of cable being delivered to one of the manholes. In this case, the truck is that of a private firm which was contracted to deliver the cable to the site; normally, Telecom Austria used their own trucks to haul cables.

The photograph to the right shows the delivery of the other piece of cable involved in the throw. This cable was pulled into a conduit between two manholes.

The red plastic conduits lying on the ground, to the right of the truck, were intended for a new manhole, which was constructed a few weeks *after* the cables referred to in this tale were pulled in and spliced. As an aside: the cable reel stands about 7 feet tall, and the core diameter is equal to the smallest bend radius that the cable will stand. Back around the year 2000, Telecom Austria had their car and truck park painted in a nice, deep yellow color, with just the word "Telekom" painted on the doors.


Figure 4


Figure 5

I previously wrote that it's next to impossible to be allowed to enter a manhole … the private firm which pulled in the cable (from this manhole towards a splicing trench) had opened up the manhole just a short while before the cable was delivered, because they were looking for the proper conduit to pull the cable into. I just innocently walked up to the foreman and simply asked him to leave the manhole open for a few moments longer, because I wanted to take a look inside … apparently, the guy didn't care who I was or why I wanted to look around down there, because he simply said, "no problem."

I shot one photograph of the open manhole and then climbed down for a looksee. It was pretty dark down there, and I didn't have a flashlight handy, so I was limited in my wanderings to those portions where daylight reached – while shooting a few more photographs for posterity, since I didn't think I'd ever get a *second* chance to climb down there.


Figure 6


Figure 7

The photographs above and to the right are from this first entry into a manhole on Friday. I felt that being down there was almost like Christmas and Thanksgiving combined … although I wasn't dressed for the occasion.

The group of conduits shown in the upper right-hand photograph lead to another manhole (which is 111 meters upstream from this one) … the two conduits marked in red each carry four smaller conduits of 40 millimeters diameter, some of which carry inter-office fiber optical cables. Of the four cables in the bottom row, the first one carries 900 pairs of 24 AWG wire, the other three all carry 1800 pairs of the same gauge.


Figure 8

Readers may wish to take note of a few unusual details in the two right-hand photographs: in the upper one, the 900 pair cable in the lower left-hand corner of the conduits is protected against sheath chafing (due to cable creeping) by a cable shield made of zinc, and the splice case in the lower left-hand corner in the lower picture has a portion of "zipper" type 3M® shrink sleeve on the cable adjacent to the splice case. Apparently, the cable sheath was damaged there at some point in time ….

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Figure 9

Figure 10

Two more photographs from the first entry into the manhole – they simply show some of the cables which run through. There is a plank standing upright, in the foreground of the picture on the right, which hides some of the conduits. As may be seen, most (but not all) of the conduits which are not in use are sealed with plastic caps … these are intended to prevent natural gas (from a pipe leak) from flowing into the manhole, as well as to keep water seepage out. The two green cables exiting the uppermost left-hand conduit in the right-hand picture are CATV feeder/distribution cables.

Figure 11

It was Friday afternoon when the one cable was pulled in by personnel from the same firm which had delivered it. First thing they did was to pull a flexible, yellow fiber-glass rod from the manhole to the end of the buried duct … they pulled in a blue plastic-fiber rope with this, which was then used to pull the cable in.

In the photograph to the left, the end of the cable – complete with its cable grip sleeve – may be seen behind the take-up reel for the fiberglass rod. A bottle of cable lubricant is to be seen in the right-hand foreground … (normally only used on unarmored cables).

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In the picture to the right, one can see the blue cable-pulling rope as it exits the short length of conduit which ends in the manhole shown on the previous page. The slate-colored conduit which may be seen carries two 40 pair cables which belong to the telephone network of the Vienna fire department; 5 of the cables to the right of the conduit are telephone cables – 3 of them are in use, 2 are dead. The other cables belong to the electrical power company.

Two of the live cables will, in the course of the work in progress, be cut and spliced to the new piece of cable about to be pulled in. Fortunately, the folks from Telecom Austria used cable locating equipment to find the two cables to be cut – it would've been *quite* a spectacular sight if they'd accidentally cut a live, 3-phase 380 volt feeder cable by mistake!

Figure 12

Figure 13

In the picture to the left, the new cable is just being pulled in. There was one man to turn and/or brake the cable drum as the cable was being fed into the manhole. There was another guy, down inside the manhole, pulling and guiding the cable within the manhole and out through the conduit.

The yellow piece of metal to be seen in the mid right of the picture is a part of the cable reel stand.

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Figure 14

This picture shows how the guys pulled the cable in – with the aid of an *excavator*! Normally, a special cable winch would be used, in order to prevent the cable from receiving too much stress (which could cause damage to the sheath and/or the cable core) while being pulled in. Obviously, the method depicted here isn't *quite* per Telecom Austria standard practices ….

I was originally standing next to the excavator shortly before I snapped this picture, because I had wanted a "straight down the throat" view of the cable as it was pulled out of the end of the conduit.

However, when I saw just how much tension the rope was under, I decided to get out of the way in case it snapped – and the vantage point then chosen was the best I could do, because the cable would only barely have been visible against the background of a pile of brown soil. As a matter of fact, they *did* manage to damage the cable sheath … and had to pull in an extra 6 feet of cable just to be on the safe side, as far as cable length goes, for the subsequent splicing job.

The picture to the right was taken from roughly the same position at which the excavator was standing in the previous photo. The splicing trench is visible; the planks on the left, above it, mark the spot where the new cable enters the trench. Telecom Austria (and others) protect open splicing trenches with tents during inclement weather, and such a tent from Telecom Austria is visible in the left foreground.

Figure 15

This new cable was rung out and spliced to the cable between the two manholes during the evening hours of the same day (Friday). The following pages document aspects of this work.

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Figure 16

The new cable in the splicing trench is being rung out at the same time it was being spliced to the new cable between the manholes; the latter cable was, at the same time, being spliced to a cut, but already laid, cable which leads to the exchange. Since it wasn't possible for me to photograph all of these operations at the same time, I opted for staying close to the end where most of the work was in progress.

The task of the man seated on the left is to find and separate the tip lead of pair 1 of each quad (counted out counter-clockwise, since we are looking at the cable end distant from the exchange) and handing the quads on to the man on the right. His job is to remove a small portion of the paper insulation from the wire and wait for the man at the other end of the cable to make himself heard; literally, since both men wear a headset, so that they can talk to one another if this should be necessary. If readers look closely, they can see that there is a wire plugged into the back end of the cable splicer's knife – the other lead of the headset is connected to the cable sheath.

The circuitry of these headsets is very straightforward: transmitter and receiver are wired in series in both headsets, and one of the two headsets additionally has a 9 volt battery connected to it.


Figure 17

The photograph to the right is the only half-way clear shot of one of the splicer's headsets that I could find. These headsets were originally intended for switchboard operators, but they found their way into cable splicing operations very soon, since two of them and a battery were *much* cheaper than other wire/cable testers intended for cable splicers.

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Figure 18

A second photograph of the men in the splicing trench … luckily for me, the weather was good and the tent wasn't needed (it would've been very crowded and I possibly wouldn't have been allowed inside).

The most interesting detail in this photo is the plastic "bag" draped across the slate-colored conduit behind the man on the left. This is a special type of bag, used to temporarily protect an open splice from moisture. The bag has one closed side, while the three open sides are furnished with double-sided, self-adhesive tape. The yellowish object near the center of the picture is nothing more than a relatively clean plank, which was used to support the end of the cable so that it stood in a nearly vertical position so that the splicers had easier access during the ringing-out phase of work. Readers may note that not very much attention was paid to whether or not the guys were seated comfortably … they're sitting on a tarpaulin spread across some of the other cables in the trench.

The photo on the right was shot in the manhole nearer the splicing trench and shows the last step in completing a 25-pair splice using the MS²® splicing system from 3M®.

The cable in the right-hand foreground is the one which runs to the splicing trench. One can see that some of the quads of the cable have already been fanned out for the next splicing operation.


Figure 19

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Figure 20

While I was down in the manhole, I shot a few pictures of the other cables running through ….

One can see the newly pulled in cable in the lower middle background; it has a piece of slate-colored paper wrapped around it, near where the splice was being made.

The cable in the left foreground carries the typical cable ID tag used by Telecom Austria. Purple is the color used to designate subscriber cables, while orange is used to mark inter-office (trunk) cables, and off-white for coaxial cables. These ID strips are normally wrapped around the cable as a ring. At one time, cable ID tags were made of longer or shorter strips of pure lead, where the information was stamped into the metal. These lead strips had the advantage that the lettering could not fade over time (as is the case with the plastic tags – especially if the cable is directly buried in the earth).

Although it isn't possible to directly read what is written on the strip in the left foreground of the picture, typical labeling would be as follows: "750p 0.8 aa123 – bb45." This means 750 pairs of 0.8 millimeters diameter wire (roughly 20 AWG), "aa" is a placeholder for the designation of the originating CO, as is "bb" for the destination CO – I am not going to reveal the actual exchanges concerned (such information *could* give away which manhole(s) I was in, and I certainly don't want to get anyone in trouble – not even after all these years). The numbers are simply unique designators for the respective cables.

Readers may be wondering why, since this cable seems to be an inter-office cable, it has a purple ID strip and not an orange one. The answer is simple: exchange service boundaries don't necessarily coincide with district boundaries, and some of the pairs in this cable serve a small region in a neighboring district; where the service cable for the neighboring district is branched out, the new cable bears the sole designation "bb45." There is even one cable passing through the manhole which *exclusively* serves an adjacent district; there are over 18,300 live subscriber pairs running through this one manhole.

Figure 21

Figure 22

The two photographs above tell the tale of what happens if the splicers don't pay enough attention to what they're doing … they managed to split the two pairs of one of the quads in the cable. The repair for such split pairs is to cut the four wires off at the MS^{2}® splice and re-splice them in the correct sequence, using a hand crimping tool & Picabond® splices.

The project manager was busy verifying that ID/locator tone had been placed on the correct cables in the exchange the next morning (Saturday) – namely those which were to be cut and spliced in the trench. The photographs below show him checking for tone in some of the relevant distribution cabinets.

Figure 23

Figure 24

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Figure 25

Here, the first of the two cables is just being cut. The new cable, to which it will be spliced, runs underneath and presently ends within a sealed plastic bag.

There isn't much more to be said about the cutting, except to note that the cutter operates by hydraulic power derived from a hand pump, which is integrated into the tool handle.

After the cable was cut to length, the outer jute rovings were cut through with a cable knife, right down to the first of the two overlapping steel armor tapes.


Figure 26


Figure 27

Here we see the outer layer of steel armor tape being unraveled from both ends.

It's easy as pie to do so from the end of the cable, but a bit tedious from "in the middle." The steel tape is deeply scored with the cable knife and then the edge of the tape is grasped with a pair of slip-joint pliers. The tape is then bent upwards at the scoring, and it parts rather cleanly.

The second steel armor tape is bedded on a thick layer of jute roving, so as to prevent it from coming into direct contact with the lead sheath.

The trick here, in peeling the cable, is to heat the bitumen sufficiently so that the tape may be grasped and pulled back as before.

After the second steel tape has been unraveled for a short distance, the remaining portions of the cable protection are pulled back a little way ….


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Figure 29

The protective cable coverings have been pulled back just far enough to allow the lead cable sheath to be scored and broken off at the proper point for the splice.

The lead sheath looks to be very clean in this picture, cleaner than one would expect. The reason is that, while the sheath was still hot from the previous treatment, it was cleaned with a special chemically treated cloth.

After having been cleaned and nicked, the lead sheath is gently bent back and forth until it *breaks* where it was previously nicked (a lead sheath is *never* cut through).

The sheath is then pulled off the cable, as may be seen here. Underneath the sheath there are two overlapping wraps of brown paper (one wrapped in a clockwise direction, the second one counter-clockwise) of which the top one may be seen.

As an aside: the paper used in the construction of telephone cables is of a special type having high dielectric strength and being chemically inert to the point that it won't corrode copper or lead in the event that moisture should ever enter the cable.


Figure 30


Figure 31

The photograph to the left is simply included to show that the cable is unit stranded, and to demonstrate that the cable contains two *spare* spiral four quads, which are laid in separately from the stranded units.

Readers may note that the end of the outer protection of the cable has neatly been dealt with and covered with electrician's tape; this is done to prevent injury to the cable splicers and to the seal when the splice is encased in its outer shell.

Here, the cable splicers are beginning the work of fanning out and assembling the spiral four quads into their proper groupings for the subsequent splicing operation.

The separate cable units in this instance are marked with plastic ribbon binders; one can see the single red binder which identifies the tracer unit from which counting begins.


Figure 32


Figure 33

Here, the cable splicer is assembling the lower crimping head for the MS$^{2®}$ splices.

This photo also gives the reader a good idea of how deep the splicing trench actually was and under what physical conditions the splicing was being performed … it was very lucky that it wasn't raining, because otherwise plenty of water would've run into the trench despite the tent which would've been used.

After the support bar has been attached to the two cables, the lower crimping head is attached to the bar.

Assembling an MS$^{2®}$ splice roughly involves the following steps: first, a splice cap is placed in the crimping head base; then the relevant spiral four quads are fanned out into individual wires and these are run between wire comb teeth and are held in place by these; then the crimp body is inserted into the crimp base and the relevant wires from the other cable fanned out and laid in as before. This stack-up is completed by adding a second splice cap and attaching the upper portion of the crimp header.

The crimp header is operated by means of a small hydraulic pump integrated into the handle. The splice isn't only compressed as the hand pump is operated, but the over-length of all wires is cut off in the process as well.


Figure 34

Figure 35

In this photograph, one can see the first splice in a semi-completed state.

It's interesting to note that the crimp head in use allows for the completion of two separate splices of 25 pairs each.

After the first of the two cables was completely spliced to the new feeder, two medium-sized perforated plastic bags of silica-gel were wedged between the wire bundles.

The silica-gel crystals are supposed to absorb any moisture within the splice; they're of a bright blue color when factory fresh and dry, and turn a nice shade of pink when they've absorbed moisture.

Figure 36


Figure 37

The splice is then thoroughly and tightly wrapped in clean cable splicer's muslin. This is done for two reasons: 1) the muslin helps hold the bags of silica-gel in place, and 2) it confines the splice in the smallest space possible, in order to prevent any of the wires from coming close to (or even touching) the lead spice case. The latter is necessary in order to prevent the paper insulation from scorching to a point where crosses and/or shorts to ground occur while the splice case is being soldered.

It was just about noontime on Saturday when splicing of the first cable was finished, so the splicer just bundled the remaining wires from the new cable up a bit, tied them to the finished splice and temporarily protected everything with another one of those plastic baggies ….


Figure 38

Figure 39

There was no sense in documenting the steps previously described again for the second cable, so I simply shot one photograph during this splicing, just to show that the second cable indeed *was* also spliced (this photo was shot around 9 a.m.) I had other, *much* more interesting things to do that Sunday morning – namely to watch and document how a lead splice case is soldered and wiped to a lead-sheathed cable…

This turned out to be a bit of a ticklish operation, because (at the time) the manhole was located under the rightmost traffic lane on a busy street and the cover was situated to one side of a pedestrian crossing. Luckily, traffic was light that morning.

Figure 40

Here, the cable soldering specialist (the guy on the right) and a helper are busy setting up a manhole guard and getting the lifting tool attached to the manhole cover.

The manhole cover is of the hardened type, which will carry the heaviest road loads without breaking apart. It consists of a flat, thick, die-cast iron base & frame, with four fields on top filled in with heavy-duty cement.

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This photograph gives readers a better idea of exactly where the entrance to the manhole was located, and also gives an idea of just how thick the manhole cover actually is (a good 2 inches).

I was *very* surprised to discover just how different the environmental conditions can be in two manholes which are separated by a scant 300 feet. This one had to be pumped out before splicing operations could begin, while the other one was bone dry.

Figure 41

Figure 42

This photo, taken in July, 2012, shows exactly where the manhole above wound up being later on … right smack in the middle of a traffic lane on the *opposite* side of the street.

Entry into this manhole is now a matter of having very good nerves and placing ones trust in a well-blocked traffic lane.

We are now down inside the second manhole; I was standing on top of some live, unarmored, 1,800 pair cables, ruining a good pair of shoes in the process, because I was standing in roughly four inches of fine, wet muck in which the cables were buried, while documenting the work in progress.


Figure 43

The splice shown here was protected by one of those ubiquitous plastic bags from Friday night to Sunday morning; the cable soldering specialist had already removed the bag and begun to wrap the splice up almost before I had my camera ready. The picture affords a good view of one of those bags of silica-gel being wrapped up in the splice ….


Figure 44

While the muslin wrapping on this splice may not win any blue ribbons for neatness, it's quite sufficient to serve its purpose.

A fact worth mentioning is that the cable supports used are usually of the type as shown here. They have a smallish iron core and are encased in asbestos cement – this is intended to prevent dissimilar metal corrosion between iron and lead. Not *really* very healthy, with what we now know about the hazards associated with asbestos fibers ….

Here, the cable soldering specialist is wrapping the pre-formed lead splice case around the wrapped splice.

After tentatively securing the case to the cable sheath, he will bang the case into its final shape with a wooden mallet.

Readers may take note of the fact that the lead sheath of the cable has been brushed and scraped until it's bright and shiny where the throat of the splice case touches, in order to facilitate the soldering and wiping operations and in order to ensure that the joints form a hermetic seal.


Figure 45


Figure 46

Here, the splice case and cable sheath are being heated with a hot, light-blue propane gas flame, prior to applying some wiping solder to the joint.

As may be seen in the next photograph, the first application of wiping solder is no more than a big, flat blob, which holds the splice case in position while it's knocked into its final shape ….

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Voila – "le blob" is in its intended place. This photograph shows that a piece of armored cable, normally intended for direct burial in the ground, was pulled into a conduit between the manholes, instead of a section of unarmored cable, as is normally intended for installation in conduits.


Figure 47


Figure 48

After the blob of wiping solder on the right-hand side of the splice case was allowed to cool, a similar blob was applied to the left-hand end.

As is obvious from this picture, the cable soldering specialist doesn't have all that much hair on top of his head anymore, and he will be losing some of what ***is*** left in the course of wiping solder into the seam of the splice case a bit later on.

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The cable soldering specialist is now in the process of forming and wiping the seal on the left-hand end of the splice case, after first having literally knocked the splice case into shape.

The seal has already attained the approved form and size, being about 1 centimeter thick at its highest point, and about 2.5 centimeters (roughly one inch) wide at the base.

Figure 49

Figure 50

Now the cable soldering specialist is in the process of forming and wiping the seal on the right-hand end of the splice case.

At this moment, the wiping solder has the consistency of putty and is wiped into shape with the aid of a piece of moleskin soaked in tallow. The tin which holds the tallow may be seen in the lower right-hand corner of the picture.

The solder used has the following composition: 33% tin, 66% lead and 1% antimony. This is basically the same alloy as the cable sheath; the 1% antimony helps prevent the solder from crystallizing and breaking due to vibrations.

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After the wiped solder joint has attained the desired shape, it's cooled by pressing and rubbing a block of stearin against it.

The stearin actually serves a twofold purpose, namely to cool the joint, and also to remove any oxides which may have formed during the wiping process.

Figure 51

Figure 52

After both end seals have had time to cool down completely, the seam is gently heated and stearin is applied in order to clean the lead prior to the soldering and wiping operations.

It was just about at this point that the soldering specialist managed to set what little hair was still on his head afire ….

He had been applying a *very* liberal amount of stearin to the seam, and apparently a small pool formed inside the splice case. Within a short time, the stearin began to boil and evaporate, reaching its flash point at the very moment the guy bent his head down to see how far along the seam the lead was clean… yes, even such folks can lead very exciting and dangerous lives.

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In the photograph to the right, the soldering specialist is in the process of more or less "dripping" the wiping solder into the seam of the splice case.

It's interesting to note that the seam isn't soldered/wiped closed in one fell swoop, but is rather done up in short segments.

Figure 53

Figure 54

The cable soldering specialist had just begun to wipe the lead into the first portion of the seam when the photograph to the left was taken.

One can see that the soldered, but yet un-wiped, portion of the seam extends not much further than one third the length of the splice case.

The splice case after having been soldered and wiped per Telecom Austria standard practices.

Not necessarily anything beautiful to behold, but a dying handicraft under all circumstances.

At first, I thought that the picture showed the splice case after the first third of the seam was wiped, but since the tin can with the tallow (below the splice) is closed, the job must have been finished.


Figure 55


Figure 56

The work of jointing the splice case began at about 10:30 a.m. and was finished about an hour later. It was just about time for me to go home for a quick change of clothes and to drive off to visit my mother and have lunch with her. On the way home, I checked out how far the cable splicers had gotten in their trench … I was rather surprised to see that they'd just finished wrapping the second splice in muslin.

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When I returned to the splicing trench around six o'clock in the evening, the cable splicers were long finished with their work.

They'd attached the lead splicing case to the three cables and sealed this case in an outer shell of hard and durable plastic. Polyurethane foam was used to fill the airspace between the two splice cases. Some of the brown foam spilled out.

Figure 57

Figure 58

The remains of the two old cables were dead-ended with heat-shrinkable caps, and were buried without concern that the blank lead sheathes might start to corrode one of these years.

Outside Plant in Vienna & Austria

This is an attempt at an in-depth explanation of the method by which Telecom Austria distributes outside plant, starting at the exchange MDF and ending at the subscriber distribution boxes (which are covered in the next tale.)

The "system cables" from the switch are wired to the horizontal side of the MDF in numerical sequence, from where they're connected to the terminals on the vertical side via jumpers.

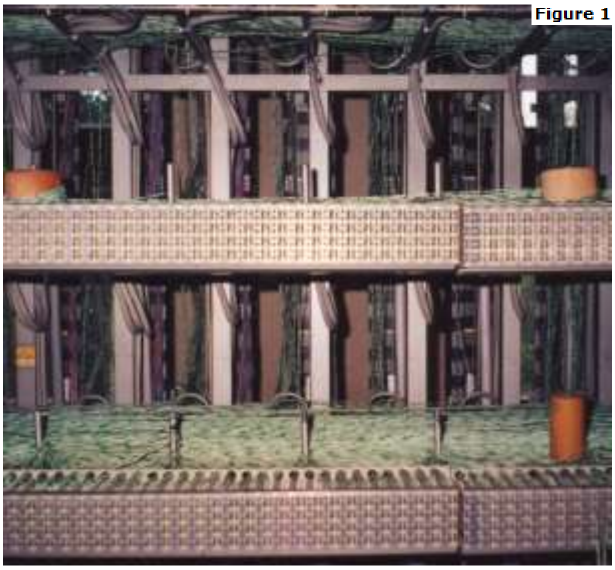
Figure 1

The horizontal side of this specific MDF is constructed employing the most modern IDC terminal blocks currently in use, which each serve 200 pairs of wire, with 5 pairs per vertical. There was work in progress on this MDF, as is evidenced by the wooden rolls placed over some of the horizontal wire guide pins. The jumpers used to be brown-white pairs (white=tip), back when the switches were analog types. Since it wasn't possible to replace any specific analog exchange in Vienna with a digital switch in one fell swoop, it was necessary for the CO technicians to be able to distinguish the pairs serving each type of switch, so they used green-white jumpers to designate lines running to the digital portions of the switch. Green-white twisted pairs have, in the meantime, become standard throughout all of Austria – although the older brown-white jumper wires can often still be found in cable cross-connect cabinets.

The photograph to the right shows a portion of the vertical side of the same MDF. This specific MDF is rather unique in that, at the time the picture was taken, the terminal strips were of the older 1971 model and *not* of the same type as on the horizontal side – as would normally be the case. The distribution cables from the cable vault terminate on the left-hand side of the terminal strips on the vertical side of the MDF. Both types of terminal strip, as shown here, allowed the attachment of a test connector, so that both the inside and the outside lines could be patched to a local (or, in most cases, remote) test board for troubleshooting. Subscriber and inter-exchange cables are both terminated in the same manner on the MDF.

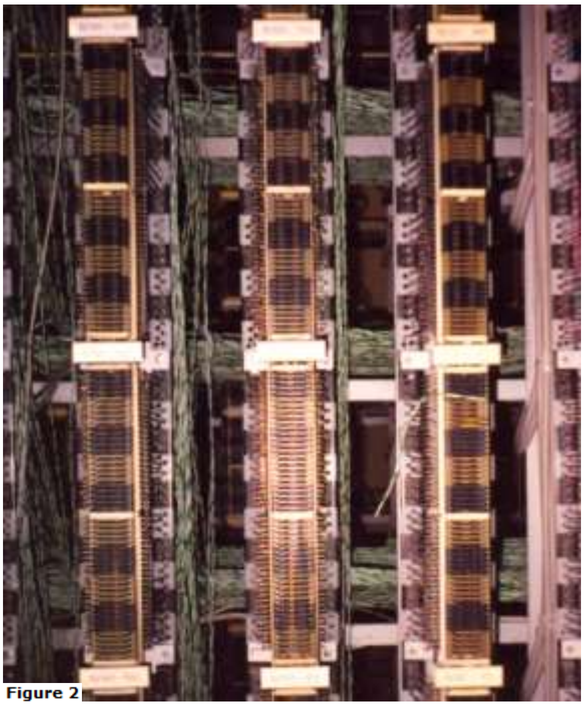
Figure 2

As an aside: the inter-exchange cables had one pair reserved for troubleshooting purposes; patching into a specific pair for troubleshooting between exchanges was often performed using small, old, defunct, wall mounted magneto switchboards installed somewhere in the MDF room. The same holds true for the so-called district cables which link the various local exchanges to the Vienna toll exchange.

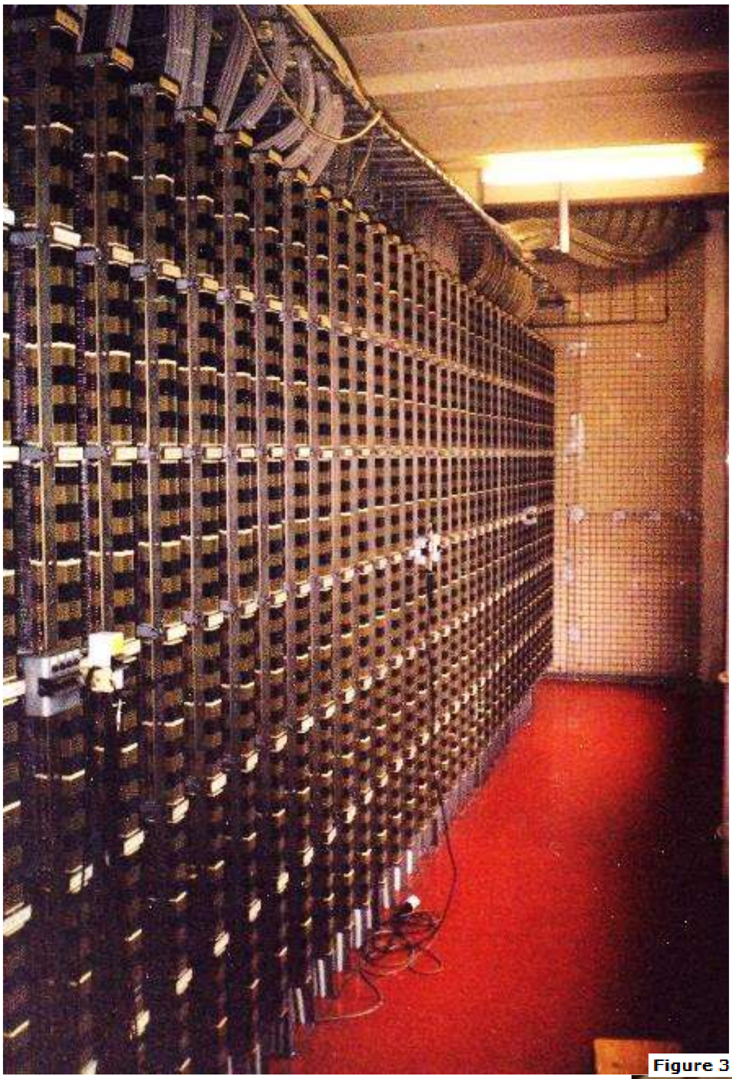

Figure 3

The photograph to the left gives a good idea of the size of a small MDF. Each of the vertical terminal strips carries 300 pairs, and each and every wire on these old terminal strips had to be soldered by hand – no IDC terminals here. The cables running from the horizontal side of the MDF to the switch can be seen in the upper right-hand background.

If one looks closely, one can see a soldering iron, hanging upright and plugged in, near the center of the picture.

The small, silver-painted box located near the left-hand center edge of the picture is used to patch the inside and outside wires of subscriber lines through to a test board.

As far as I can recall, the majority of *subscriber* line test desks were located in the "Zollergasse" exchange in Vienna's 7th district, while the test desks for the Viennese *toll* cables were located in the toll exchange building.

This magneto switchboard was one of those referred to on the previous page … after its useful life as a small village exchange, it was used in the MDF room of an unknown exchange in Vienna and later found its way to a flea market in Austria.

In its latter capacity, there was no need for the original plugs and cords, so these were simply scrapped. However, I have managed to lay my hands on enough original plugs and modern (but cloth-covered and original style) cords to be able to restore this board to its former glory one of these years, when I'm *really* bored.

Figure 4

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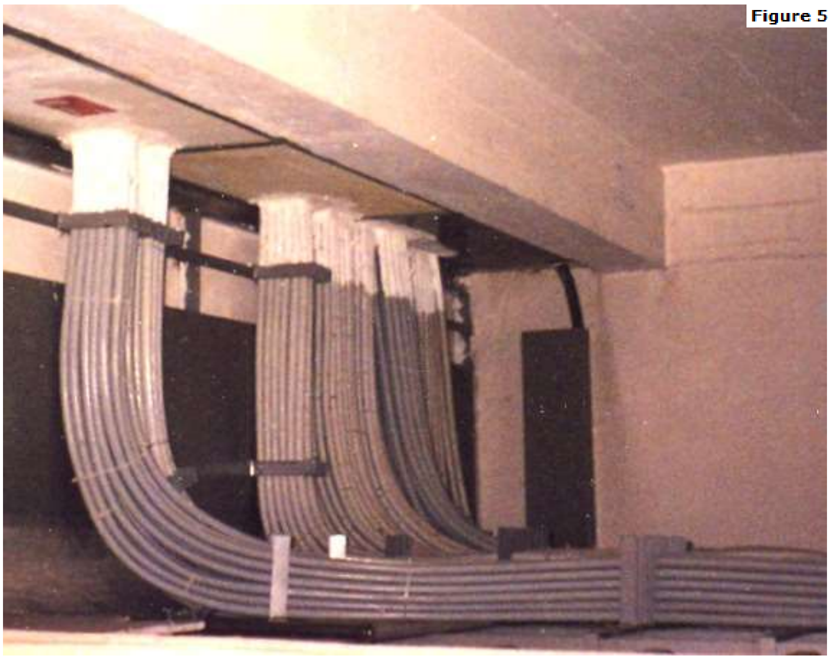

Figure 5

The distribution cables (usually 100 pair stuff) from the vertical side of the MDF run through the floor, down into what the folks at Telecom Austria refer to as the "cable basement" (in the States: cable vault).

The cables are sealed 100% where they run thru the ceiling, so that a fire in the vault can't spread to the MDF via the so-called chimney effect (at least in theory).

Way back when, like in the 1930s and 1940s, these cables would've been lead-sheathed and have had enameled wires protected by two layers of silk, but nowadays they're of the more prosaic PVC type. Mating several PVC cables to a large distribution cable, ending in a *lead* splicing/fanning case, in such a manner to guarantee a hermetic, moisture proof seal is a bit of a challenge, since it isn't possible to simply fill the case with hot pothead compound – this would melt the PVC insulation. What to do?

Figure 6

Well, the lids of the cases have short leaden stubs, which originally would've been soldered to the sheaths of the distribution cables, so the PVC cables are run through the stubs and mated to them with heat-shrink sleeving, which has a heat-activated adhesive on the inside.

Naturally, the temperature at which the sleeving begins to shrink, and at which the adhesive begins to melt, must be lower than the temperature at which the PVC begins to soften.

The slate-colored bars with the vertical yellow & green stripes are copper grounding bars to which the lead sheathes of all the cables are bonded; two such bars may be seen in the above photograph … *electrical* grounds in most of Europe are identified by combined yellow & green stripes, while *telephony* ground is red; however, the red color on the fanning case in the middle foreground of the picture was apparently applied to identify the cable as belonging to a PCM system.


Figure 7

The subscriber and inter-office cables exit the cable vault through an outside wall, which is normally adjacent to the office manhole, from where they're fanned out.

The feed-through holes which are not in use are stoppered with plugs made of cement, which are wrapped with a cloth tape impregnated with a waxy substance (known as "Denso tape" in Telecom parlance); this gives a more or less gas- and waterproof seal which is supposed to prevent water and/or gas from entering the exchange from the outside.

The cables are sealed around the feed-through holes with special, self-hardening putty which must meet certain criteria; above all else, it must *not* attack or damage the lead sheath in any manner and must *not* crack in any case.

The outside plant philosophy of Telecom Austria is along the lines that, at any given point in the cabling, there must be a certain number of spare pairs in the cables in order to be able to cope with future demands. Thus, an 1800 pair (high-order) cable exiting the exchange will usually be spliced to two feeder cables of 750 pairs each. Each of these, again, will be spliced into two cables of 300 pairs each (or possibly also into three cables of 200 pairs each) … such 200 to 300 pair cables will enter the basement of a building and there be spliced into several cables of 50 or 100 pairs each.

Such a 50 or 100 pair cable will then be run through the basements of adjacent buildings, with single cables branching off and running to cable cross-connect cabinets, usually found in the ground floor hallways of the buildings. The cables are wired up to terminals of (usually) 100 pair capacity inside the cross-connect cabinets; there are usually a few smaller cable terminals inside these cabinets as well, which are wired to cables of between 10 and 40 pairs, and which serve the subscribers within the individual buildings. The lower photographs on page 19 respectively show the insides of a cable cross-connect cabinet and of a subscriber distribution box.

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Figure 8

A 50 pair lead-sheathed, paper-insulated cable is terminated on a screw terminal of 100 pair capacity in this cross-connect cabinet, and distributes the pairs to a maximum of 4 buildings. The 100 pair terminal is potted in order to keep moisture out of the paper-insulated feeder cable, while the two cables (on the left and right) exiting the cabinet are good old PVC-insulated stuff. The 100 pair terminal is divided into brown and white segments, which allow for simple counting of the pairs (and have nothing to do with the identification of tip and ring).

The terminals for the two PVC cables are of a modular type, which can be expanded in steps of 10 pairs; they're not filled with any sort of potting compound. As previously mentioned, the jumpers within this cross-connect cabinet are of the older, brown-white style – it'd simply be too much work, and be too costly, to want to go and replace all of these old jumpers with new ones, just for the sake of consistency. However, any *new* connection made in such a cabinet is made with green-white jumper pairs.

There are a few things to take special note of, concerning the specific cross-connect cabinet shown on the previous page:

Although the terminals on the left and the right are labeled with numbers from 1 to 40 and 41 to 80, respectively, readers will note that only the left-hand side of these terminals is actually in use, and thus this specific cabinet serves a maximum of 4 buildings, with ten pairs each. Ten pairs for a building with, say, 25 apartments appear to be a miscalculation, but this wasn't the case ….

Back at the time when service needs were defined, Vienna had a *very* high proportion of party-line telephones – nearly 80 percent of all subscribers had party-lines, which they shared with a maximum of three other parties. The Austrian PTT was in the habit of assigning party-line phone numbers to subscribers in one and the same building, or, at the most, in adjacent buildings. The reasoning behind this being that, since the type of party-line service offered didn't allow one to call the other parties who shared the same line, it was deemed to be no hardship for a subscriber to have to talk to their party-line mates face to face.

Since it would've been a huge waste of resources and money to feed the pairs belonging to four-party party-lines from common terminals in the exchange all the way to the individual subscribers, pair distribution was either performed in the cross-connect cabinets, or in the subscriber distribution boxes ….

The Austrian PTT wanted their distribution system to be neat and tidy, so that it'd always be easy to trace any pair of wires, so they came up with an interesting method for distributing party-line pairs. If one looks closely at the picture on the previous page, one can see some rather lonesome terminal strips along the bottom of the cabinet, of the same type as the one shown below. If a party-line was to be split between adjacent buildings, the incoming line was attached to the screws on the bottom of the terminal strip, with the distribution jumpers being connected to the other screws on the same rows.

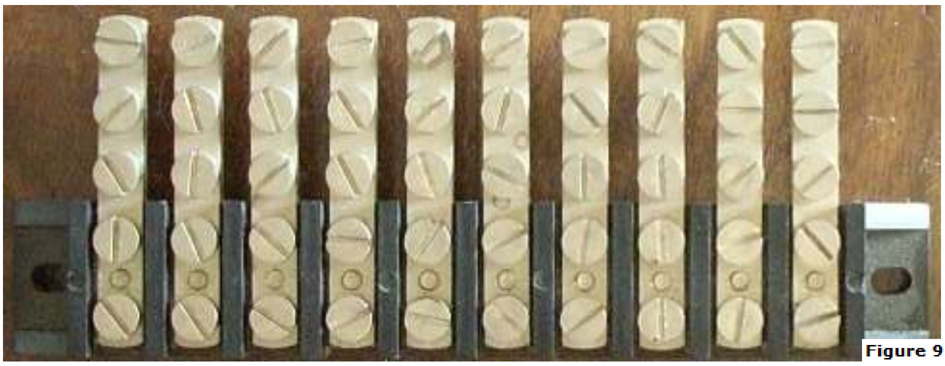

Figure 9

Subscriber distribution boxes were (and usually still are) pretty narrow and short affairs, which don't have enough space inside to allow an extra terminal strip, such as the one shown on the previous page, to be installed. The PTT had a different solution on hand for this problem.

Figure 10

Here we have a Bakelite cable terminal, model 1948, which is a type that is still in widespread use throughout Austria. The one shown here was intended for a maximum of five private (single) line subscribers, since the legends 1 a/b thru 5 a/b are embossed on the cover ("a" = tip). These terminals were built with 5, 10 or 20 pair capacity, with the 10 pair type being the one most commonly employed. The five pair terminal shown here was manufactured in 1958 and is dusty NOS.

This same cable terminal could, however, just as well serve a total of five party-lines, with a total of 20 subscribers – by employing the nickel-plated brass distribution strips as shown attached to pair three.

This type of cable terminal was modular in that, if it were only required to distribute pairs to private (single) lines, the insulated bus bar (seen to the left of the screw terminals) wouldn't be attached, since it's only required when the ground wire necessary for party-line operations was to be connected.

There is a small channel in the Bakelite, one for each ground terminal, on the bus bar; the lowest terminal doesn't have this channel slanting upwards, but rather downwards instead. That was because the wire which was attached there was soldered to the lead sheath of the incoming cable – the lead sheathes of all distribution cables were used as the common ground-return for party-line service.

The top end of the cable terminal has a screw-on cap … after the paper-insulated wires were terminated on screw connections inside, and the cover had been reinstalled, this type of terminal was filled with a potting compound for moisture protection.

As an interesting side-note, most cross-connect cabinets have several pairs which are not spliced to the preceding higher-order cable but which are, instead, spliced to pairs routed to adjacent cross-connect cabinets instead … this allows for more flexibility in that, if all distribution pairs are in service in one cabinet, but there are still some pairs available in an adjacent one, these can be rerouted to the first cabinet, instead of having to lay in a new, larger cable.

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The following three pictures were taken *quite* a while back, by connecting an old, analog, color TV camera to a personal computer equipped with a Creative® Video-Blaster® card (I didn't own a digital camera back then). The quality of the pictures really isn't good, but nothing better is available, since the splice shown is no longer part of my collection.


Figure 11

This is a wye splice of a 300 pair cable into 2 100 pair cables which led to two cross-connect cabinets … I dragged it home from a junkyard and cut it open for a looksee.


Figure 12

The photo to the right shows the splice after the muslin wrappings were removed. In this case, TYCO® Picabond® splices were used; as may be seen, there are 50 quads dead-ended within the lead splicing case, so that there were plenty of reserve pairs available at this last distribution splice along the line.

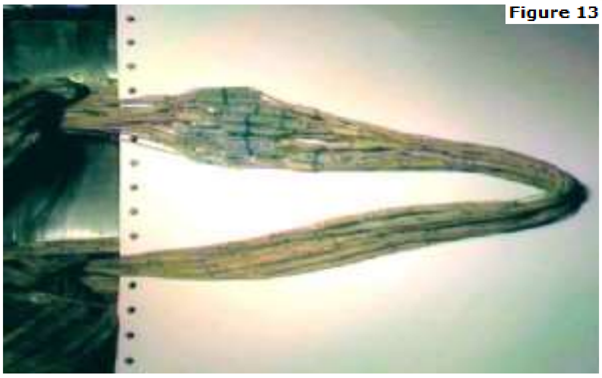
Figure 13

5 of the quads in each of the 100 pair cables were *directly* spliced to each other, thus allowing free subscriber lines in one cross-connect cabinet to be routed to an adjacent one … a very neat and simple idea.

Concerning Austrian Telephone Cables

In Austria, as in every other country, telephone cable construction methods evolved over time. The following text is my personal translation of a German-language text, taken from the book "Lernbehelf für die Telegraphendienstprüfung II, Band 3, 4. Abschnitt" (Learning Aid for the Telegraph Service(s) Examination #2, volume 3, section 4.) The original German-language text was printed in 1953, and naturally concerns itself with cables constructed and used up until that time. Unfortunately, the original text makes no mention of when, exactly, which of the cable types described was in use.

"In the beginning, cables were modeled after the normed open-wire lines, having 52 or 104 pairs of 1 or 0.8 millimeter diameter (approximately 18-20 AWG). After the first cable conduit systems came into use, cables with 208 pairs were employed; in some instances of network rearrangement, cables with 312 pairs were used.

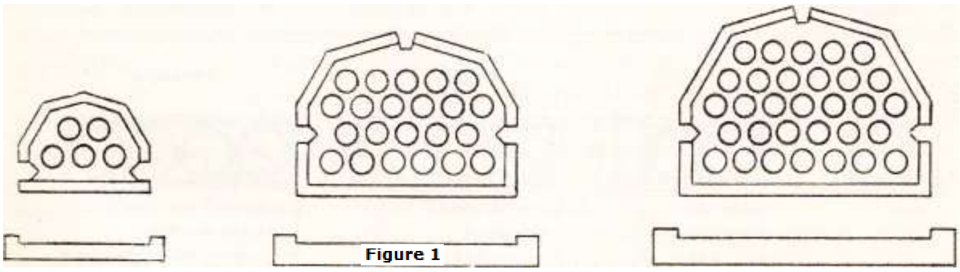

Figure 1

The above drawings show the oldest type of cable conduit system used in Vienna, of the type "Hultmann." The individual cement blocks were roughly 1 meter (39") long; these blocks rested on cement platens as shown, and the individual ducts had a maximum inside diameter of 80 millimeters (roughly three inches).

At the time when cable cross-connect cabinets, which catered to multiples of 30 pairs, came into use, cables with 30, 60, 120 and 240 pairs of 1 millimeter diameter were manufactured. In local networks with more than one central office, the type with 240 pairs was often used for inter-office trunks. In the further course of development, and due to new planning guidelines, these cables were also manufactured with wires of 0.8 millimeter diameter.

As the service area of the cross-connect cabinets decreased, cables were produced in further pair sizes, ranging from a single pair up to cables with 360 pairs. The reason that no cables with more than 360 pairs were manufactured at the time had to do with the fact that, because of the cable construction techniques used, cables with more than 360 pairs were too thick to be pulled into the conduits then in use.

At the time dial service was introduced in Vienna, cables with 270 and 135 pairs were the norm, due to the manner in which the switches were designed … these inter-office cables required **3** wires for each circuit, hence the 270 *pair* cable could cater to 180 inter-office *circuits* – 2 pairs were for tip and ring of 2 circuits, the third pair carried the "test busy" lead for these two pairs, &c.

So-called "combined cables" were manufactured to link the local exchanges to the building in which the Vienna toll exchanges was located (prior to 1927); these were composed of 135 pairs with 0.8 millimeter diameter wires and 10 quads of Krarup[1] wires of 2.0 millimeters diameter. The 135 pairs were intended for local traffic to the toll exchange and the 20 pairs for toll tandem traffic.

[1] Named after the Danish engineer Carl Emil Krarup, who invented cables with distributed, artificial inductivity – which were produced by wrapping thin, annealed iron wire around the copper wires in closed spirals; Krarup cables were used wherever it wasn't practical to use loading coils (such as on shorter submarine cables). Krarup cables were expensive to manufacture and didn't find widespread use.

After the new Vienna toll office went into operation, special cable types were developed which were exclusively used for toll tandem traffic. On the one hand, these were cables with 20 or 40 pairs of 2.0 millimeters diameter, with an additional 10 or 20 pairs of 0.8 millimeter diameter and, on the other hand, cables with 20, 40 or 80 wires laid up per the Dieselhorst-Martin standard of 1.4 millimeters diameter each, with an additional 10, 20 or 40 wires of 0.8 millimeter diameter.

The next developmental step saw the introduction of cables stranded in spiral four quads for subscriber distribution cables with substantially greater numbers of pairs. At a somewhat later date, subscriber (distribution) cables were exclusively stranded in spiral four quads; cable up to 100 pairs were manufactured with multiples of 10 pairs, larger cables in multiples of 100 pairs. Further, with the introduction of cable terminals for 70 pairs, cables with multiples of 70 pairs were placed into service. Taking the latest norm for cable terminals into account, subscriber (distribution) cables with multiples of 30 pairs will be manufactured."

In a type III spiral-four quad[2] (the type used for local subscriber cables) the four conductors are twisted around each other in a fully symmetrical fashion, as may be seen in the upper portion of the drawing to the right. The four wires are equidistant to each other throughout the length of the cable. This type of cable construction is the least expensive, but still affords some measure of protection against crosstalk.

[2] Spiral-four quads are known as "star" quads in Austria and Germany.

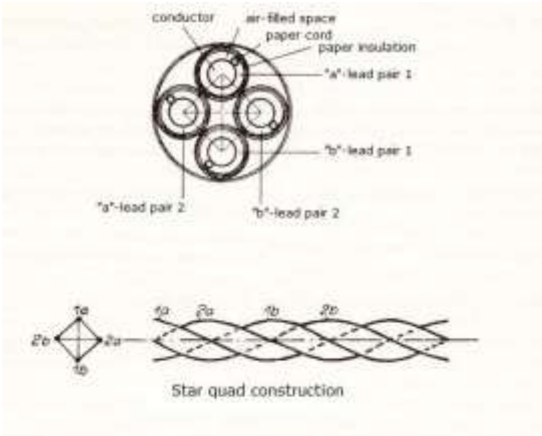

Figure 2

Dieselhorst-Martin (abbreviated "DM") quads, on the other hand, are constructed so that no adjacent pairs or quads have the same length of twist. Quads are built by one of two possible methods: either the twists of the individual pairs of a quad are shorter, or are longer, than the twist given the two pairs forming any quad, as is shown in the lower half of the drawing. DM quads offer excellent protection against crosstalk, but are very expensive to manufacture.

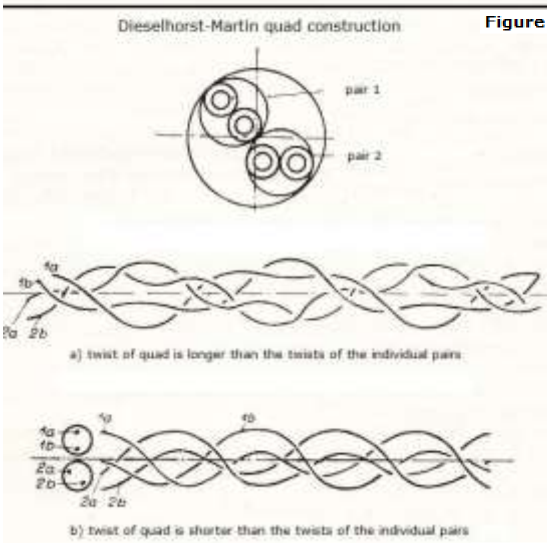

Figure 3

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A third method of constructing cables with quads was in use for a number of years until it was found to be wholly impractical: the type I spiral four quad (the German-language term for such cables was "local cable with toll cable characteristics"). In this type of cable, half the pairs had one specific length of twist, and the other half had a distinctly different length of twist. One pair of each twist length was then twisted together to form a rather imperfect quad, whereby the length of twist was equal in all quads.

Practically all early cables in Austria were laid up in concentric layers of wires twisted in pairs. The wires in such cables were usually protected by two layers of paper ribbons; these were unmarked. Figuring out which wire of a pair was the "a" lead and which was the "b" lead (equal to tip and ring, respectively) was made easy in that the "a" lead was made of bare copper wire, while the "b" lead was tinned.

Naturally, cable splicers needed some sort of identification in the individual layers as to which direction the pairs were to be counted out in (clockwise or counter-clockwise) and, above all, where to begin counting from. This was done by having a tracer pair in each layer being done up with an outer layer of red or purple paper, instead of plain brown.

Toll cables are a different matter, as far as wire identification and wire layup are concerned. These cables were made up of either spiral four quads (type III, rather rare) or per DM. In a DM cable, the tip lead of pair 1 had a yellow stripe, ring of pair 1 a red stripe; tip of pair 2 had a green stripe and ring of pair 2 a black or blue stripe. These stripes were printed *lengthwise* on the outer paper ribbon, but since the paper is wrapped around the wire in a spiral, the stripes appear to be spirals.

Figure 4

The cable core shown to the left is a piece of a DM toll cable. However, it was a *very* special toll cable, known as "war cable." Yes, this stuff was manufactured during WWII and, accordingly, has *aluminum* wires instead of copper.

It's also a so-called "combined" cable, since it's built up with quads of different wire diameters: the outer two layers have a wire diameter of 1.8 millimeters (equal to 1.4 millimeter copper wire), while the third layer has a wire diameter of 1.15 millimeters (equal to 0.9 millimeter copper wire).

The *core* of this cable is highly specialized; it's made out of four *pairs* of 1.8 millimeters diameter, with each pair being twisted together with two *paper cords* of a similar diameter as the wires, in order to form a sort of quad.

Each pair is individually wrapped with a layer of paper, over which there is a spiral wrap of aluminum or tin foil (complete with a separate drain wire), over which there is another layer of paper. These pairs are designated by the German-language abbreviation "PiMF" – in German and English, this means "pair in metal foil."

These pairs were either used for carrier current systems, or else for carrying low-frequency radio modulation signals (voice and/or music – sometimes, PiMF pairs were referred to as "music lines"). All in all, this cable has 46 DM quads and the 4 pairs in the core. This specific toll cable was, in its time, a very important one – the first layer beyond the core contains a DM quad in which the four individual wires are specially insulated by a layer of enamel lacquer, applied directly on the aluminum. These wires were used for testing purposes, since the lacquer kept the wires insulated even if the cable core should become soaking wet.

There is a single, spiral wrap of iron tape *beneath* the outermost layer of paper. This spiral wrapping is actually made out of spring steel, and it doesn't serve the normal purpose of such a layer (namely protection against induced currents). This spring steel spiral was intended as an internal, physical support for the lead sheath of the cable, which was markedly thinner during the years of WWII, since even such things as paltry as lead were in short supply.

The manner in which I managed to get hold of this bit of cable core may be of interest … during the construction work referred to in the tale "Manhole Adventures," the Austrian Federal Railways dug up a longer portion of their right of way, in order to expand their own outside plant (signal, block and communications cables). Somewhere along the right of way, one of the construction gangs apparently stumbled across a dead segment of this wartime cable, and removed it.

At the time I sighted this cable, laying in a gutter along a street, all but roughly 18" of it had been run over by a big truck which had parked on top of the cable. When the truck was gone, I "bribed" someone from the construction gang to saw off the intact piece for my collection.

Figure 5

This photograph shows this intact piece of cable, just as I received it. The lead sheath was protected by two layers of paper soaked with bitumen, on top of which there originally was some armor in the form of flat iron wires, wrapped around the cable in a spiral pattern, imbedded in rotting jute roving's.

My original plan had been to leave a short piece of the paper on the lead sheath, while preparing the core as previously shown, but it turned out to be next to impossible to handle the cable without spreading the bitumen onto every-thing, so that the only option was to remove the sheath, complete with the paper layers. Cables with aluminum wires were not often installed and are therefore rather rare in Austria all told, roughly 250 kilometers (circa 140 statute miles) of aluminum cables were installed throughout Austria during, and shortly after, WWII.

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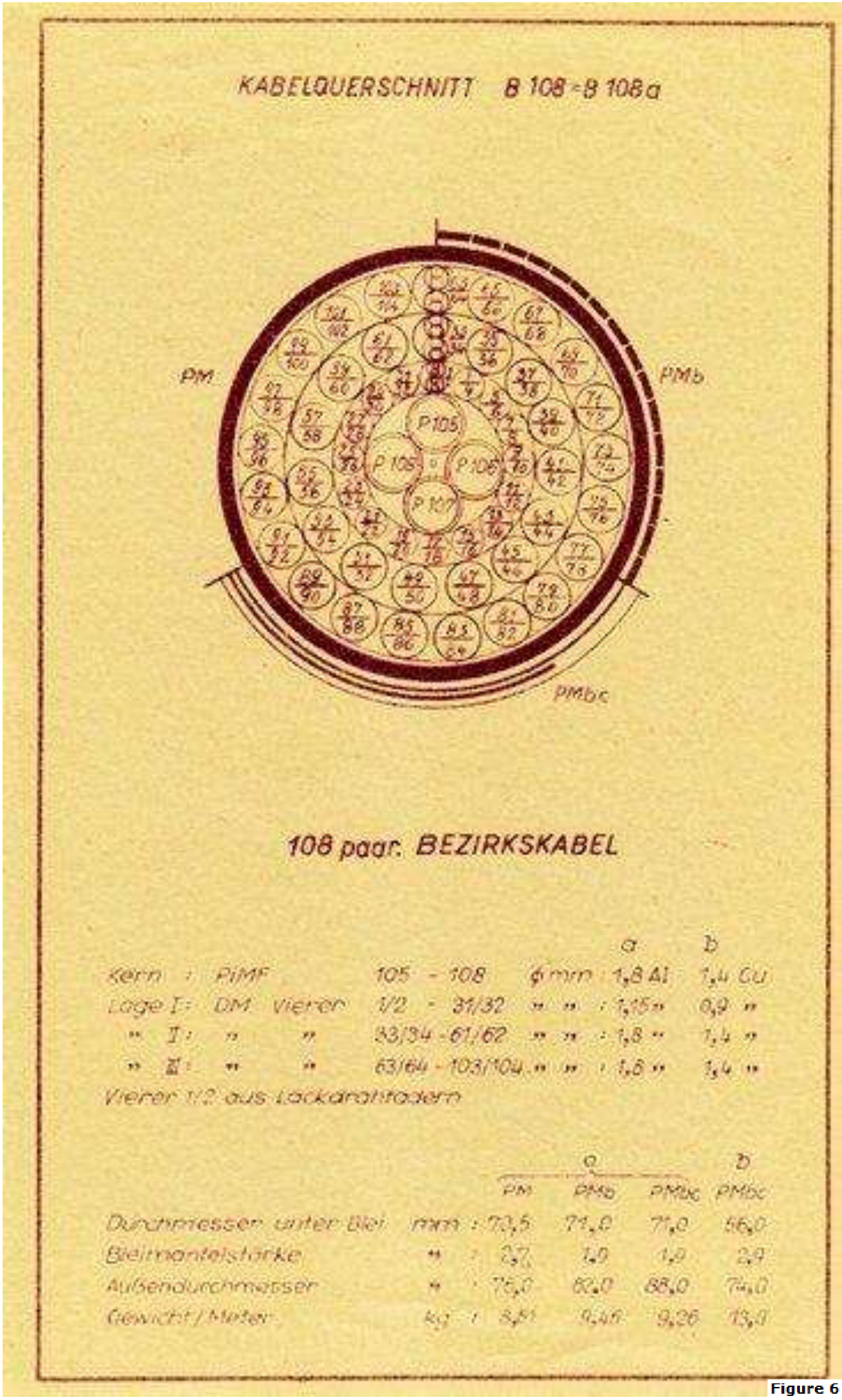

Figure 6

Here we have the scan of a blueprint from 1942, showing the construction of the cable type as shown on the previous two pages. The only real difference is that the cable shown above had a lead sheath of normal thickness and did away with the spring steel spiral; as per the German-language text, the above cable was a “district” toll cable, available with either copper *or* aluminum conductors.

Paper insulation was applied to the bare wires of the various cable types in one of three possible ways:

1) The least expensive variant, having the highest electrostatic capacity, is to wrap a single layer of suitable paper ribbon around the conductor in a spiral with circa 30 percent overlap. This is the most common type of insulation used on subscriber distribution cables.

2) The next variant, with somewhat lower electrostatic capacity, is to wrap two layers of paper ribbon around the conductor; one layer in a clockwise direction, the other layer in a counter-clockwise direction, as shown below:

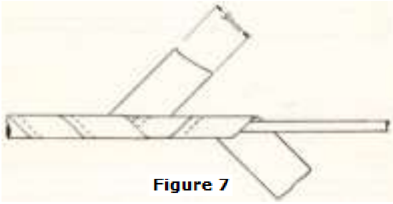

Figure 7

3) The most expensive variant, having the lowest electrostatic capacity, is to first lay a thin paper cord around the conductor in a spiral, and then to wrap a ribbon of paper over this paper cord in the opposite direction. Toll cables are usually the only ones to have this type of insulation, which was referred to as "hollow paper insulation" in German, and which is illustrated here:

Figure 8

Over the decades, the methods of splicing cables were subject to change. Way back when, around 1915, small, oval, copper sleeves were crimped to the bare ends of the wires. Later, the bare ends of the wires were simply twisted together and soldered. As cables containing really large numbers of pairs (or later: quads) came into use, it became very time-consuming to solder each and every splice, so it was decided that splices in subscriber distribution cables would simply consist of twisting the bare ends of the wires together for a distance of about 30 millimeters (roughly one inch). The illustrations below show this method.

Figure 9

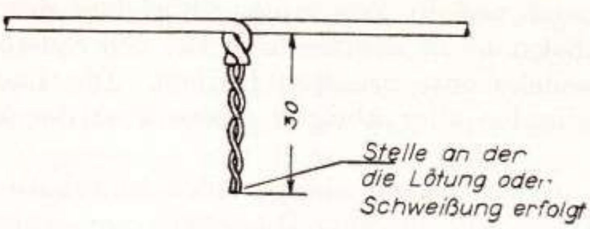

Figure 10

The German-language text at the top of the last drawing shown on the previous page translates as: "point at which soldering or welding is to be accomplished." This raises an important point: since toll cables were much more valuable than subscriber distribution cables, because their traffic brought higher returns on investment, the splices of the pairs or quads of toll cables (of smaller wire diameter) were normally soldered. If solder wasn't available, then the tips of the wires were to be welded together, just the same as was done with aluminum wires. The photograph below shows a welded splice on copper conductors of a spiral four quad. As can be seen, the splices were protected by cardboard sleeves, and the four wires of the quad were held together by short cardboard sleeves, referred to as "group rings" in German.

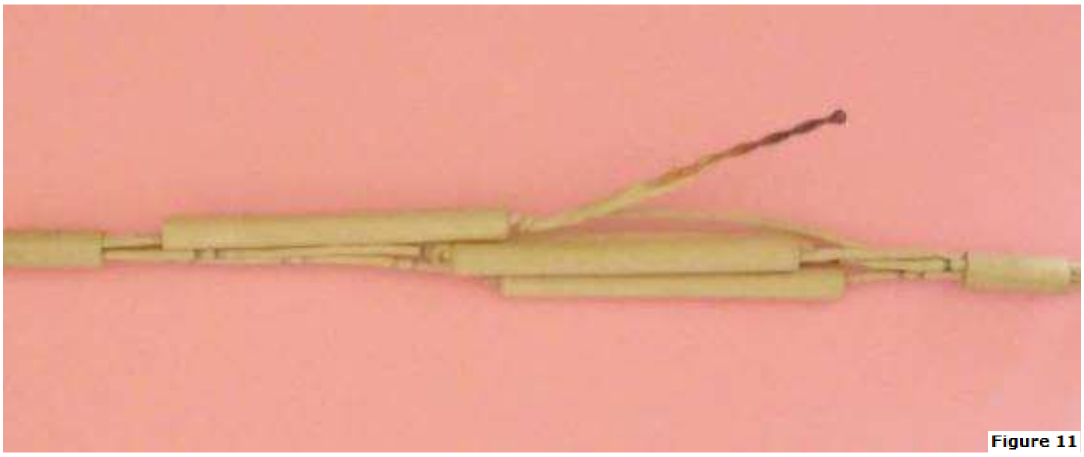

Figure 11

Toll cables with copper conductors of larger diameter (circa 2 millimeters and upwards) were usually spliced by inserting the bare ends of the wires into short copper tubes and being soldered. The copper tubes were slit lengthwise in order to allow the solder to flow better.

The drawings below show a relatively simple method of twisting the wires together; after the first twist, which only serves to hold the wires together, the ends of the two bare wires are simply grasped with the fingers of the right hand and rotated as one would turn a crank, while the thumb and forefinger of the left hand are slowly moved up while grasping the wires. Readers may wish to refer to page 4 of the March, 2007, issue of Singing Wires, concerning the lead article "Outside Plant Wire & Cable" where a similar method of splicing paper-insulated wires is shown.

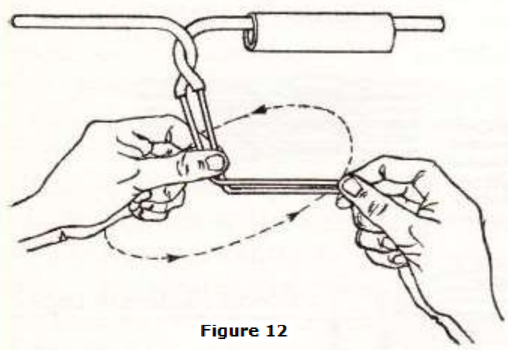

Figure 12

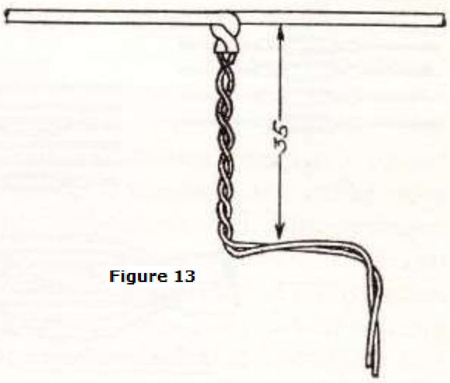

Figure 13

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As the old adage goes, there is more than one way to skin a cat – or a wire, for that matter. In times when proper tools were lacking, the wires were first twisted together tightly for 2-3 turns and then the paper pushed back on the wire and simply torn off. Not really neat, but efficient.

The photograph below shows a wire stripper, as used by cable splicers of the Austrian PTT, to strip paper and PVC insulation from wires. One of the two jaws is adjustable by loosening a single screw and moving the jaw up or down.

Figure 14

Up to now, only more or less "standard" telephone cables and splicing methods have been discussed. Now I'd like to show the blueprints of two unusual cables which were used in Austria at some point in the more distant past.

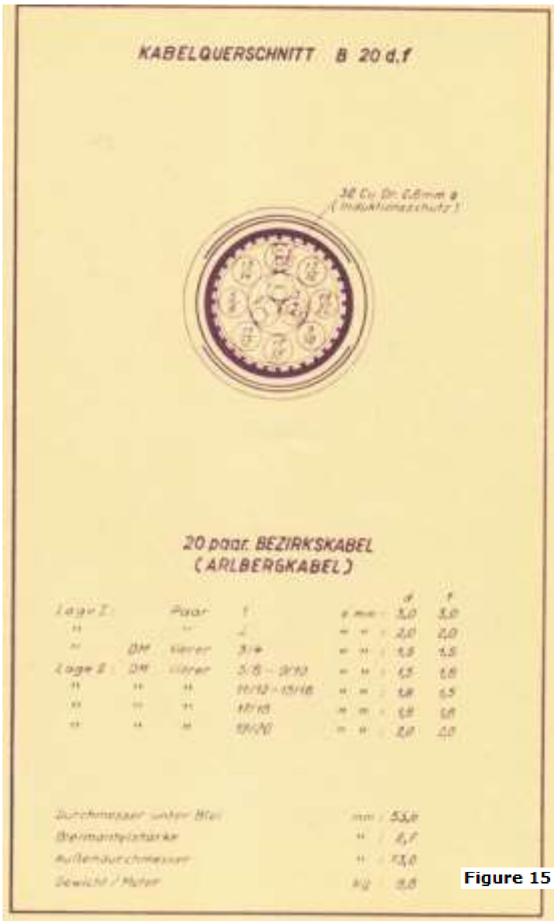

Figure 15

The cable illustrated is officially designated as another type of "district" toll cable, one which is a combined cable because it has three pairs of wires **three** millimeters in diameter in the core, while the other layers of the cable are composed of DM quads of either 1.5 or two millimeters diameter.

This cable is also interesting because it's one of very few cables which feature protection from induced currents, which is provided by the 32 spirally-wrapped, bare copper wires between the cable core and the protective paper layers beneath the lead sheath.

There is a special reason for this cable being protected from induced currents – it was buried along the right-of-way of the electrified Arlberg Railway, which was (and is) part of the Austrian Federal Railways (return currents from the engines sometimes go vagabond and choose alternate routes, such as lead cable sheaths, instead of passing back along the rails).

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Figure 16

The cable illustrated here is interesting because it's designated as a "14 conductor district cable, previously 'telegraph cable'."

It was, indeed, just that because the wires are **not** arranged in pairs or quads, but rather as single conductors ….

The inner 6 wires were of one millimeter diameter copper, and the outer eight wires of two millimeters diameter copper. The outer layer of wires is especially interesting because they're individually foil shielded to help prevent crosstalk.

Information as to exactly how this telegraph cable, obviously with ground return, was employed in telephony is unfortunately lost in the dust of history.

Next in line is a bit of short-haul toll cable (commonly referred to as a "network group cable" in Austria) which I picked up at a junkyard several years ago.

The first thing one notices is that this specific cable doesn't adhere to the standard manner in which the identifying rings are printed on the paper insulation. I was surprised to discover that this particular cable wasn't of Austrian origin, but was rather manufactured in Delft in the Netherlands.

Figure 17

Figure 18

This close-up shows that the four wires of each quad are simply marked with one, two, three or four equally spaced rings in red. The two bits of white cardboard to the left of the tie are group rings, which are used to mark the individual quads; in this specific case they're on the number one quad in the core.

Although this piece of cable is from an older toll line, the quads are not laid up as Dieselhorst-Martin quads, but rather as regular star quads. Thus, this cable was built up to conform to the so-called "St-I" specification, while all subscriber cables were built to "St-III" (whereby the "St" is the German abbreviation for "Stern" = "star").

Figure 19

Figure 20

The two photographs above show both sides of one of the splices cut out of the cable during recovery; as can be seen, the cable on the left conforms to the "old" standard, having stripes in red, black, green and yellow. There are 12 quads in both cables; quads numbers one and four are marked with two group rings, and the wires are connected with standard TYCO® Picabond® splices.

The *core* quad is spliced the old-fashioned way, using solder to achieve a perfect, low resistance splice, which will remain stable over a very long time. This was done so as to always have a good quad for measuring purposes, even if the cable core was wet.

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At the very beginning of this collection of tales I mentioned the fact that the Austrian PTT used PVC spaghetti to insulate splices immediately after WWII; the next few photographs show such a splice, complete with corroded wires.

Figure 21

Shown above are some splices which were cut out and redone with standard TYCO® Picabond® splices. The interesting thing here is that the four wire bundles in the foreground (of which three are visible) run straight through the (removed) leaden splice case, while the spliced wires branch out into a separate cable.

Shown below is a bunch of wires where the splices are insulated with PVC spaghetti; in some instances, the PVC spaghetti became hot enough (during the soldering of the splice case) that the individual pieces adhere to each other.

Figure 22

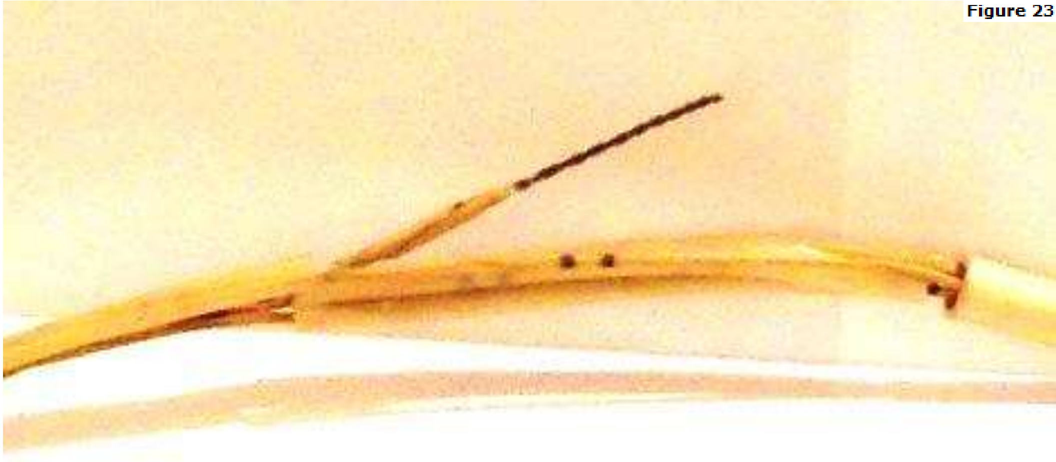

Figure 23

The above shows the condition of one of the splices after the spaghetti was pushed away. The bare wires are of a dark brown color (which is unusual for wires not welded together at the tip); what can't be seen well are the spots of copper chloride on the wires.

Here we have a nice bundle of splices protected with small-diameter cardboard sleeves, as was standard practice for many decades. Some of the sleeves are a tad darker on the right-hand side – this indicates that the leaden splice case was overheated while being soldered closed.

Figure 24

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The photo below shows the unusual method by which a portion of the main cable was branched out into a separate feeder cable. Instead of splicing the star quads on a 1:1 basis between the two cables, the quads of the main cable were *split* into their component pairs and these were spliced onto the quads of the feeder cable in a zigzag pattern.

Figure 25

Figure 26

Here we can see one of the major drawbacks of wires which are insulated by means of a single layer of spiral paper ribbon ….

The red stuff is plain insulation tape, which was applied to the wires wherever the paper insulation was torn (or otherwise damaged) during the splicing process – and there was quite a bit of insulation tape on the splices of the small feeder cable, all of it on that side of the splices which belong to the feeder.

It's very likely that the core of the feeder cable was overheated during the baking process, which was intended to dry the core out prior to being wrapped and encased in a lead sleeve; overheated insulation paper has a tendency to become brittle and easily tear apart.

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Figure 27

This is the only bit of cable I was able to recover from a splice with its sheath; the cable stubs on all the other splice cases I opened up were so short that the sheaths slipped off the cores right away … and it's next to impossible to stuff a paper insulated core back in its sheath.

As one can see, the lead sheath is widened a bit at the end. This was done so that a special brown-colored tape could be wrapped in such a manner as to also cover a bit of the core *beneath* the lead.

This tape serves two purposes: 1) to protect the cable core from damage during splicing, and 2) to prevent a flashover between core and sheath in the event that vagabond currents from nearby lightning strikes were to be conducted by the sheath.

Both of the photographs on this page, as well as the two on the following page, show details of one and the same splice.

There are various details to be noted in the photo on the right; there is a mixture of group rings to be found on the spiral four quads – most are plain cardboard, while others have yellow insulation tape wound around them. This indicates that the splice case was opened for a rearrangement of connections at some time while still in service. One can also see a bag of desiccant wedged between the wires.

Figure 28

Figure 29

As may be seen above, one of the cables in this particular splice is different from the others; most of the wires have plain paper insulation without distinguishing marks, with an occasional pair with red or purplish-blue insulation. Cables of this design were manufactured in Austria only prior to 1931, and have twisted pairs (instead of quads) which are laid up in concentric layers. There is a single pair with colored insulation in each layer – this tracer pair is the one from which all other pairs in the layer are counted out. One wire of each pair is tinned copper (the "b" lead = ring), while the other one is bare copper (the "a" lead = tip).

Figure 30

I took a good dozen pictures of the twisted splices shown to the left and only in one was it even barely possible to tell the wires apart. The left-hand wires are both bare copper, while one of the wires on the right is tinned.

The twisted splices are in excellent condition, without the slightest bit of tarnish or signs of corrosion. This is rather remarkable when one considers that one of the cables is at least 80 years old.

The information presented up to now has concerned itself with the distribution and splicing of subscriber cables in high-density residential areas of Vienna (and Austria), as well as a smattering of information concerning different types of toll cables … the next few pages have photographs and descriptive text relating to subscriber distribution cables in low-density residential areas.

Burying telephone cables all the way from the exchange to the individual subscriber distribution boxes is only cost-effective in areas where a larger number of cables run in the same direction, and/or where the buildings are multi-level and multi-family. Such methods are not cost-effective in cases where single-family dwellings receive telephone service, and therefore such areas are served via aerial distribution cables.

The head end of any such aerial cable run is an outdoor cross-connect pedestal or cabinet, which may be any one of several types, depending upon how large an area is to be served and upon how thick the individual aerial cables are (aerial distribution cables are normally five, ten or twenty pairs each, subscriber drop cables are usually two pair).


Figure 31


Figure 32


Figure 33

The three most common types of outdoor subscriber cross-connect pedestals or cabinets in use today are shown above. The largest one can handle up to 800 pairs and is often used to split cables up, prior to their runs to pedestals or cabinets as those shown in the other two pictures. The pedestal shown in the middle can handle circa 100 pairs, and the cabinet on the right (mounted in a concrete mast) up to 200 pairs.

Referring to the subscriber cable cross-connect pedestal in the middle, readers can see a concrete pole stub to the left of the pedestal, as well as the side of the pole; attached to the pole is a slate-colored plastic pipe, through which the cables are fed up the pole to the next distribution point … as may be seen in the following pictures.

Here we have two ten-quad cables which were originally fed from the middle one of the cross-connect pedestals shown on the previous page; a third cable was later added, as is indicated by the third distribution box on the pole being of a more modern, lockable type (as if it wouldn't be easier to tap into a phone cable on the ground instead of 20 feet up in the air).


Figure 34

The feeder cables are simply connected to the distribution cables via screw-down terminals inside the distribution boxes – aerial distribution cables of up to 20 pair size are *not* normally spliced.

The distribution cables are of a type with an integrated messenger strand, which is molded into a separate polyethylene jacket and attached to the jacket of the cable by a thin, continuous web; such cable is commonly referred to as "figure 8" cable in the States.


Figure 35

The wires inside these self-supporting cables are "St" type III quads, with polyethylene insulation. The quads are protected by a spiral wrap of clear polyethylene foil, covered by an aluminum shield which has its own electrostatic drain wire.

This pole is another one used for distributing cables coming from a cross-connect pedestal. In this instance, the pole is also used to support and terminate two subscriber drop cables – the two cables sloping downwards towards the right in the picture.

Following standard practices, the two drop cables are terminated in their own tiny distribution boxes, as may be seen to the right of the slate-colored, vertical bit of plastic pipe on the pole.

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Figure 36

Sometimes it happens that a distribution cable is temporarily taken out of service – like the one shown here; the end pole to which the cable was originally attached had to be removed due to construction work on the plot of land on which the pole originally stood.

The bundled-up cable *isn't* secured to the pole in any manner and could fall on some unsuspecting passerby's head at any moment. I am unaware of any facts which would make this sort of thing a standard practice in Austria but, as readers are well aware, not everything which happens in real life is in line with approved standards.

Although next to invisible in the photograph, the bare ends of the wires in this cable were not insulated when the cable was bundled up, but rather only fanned out in order to prevent short circuits.

This is what happens when the folks from the Austrian PTT and homeowners don't really talk to each other before the drop cable is installed ….

Not only is the termination box dangling away from the wall & upside down, so that rain water could enter, but they also had to chop a bit out of the gable to make room for the drop attachment. A *really* smart bit of work on someone's part.

Figure 37

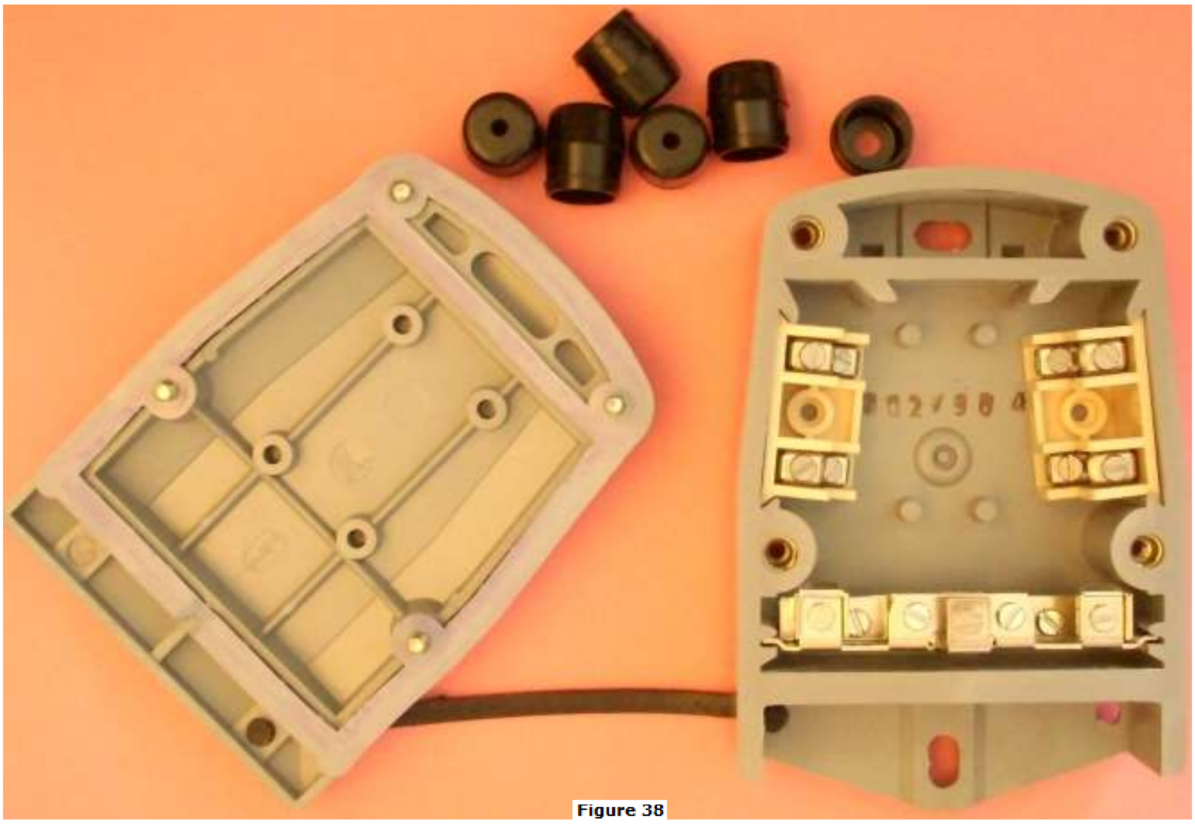

Figure 38

The photograph above shows the various pieces of a NOS subscriber drop terminal. The housing is made of a tough phenolic resin reinforced with stiff fiber material to make it very rugged. The cover is supplied with a silicone rubber gasket, and the punch-out's at the bottom are provided with a variety of cable entrance plugs, in order to make the terminal more or less moisture proof. The screw terminal blocks are slide in – slide out, although they're provided with a screw hole for fastening.

Figure 39

The clamp strip at the bottom of the terminal not only holds the cables securely, but is also intended for terminating the electrostatic drain wires (for use as a ground), way back when, at the time when party-line service was still available.

The picture to the left shows one of these cable terminals with a two-pair drop cable and two subscriber entrance cables.

The *really* neat thing is that the Austrian PTT didn't bother to remove the insulators from the original mast when service was converted from open wires to cable … it's relatively rare, although not *entirely* impossible, to find remnants of open wire service in and around Vienna if one keeps one's eyes wide open and looks at *rooftops* instead of sidewalks and house façades while walking down streets.

This is another nice example of an old, open wire line where the PTT didn't bother to remove everything when converting to cable service.

It is very interesting that the original buried cable terminal not only survived, but that the door is open as well. If one looks really carefully, it's possible to see the remains of the cable protection (fuses and carbon discharge blocks) still inside.

Figure 40

Figure 41

This is a *disused* and open cable terminal box (where buried cable was connected to aerial cable) which I once discovered in an outlying district of Vienna.

The cable terminal is for 20 pairs in this case, complete with the grounding bus bar for party-line service. It's just possible to see that the fourth pair of terminals on the left side is equipped with party-line distribution strips, such as those shown on page 43.

At the end of this tale, a brief look back at underground telephone cables… the photograph below is one of my all-time favorites when it comes to splices in buried cables.


Figure 42

Yes – that is but a single cable with two splices not more than eight feet apart … as can be seen, one of the exterior splice cases is of the old, cast-iron type, while the second one is of the newer plastic type. Telecom Austria didn't rectify this situation by cutting out the two splices and replacing them with a single one before this cable was buried again.

The upper left-hand photo on page 13 shows a leaden splice case which is physically "wrapped" around a corner in a manhole.

Here is another way of dealing with splice cases … heaven knows why anyone would place a splice beneath a single cable holder, instead of between two, which would be standard practice.


Figure 43

Inside the Viennese Toll MDF

The MDF shown on pages 37 & 38 is of a type commonly used throughout Austria, which usually consists of one or more rows of frames, each with a "horizontal" and a "vertical" side; the so-called system cables from the switch end in numerical sequence on terminal strips mounted horizontally on one side, with the distribution cables coming up from the cable vault terminated in sequence of the cable numbers and pairs on terminal strips mounted vertically on the opposite side.

Decades ago, *very* small exchanges got by with but a few frames of MDF, in some instances with so few that the frames were attached to a wall for support and both the "horizontal" and "vertical" sides were found on the front of the frames.

The toll exchange in Vienna, and the one in the city of Graz in the province of Styria, were the only ones which had (respectively have) an MDF which is constructed along entirely different lines … in these instances, the cable terminals of the outside plant carry so many pairs per terminal that these are mounted in equally spaced rows of frames (which allow access to the front *and* rear sides of the terminals), where the separate rows of frames are linked to each other by means of overhead wire racks, giving the MDF the appearance of a bower … in Austria, this is also the official telecom idiom for them: bower MDFs (this is also the reason why one can, very literally, be *inside* this MDF).

Figure 1

The photograph to the left was shot looking down one of the corridors of the toll office MDF in Vienna, towards the front of the room; there are cross corridors at 1/3 and 2/3 the length of these corridors.

The cable terminals which form the "walls" are designed to handle cables with up to 720 pairs each; from top to bottom, these cable terminals stand a bit over 7 feet tall, with 360 pairs terminating on each side, whereby each side is subdivided into two separate legs or wye branches.

I really got a kick out of seeing the two temporary terminal blocks strapped to the upright on the left edge of the picture ….


Figure 2

This photograph gives an impression of how the cable terminals are lined up and also shows one of the cross corridors previously mentioned. In Austrian PTT terminology, these cable terminals are simply designated as being "type T" – available in the sizes 360 and 720 terminal *pairs*.

As already mentioned, the ones in the Vienna toll office cater to 360 *quads*. One could think that the terminal pairs are simply numbered from 1 to 720, starting in the upper left-hand corner on one side and finishing in the lower right-hand corner on the other side.

Nope – things aren't done *quite* so simply … when viewed from the correct side (in this case, the side of the terminals as shown in the fore-ground), the terminals begin with # 1 in the upper left-hand corner of the left leg and continue on down, in a zigzag pattern, until #180 is reached in the bottom right-hand corner of the left leg. However, terminal pair # 181 *isn't* the top left-hand pair on the other leg, but rather the top left-hand pair on the opposite side of the *same* leg. When terminal pair #360 is reached, the numbering continues with terminal pair #361 in the upper left-hand corner on the front side of the right-hand leg, and so on. It may be of interest to note that the terminals serve cables of varying diameter (which obviously have more or fewer quads).

As readers can also see in the photograph, not every pair of every cable terminal is in use, and it appears that the last two cable terminals have the terminal plates reversed, when compared with the first three – to wit: the ones on the left have four plates of 40 pairs each from top towards the bottom, with one plate for 20 pairs at the lowest position, while the last two have the plate with 20 pairs in the top left-hand position. The reason is that the front and back sides of these terminals are constructed differently. The first three cable terminals present themselves with terminal pair #1 in the upper left-hand corner, while the last two have terminal pair #361 in the upper left-hand corner in this view.

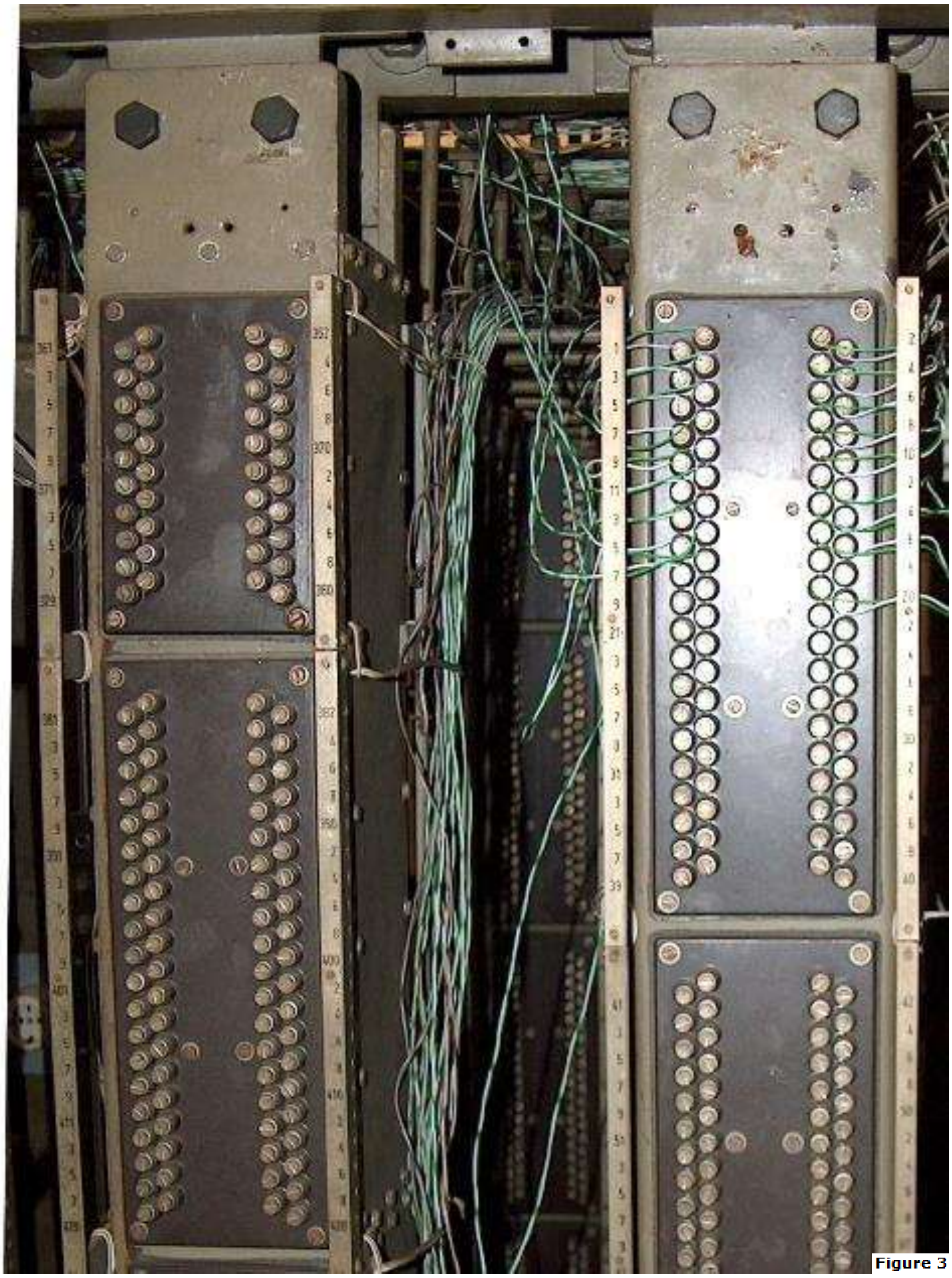

Figure 3

One normally expects the "a" lead (tip) of each pair of cable wires to be the first terminal of each vertical pair of screws, but here, the "b" lead (green color = ring) is on the top position; by definition, the lighter colored wire (in this case white) is normally viewed as being the "a" lead. However, referring back to an old textbook (1954), I find that the upper (inboard) terminal of each pair on these cable terminals was defined as being tip … compare the color sequencing of the jumpers here with those shown on page 41, where the upper terminal of each pair is white – the vertical sequence *there* is tip/ring, tip/ring.

Some of these cable terminals have been in place since the toll exchange was opened in 1927; it takes time for rust spots to form on painted iron which has always been indoors.


Figure 4

This picture was obviously shot from one of the cross corridors and gives a very good view of the overhead wire racks.

If readers examine the photo in detail, one can see that not all of the jumpers are of the "digital switch" green-white pairs, but rather that a goodly portion are of the older, brown-white pairs … this was intentional, since at the time the pictures were taken (circa the year 2000), some portions of the toll exchange were still analog switching equipment, not yet replaced with (modified) Nortel DMS switches.

Figure 5

This photograph is simply a snapshot of the enameled signs on the door to the MDF room. The upper sign reads "main distributer" (aka MDF), and the lower one reads "entry forbidden" (well, yes, but that didn't apply to the employee of Telecom Austria who was kind enough to take the snapshots used in this tale).

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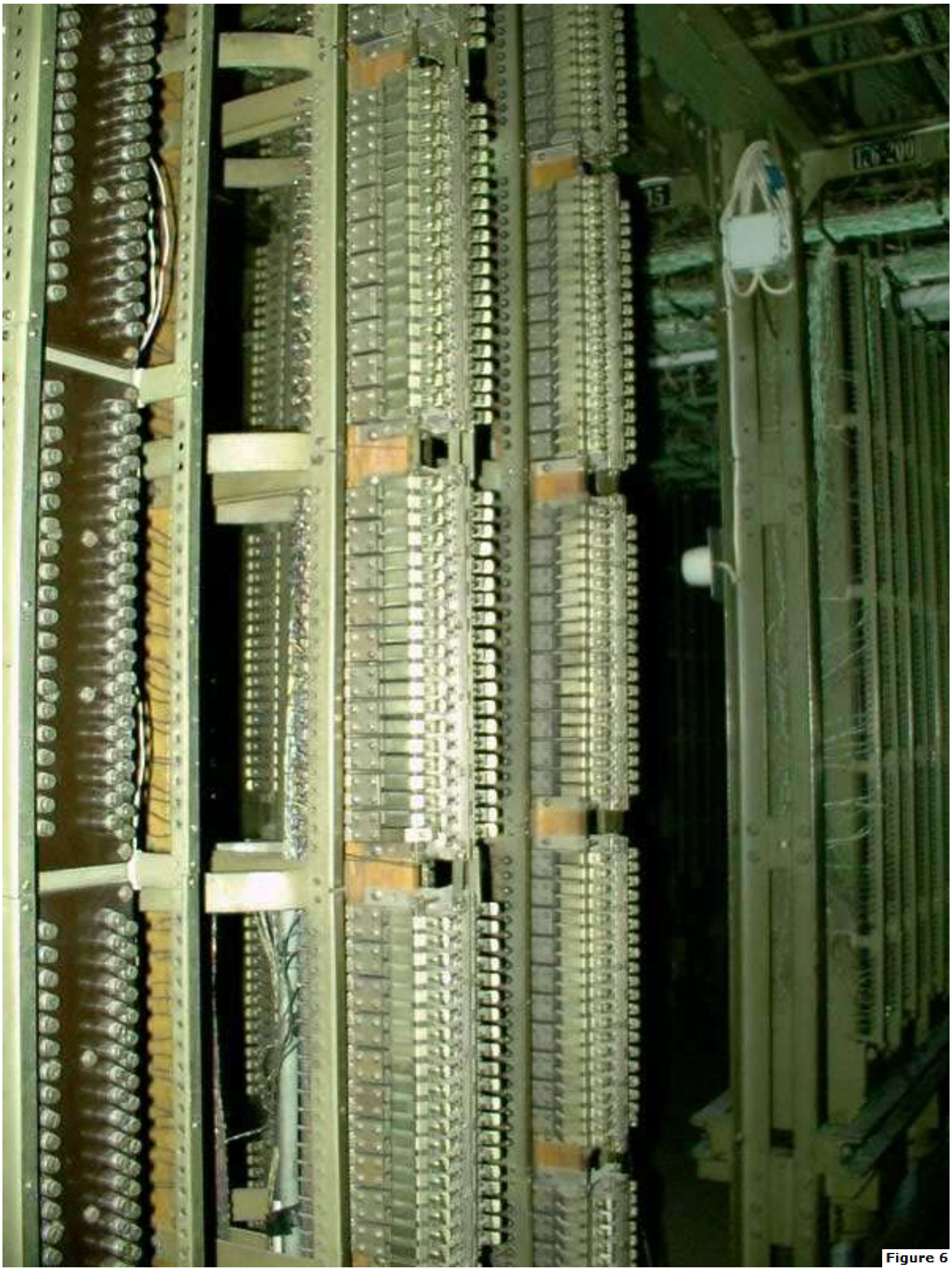

A *very* rare find on the bower MDF in Vienna: a type “T” cable terminal which is still equipped with its original lightning and sneak current protectors from 1927.

Figure 7

This is the "other end" of the bower MDF, where the system cables are terminated. The cable terminals here are 8 pairs wide by 20 pairs high (= 160 pairs each), with solder lugs on the back and screw terminals on the front.

Readers may note that there is a small fixture, surrounded by red paint, just above and to the left of the power outlet on the upright … this is nothing more than a *very* big grounding jack, used in conjunction with a small, 60 VDC test lamp. Red = ground? In telephony in Austria (and other countries) *yes*, because positive and negative battery are designated by the colors red and blue (respectively), and the positive terminal (red) of the CO battery is grounded, giving an on-hook line voltage of minus 60VDC when measured against any local ground.

Here, readers can see that the individual bays of the overhead wire racks were numbered from *right* to *left*.

The photo shows the first of several corridors, with the terminal banks for the system cables on the right.

Figure 8

Figure 9

It’s common practice to have the MDF located on the ground floor, as nearly as possible directly above the cable vault; therefor readers may find it surprising that the toll exchange MDF is located on the third floor (if my information is correct); anyway, the cables are supported by rows of “I” beams on all floors, and are thoroughly sealed where they pass through the floors and ceilings (to prevent the spread of fire via the chimney effect, as already mentioned elsewhere).

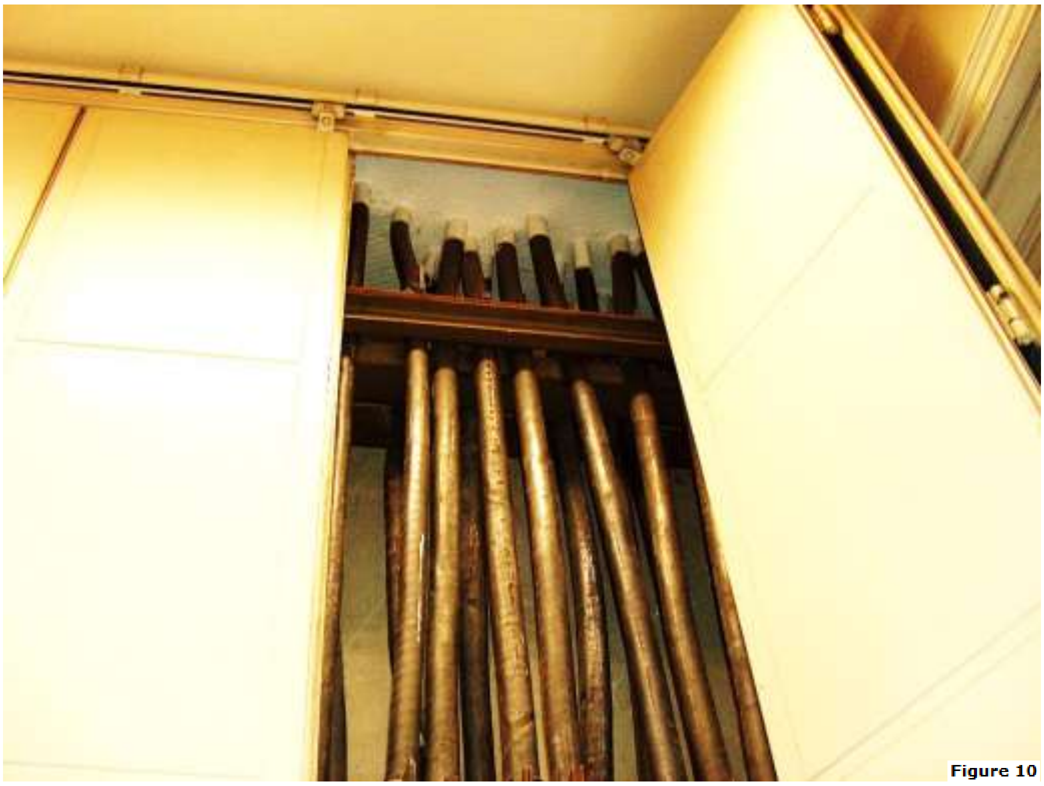

Figure 10

The Vienna toll MDF room is crammed full of cable terminals – from what I heard, there is very little space for anything else, and therefore the toll test boards are located elsewhere in the building. However, there is enough room on one of the walls for a small, 20 line magneto wall switchboard – it's of a very similar design as the one shown on page 38, but this one is a reconstruction which uses old parts.

Figure 11

By no means does this little magneto board have a line to each and every local exchange in Vienna, but it is connected to the most important ones, among them the old Vienna stock exchange (where the international toll transit exchange was located), the old Viennese military arsenal (where a large microwave tower and satellite dishes [for TV transmissions] are to be found) and to the exchanges "Zollergasse" and "Taubstummengasse," where most of the local plant test boards were located.

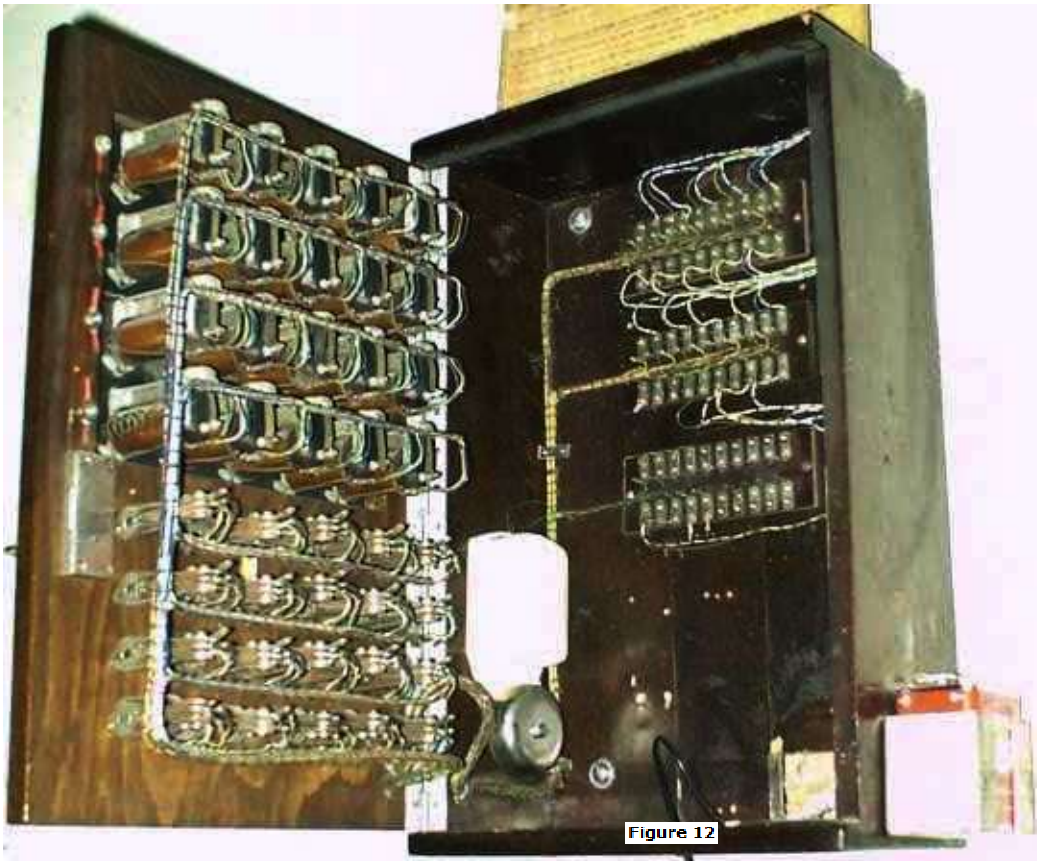

Figure 12

The snapshot above shows the guts of the magneto switchboard in the MDF room. This switchboard, as well as the one shown on page 38, required an external magneto telephone (wall or desk model) as the operators' set. This "reconstructed" one has the batteries for the drop-actuated DC bell bolted to the outside.

Figure 13

The photograph to the left is a distant shot of the microwave tower on the grounds of the old military arsenal in Vienna; the small, square towers below and to the right of the microwave tower belong to one of the original arsenal buildings.

Not seen in this photograph is the fenced-in area to the left of the microwave tower, where the satellite uplink and downlink antennas are located; Telecom Austria is responsible for TV audio and video feeds on behalf of the Austrian Broadcast Service, which itself is responsible radio and TV broadcasts in Austria.

It took me a while, but I managed to find a small snapshot of the antenna farm; I have included it here for the sake of completeness.

Figure 14

A Fire Department Telephone Cross-Connect Cabinet

Around the same time as Telecom Austria was busy with their little cable pull, as described in the tale "Manhole Adventures," the Viennese fire department was forced to slightly readjust their outside telephone plant (emergency magneto service between fire brigades) by moving a cable cross-connect cabinet by roughly 75 feet.

Moving the cabinet meant that two of the original cables would be too short and the others too long. Granted, it doesn't sound like a big deal, but the "juicy" bit was that four of the original cables had paper-insulated wires under a lead sheath – and just to make things complicated, the lead sheath of the cables had a protective layer of polyethylene, leaving them with the appearance of being modern P.I.C.

Another interesting fact about the relocation was that the work was performed by personnel from Telecom Austria, under contract with the fire department. The only work which an employee of the fire department performed was ringing out the cables and installing the jumpers in the new cabinet.

As before, it wasn't possible for me to be in two places at the same time and so I didn't document repetitive work.

Figure 1

When confronted with a whole bundle of cables and isn't sure which are the correct ones, then the best bet is to use cable locating equipment. In the photograph to the left, a technician from Telecom Austria is busy connecting a locator tone generator to a pair in one of the cables sought. The cabinet in question is the old one, which was completely removed when the new one was wired up.

Figure 2

After having located the proper cables, it was only a question of gaining access, and the fastest, although certainly not the neatest, way of getting at the cables was to simply pound on the plastic conduit with a big hammer until it splintered and broke apart. The base of the new cabinet, with two of the new cables entering it, may be seen above the man's back.

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Figure 3

Ah, sweet success at last! The cables have been "liberated" from their conduit and will soon be cut for splicing into some new P.I.C.

Of the two cables in the conduit, one is P.I.C. and will be terminated in the cabinet directly, while the other one will require splicing into a piece if P.I.C. before entry. The fifth cable which will enter the cabinet is the slate-colored one underneath the two black cable loops in the lower middle of the snapshot.

Readers may take note of the fact that the cables leading into the new cabinet were laid in with a loop as spare length – this was a wise idea, as will be seen later.

In the photograph to the right, the slate-colored cable mentioned has already been cut and partly prepped for the splicing operation.

The buildup of this cable type is rather interesting: paper-insulated wires, beneath a lead sheath; the lead sheath has one layer of jute rovings covered with bitumen, over which a single steel tape is wound. The steel tape itself is then covered by a polyethylene sheath.

In this instance, the steel tape has no function as a protective cover but is rather used as an electrostatic shield – which is certainly a good idea, considering that there are a few power cables running parallel.

Figure 4

I have already mentioned the fact that Telecom Austria uses ID rings colored purple, orange or off-white to mark their different types of cables … as may be seen in the photograph above, the fire department uses ID rings in red. (After all, what color could be more appropriate?)

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Figure 5

In the snapshot to the left, two cable splicers from Telecom Austria are busy prepping the end of one of the "extension" cables at the far end of the new cross-connect cabinet.

At this point, the rubber boot (which will later form one of the seals with the splice case) has been pushed onto the cable, and the men are busy fanning out the spiral four quads in the polyethylene-insulated cable (P.I.C.) These quads have the individual wires insulated in the following colors: red, green, blue and translucent. The tracer quad from which counting is begun in each layer is the one where the conductor normally insulated with translucent polyethylene is insulated in black instead.

Figure 6

In the snapshot to the right, one of the splices has already been finished, but the second one is just getting started … here, we see a cable splicer from Telecom Austria prepping the second old cable to be extended.

The inner (lead) sheath is to be seen, while the other protective covers have already been removed. Lying on top of the finished splice is the P.I.C. which was being prepped in the previous photograph.

These older cables, with their paper-insulated wires, were a bit of a headache for the splicers. Readers may find the solution to this headache to be veritably archaic, considering that these photographs were shot in the 21st century (and not a hundred years earlier).

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Figure 7

In the photograph above, the old cable has been prepped for splicing. Since the splicers were a bit exuberant in removing the protective covering from the old cable, they overdid things a bit and had to shrink a length of sleeve over the exposed lead sheath, almost as far as the bare cable core.

The sealing boot has also been installed onto the cable, and the outer quads of paper-insulated wires have been folded back, exposing the two quads in the core. Interestingly enough, these two quads are color-coded as if they belonged to a toll cable, as explained in a previous tale.


Figure 8

Referring to the lower photograph on the previous page, readers should closely observe what the splicer on the right is doing. Yes – he is slipping a *cardboard* sleeve onto the paper-insulated wire (and he will be doing so for all of the wires belonging to the two quads in the cable core). The reason behind this is that the core wires in the old cable were of 1.8 millimeters diameter, while all of the wires in the P.I.C. are of 0.8 millimeter diameter; the difference is larger than any single, mechanical splice (such as a TYCO® Picabond® or a MS²® from 3M®) can handle, so the splicers were forced to resort to the hoary old splicing method of yesteryear.


Figure 9

After the cardboard sleeves were placed on the 8 wires in the core of the old cable, the appropriate wires of the old and the new cable were stripped, the bare ends were twisted together and soldered (with an electric soldering iron powered by a portable generator), as may be seen above.

It's rather amusing to see exactly how much faith the cable splicers had in their own handiwork, and in the supposedly hermetic seal afforded by the plastic splice case; a layer of tough PVC foil is wrapped around the finished splice. The lengthwise seal is a piece of double-sided self-adhesive tape, and the ends are simply wrapped around the cable and then attached with the aid of some good old, PCV-based, insulating tape.


Figure 10

All eight cardboard sleeves now protect the soldered splices of the core wires belonging to the old cable, as may be seen in the photograph above.


Figure 11

The remaining quads from the old cable, being of the same diameter as those of the "extension" cable, were spliced using MS²® splices from 3M®.

The splice crimping head is of a smaller size than that used on the cables of Telecom Austria – the one used here can splice a maximum of 2x 5 quads simultaneously; the cables have 20 quads each, 18 of which will be spliced with MS²® splices.

As can just barely be seen here, the pairs of the quads are translucent & red (tip and ring of pair 1), green & blue (tip and ring of pair 2). The tracer quad has red & black as pair 1, but contrary to *Bell* standard practices, red is *tip* (since it's the "lighter" color when compared to black).

One small-sized bag of silica-gel was wedged between the wires, as is standard practice when they are paper insulated, and the splice then wrapped in clean cables splicer's muslin, as may be seen here.

Afterwards, the splice case was placed over the splice, the two halves locked together with 16 quarter-turn nylon fasteners, the cable boots pulled over the securing lips on the ends of the case, and the entire splice then wrapped in plastic foil.


Figure 12


Figure 13

While the splicing of the extension cables was in progress, one cable splicer was busy prepping and terminating the various cables in the new cross-connect cabinet.

While the old cross-connect cabinet contained a mix of cable terminals, four with screw connections and one modern one using a group of IDC punch-down connecting blocks, the new one only contains IDC punch-down blocks, manufactured by the German firm "Krone" ("crown" in English).

The electrostatic shield (copper in the case of the P.I.C. and steel in the case of the one PVC cable laid in) of all of the cables will be terminated on a separate grounding punch-down terminal block. In the photograph above, the cable splicer is busy tying down and securing the second layer of quads in one of the new cables.

Figure 14

As may be seen to the left, the first of the cables is being adjusted to its final position, prior to being clamped to a securing rail and the wires being fanned out and punched down on the IDC terminal blocks.

These terminal blocks are clipped into "U"-shaped channels which not only hold them securely, but also leave plenty of space behind the terminals for running the wires up.

The hand in the foreground, holding the door open, is mine (the door kept falling closed because there was a bit of wind blowing).

Each of the five IDC punch-down connecting blocks in the picture to the right only terminates 4 quads (8 pairs), although they're designed for 10 pairs. One can just barely make out the gap between the second and third quad in each row; the quads were installed in this manner simply to make things symmetrical.

The red terminal block in the lowest position on the left-hand side is intended for the termination of the electrostatic shield of all of the cables.

Red = ground? This is just as valid for a magneto telephone network (which doesn't rely on a CO battery power source) as it is for any automatic telephone network in most of Europe.

Figure 15


Figure 16

Oops – looks like the cable splicer made a mistake … the grounding terminal block was obviously in the way of the cables which are to be terminated on the left-hand side.

The most interesting thing, though, which may be seen, is that an employee from the fire department was already busy ringing out the newly terminated cables. The headset and the associated test set may be seen resting on top of the cabinet; if readers look *very* closely, they will see that the test set is plugged into, and thus bridged between, *two* different pairs – in order to be able to determine if the jumper lists are correct or not, before the jumpers were punched in.

There isn't much to write, concerning this photograph, other than that the fire department employee is busy ringing out further pairs (also in a bridged configuration).

For reasons no longer known, I didn't take any photographs of the new cross-connect cabinet with the jumper wires in place … possibly there was no unexposed film left in the camera (once again).


Figure 17

Figure 18

As may be seen on the left, I had cut out two of the cable terminals in the old cabinet for my collection of such things.

The *nasty* bit came when, although I had first asked for, and *received*, permission from the fire department employee to go ahead and cut these terminals out, this very same guy later on wanted to verify a few cross-connections in the old cabinet; he was rather peeved that this was no longer possible.

The two cable terminals which are laying on top of the cabinet are of the types common in the 1960s & 1970s; the two terminals in the upper middle and right positions inside the cabinet are also from the 1960s, and the punch-down IDC blocks in the lower middle of the cabinet became common in the 1980s. While this isn't obvious or plainly visible, the IDC terminals are of the same design of those installed in the new cabinet. These are constructed in such a manner that the wires are punched into the terminals along the extreme top and bottom, while there are dual test points, in a row, along the middle of the terminals. These blocks also have small, integrated bridle rings on both ends.

The snapshot to the right shows the new cross-connect cabinet in place, with a new CATV repeater cabinet next to it – these two were in the same configuration at their old location.

A few pages back, I wrote that it was a good idea to leave spare loops of the cables buried behind the cabinet. The next photograph shows exactly ***why*** this was such a very good idea ….

Figure 19


Figure 20

Yep – some truck driver simply wasn't paying close attention to what he was doing while backing his rig up; he managed to completely flatten the cabinet and damage it beyond repair … so much work for the birds, just because someone didn't know what side-view mirrors are good for.

BTW – if readers compare this picture with the lower one on the previous page, it can be seen that the door of the CATV repeater cabinet is no longer facing towards the camera. This is because the construction gang finally read the blueprints as to how the park was to be laid out when finished – both cabinets would've had their doors facing backwards, into the middle of some shrubbery, if left as originally installed.

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As a very last afterthought, and because I just happened to stumble upon the photograph while looking for something else, here is a snapshot of the *old* fire department cross-connect cabinet in all its glory while being rung out by an employee from the fire department, a few weeks before the move described in this tale began.

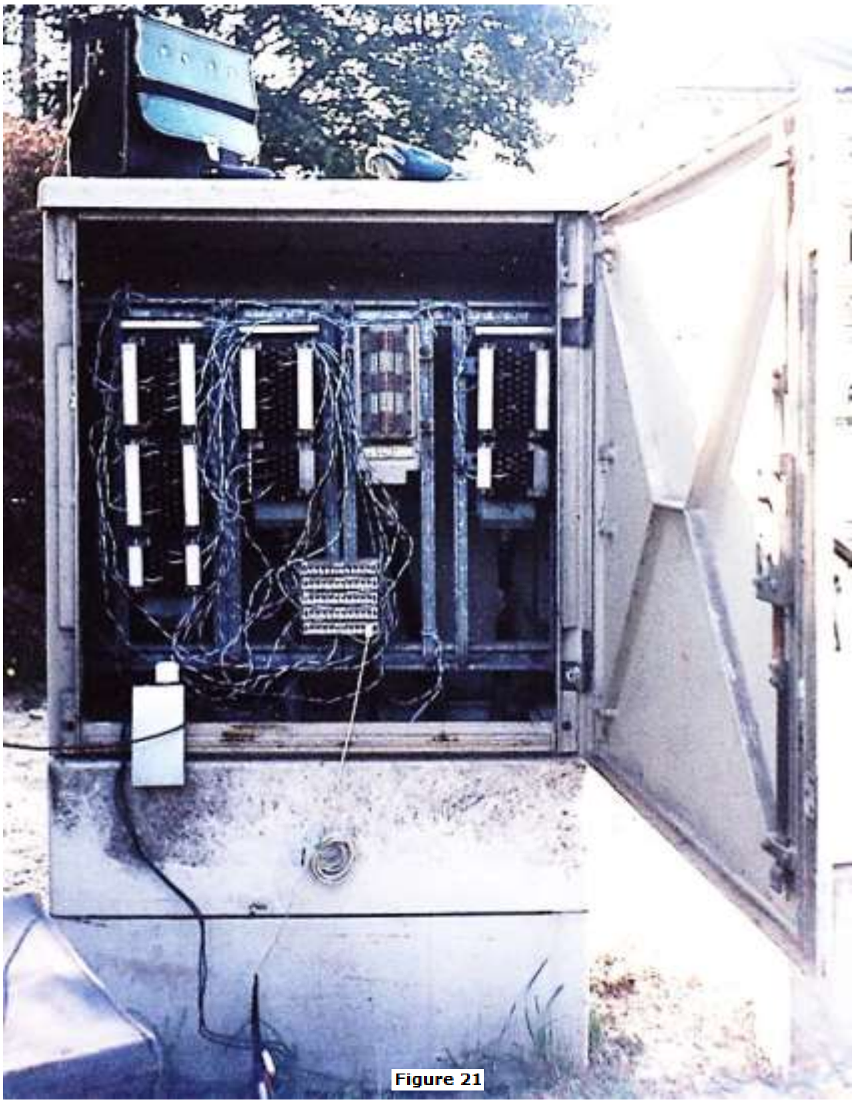
Figure 21

As is painfully obvious, the Viennese fire department wasn't overmuch concerned with such fine and subtle details as stringing the jumpers through the bridle rings in a neat and tidy manner.

The Demise of Electromechanical Switching

It's said that a picture is worth a thousand words, so here are some photographs of the demise of an electromechanical telephone exchange in Vienna … (however, a few words will be written, as appropriate).


Figure 1

After the cutover to a digital switch (either Nortel **D**MS or Siemens **E**WSD, known as OES-**D** and OES-**E** in Austria), recovery of floor space was a prime objective in the various exchanges – the old switches were simply scrap and they were treated as such. In some instances, most notably the Vienna toll exchange, entire floors of what once housed switching equipment have been converted into luxury apartments … personally, if I were wealthy, I'd have bought one of those apartments – but complete with its original contents.

Figure 2

With the old switching equipment in such a state of disarray, there was no hope of salvaging anything in useable condition; wire bundles and cables were simply cut through and the gear unscrewed from the frames and left to fall to the floor as it may … nothing more than lots of copper, iron and a small tad of precious metals in the relay contacts.

Figure 3

Dinged up, trampled upon – simply junk of yesteryear, not worth preserving. By the time I received the photographs of this particular site, it was too late to contact anyone or to do anything more than to dry a wet eye.

Speaking of electromechanical switches: back in the early 1980s, my mother owned and operated a small copy shop in Vienna; the CO serving the district was already in its death throes and often malfunctioned. We kept receiving calls intended for others … it was easy to distinguish such calls from intentional calls to the shop – the *unintentional* ones caused the phone to give half a ring, then a pause and then normal rings. She complained about these nuisance calls, but the Austrian PTT wanted *her* to pay for the repair. She refused to do so, and **I** did something nefarious instead.

Whenever the phone gave off one of its unusual rings, I answered with a noncommittal "Yes" or "Hello." I accepted appointments from some of the parties involved, and accepted orders for goods from others … the Austrian PTT was then snowed under with complaints – and made the necessary repairs without mother having to pay for them (insert a *very* evil grin here).

Figure 4

One of the first things that was done when a portion of an old switch was retired from service was to sever the interconnect cables in such a manner as to preclude *any* chance of reconnecting the equipment – sort of burning ones bridges, in a technological sense of the word.

Figure 5

These two photographs show the remains of a crossbar exchange, found at one of the largest junkyards in Vienna.

Figure 6

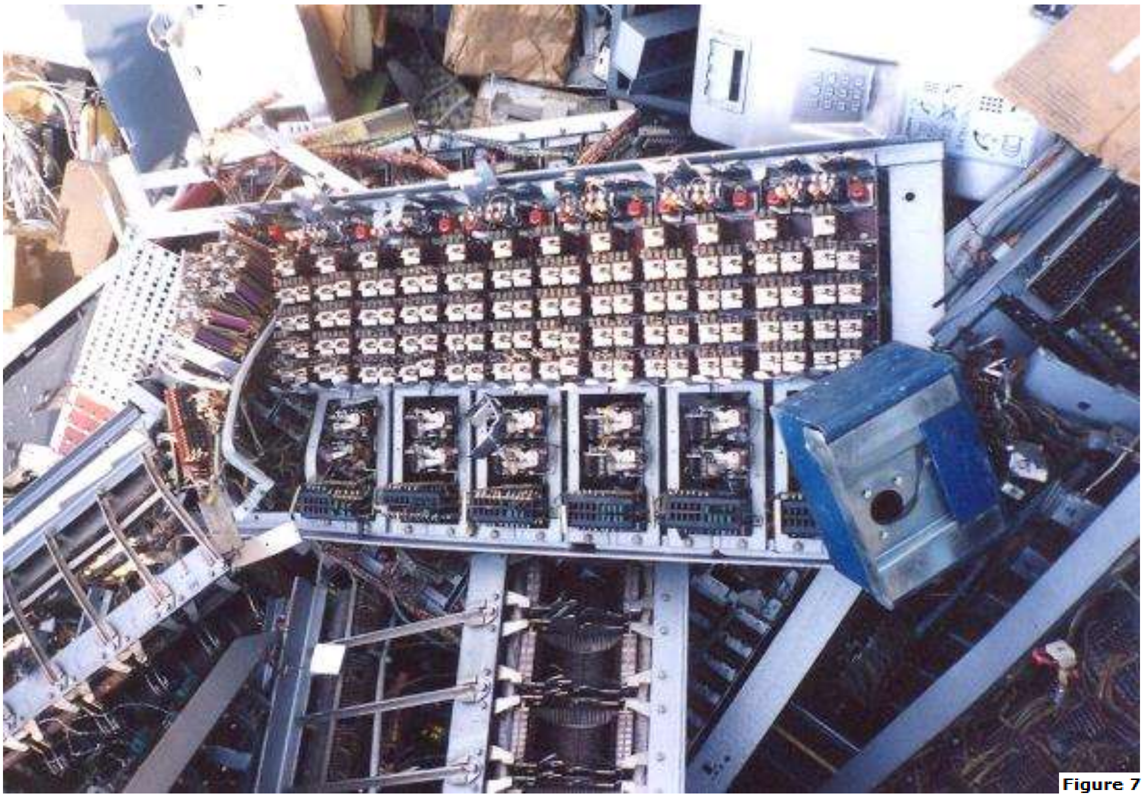

Figure 7

A sad, sad sight indeed – the frame in the center of the photograph above is party-line equipment, each individual unit in the frame supported 2 x 4 subscribers … and, in the photograph below, the main feature are some model 1980 pay phones, surrounded by more frames of party-line equipment. The junkyard was legally bound to *destroy* this equipment, so it wasn't possible to buy so much as an ounce of the stuff.

Figure 8

Figure 9

The stuff in the background of the upper photograph is miscellaneous electromechanical switching gear; the boxes in the foreground contained NOS bits and pieces of cellular telephone base stations – fresh out of storage, loaded onto trucks and shoved off the back end at the junkyard (this stuff was outdated, from the mid-1990s). The lower photograph is just a pan to the right from the photograph above – literally 100s of cubic feet of twisted-up switching equipment, all for the birds.

Figure 10

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A Brief View on Outside Plant near Helsinki, Finland

It was in May of 2009 that I spent a fortnight in Finland while on a course of hands-on, practical technical training for the Brazilian Embraer ERJ 170/190 series of commercial passenger airplanes at Finnair, in order to obtain the necessary endorsements on my aircraft maintenance license (as an avionics engineer).

The hotel in which I stayed was on the outskirts of the city of Vantaa, not all too far from the airport, and my training schedule was such that I occasionally had some free time in the earlier morning hours or in the later afternoon. Some of this time was spent investigating the immediate vicinity on foot … and when underway, I always like to keep my eyes wide open for a look at local telecom practices, insofar as these are visible.

As such things go, the environs near the hotel were not at all disappointing, because the outside plant consisted of aerial cables.

Figure 1

The first view of the aerial cables I found is shown above. The feeder cable peters out in a splice case, which is practically nothing more than a bit of large diameter, corrugated plastic pipe. The cable stub, which runs to the distribution box (which is hanging on the pole rather haphazardly), exits the splice case from the *left* end, while there are two cable *stubs* exiting on the right-hand side … these stubs are sealed off with PVC insulation tape. It appears that 5 or 6 subscribers are terminated at this particular distribution box, which is obviously of an older design.

Figure 2

This is a better view of the splicing case shown on the previous page. The method by which the messenger strand is attached to the pole is unusual; the eye-bolt is offset from where one would normally expect it to be attached to the pole by 90°, thus placing an unnecessary strain on it (especially when one considers how long, frosty and severe winters are so far up north).

I really like this snapshot, because one can see a wasp homing in on the pole, heading for one of the many small holes burrowed into the wood – the pole is literally pockmarked with such insect holes.

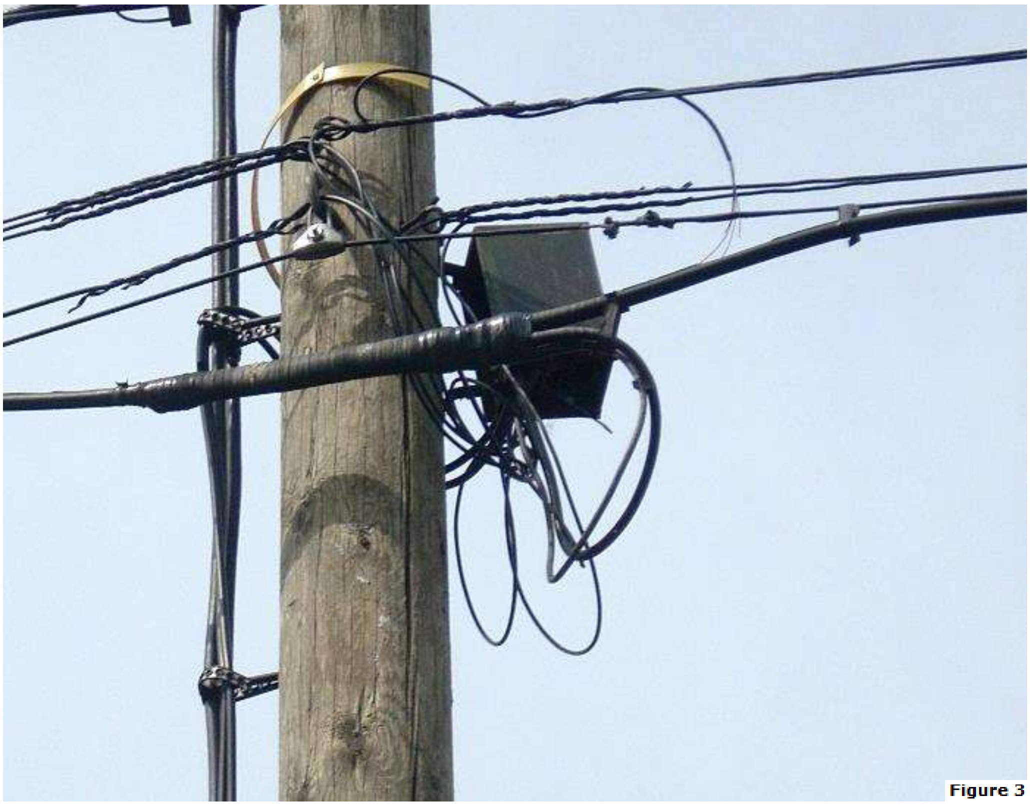

Figure 3

The Finnish PTT doesn't really seem to apply any specific standard when branching and splicing cables. In this instance, the entire splice is simply wrapped with insulation tape, with the insides possibly filled with a moisture-proof jelly or putty.

One of the subscriber drops at the top right on the pole has been disconnected, but left in place for future use. The drop cable contains four conductors; if I recall correctly, the colors are red, blue, black and yellow and the wires are solid copper, roughly 20 AWG, arranged as a spiral four quad. The sheath is very thick for the cable size (the outside diameter of the cable is roughly equivalent to a number two pencil) and appears to carry the greatest part of the mechanical load.

Figure 4

The *other* end of this particular distribution run is fed by an underground cable. The feeder cable branches out into two smaller cables, one of which is spliced after exiting the "octopus" style splicing case.

In this instance, the cable splicing case is the closest thing to a standard that I saw – a simple piece of plastic pipe with two nice cable boots … and here, too, the eye-bolts are offset by 90°.

This photograph shows another underground feeder cable, which in this case is split into three distribution cables and one stub to the distribution box on the opposite side of the pole.

As can be seen, at least two of the distribution cables are spliced to stubs exiting the octopus splice (this appears to be a second cable splicing standard, because the likes are also to be seen on the previous page).

The in-line splices are, once again, simply wrapped with insulation tape and are also attached to the messenger strand with tape, instead of something more robust, like a tie-wrap or a cable clip.


Figure 5


Figure 6

A second view of the distribution setup shown above ….

The octopus splice for the feeder cables is attached to the pole with a single tang and lug – despite its obvious weight. The subscriber distribution box is properly attached to the pole here, with two lag screws, so that it doesn't sway around in the wind.

This photograph also makes it obvious that the poles are joint use and also carry electrical power cables and the wires for the street lights.

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Figure 7

Finally, a more modern subscriber distribution box (!). And *another* one of those “standard,” taped, break-out splices. It rather looks as though the stub cable wound up being a bit too long, and this raises the question as to why this should be so? Alas, I wasn’t able to find anyone to ask, but one could almost believe that the Finnish PTT has folks who only splice cables and stubs, and other folks who wire up distribution boxes and subscriber drop cables. At least, I can’t come up with a better explanation.

There seems to be plenty of reserve for future growth at this particular pole, but the opposite is actually true – many subscribers have given up their land-line phone in favor of a cell phone, thus leaving very many spare pairs.

The feeder cable is much thicker than an average mans’ thumb, and the cable stub exiting the octopus splice isn’t really much thicker than the subscriber drop cable. The folks from the Finnish PTT must have had fun trying to seal those measly little cables at the bottom of the octopus splice case.

Figure 8

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Figure 9

Although one might think that the photograph to the left is simply another view of the previous pole, this isn't so.

The stub from the feeder cable is thicker in this case, and the one and only subscriber drop cable has, literally, dropped to the ground – because the house which it once served was in the process of being torn down when the snapshot was taken.

Being a *really* determined collector of all things telephonic, I walked a mile (no, not for a Camel®, although I am a heavy smoker) to reach a hardware store, where I bought a pair of strong diagonal wire cutters and snipped a few feet of this drop cable off for my collection … unfortunately, I can't remember where I put it after I got home.

Figure 10

This photograph shows a portion of the house being torn down … although barely visibly here, the object inside the red circle is a telephone wall jack (which also became part of my collection).

If readers are wondering why there is so much sawdust lying about, the answer is very simple: the stuff was used as "poor man's" thermal insulation between walls resp. between attic and ceiling, instead of fiberglass mats.


Figure 11

The subscriber drop terminal on the front of the derelict house.

I wanted this for my collection as well, but there was no ladder or other suitable climbing aid on hand, and I simply *wasn't* going to walk back to the hardware store and buy a 10 foot ladder as well. Instead, I hoped that the box would become accessible when the wall was torn down, but when I came back the next day, not only was the wall gone, but everything *else* as well, except for the foundation and basement.

Some you win, some you lose, and some are just rained out ….

One thing I am always thankful for is when the local PTT forces manage to forget to replace a cover somewhere.

The situation shown here is rather interesting: there is a 4 (or 6?) pair feeder cable running up the pole, and the distribution box currently serves but a single subscriber.

One wonders if it wouldn't have been less expensive to supply service from some other distribution point.


Figure 12


Figure 13

A very nice, albeit slightly fuzzy, close up of the open subscriber distribution box from the previous page. The connection strip looks like some sort of "plain Jane" barrier terminal strip, and it obviously has no more than twelve screw terminals. Possibly, though, sneak current fuses are installed, owing to the unusually wide gap between the terminals on the left and right sides. It's a sad thing that TCI doesn't have any members living in Finland, because then it would've been possible to obtain 100 percent correct data on such things.

Naturally, I didn't spend *all* of my free time running around this one small area; I also took the train into Helsinki proper a few times and there, too, kept my eyes peeled. Unfortunately, outside plant in downtown Helsinki is all buried – but at least I found one street torn up so that the various types of ducting used (for all sorts of cables) were visible.

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Figure 14

Here we have a nice example of modern, plastic conduits next to older, cement conduits which remind one of sewer pipes. As can be seen, the latter didn't hold up too well during excavation.

At the very least, the two cables which may be seen at the right-hand end of the cement conduits are probably phone cables, since their diameter is too small for proper power feeders.

Figure 15

Very nice, old conduits made of vitrified clay. These were much more expensive, from a material point of view, than those made of cement.

I sure would've liked to know whether the nice, thick cable in the left-hand conduit was a power feeder or a phone cable.

Interestingly enough, there don't appear to have been any sort of plastic "signal" or "warning" ribbons buried in the ground, above the conduits, as is standard practice in some European countries (such as in Austria, for example).

Figure 16

I only included this snapshot in order to show the construction of an average street in Helsinki – they didn't bother to first pull up the old cobblestones before converting to an asphalt roadbed.

I had a full weekend of free time on my hands, between the two weeks of practical training; Saturday was spent wandering around the waterfront in Helsinki, as well as taking a guided boat tour out around some of the nearer islands in the Gulf of Finland. The larger of these islands have electrical power and telephone service, provided by submarine cables. In such cases, it's important for the captains of ships to know the general vicinity in which the cables are landed (so as to not drop or drag their anchors in the neighborhood) – notification is done with big signposts, as shown below.

Figure 17

Figure 18

Sunday was spent on a trip across the Gulf of Finland, through the Baltic Sea and the Gulf of Riga (and back, naturally), to visit the old, historic portion of the city of Tallinn in Estonia.

I had hoped that I might come across the one or the other antique shop in Tallinn, and possibly find a nice, old Estonian telephone for my collection. No such luck – although several antique shops were open, only one of them even had such an "unusual" item as an old telephone for sale, and that was but a poorly restored German desk telephone from the 1930s. Shucks.

The only *really* old telephone I saw was used as a wall decoration inside the restaurant where I had a late lunch … unfortunately, the proprietor didn't want to part with it.

Figure 19

Figure 20

The only other telephones I saw in old Tallinn were modern pay phones which used prepaid chip cards. Funny thing that the handset on the pay phone bears a very strong resemblance to Western Electrics' old G-style handset.

While in Tallinn, I was also on the lookout for any possible remnants of open wire telephone plant – and I was lucky enough to actually find two examples ….


Figure 21

Although next to impossible to see in the photograph, the insulators are definitely of a type more commonly used with open wire telephone lines than with electrical power.

The wires must have been under considerable strain for the supporting mast to be as long and thick as it is.

It's unusual that nobody had the idea of directly using this old phone wire mast as an antenna support, although they did attach one of the antenna guy wires to it.

Another old, open wire mast, but for 6 subscriber pairs in this case. Although it looks as if the two lower crossarms are steps, one would be hard-pressed to imagine anyone climbing up such a slim and shaky mast.

What is really strange, though, is that the uppermost positions carried more wires (and thus more strain) than the lower positions … this appears to be contradictory to any standard practice I am familiar with.


Figure 22

Outside Plant in the City of Châtellerault in France

I spent 3 days in the city of Châtellerault in the southeast of France in April of 2009, while receiving technical training concerning emergency locator transmitters (ELTs for commercial airlines) at Thales Aerospace. This was another occasion for me to be on the lookout for outside telephone plant ….

Figure 1

Talk about being out on a limb; this subscriber distribution box is mounted about 3 feet away from the outside wall of a building, directly *above* a busy street. At least 6 subscriber service drops are attached, as well as one thin feeder cable (the third cable from the top at the right.) I discovered that *most* of these distribution boxes carry a unique code number, in this instance "A07 6 7."

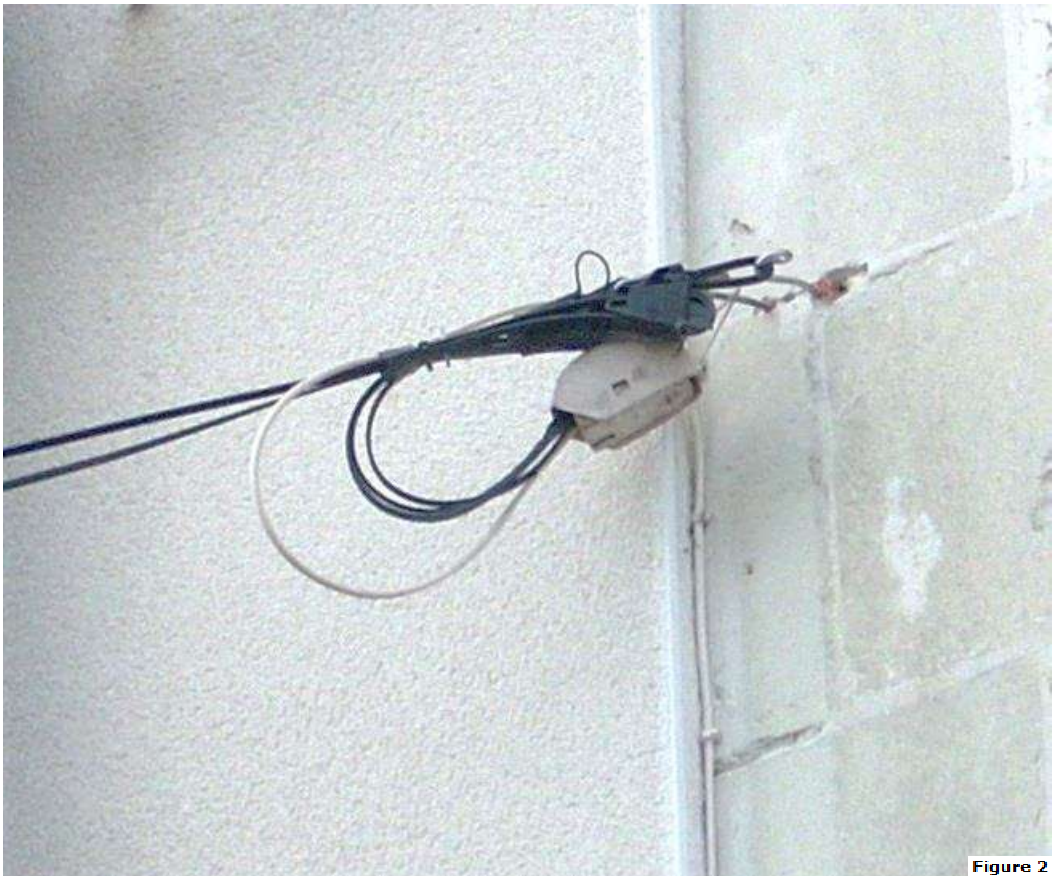

Figure 2

A very unusual type of distribution box; the feeder in this case is the white cable attached to the wall, while the subscriber drop cables fall away to the left. The feeder is attached to the wall with plastic cleats which aren't really all that strong – if one gives the cable a good yank, it'd be easy to pull it right off the wall.

The bridle ring supporting the drop cables is screwed into a plastic expansion sleeve which is none too securely driven into a crack between two blocks of concrete.

Figure 3

The distribution box on the left was the only *really* old one which I saw. The feeder cable enters at the rear lower end, while the subscriber cables exit at the sides.

It seems a bit strange that an electrical power cord (slate colored) is dangling so near to the box, almost as if it was connected to the box at some time in the past.

Figure 4

This photograph of a subscriber distribution box, wedged in between all sorts of 220 and 380 V.A.C. cables and wires proves that France Telecom doesn't have the slightest qualms concerning the possible dangers of crosses with power lines.

The distribution box shown here is apparently an older variant of the one shown in the picture on the first page of this tale.

It's rather funny that the box is marked with a big, red "X" (as in: "ex marks the spot") – although it is obvious which of the many boxes on the wall belongs to France Telecom.

Figure 5

Hmm … why is the distribution box in the photograph above hanging at such an angle? Maybe it was just about to fall off of the wall all on its own; one can also see that the subscriber phone cables pass immediately underneath a galvanized drain pipe and beneath a 3 phase 220/380 V.A.C. power feeder cable.

Figure 6

An interesting telephone cable splice, adjacent to one of the most modern distribution boxes found.

The splice case or housing is a piece of "zippered" heat shrink sleeve from 3M®.

The coding on this distribution box is more complicated than that on the first box shown in this tale – perhaps some of the symbols on that box had already fallen off?

I was relatively certain that I'd be able to find an open telephone distribution box if I kept my eyes open long enough … and here it is!

Counting out the screw terminals, this box is equipped to serve 7 pairs. The wires from the black feeder cable are fanned out along the inside top of the box, with the subscriber cables being connected immediately below.

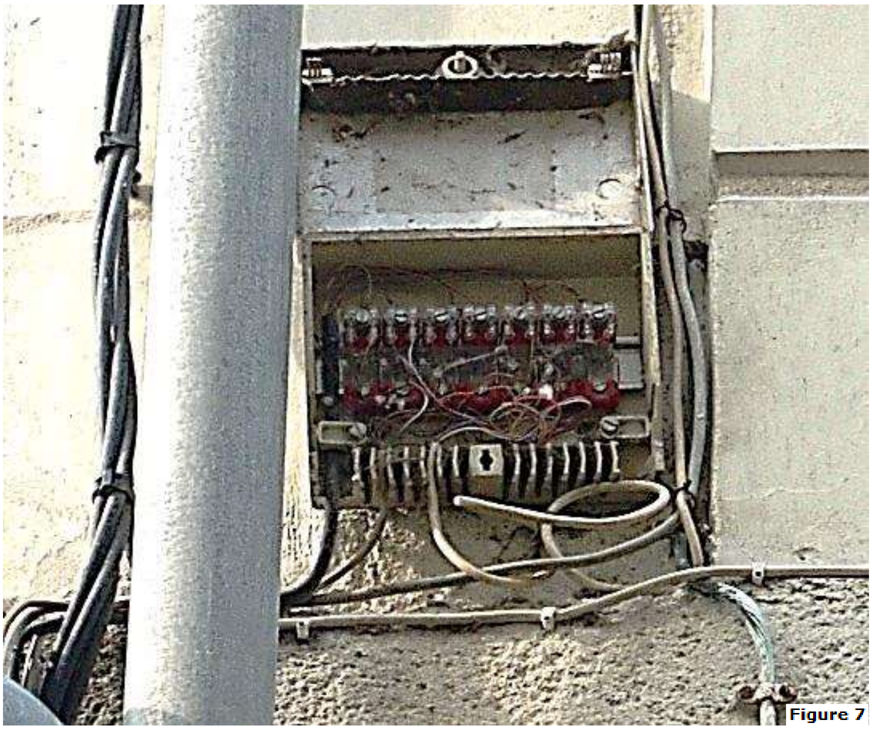
Figure 7

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Figure 8

When I am outdoors and hunting down telephone plant, there is simply no telling where I might eventually wind up ….

In this case, I found myself in the courtyard of one of Châtellerault's oldest buildings, where I discovered the nice glass telephone insulator shown to the left.

As has been found in similar cases elsewhere, the old supports the new; however, if one takes a *really* close look at the picture, one can see that there is a small bit of the old bronze wire still attached to the left-hand "nose" of the insulator.

Even when invited out to lunch by the folks from Thales Aerospace – yes, even then – I was on the lookout for odd or unusual telephone plant to round this tale out with ….

And I found this wonderful trio of splices on a pole right across the street from the restaurant; a most interesting group, actually, showing the expedient, the tidy and the "official" way of splicing a phone cable in France.

It would've been nice if I had run across a craftsperson from France Telecom, with whom I could have chatted, but this wasn't to be.

Figure 9

Outside Plant in Montreal, Canada

I was in Montreal, Canada, back in the summer of 1994, undertaking an 8 week long course of theoretical training in aviation electronics (aka avionics) at the Bombardier Aerospace factory next to Dorval Airport (Pierre Elliott Trudeau International), for the Canadair CRJ 200 (officially: CL600-2B19), a 50 seat regional passenger twinjet.

I was on the lookout for interesting outside plant here, as usual, mainly in the area around the Rue de St. Catherine, where I was living in a hotel … I was *very* surprised to find outside telephone plant which partly consisted of lead sheathed cables and stubs; I hadn't expected such cables to still exist and be in use anywhere in the western world (aside from Austria, of course). Granted, not every photograph in this tale concerns itself with lead sheathed cable – I simply found that some of the other snapshots I took might be of interest as well. Canadian members of TCI may please forgive me any perceived leg-pulling, &c.

Figure 1

In the tale on the demise of electro-mechanical switching, I mentioned the fact that one of the first things done is to cut the cables – no matter how long it may take to get rid of the equipment afterwards.

Bell Canada appears to have followed a similar line of thought, albeit concerning their outside plant ….

As can be seen, the underground feeder to the cable terminal (cross-connect cabinet) was chopped through, and a section of the cable removed as well. Everything else was left in place to be tidied up at some later date – the main thing is to *make sure that it won't work again*.

Figure 2

I certainly wouldn't have wanted to park my rented car underneath this bunch of dangling cables – they'd probably turn a limousine into a compact car if they actually dropped down (luckily, though, this lot of cables was in an alley where no sane person would park a nice, new car anyway). At least I now know why they call it a cable *throw*.

Figure 3

The orange-colored warning flag hanging down from the pole balcony caught my attention; more than one truck had obviously backed into it in the past.

I have this "thing" about these large cross-connect cabinets; there was one, at ground level, just across the street from where I once lived in California. Every time I saw a craftsperson from Pacific Bell Telephone & Telegraph at work there, I'd mosey on over to see what was going on. One of the guys managed to drop his diagonal wire cutters into the shrubs around the base of the pole – and not find them afterwards. They were the very first Bell System tool in my collection.

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Figure 4

Now here's an interesting sight – a distribution (or fuse?) box with a lead-sheathed cable stub exiting from the top, where the stub is wye-spliced into P.I.C.; and not only that, but the second cable exiting the box is spliced about one foot away from the same as well.

From the look of things, one could almost imagine splicing the two cables together and doing away with the box for good – after all, it looks as if one cable enters the box and one cable exits, so why bother with possible corrosion on 100+ stud and nut terminals?

Actually, I rather doubt that the box provides anything more than terminal connections because the feeder cable entering the bottom portion of the wye-splice is buried plant, which doesn't normally require any protection.

Another nice, *tall*, cross-connect cabinet on a pole – but what really interested me was the very big, lead splice case *beneath* the pole balcony … now *that's* a whopper!

The most curious thing about this splice case, though, is that all of the cables are P.I.C., instead of being lead-sheathed. Although most unusual, this *was* the approved Bell method by which "alpeth" cables were originally spliced, circa 1950 (readers may wish to refer to Bell Telephone Magazine, Volume XXVII, 1948, page 85 for more info).


Figure 5

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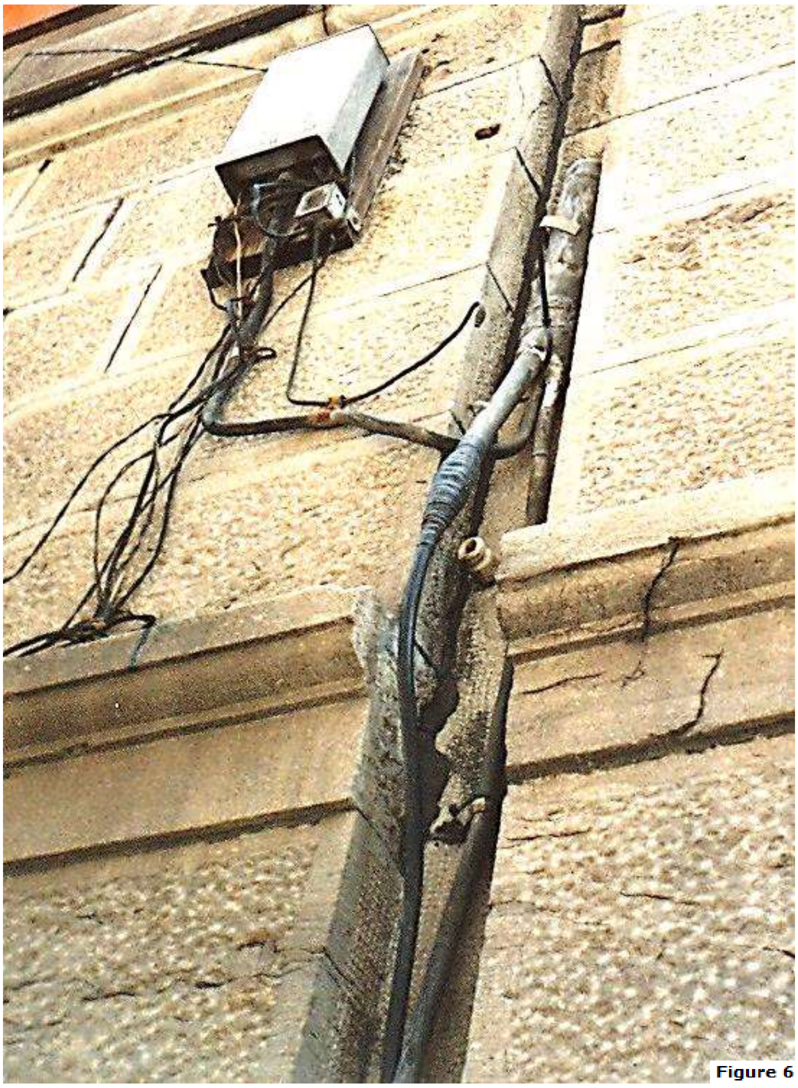

Figure 6

How about that … a lead-sheathed octopus splice; one feeder cable is P.I.C. and is apparently fed through the lead sheath of an old and empty stub, the second feeder cable is good, old lead-sheathed stuff, and the stub cable to the distribution box is lead-sheathed as well.

The sheath of the distribution box cable is going to corrode right through some day, because it's in intimate contact with a rusty iron cleat.

Another nice detail about this setup is that most of the subscriber drops still consist of ancient, *twisted pairs*.

Figure 7

Once upon a time, it was standard practice to pressurize lead-sheathed, paper-insulated phone cables in order to prevent water from entering.

I was pretty surprised to discover a bicycle stem valve soldered to a lead-sheathed cable (for pressurization), as well as a pressure switch attached to another lead-sheathed cable (for remote sensing of pressure loss).

Figure 8

Figure 9

Figure 10

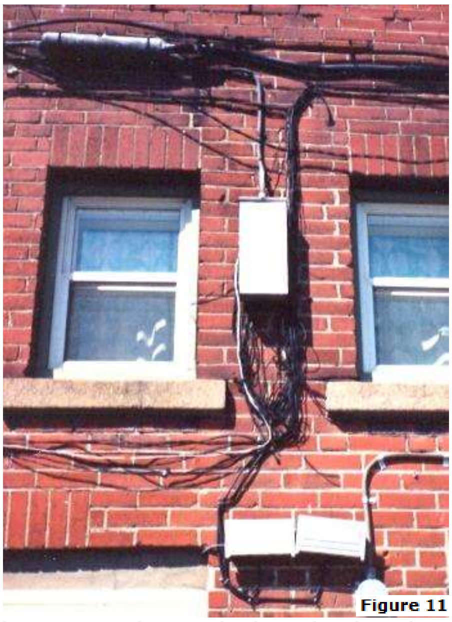

Figure 11

Three more fine examples of subscriber distribution boxes with lead-sheathed cable stubs; the distribution box in the right-hand photograph has its stub spliced to a lead-sheathed feeder cable, and the splice case is leaden as well.

Figure 12

Another pole I was fond of … not just because it's leaning over like a drunk, but also because the buried feeder cables wrap themselves around the pole in a majestic, loose spiral – practically without any visible means of support until nearly halfway up the pole.

To top it all off, the distribution box near the top has a lead-sheathed stub which is terminated in a lead splice case which is circa 2 feet below the box itself.

It seems odd that the pole isn't leaning in the direction of the aerial feeder cable which disappears in the upper left-hand corner of the snapshot, but rather in the direction of four measly subscriber drops. One would normally expect the pole to lean in the direction of the greatest strain, but this one defies logic.

Figure 13

There is (or, at least, *was*) an indoor flea market in one of the dockyard buildings down along the Quai de l'Horloge in Montreal, and one of the sellers there had a large stock of newer and older telephones for sale.

Nope, I didn't buy anything from this guy – he was *far* too expensive; the cruddy, beige princess phone (partly hidden behind a pay phone sign) had a price tag of 150 Canadian dollars. However, I managed to get the seller to divulge his telephone "source" – Phoneco, Inc.

Well, anyway, I didn't have all *that* much free time during those 8 weeks of technical training – there was a 100 question multiple choice test every Friday for the first 7 weeks and a 250 question multiple choice test at the end of the course. I never fell below 83 percent on the weekly tests and had the highest grade of any participant of the course on the final test (97percent). After all, one can't be thinking of telephones *all* the time; funny thing, though, was that I was *dead sure* I had flunked that final exam.

Manhole Covers

I was uncertain as to whether or not I should include manhole covers while writing the tales concerning the outside plant I found in Canada, France, Finland and Austria … it's obvious that I didn't include them, so here they are now.

Austria:

The majority of manhole covers in Vienna and Austria don't advertise whom they belong to and are simply left without any markings, other than perhaps the manufacturer's name and the number of the standard(s) the cover conforms to. Practically the only place I ever found any marked manhole covers in Vienna was along the "Ring" – the wide boulevard which encircles the 1st district.

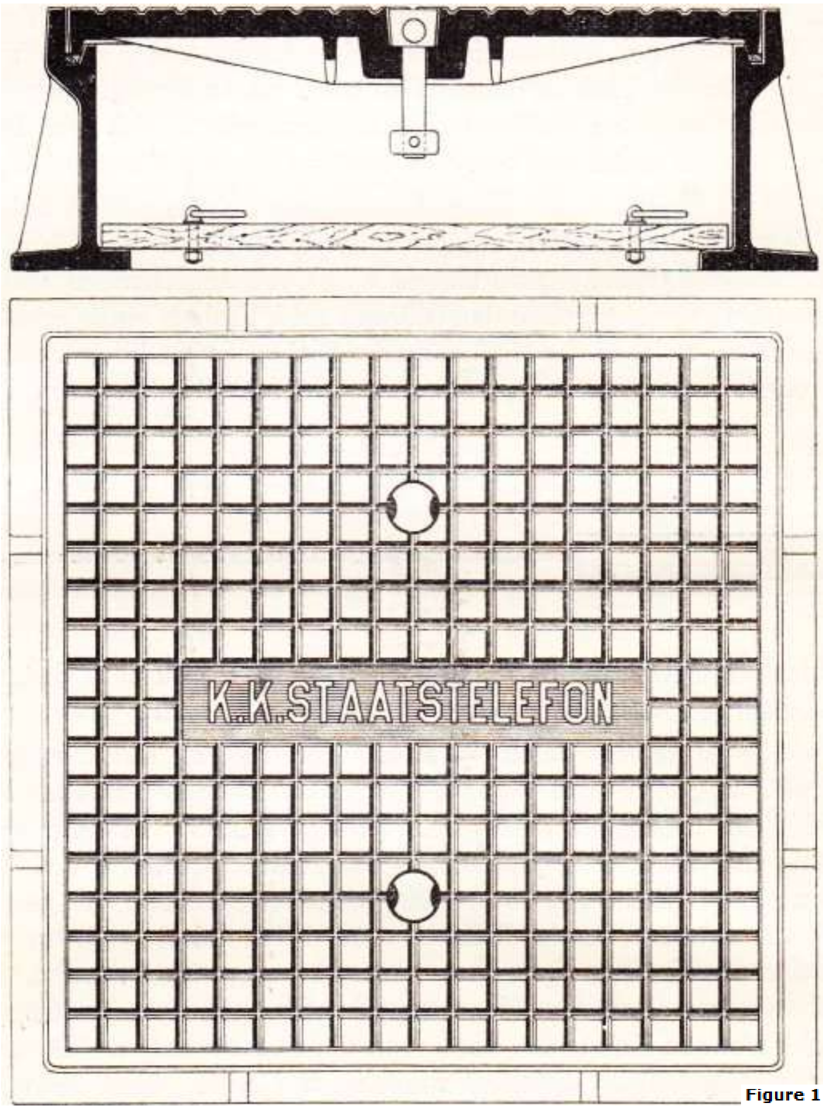

Figure 1

The scan on the previous page shows a woodcut from a handbook of standard practices of the Imperial-Royal Administration of Posts and Telegraphs from 1915. It reveals two interesting facts: there was a thick, wooden cover beneath the one made of cast iron, and the cover had two integrated lifting links.

Considering that the Austro-Hungarian Empire fell apart in November, 1918, one would hardly expect to find any manhole covers left over from that era – especially after the severe bombing raids towards the end of World War II. However ….

Figure 2

Figure 3

These photographs were taken in the year 2012, but I have not walked along the Ring in the years since and can't guarantee that these manhole covers still exist, but at the time the pictures were taken, both covers were over 90 years old. The wording on the cover translates to "Imperial-Royal State Telephone."

These were the only two *really* ancient manhole covers to be found along the Ring. It may be of interest to readers that neither the cover frames, nor the covers themselves, exactly match the design as shown in the scan on the previous page … the frames only have four notches (instead of eight), and the two lifting links are missing. I didn't attempt to lift one of these covers and check whether or not the inner, wooden, cover was still in place.

It's rather surprising that these two manhole covers should show such little wear and tear, considering how many people must have walked over them in the past nine decades.

Figure 4

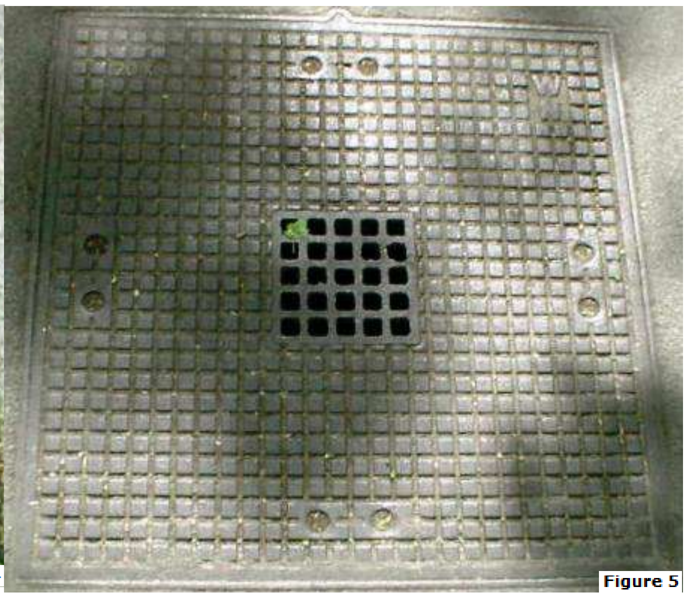
Figure 5

The manhole cover on the left was also discovered while walking along the Ring and only one of this type appears to have survived. This cover has the same dimensions as the ones from the time of the Empire, but it dates from circa 1925 – and, naturally, the institution was no longer the Imperial-Royal Administration of Posts and Telegraphs, but rather simply the Administration of Telephones[1]. Curiously enough, this cover *has* the two lifting links which the older covers *should* have had.

The manhole cover on the right dates from the late 1950s, early 1960s; the dimensions are still the same as before. An interesting point is that this cover has a ventilation grating, which allows any trapped natural gas (from possible pipe leaks – some of the largest gas mains are only a few feet away) to escape. Of course, snow and rain can enter the manhole via the same route, but a small bucket hangs from the bottom of the cover, centered below the grating, which catches anything falling through. BTW – the square holes are *just* the right size to trap any woman walking by in high-heeled shoes.

[1] The German-language term "Staatstelefon" (State Telephone) on the manhole cover doesn't infer that the cables inside the manhole belong to a special governmental phone network, but rather attributes ownership to the State Administration of Telephones.

Canada:

The manhole cover to the left below is the oldest one which I came across while wandering through Montreal. "B.T.Co." can only mean Bell Telephone Company, and it certainly has been a while since the Bell System went by that name. As to age, I feel that this one could actually rival the oldest ones I found in Vienna … apparently, there was no separate Bell Telephone Company of Canada at the time, and this cover may have been imported from the USA.

Figure 6

Figure 7

In the progression of things, I believe that the manhole cover on the right is the next iteration, seeing as how this one proudly proclaims to belong to the Bell Telephone Company of Canada. It'd be interesting to be able to compare the two covers as to their weight, because the one on the left has two slots for lifting hooks, while the one on the right only has a single slot – or was the only difference one of convenience?

Figure 8

This particular manhole cover could be another import from the USA, since it belongs to the "generic" Bell System, without specifically stating that it belongs to Bell Canada. It's also interesting that the non-slip design of the cover is slightly different than that of the two previous covers. A rather marked change is that the "cogwheel" or "gear" which surrounds the central logo is offset – on the previous covers, one of the teeth was vertically aligned with the center of the bell.

Figure 9

A step backwards in time, design-wise, and at the same time a step forward, since ownership is by Bell Canada. Those readers who pay great attention to detail will have noticed that this cover has two defects which occurred during casting … the cogwheel is broken near the 12 o'clock position, and the hex-shaped figure near the 4 o'clock position is halved.

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Finland & Estonia:

I only found three different types of telephone manhole covers during my wanderings through Helsinki; there are probably more to be found.

Figure 10

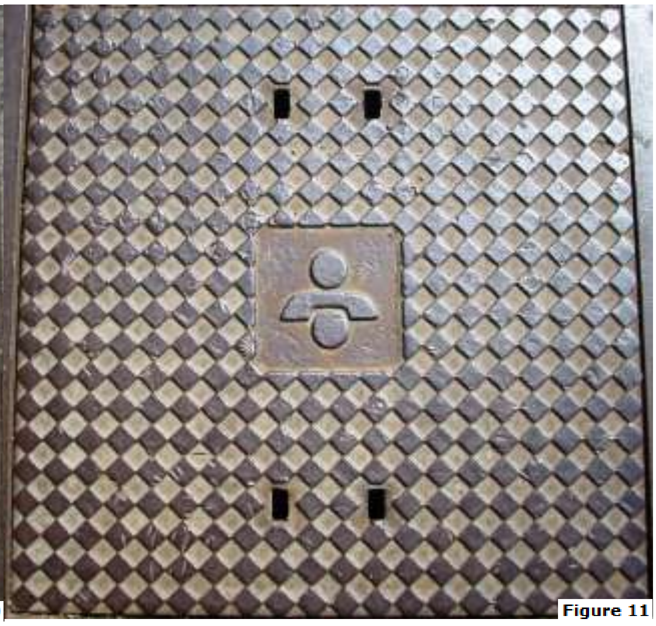
Figure 11

I'm not 100% certain that the cover shown to the left above belongs to the Finnish PTT, but the legend "TTO" is very reminiscent of the classic "PTT," so it could well be. The legend "40 T" refers to the fact that the cover will withstand a traffic load of up to 40 metric tons (40,000 kilograms – roughly 86,000 pounds) … good to know it wouldn't buckle if I walked over it ;-}

There is obviously no need for words or abbreviations when a simple pictogram will do the trick, as can be seen on the manhole cover to the right. Although it looks more like a stylized "head and shoulders" symbol, the mid portion is obviously (?) a handset.

Just for the record: these two covers were only a few yards from each other and its unknown which of the two designs might be the older one.

Figure 12

The manhole cover shown here wasn't actually found in Helsinki proper, but rather on the outskirts of the city of Vantaa – near Helsinki. The word "Tele" is a dead giveaway as to ownership, but I haven't been able to figure out what the 5 symbols to the left of the word are supposed to represent … they *could* be stylized telephone handsets. "40" again represents a traffic load factor of 40 metric tons.

Before we leave Helsinki and environs for a short trip over to Tallinn in Estonia, here is one last manhole cover I came across in downtown Helsinki, near the railway station.

Figure 13

Although definitely **not** a *telephone* manhole cover, I found this one to be *so* very unusual that it well deserved to be photographed and presented here. This cover was cast in commemoration of 450 years of public water works in Helsinki (the text on the cover is in Finnish and Danish). Commemorative coins, medals and stamps are nothing new to me, but a manhole cover? I guess this is the sort of thing folks come up with in a country where it's pitch black for many a month, and in which alcohol is a rather common solace ….

BTW – yes, I *now* know that Helsinki has a splendid telephone museum; while there, I didn't know anything about it (and wouldn't have had the time for a decent visit if I *had*).

Estonia:


Figure 14

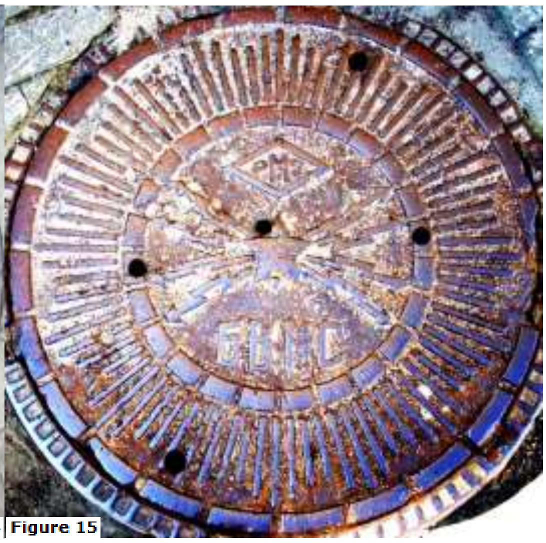
Figure 15

Even though the lettering is Cyrillic on the left-hand cover, it's easy to guess that the abbreviation equals "PTT." This particular one is a well-worn example of the type I saw most often while walking through the old city center of Tallinn. On the other hand, the design on the manhole cover on the right *could* either symbolize electrical power or telegraphy – six lightning bolts radiating from a nice, five-pointed communist star.


Figure 16

Figure 17

The type of telephone manhole cover shown to the left was relatively common in Tallinn; it bears more than just a passing resemblance with the one shown on page 123, because both of them have a non-slip surface consisting of a pattern of 20 by 20 raised diamond shapes.

There is no doubt that the manhole cover shown to the right belongs to the State Telephone System of Estonia. This type of cover was the most modern one which I saw in old Tallinn, and it was the least common type found. A rather un-trustworthy cover, seeing as how its allowable traffic load is but a meager 10 metric tons.

France:

I found more variations of telephone manhole covers in the city of Châtellerault in France than anywhere else I have been within the last decade, with two or three different styles often being found around the corner from one another.

Figure 18


Figure 19

The unobtrusive PTT logo on the covers shown to the left is of a similar type as on the subscriber distribution box shown in the lower photograph on page 108, but it isn't an exact copy, so it's safe to write that even something as simple as this logo evolved over time. This style of manhole cover was the least common type I saw in Châtellerault. I doubt that anyone, anywhere, who is familiar with good old dial telephones, could possibly misinterpret the pictogram on the manhole covers shown on the right ….

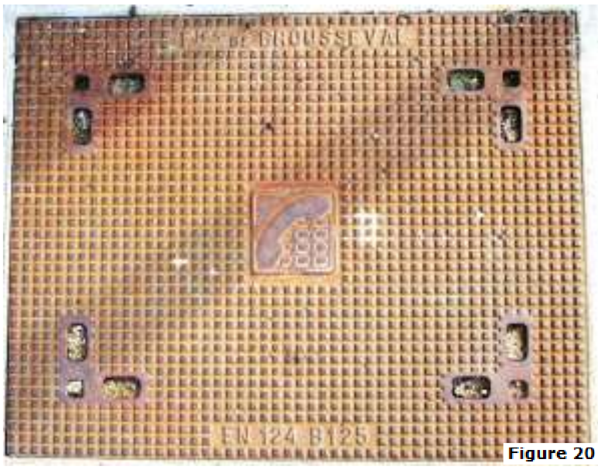

Figure 20

Figure 21

When *dial* telephones are a thing of the past, the old pictogram could prove to be misleading or even illegible, so what better thing could be done than to use a pictogram showing a handset and keypad? The lettering at the top of the cover spells out the manufacturer's name, while the lettering at the bottom states that this manhole cover meets the specifications set forth in European Norm 124 B125.

Being a larger and heavier manhole cover, the one shown to the right is split diagonally and is almost 40" long and wide. It's obviously from the same timeframe as the one on the left, since the pictogram is of the same style.

Figure 22

The telephone manhole cover shown above is the most modern design which I came across while wandering around in Châtellerault. No need to guess whom it belongs to ….

Open Wire Plant Archaeology in Vienna, Austria

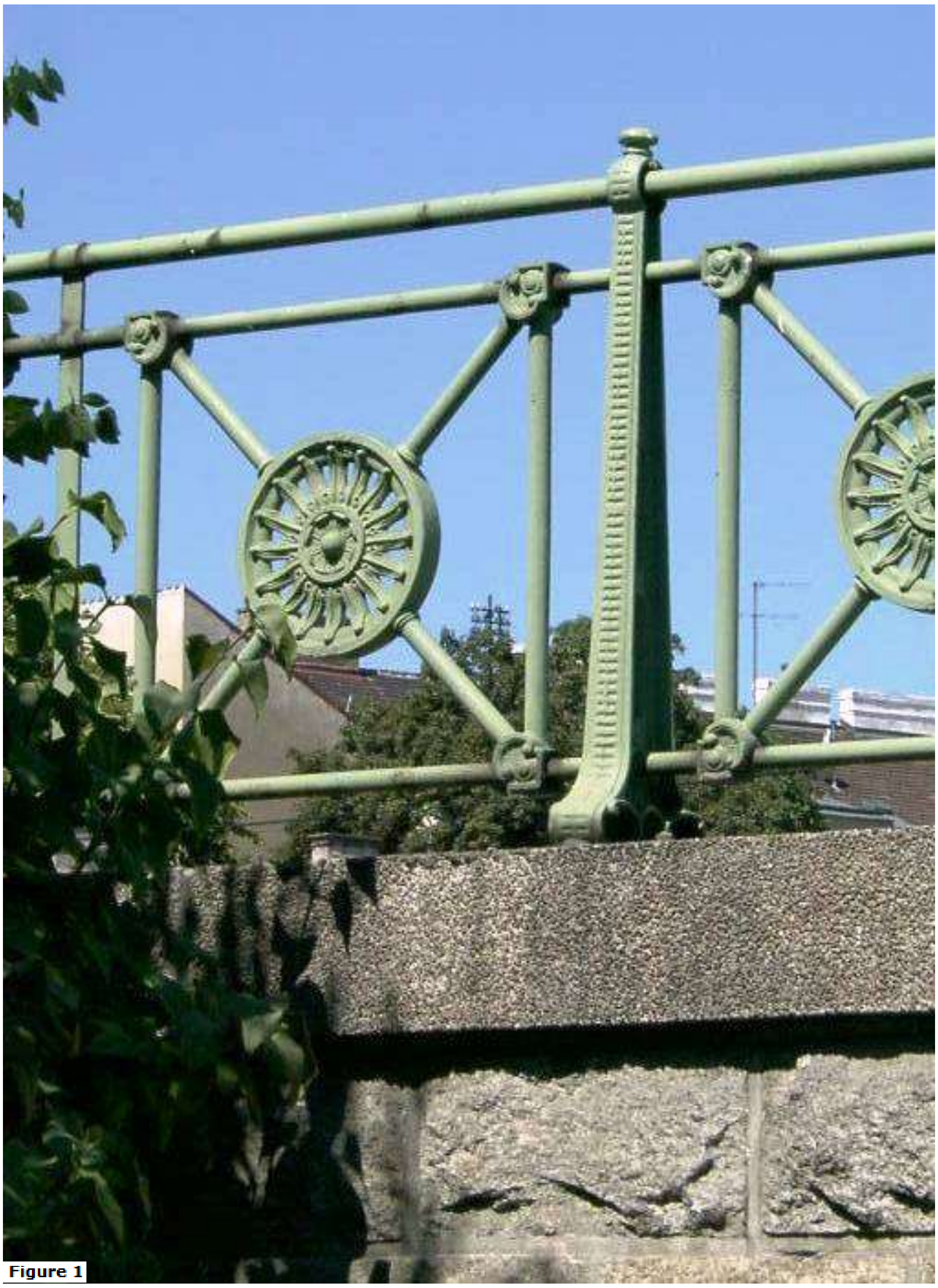

Figure 1

It was in July, 2001, that I was taking a walk along the northern boundary of Vienna's 12th district, looking for interesting motifs to photograph with my very first digital camera. Since digital photographs themselves are dirt cheap (not taking the cost of the camera, back then, into account), I took *quite* a number of snapshots – among them the one shown above, which is only a section of Art Deco safety railing. I wasn't really paying attention to anything other than the foreground, and it wasn't until I had downloaded the photographs to my computer that I took a closer look at the *background* … what on earth? There is an open wire telephone mast on the rooftop of one of the buildings – wow!

It took me a while to locate the building where the mast was located, and I took a few pictures of it from different angles – and then forgot all about it until 2004. In the meantime, I had embarked upon a nearly herculean task, namely to extract and compile all of the telephone subscribers (by family name, street address and telephone number) who were connected to the Meidling (12th district) telephone exchange in 1938.

The Viennese phone directory of that year has 794 pages of listings, and it was necessary to read the letter prefix and the first digit of every single entry, looking for telephone numbers which began with "R-3" … one thing that I soon noticed was that the service boundaries of the exchange didn't coincide with the geographical boundaries – there was some spillover into the districts 13, 14 and 15.

The work of compiling and recompiling the extracted lists cost me roughly 600 man-hours, but by the end of things I had even managed to match up all of the party-line telephone numbers which were spread throughout all those pages.

Well, anyway, this tale is supposed to be about some old open wire telephone masts, and I'll be getting on with that in a moment … one thing I always did whenever I bought a new digital camera (with higher resolution and a higher optical zoom factor) was to go out and photograph the mast and other tidbits again and again.

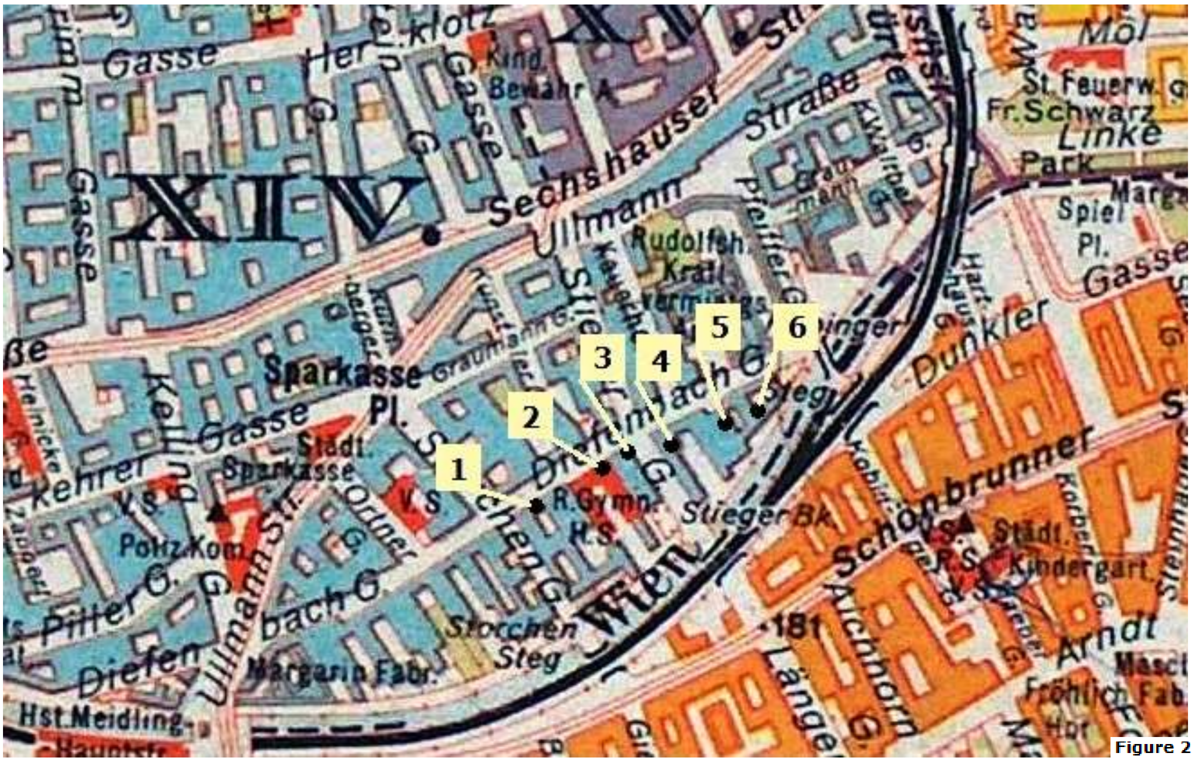

Figure 2

On the map excerpt shown above, the orange portion belongs to the 12th district, while the blue portion belongs to the 14th district. Reference to the boxed numbers 1 thru 6 will be made throughout this tale – box number 1 is a "phantom" reference point, since the buildings shown no longer exist; the distant end of the lines connected to the numbered boxes point out the exact spots where the various segments of open wire lines ran at one time.

It was only after I had compiled my private version of the Meidling directory that I had the idea to attempt and combine the appropriate listings with the remnants of the open wire lines found … it turned out to be a neat idea. A few notes on the realization of the idea: until 1934, Viennese party-line numbers had the 100s digit being either 1, 2, 3 or 4, respectively 6, 7, 8 or 9 (a 100s digit 0 or 5 identified a private [single party] line); party-lines added from 1934 onward had one of the suffix letters B, U, L or Z. In the directory extracts as concerning the odd house numbers from 1 up to and including 21/23 "(PL)" identifies a party-line number and "(SL)" a single party (private) number.

When associating the reference points 1 thru 6 with the actual subscribers present in 1938, it becomes obvious that some additional wires were strung at some (unknown) later date ….

Reference Point number 1:

Diefenbachgasse 21-23 R-35-4-43 (SL)

Taking into account that the map from which the excerpt was taken from dates from 1940, the building with the address Diefenbachgasse 21-23 was torn down at some later date; however, reference point #1 is of interest in conjunction with reference point #2.

Reference Point number 2:

Diefenbachgasse 19 R-32-8-66 (PL)
Diefenbachgasse 19 R-38-4-98 (SL)

Figure 3

The address Diefenbachgasse 19 is a public school, which still exists. The photograph shows the open wire mast which is still attached to the left-hand end of the roof gable. The mast is constructed "upside down" when compared with the scan shown below. The upper crossarm of the mast still carries remnants of the lead-in wiring, so it's safe to say that the two telephone numbers listed above were terminated there.

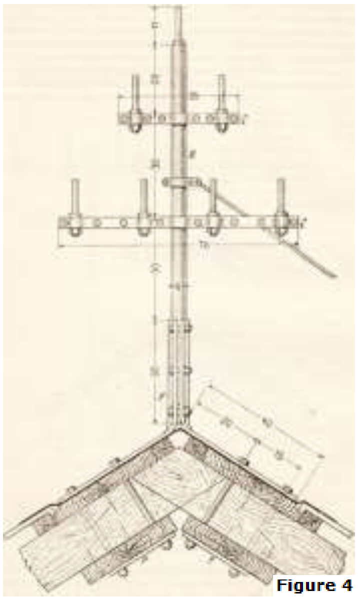
Figure 4

Since the upper crossarm provided telephone service to the school, the lower crossarm *must* have carried the pair which served reference point number 1. Therefore, there must have been a mast with a crossarm, for a single pair, at the other end of the school roof – but this no longer exists.

The snapshot to the right will give readers an idea of where the service mast shown on the previous page is located; it's to be hoped that the poor cluck who had to climb onto the roof to mount the mast and string the wires didn't suffer from dizziness ….

The view shown is the back side of the school, to wit: Diefenbachgasse is *behind* the building. The equipment in the foreground of the picture used to belong to a car dealership, but in the meantime everything on the lot has been removed (and the small, old buildings adjacent to the lot torn down) to make room for a new hi-rise office building.

Figure 5


Figure 6

Yes – there it is; the elusive distribution mast, as seen in the background of the photograph on page 128, in all its glory.

The mast is intact, complete with the original guying rods, balcony rail (the lowest of the three rods on the left), all 30 porcelain insulators, right down to the lightning rod tip at the top of the mast. The wires dangling down are mostly the remains of twisted pair drop wires which were intended for short term service, but a few of them are still the original bronze wires … this distribution mast actually stands atop the building at Stiegergasse 6, around the corner from Diefenbachgasse.

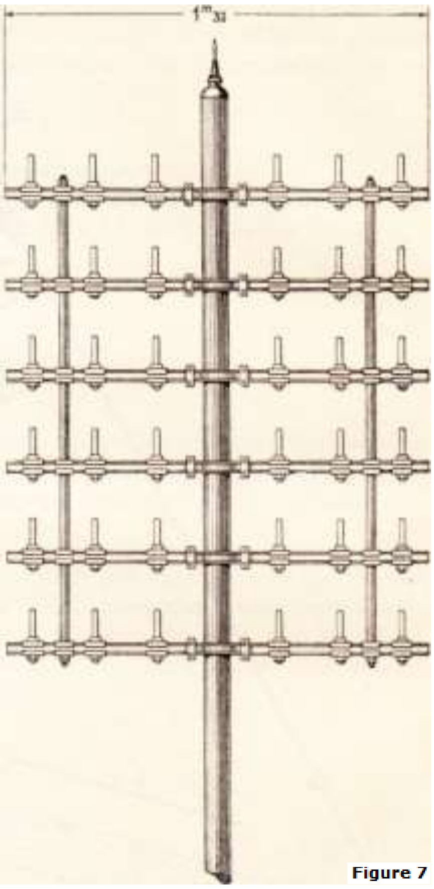

Figure 7

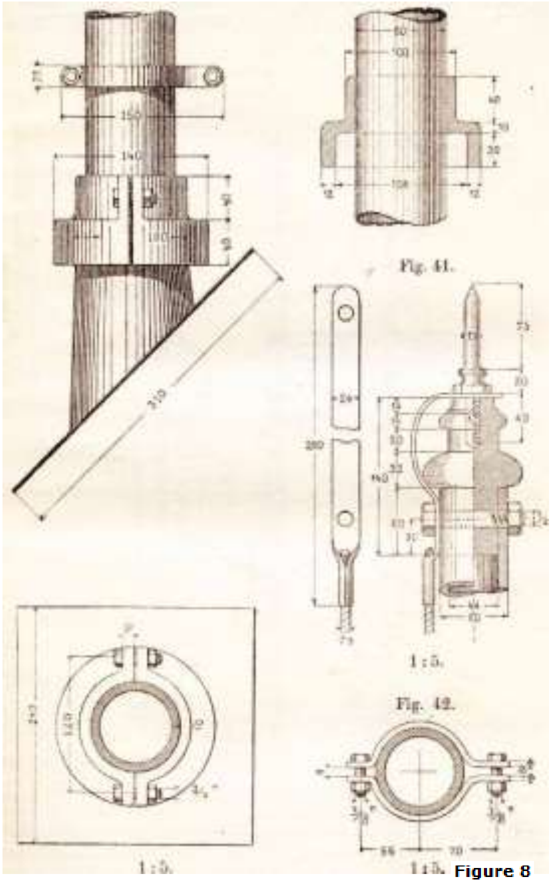

Figure 8

The scans depict some standard practice drawings from 1915, showing the construction of the mast and also some of the details, such as the lightning rod tip – the mast shown on the previous page, below and on the next page is of the same design.

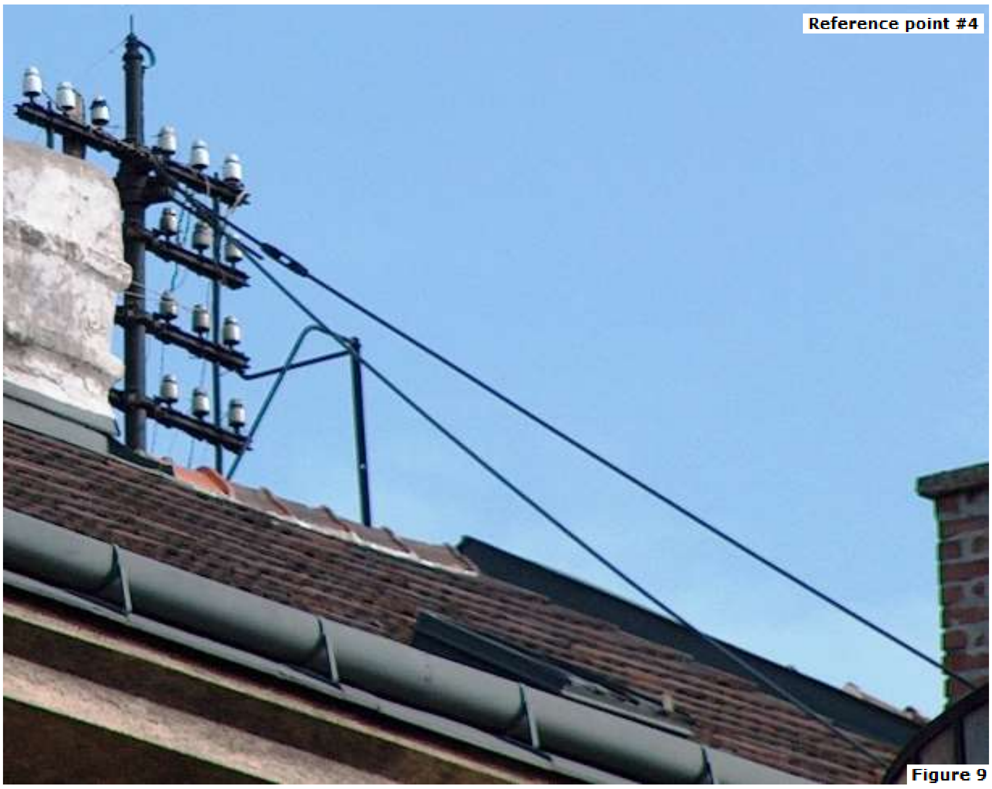

Figure 9

Figure 10

Although there is no longer any remnant of a service mast on the building Diefenbachgasse 9, it had service in 1938; the first two phone numbers shown below belong to the same party-line.

Reference Point number 3:

Diefenbachgasse 9	R-32-**2**-46 (PL)
Diefenbachgasse 9	R-32-**3**-46 (PL)
Diefenbachgasse 9	R-32-6-40 (PL)

Reference Point number 4 is the distribution mast on top of Stiegergasse 6.

Reference Point number 5:

Stiegergasse 5a	R-31-4-91 (SL)
Stiegergasse 5a	R-33-**6**-13 (PL)
Stiegergasse 5a	R-33-**7**-13 (PL)
Stiegergasse 5a	R-33-**8**-13 (PL)
Stiegergasse 5a	R-33-**9**-13 (PL)
Stiegergasse 5a	R-31-1-14-Z (PL)

These four phone numbers, with 100s digits 6, 7, 8 & 9, belonged to one and the same party-line and thus only required one pair.

In the same manner, the wires from the lowest crossarm of the distribution mast ran to the mast at reference point number 5 and those from the remaining two crossarms to the wire support structure at reference point number 6.

Readers should take note of the fact that the telephone numbers -6-13, -7-13, -8-13 & -9-13 share one pair of wires; thus, reference point number 5 is served by 3 pairs. As may be seen below, the mast supported 6 wires and is guyed to relieve strain in the direction of the distribution mast at reference point number 4.

Figure 11

Reference Point number 6:

Diefenbachgasse 1	R-30-8-65 (PL)
Diefenbachgasse 1	R-32-4-46 (PL)
Diefenbachgasse 3	R-32-0-90 (SL)
Diefenbachgasse 3	R-32-1-46 (PL)
Diefenbachgasse 5	R-30-5-23 (SL)
Diefenbachgasse 7	R-30-9-22 (PL)
Diefenbachgasse 7	R-34-0-67 (SL)
Diefenbachgasse 7	R-35-1-86-B (PL)
Diefenbachgasse 7	R-35-1-86-U (PL)
Diefenbachgasse 7	R-35-1-86-Z (PL)

Figure 12

The bracket shown above supported the 6 pairs from the crossarms (3 and 4 from the top) of the mast at reference point number 4, further on down the line to the buildings which used to stand on the plots of land at Diefenbachgasse 1, 3, 5 & 7 (these were torn down at some later date and replaced by a single modern building complex).

It's rather curious that a seventh pair of insulators was bolted onto the support structure sometime later on – where did the wires go to from there? There was no room left on any crossarm of the mast at reference point number 4.

The tangled mess of twisted pairs seen is the remnants of temporary service drops; the pairs consisted of hard-drawn copper wires insulated with red and white PVC. This type of twisted pair was phased out in the early 1980s, but I just recently picked up a complete NOS bundle of this stuff for my collection.

Up to now, the text scans and photographs have dealt with the largest single & intact set of open wire telephone masts which I have found to date … the next few pages are dedicated to some sightings made elsewhere in Vienna.

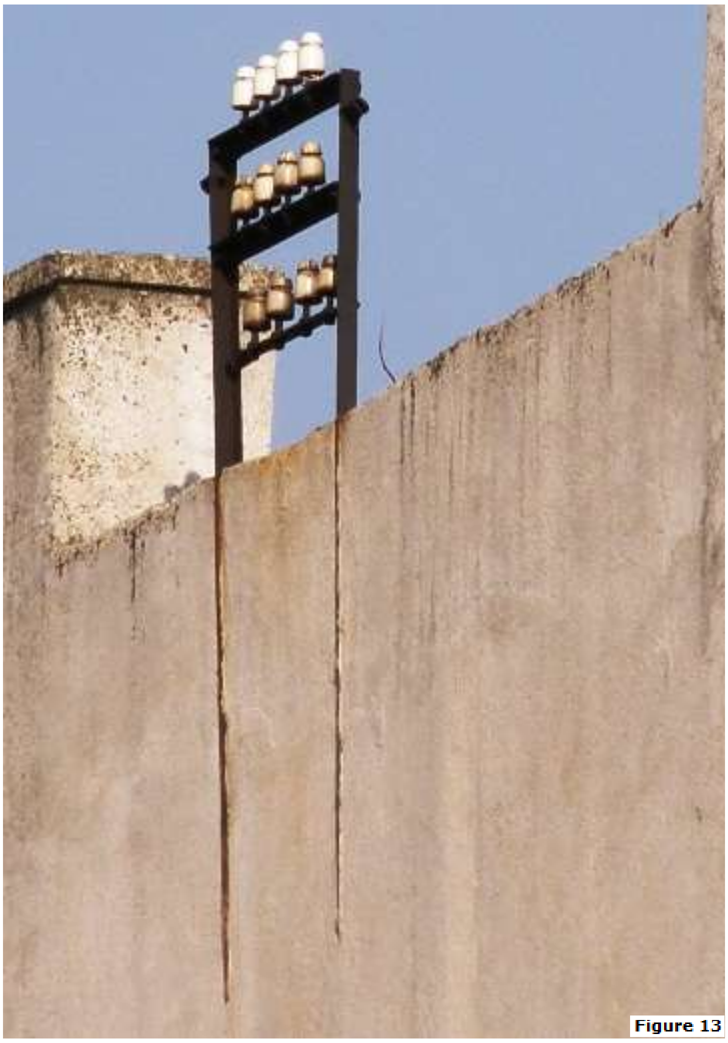
Figure 13

This "A" frame was situated at the top of the back wall of a building near the subway station in downtown Meidling, and is roughly 30 feet up in the air.

There must have been considerable strain on the frame while the wires were still in place, judging from the fact that the vertical braces are secured to the wall for a distance of circa eight feet ….

At some time in the distant past, the frame was additionally supported by two iron guy rods, of which the attachments may be seen on the exterior sides of the vertical braces, just a bit below the top crossarm.

The two pair mast to the right is attached to the same building as the A-frame above, just around the corner (so to speak).

This mast is especially unusual in that, at some later date, after the wires had been taken down, a building was erected right in front of it – the vertical, white stucco seen on the extreme right of the picture is a corner of the back wall of the new building.


Figure 14

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Figure 15

This photograph was shot in Vienna’s 5th district, very near the local flea market which is held every Saturday (excepting on public & religious holidays). I have looked at the buildings shown very, very many times without noticing anything unusual or exceptional – at least until *after* I shot this picture … I took it because I thought that I saw an unusual antenna farm on the rooftop of the building facing towards the camera.

Well, I was very surprised by what I had actually discovered … in reality, the antenna farm is a large, open wire rooftop frame to which a number of TV antennas and antenna masts have been bolted over time; these obscured the lines of the frame.

Figure 16

This heavily guyed rooftop frame was equipped with 50 porcelain insulators (of which 46 still exist), serving 25 subscriber pairs … each individual pair *could* have been a party-line, in which case up to 100 subscribers may have been served from this frame of insulators at one time.

I discovered the following setup, consisting of a wall bracket and a wooden pole, between which three of the four original bronze telephone wires were still strung, in Vienna's 23rd district. The wires themselves were no longer in service (this was, instead, provided by a small aerial feeder cable), but to date this is the only example of open wires still in place that I have been fortunate enough to discover.

Figure 17

This bracket, and the wall, deserve closer examination for a number of reasons. First of all, the aerial feeder cable previously mentioned is wrapped around the bracket a few times in order to take up the strain. Secondly, three of the original wires are dead-ended on insulators on the bracket and, thirdly, at least two of the wires are still attached to the lead-sheathed entrance "cables" by the original method (which will be explained in detail in a moment's time). The entrance cables run down the wall, below the left-hand corner of the bracket and disappear through a small hole – they're painted white and thus rather difficult to see.

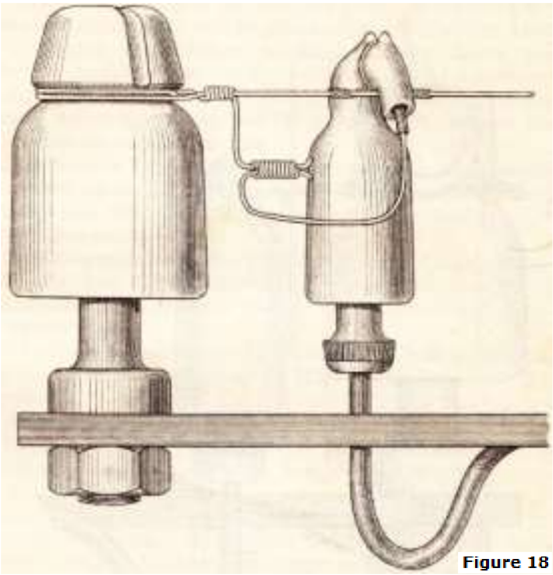

Figure 18

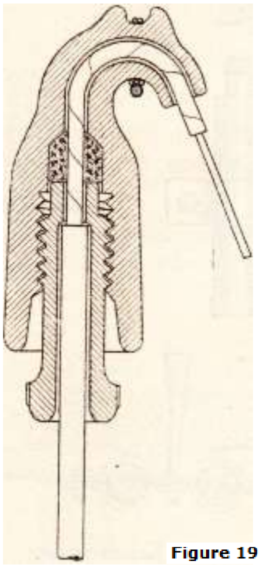

Figure 19

These two scans depict some standard practice woodcuts from 1915, showing the special feed-through insulator used to properly terminate the lead-sheathed entrance cables and how these special insulators were attached to the dead-ended line wires.

Referring to the scan on the right, one can see that the feed-through insulator consists of two parts, namely the body and a hollow plug which is screwed into the base of the insulator itself. A packing was inserted at the top end of the hollow plug, and this provides a moisture-proof seal when the packing was compressed by tightening the plug.

The lead-sheathed entrance cable is a very unusual thingamabob … the core consists of a single, solid copper wire (approximately 20 AWG). This wire is insulated by a thick layer of vulcanized India rubber, over which a narrow cloth tape is wound in overlapping spirals. A lead sheath is then pressed onto the cloth tape, thus providing very well insulated and weatherproof wire (which the Imperial-Royal Administration of Posts and Telegraphs called "cable").

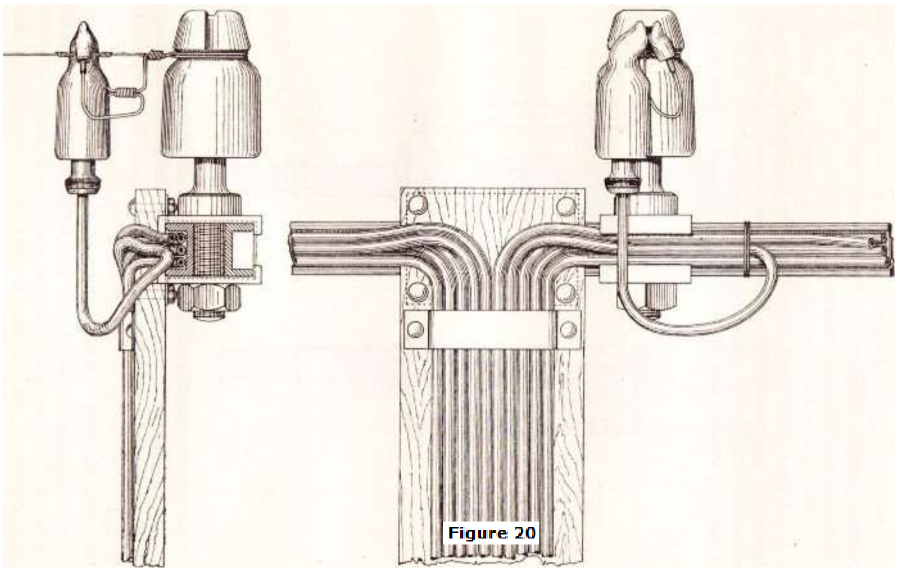

Figure 20

These two scans show some more standard practices from 1915, which show how the feed-through insulators and entrance cables were attached to and run on the crossarms of service masts.

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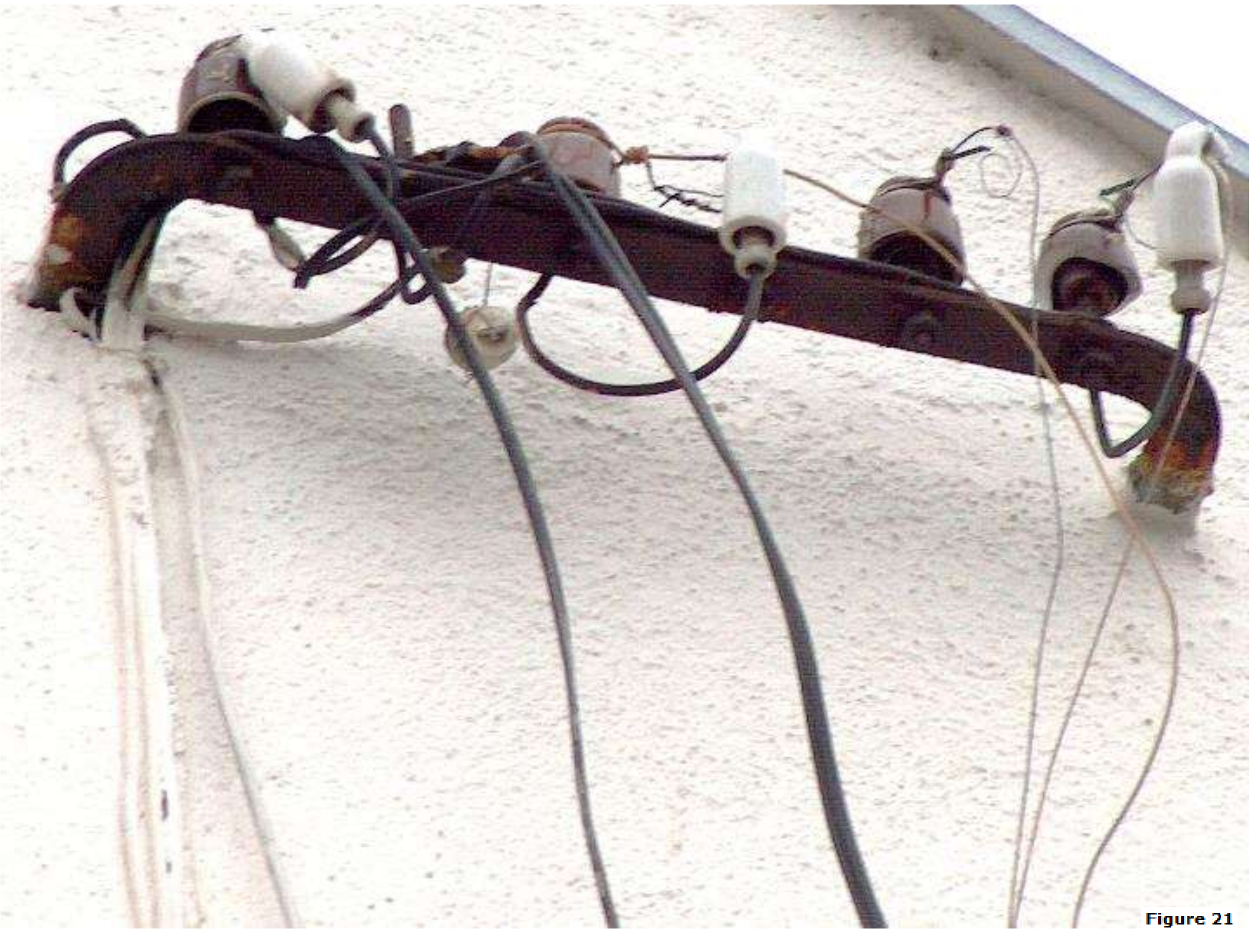

Figure 21

This photograph was taken at a later date, by which the original line wires, the aerial feeder cable and the pole had been removed by Telecom Austria. It's included here for the simple reason that the special feed-through insulators and the lead-sheathed entrance cables can be seen better.

If I had had a 30 foot ladder on hand, I'd have climbed up and grabbed the feed-through insulators for my collection (I have one of these, but it's missing the hollow plug). The entrance cables would've been of a lesser interest, since I managed to obtain two 40" long pieces from an outside wall belonging to a razed building ….

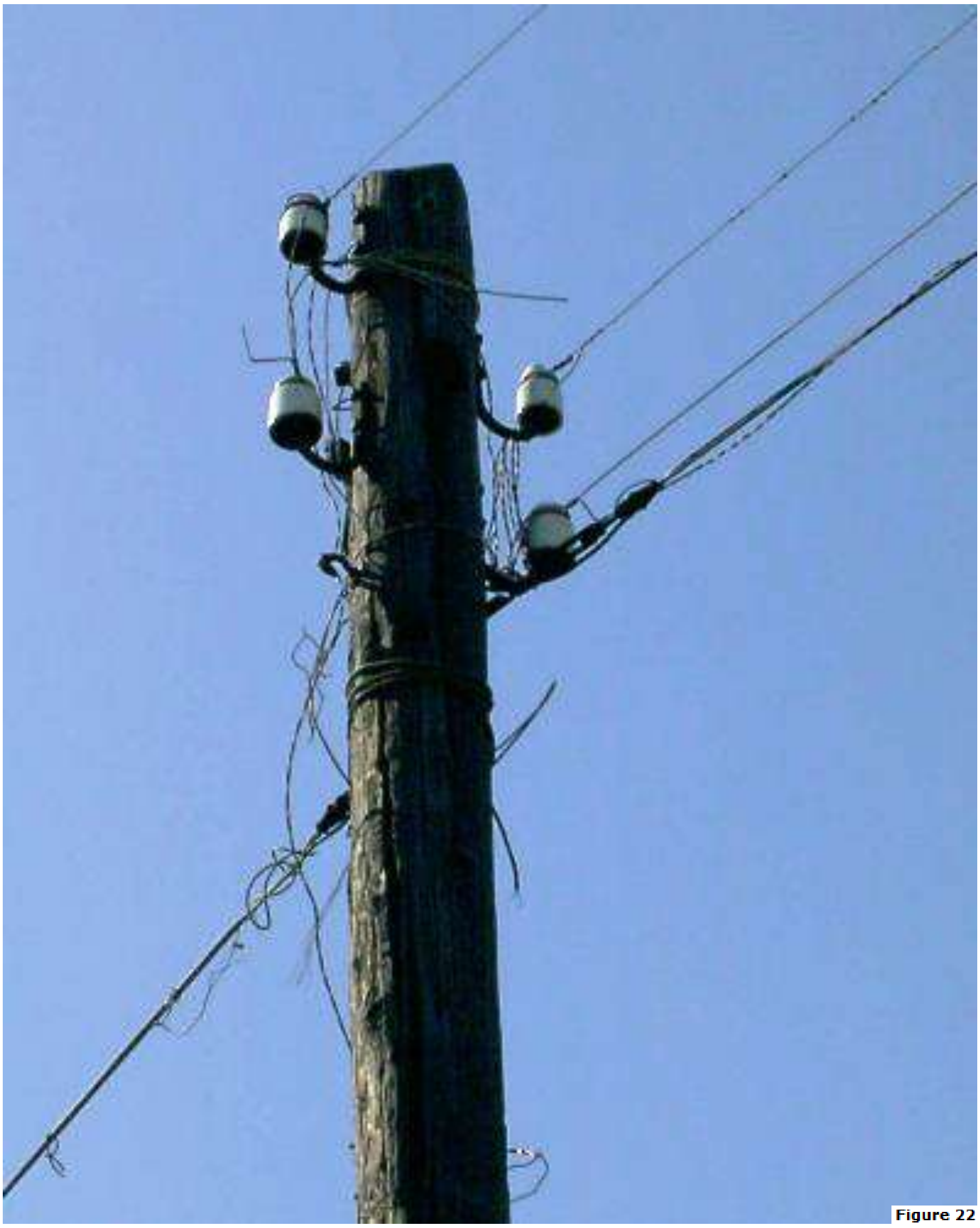

Figure 22

This is the wooden pole at the other end of the circa 150 foot long run of the bronze telephone wires. The insulators are standard subscriber distribution size "B," and each one of the four insulators is attached to its own insulator pin hook which is, itself, attached to the pole with two large lag screws.

One can also see how the aerial feeder cable is strain-relieved at the pole – yep, what looks like a guy wire slanting down into the lower left-hand corner of the photograph is actually the feeder cable as it heads to the office of a small car dealership.

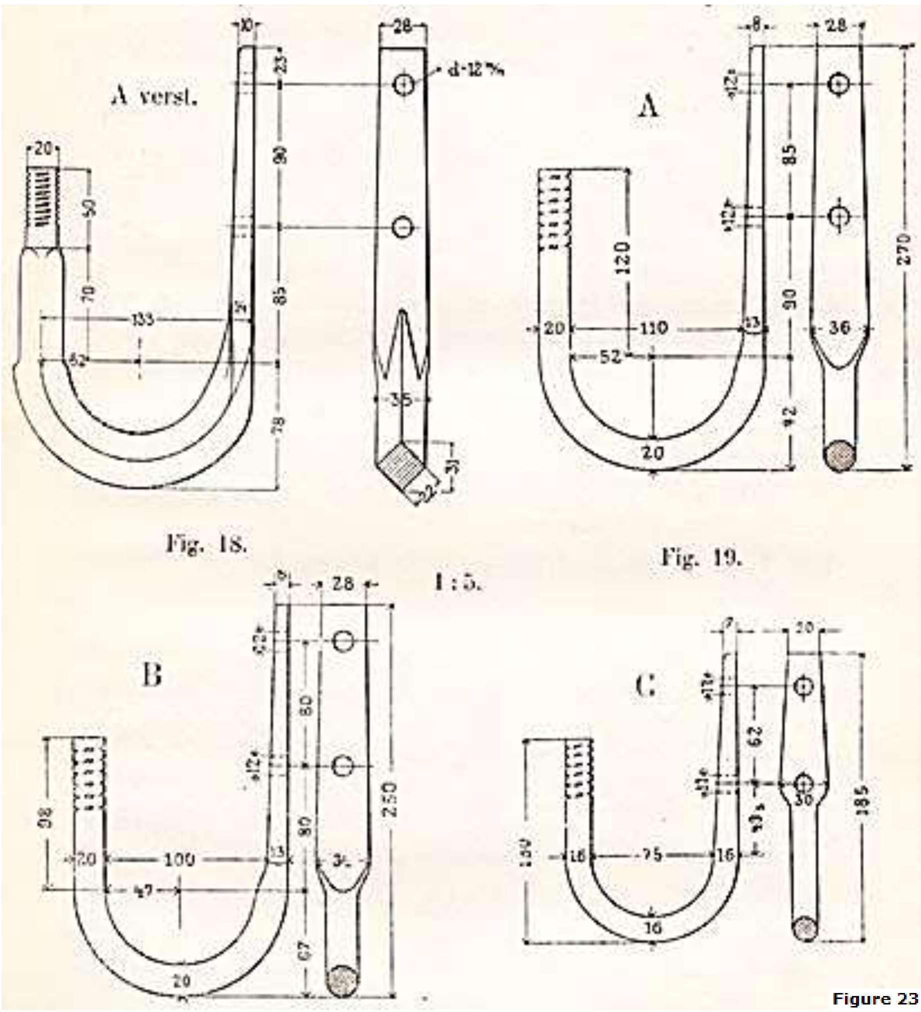

Figure 23

This scan is of another standard practice woodcut from 1915, giving the dimensions (in millimeters) of the four different sizes of insulator pin hooks as used by the Imperial-Royal Administration of Posts and Telegraphs and, later on, by the Austrian PTT. The hooks are of drop-forged, galvanized iron; they usually last much longer than the insulators themselves.

The insulators are attached to the metal pins in the following manner: a piece of hemp rope of suitable diameter is thoroughly moistened with high-grade linseed oil and then wrapped onto the steel pin in a tight spiral. The insulator is held in a vertical position and screwed down onto the hemp rope until tight. Oftentimes, the threaded portion of the inner petticoat was potted with a self-hardening, non-cracking compound. Such compound, in red color, can be seen on the insulators mounted on the top crossarm of the distribution mast shown back on page 133.

Figure 24

Open wire telephone insulators as used in Austria; the three shown here are, from left to right, sizes “B,” “C” and “D.” Longer spans of thicker wires exerted quite a strain on the insulator, requiring the size “B,” while shorter and lighter spans made do with the two smaller sizes. A size “A” insulator (used for national and international toll lines) existed as well – but, sadly, I don’t have one.

As to the physical construction of the insulators, it’s to be noted that the various Austrian PTT entities felt that porcelain was a better insulator than glass. The insulators all have a very deep, double petticoat and are glazed inside and out – with the exception of the bottom lip of the outer petticoat and the inside of the thread with which the insulators are screwed onto their pins or pegs.

The green measuring tape is in inches, and is provided so that readers may gain an idea of the actual size of these insulators.

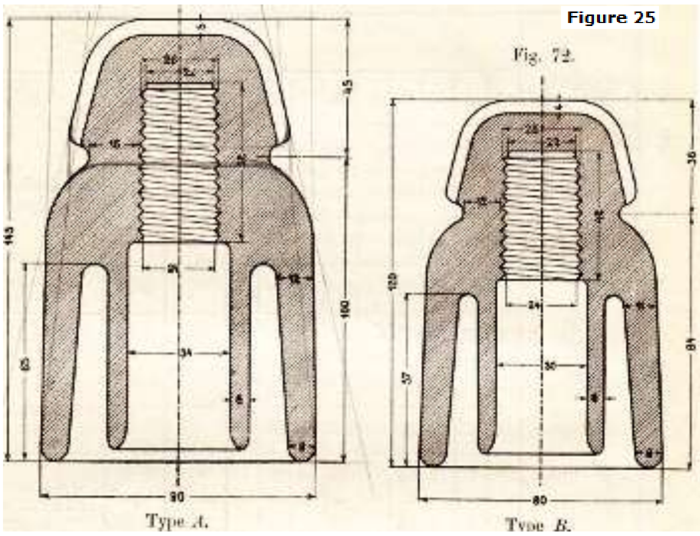

Figure 25

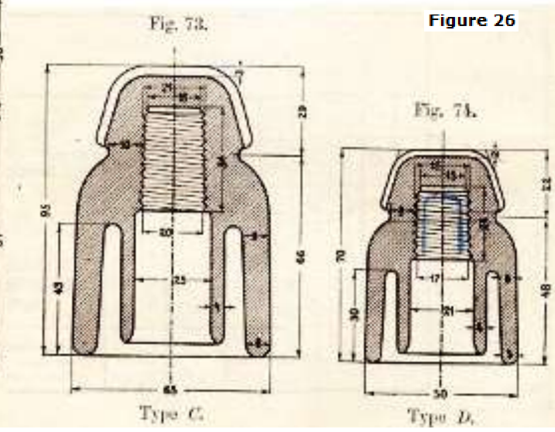

Figure 26

The scans shown above are yet from more standard practice woodcuts, giving the dimensions (in millimeters) of the four different sizes of insulator as used by the Imperial-Royal Administration of Posts and Telegraphs circa 1915.

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Hunting for Railway Open Wire Plant in Lower Austria

Back at the time when I was working as an avionics engineer for the commercial airline "Lauda-air" (1992-2003), a joint-stock company whose CEO was three time Formula 1 racing champion Niki Lauda, I was on a two day, two night shift cycle (8:30 a.m. to 8:30 p.m. or vice-versa), with four days off between cycles.

Many of my days off were weekdays when 9 to 5 folks were sweating it out in their offices, and I spent the one or the other of these days on the road in the province of Lower Austria, looking for secondary railroad lines along which the Austrian Federal Railways still operated open wire lines for communications and/or track block signals … there was (and still is) much to be found in this direction.

Figure 1

This photograph shows a few of the typical features of such open wire runs … among which are that wire sag is of no special concern anymore, the poles immediately adjacent to road crossings are not only doubled up for additional strength, but are also somewhat taller than the rest (minimum clearance is roughly 4.50 meters) and that, as far as the wire supports are concerned, anything handy is used. To wit: the double pole in the foreground has a large "J"-style insulator mount on the *left* one of the two poles, while all the other poles have a small, separate, two pin arm on the *right* side.

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Figure 2

Another typical feature is that, while the old, open wire lines are kept up, additional pairs are added in the form of "figure 8" aerial cables of spiral-four quad construction (in fact, the same type of cables as used by Telecom Austria).

While aerial cable is directly spliced to buried cable without any form of protection, the open wires are spliced to individual, insulated wires which are run through the slate-colored pipe and which terminate in a combination of sneak current and lightning protection (fuses and carbon protector blocks in the slate-colored box at the base of the pole on the left).

In this instance, the protector box is of a modern type and the lightning protection could just as well be provided by gas-filled spark gap tubes as by carbon protector blocks.

The protector box shown to the right is obviously of an older style than the one above.

A major difference between the two types is the method by which the door is attached and locked in place … while the newer type has a normal, hinged door which is secured with a tumbler lock, the older style has a cover which is held in place by four triangle-headed, metric thread bolts. The reason why a triangular head was used instead of a square or hexagonal head is because the latter types could be grasped and turned with the aid of a pair of pliers, while it's nearly impossible to get a good grip on a triangular head.


Figure 3

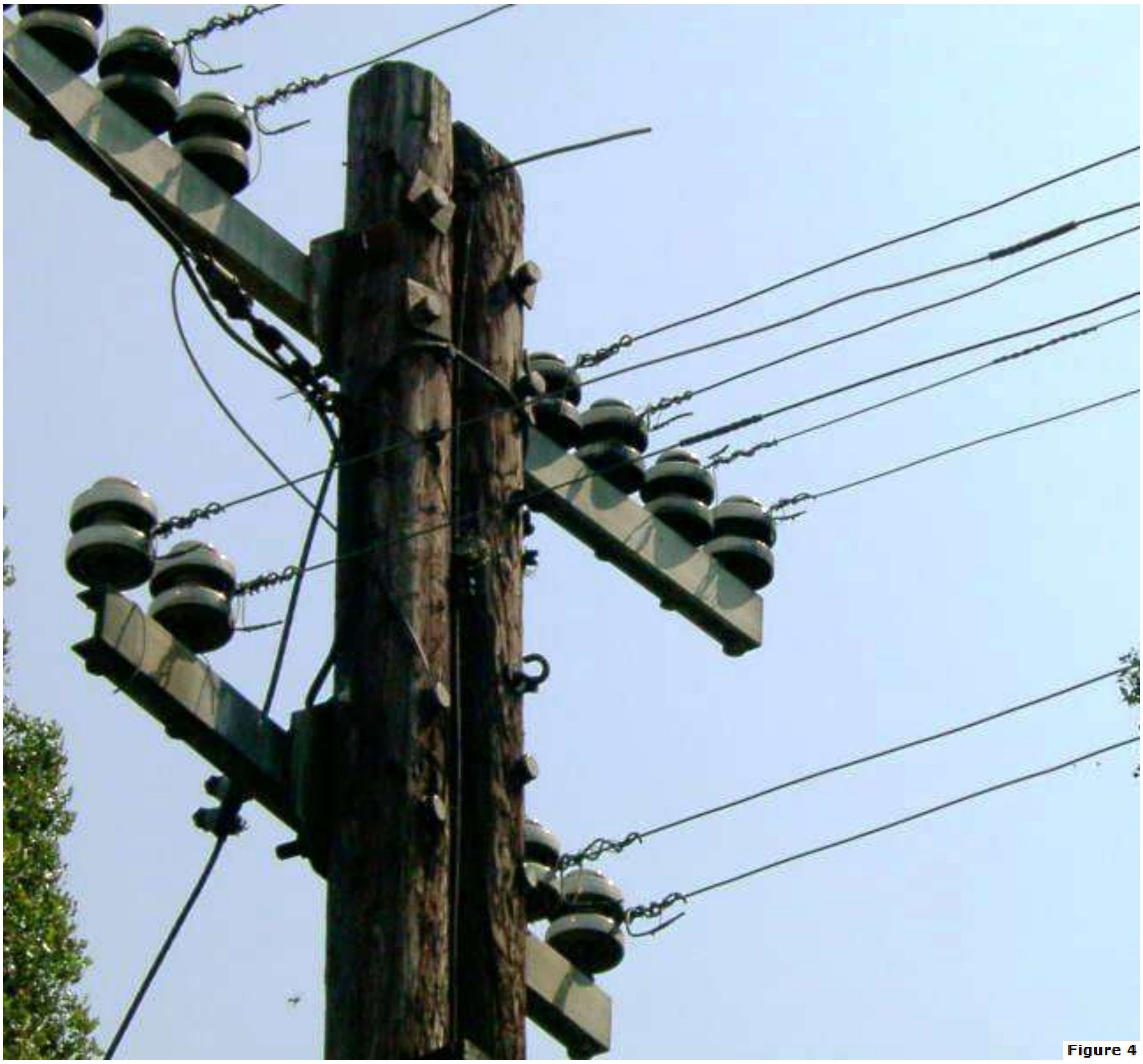
Figure 4

The photograph above shows several typical features of railway open wire lines as well as a few *atypical* features … starting at the top: what appears to be an orphaned wire, jutting out from between the two poles, is actually a bent lightning rod of 6 millimeter iron wire. The poles don't have gains cut into them for the crossarms; these are attached using special backing plates and with the aid of four large sized carriage bolts.

The insulators on the crossarms are actually the type normally used for transposing pairs, not for dead-ending wires. It's curious that the wires on the upper crossarm are dead-ended on the upper groove of the insulators, while those on the lower crossarm are dead-ended on the lower groove. Three of the wires are spliced; two with pressed copper (or iron) sleeves and one with a twisted copper (or aluminum) sleeve.

After being dead-ended, the wires are bent downwards, back parallel to the line wire and the remainder cut off, leaving a short pigtail to which the feeder wires from the protector unit are soldered – however, in this specific case, the line wires are directly soldered to the wires of a "figure 8" cable which leaves the poles almost parallel to the left-hand side of the upper crossarm.

The line wires apparently don't put much of a strain on the double pole, since the guy wire is hanging down rather slack.

Figure 5

Figure 6

Two views of another dead-end pole which carries open wires and a cable. Judging by the manner in which the crossarm is twisted, the wires must impose a considerable load – which makes one wonder why the various guy wires are all slack. It may also be of interest to note that the crossarm is attached to the pole with a saddle clamp instead of with backing plates and carriage bolts.

In the left-hand photograph, readers can just see the individual, insulated wires as they exit the slate-colored pipe. Interestingly enough, the wires are not color-coded in any manner, they're all insulated in the same color – slate in this case (black was also common, though). The wires are strung along the crossarm in a rather haphazard manner and are not tied to it at all; there is no need to do so, since the wires are approximately 18 AWG in size and solid (not stranded). The insulators used in this case are the proper ones for dead-ending the wires, namely standard size "B" insulators as shown to the left below.

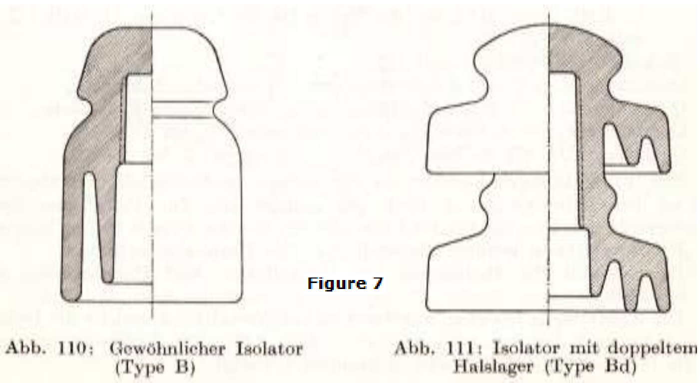

Figure 7

This scan shows the difference in construction between the standard size "B" insulator and the type "Bd" with two grooves.

The drawings are to the same scale – the type "Bd" just as tall as the standard size "B" insulator.

The type “Bd” insulator wasn’t only intended for transposing wires, but was also used for making an easily opened inline splice, so that the line could be split into separate segments for troubleshooting.

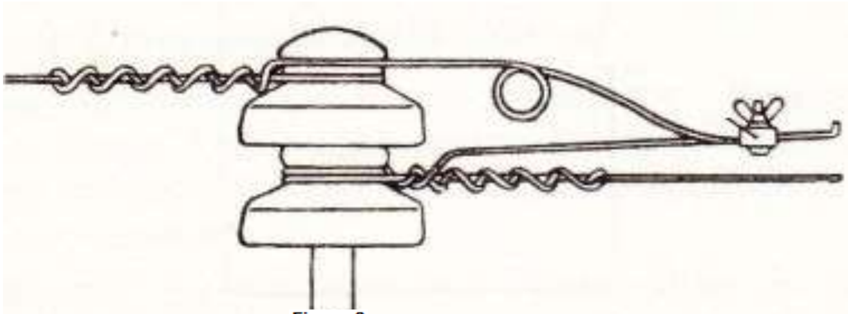

Figure 8

Figure 9

The photograph to the left shows an interesting mix of insulators. The one in the topmost position on the left is a standard size “B” insulator as already used in the Austro-Hungarian Empire, while the next three, with a wire groove on top of the head, are of a type which the German Reichspost and Reichsbahn favored.

The two insulators on the bracket at the bottom left of the pole are typical for the size “B” insulators used by the German Reichsbahn. These insulators have a dark green band near the base … this signified that the relevant wires were used for communications purposes and not for block signals.

If there was more than one pair of wires supported on insulators with green bands, one of those pairs was reserved for calling assistance from the next train station in case of a railway accident or engine breakdown – the train conductor was usually in charge of the portable magneto phone and gaff used to attach it to the wires. Such pairs were specially marked with a bent wire loop dangling from the bracket.

The photograph on the right not only gives a close-up view of some insulators attached to the pole by forged iron brackets, as illustrated on page 143, but also shows that a railway callbox is connected to the magneto phone line.


Figure 10

The cable used to connect the callbox to the line is a standard, rubber insulated *electrical* power cable; one of the wires has blue insulation (neutral power wire), while the other wire is insulated in black (phase power wire).

The phones used were magneto OB-33s, which may be read about on pages 198 ff.

These two wires are stranded and are of 18 AWG size. They're connected to the open wires by being stripped for a good two inches, the bare portion being tightly wrapped around the line wire and then soldered with rosin-core solder.

The picture also gives a pretty good view of the method by which the line wires are attached to the insulators, namely with a relatively complicated tie as shown below.

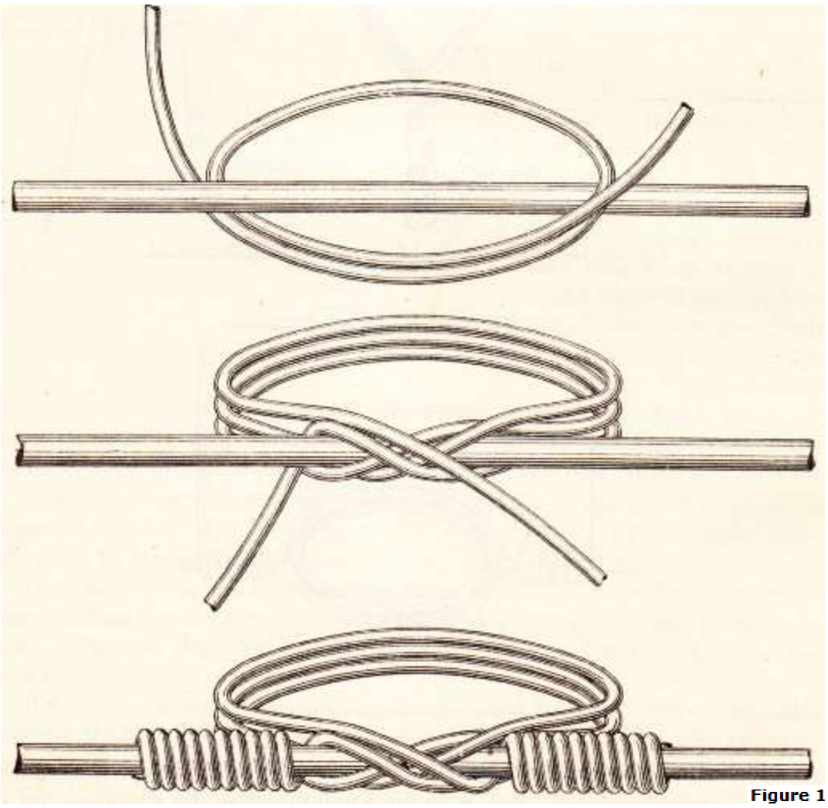
Figure 11

The wires used for making the ties were of a metal compatible with that of the line wire.

Line wires of hard-drawn copper or silicon-bronze were tied with soft copper wire, while line wires made of galvanized iron were tied with annealed iron wire.

The tie, as shown here, was a non-slip version which prevented the line wire from swinging in the insulator groove and thus cutting through the glazed porcelain.

The insulators shown in the photograph on the previous page are attached to the pole by using small "J"-style, forged iron brackets, such as those shown on page 143. There was, however, a second approved method for attaching individual insulators to a pole, as shown in the photograph to the right … in this instance, the brackets are u-shaped, with a horizontal tail which carries a thread cut for being screwed into holes drilled into the pole.

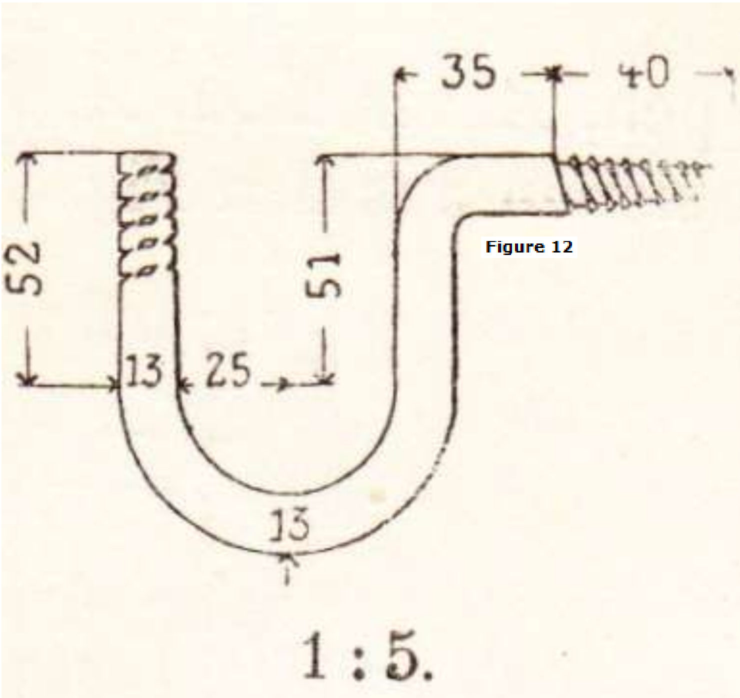

Figure 12

Figure 13

Such brackets were less expensive to manufacture and also required less work to be installed, since it was only necessary to drill one hole per bracket, instead of two.

Figure 14

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The pole shown at the bottom of the previous page is a bit unusual: first of all, the four inner pins on the top crossarm don't carry any wires, while the insulators bolted to the ends of the crossarm later on *do* carry wires. The next thing is that the lower position on the pole isn't a crossarm, but rather two separate, two pin brackets. Lastly, the messenger strand of the "figure 8" cable is attached to the pole at different heights on the left and right sides of the pole.

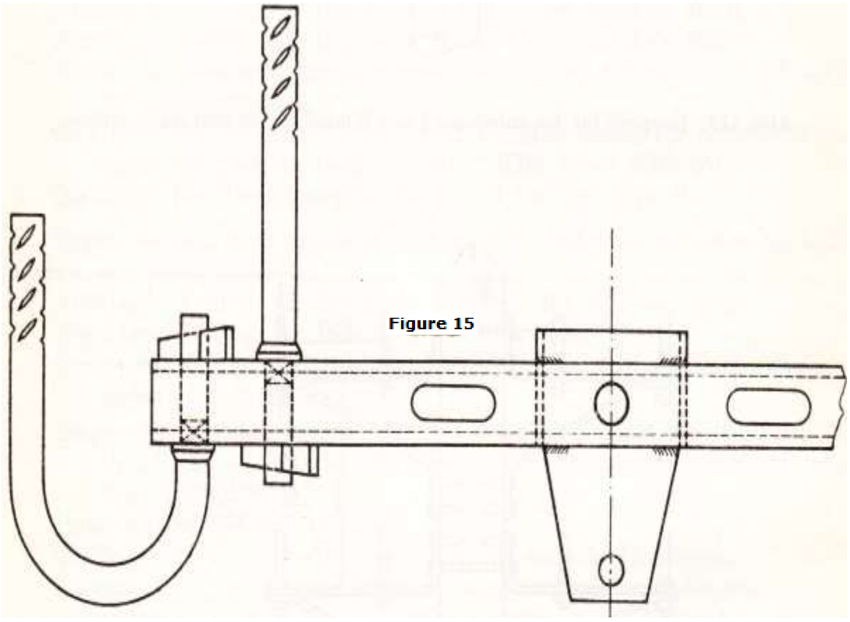

Figure 15

The scan to the left shows the general manner in which the u-shaped end brackets are attached to the crossarms.

The only differences between what is shown here and how it was done in reality is that the bracket(s) are attached to the crossarm with nuts and washers, instead of with a metal wedge, and that the pin shown above was replaced by a second u-shaped bracket.

Figure 16

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The photograph on the previous page shows a pole which is equipped with 4 two-pin brackets or arms – these don't count as normal crossarms. Two of the wires were spliced at some time, using pressed sleeves.

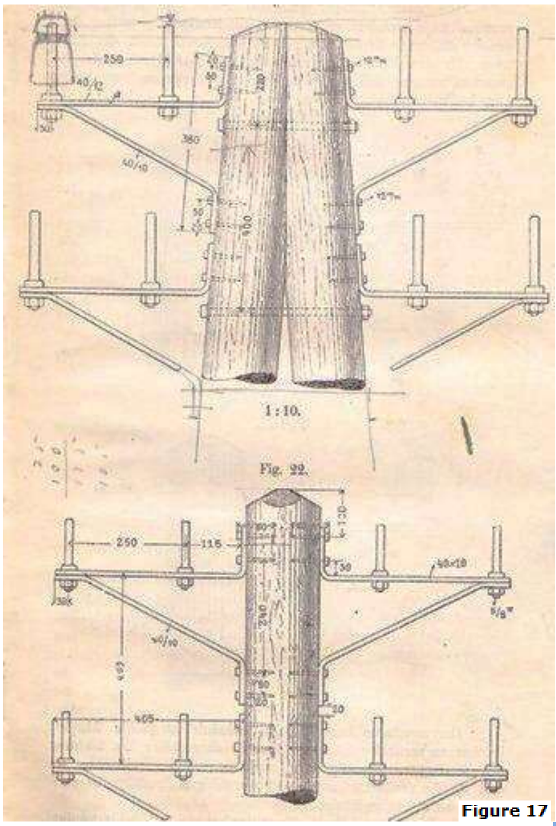

Figure 17

Another thing to be noted is that the wires are tied to the insulators on the side facing *towards* the pole; this was standard practice along straight wire runs, so that if the tie wire were to break, the line wire would come to rest on the bracket or crossarm, instead of falling off of the same (in the case of the outermost pins) and thus sagging very far down and possibly causing a short to ground.

On corner poles, the wires were tied to the side of the insulator where the line wire would be pulled *towards* the pin, instead of away from it.

The scan on the left shows the two variations of such brackets, depending upon whether they were attached to a straight, single pole or to an "A" frame double pole.

The pole on the right has several interesting features ….

First off, the pair of wires in the lower left-hand position on the pole is attached with the aid of a large, "J"-style bracket with two pins. Aside from this, the pair is marked with a wire loop, which indicates that the pair is for emergency magneto communications.

The pole also offers the very best in pair transpositions; there is a standard crossover, using four size "B" insulators, on the left side of the crossarm, while a transposition using two type "Bd" insulators is to be found at the end of the right-hand side of the crossarm.

A variation of a transposition with two type "Bd" insulators may be seen on the two pin bracket below the crossarm.

Figure 18

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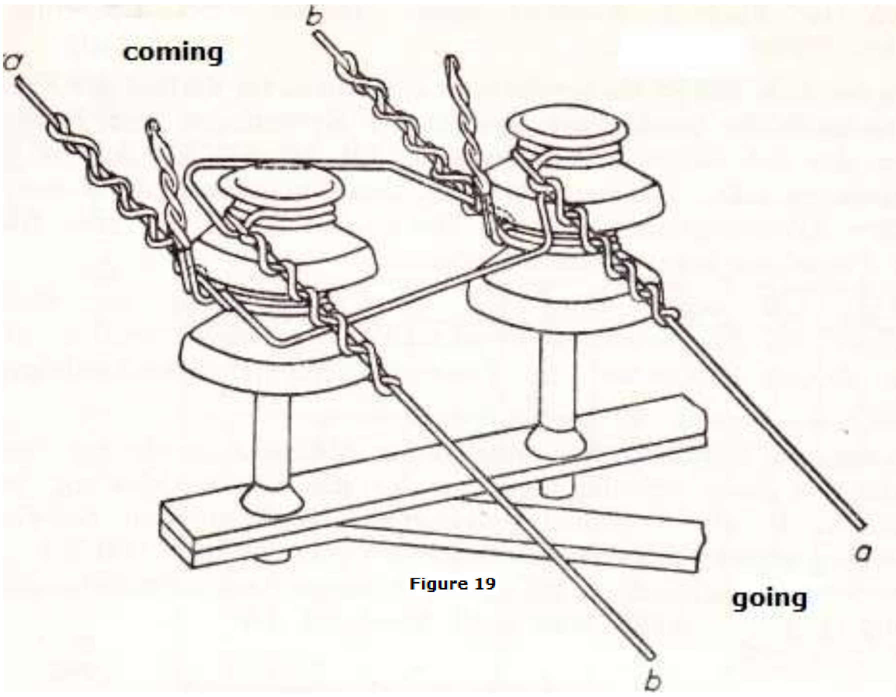

Figure 19

The scans on this page show the standard methods of transposing a single pair of wires. From an economic point of view, the method shown below is certainly less expensive and easier to realize, since it only requires two zed-shaped, flat iron bars, a few inexpensive carriage bolts and four standard size "B" insulators. The greatest advantage, however, is that the wires *don't* require cutting & splicing, such as they do if the transposition is performed as shown above.

The wires in the scan above are spliced with twisted copper half-sleeves, the open ends of which are bent over and crimped shut. These twisted splices were treated with a coating of an asphalt-based paint, intended to keep moisture out. The transpositions using the type "Bd" insulators, as shown on the previous page, are a "poor man's" version in that the splices are made by simply wrapping the wires around each other (such splices were referred to as "Western Union" splices in the USA at one time), instead of using splicing sleeves (aluminum for iron wires, copper for copper wires).

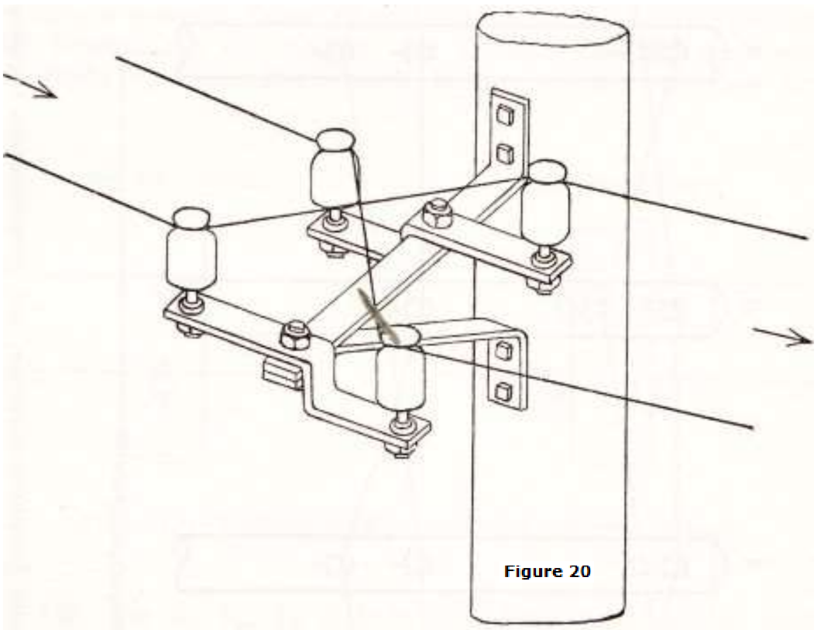

Figure 20

Figure 21

I took the photograph above while visiting the Technical Museum in Vienna in August, 2003. The demonstration mast shown is part of the display concerning itself with wire-line communications. The above is actually an enlargement of a portion of the original photograph; one can see how zed brackets and standard insulators were used to transpose a pair of wires.

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The next few photographs are a brief intermezzo showing, as they do, some of the booty a railway museum in the province of Lower Austria (about 5 minutes from Vienna International Airport) made while cleaning out one of the basement passageways beneath the now razed, old Southern Railway Station in Vienna.

I have unlimited access to this, and other, telephonic equipment at the museum because I am the manager of the rather meager telephone plant there – I am chief store-man, wire-chief and installer, all rolled into one (more about this in another tale).

The various bits and pieces shown here were found in said basement, which used to be a training ground for railway technicians being trained for open wire construction. The grime on the insulators is from the late 1970s, when training was discontinued at this particular installation.


Figure 22

The wooden box pictured above truly is a mixed kettle of fish; the bottom layer consists of A.C. power insulators, while the top layers shows three different styles of insulator pins and brackets for phone and track block signal lines.

The most prominent piece is a large "J"-style bracket with two pins, carrying two standard size "B" insulators; lying in the lower left-hand corner of the box is a type "Bd" insulator with a pin which was attached to a crossarm with a nut and washer. In the lower right-hand corner, there is a u-shaped bracket, complete with a size "B" insulator.


Figure 23

The type "Bd" insulator shown to the left is one which found its way into my collection with the blessings of the museum curator.

While it's possible to see how the lead-in wire is attached to the open wire pigtail, the first photograph on the next page shows the same in much better detail.


Figure 24

As may be seen, the type “Bd” insulator has three petticoats instead of just two, as the normal sizes “A” thru “D” have. The reason for having three petticoats is increased insulation resistance, which is of great importance because type “Bd” insulators were commonly used in transposing high-grade, open-wire phantom lines.

As can be seen, the galvanized iron wire is 4 millimeters (roughly 14 AWG) in diameter, and the feeder is an insulated, solid copper wire of 18 AWG size. It’s tightly wrapped around the dead-end pigtail and well soldered.

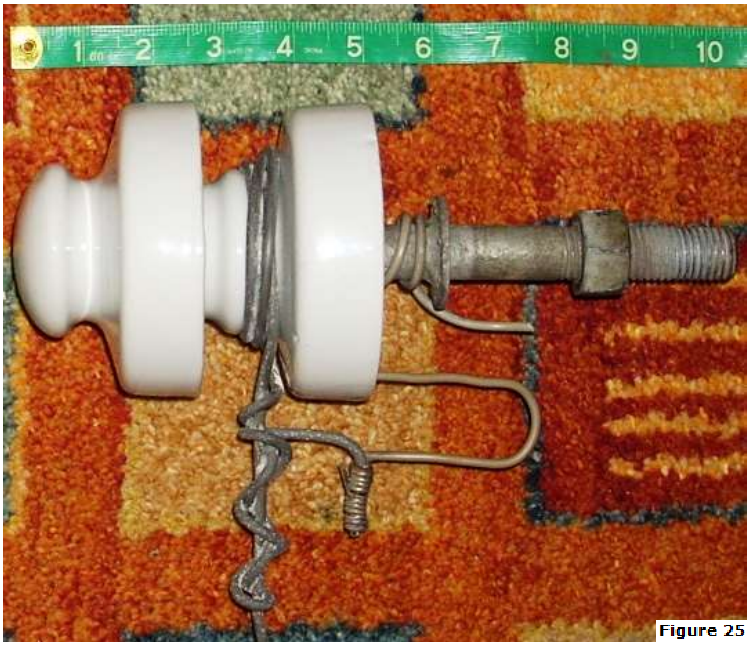
Figure 25

This photograph shows the same “Bd” insulator, after having received a thorough washing at home.

Once again, the measuring tape is in inches and, as readers can see, the type “Bd” insulator is 5″ tall – just the same as the standard size “B” insulator.

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Figure 26

A nice bunch of size "B" and type "Bd" insulators on a variety of brackets and crossarms. As can be seen, a few of the insulators terminated hard-drawn copper wire, but most were used with galvanized iron wire.

Speaking of the wires themselves, all of these insulators had spans of wire strung between them in the defunct training installation. I had been invited by the museum's curator to come along and help dismantle all of this stuff (and I certainly was more than willing to do so), but, unfortunately, I was suffering from asthma rather badly the day the work was done, and so I wound up staying at home and in bed.

I'd told the museum curator that they should take heavy-duty pliers with them and *untie* the wires from the insulators, roll them up into rings and bring them back as well. Sad to say, they didn't do this – supposedly it'd have taken too long, because the management of the Austrian Federal Railways only gave the museum folks exactly one day to pull out what they could.

One of these years, I intend to take some brackets suitable for attaching to a wall, remove the old bits of wire, clean everything, bolt the brackets to a 60 meter (roughly 200 foot) long wall in one of the display halls at the museum and string some bare copper wire between the individual brackets in order to demonstrate what an open wire line looked like.

Figure 27

The lower snapshot on the previous page was taken in order to illustrate that insulators which are the property of the Austrian Federal Railways carry the ownership mark "ÖBB" ("Österreichische Bundesbahnen" in German).

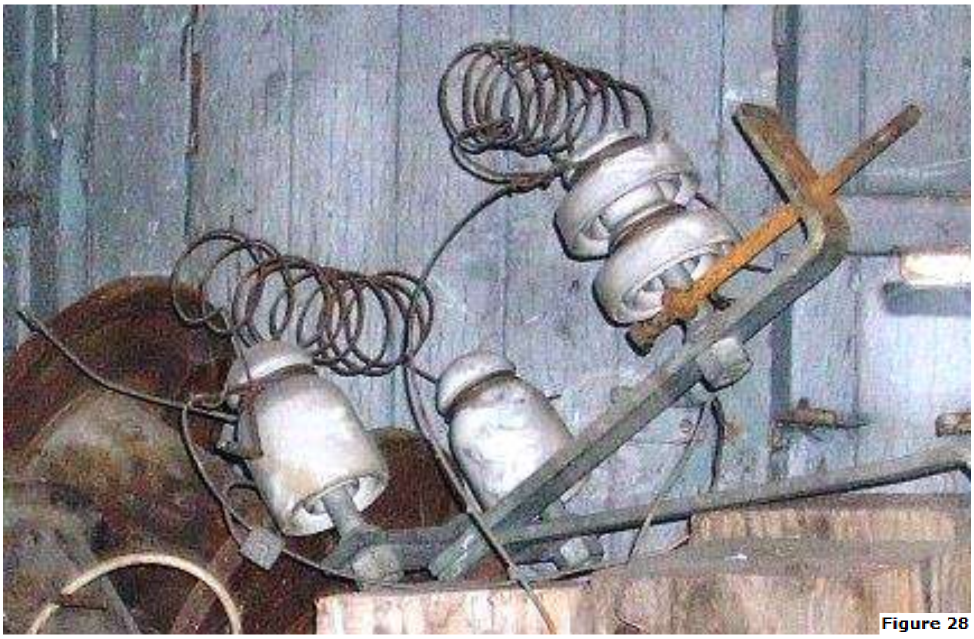

Figure 28

The tee-shaped bracket, with three insulators and some odd coils of silicon-bronze wire is a real specialty … such coils, as shown strung either between two size "B" insulators or wired up to a type "Bd" insulator (using both grooves), act as chokes. They were intended to protect sensitive telegraph equipment by blocking current surges from direct or indirect lightning strikes.

Now, back to the railway open wire lines in Lower Austria ….

The A-frame pole shown to the right is interesting insofar as that some of the wires strung were *insulated* wires – most notably those attached to the insulators on the left side, as well as one wire on the two pin bracket in the lower, right-hand position.

The only logical reason that I can think of for having used insulated wires were if the wires were strung through the branches of some trees, but this is definitely not the case here.

The reason that the insulators are more or less at eye level is that the track bed is cut into the slope of a small hill, with a public road cut into the hillside at just the right height.

Figure 29

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Figure 30

This photograph shows a portion of the same pole as on the previous page, but taken from a different angle.

Here, one can clearly see that some of the wires were insulated, and that the insulation is beginning to peel off because it became brittle from exposure to ultraviolet rays over a long period of time.

Although difficult to recognize, the lower insulator pin hook on the right-hand side of the pole has one of those odd wire loops hanging down from it. Such loops designate the magneto phone line pair to be used in reporting breakdowns and accidents by means of a portable magneto phone and wire gaff.

Back at the time when steam locomotives were still in use, it was standard practice to clean the soot and other grime from all the insulators once every few years, since the deposits could dramatically decrease the insulation resistance of the lines during inclement weather.

Cleaning was generally done using a stiff brush to apply a soap and water mix to rub the gunk off. If the insulators didn't clean well enough using this method, a mixture of turpentine and fine sand was applied by hand. In both cases, the insulators were dried with clean rags afterwards.

At the same time, each insulator was examined to see if any cracks which would necessitate replacement had developed. The insulators shown here could sure do with some thorough cleaning ….


Figure 31

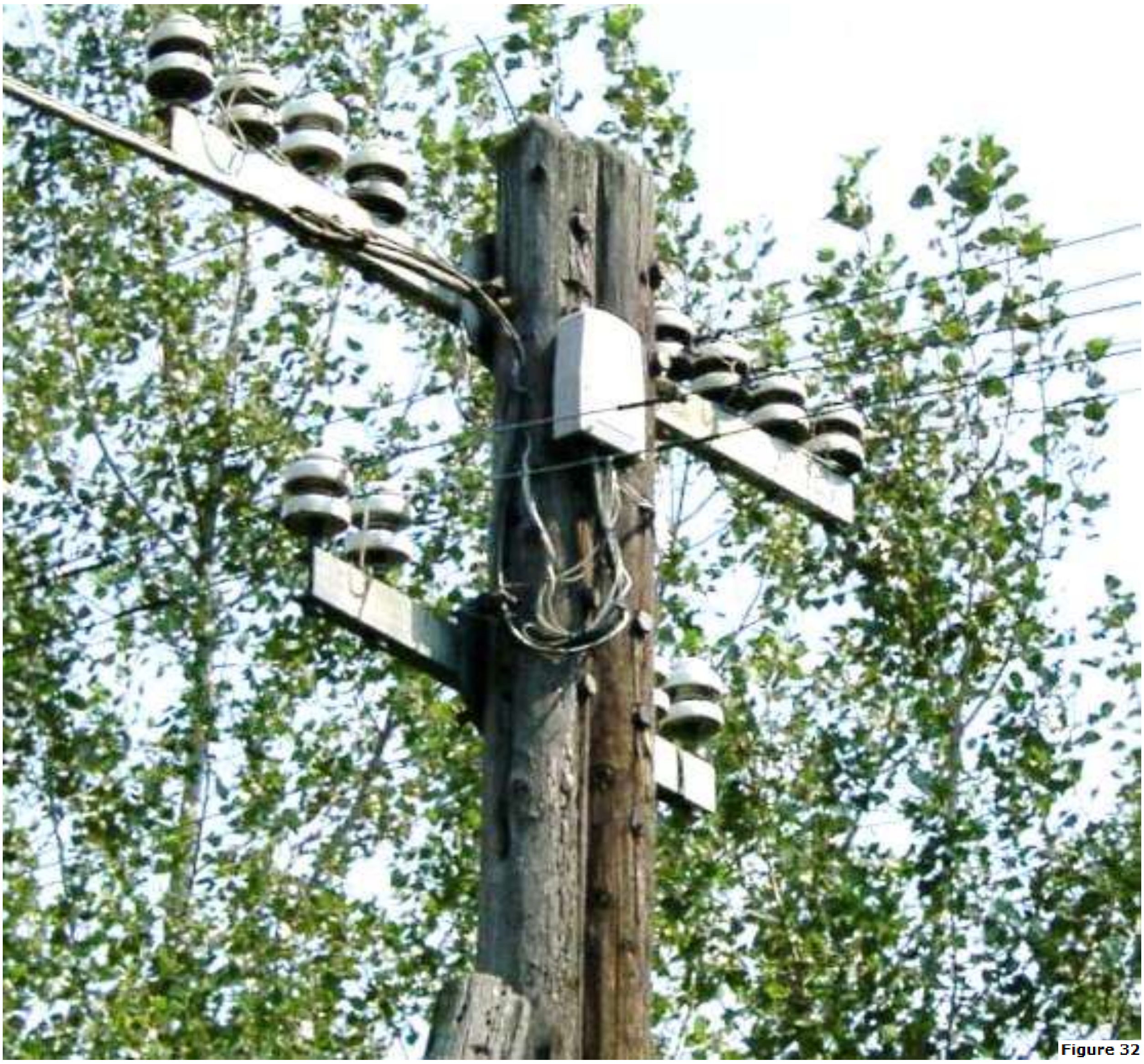

Figure 32

The photograph above would be a lot easier to interpret if it weren't for all the trees in the background … this double pole with side brace is very interesting because it's a demarcation point; the wires coming in from the right are dead-ended in the upper grooves of the type "Bd" insulators, while those continuing on towards the left are dead-ended in the lower ones.

The line wires are soldered to solid 18 AWG wires which are, in turn, connected to the wires of an aerial feeder cable by way of a standard Telecom Austria style pole junction box. The "figure 8" cable leads off to a switch-room located in a small railway station building. There, the wires from the cable are terminated on a switching panel which allows each East-West (or North-South?) open wire pair to be switched straight through or to be split for testing purposes … while it *was* possible for me to look through the window in the door belonging to the switch-room, no lights were burning inside, and the sunlight shining through the window was too weak to light the room up sufficiently so that it would've been possible to take a picture of the switching panel.

Figure 33

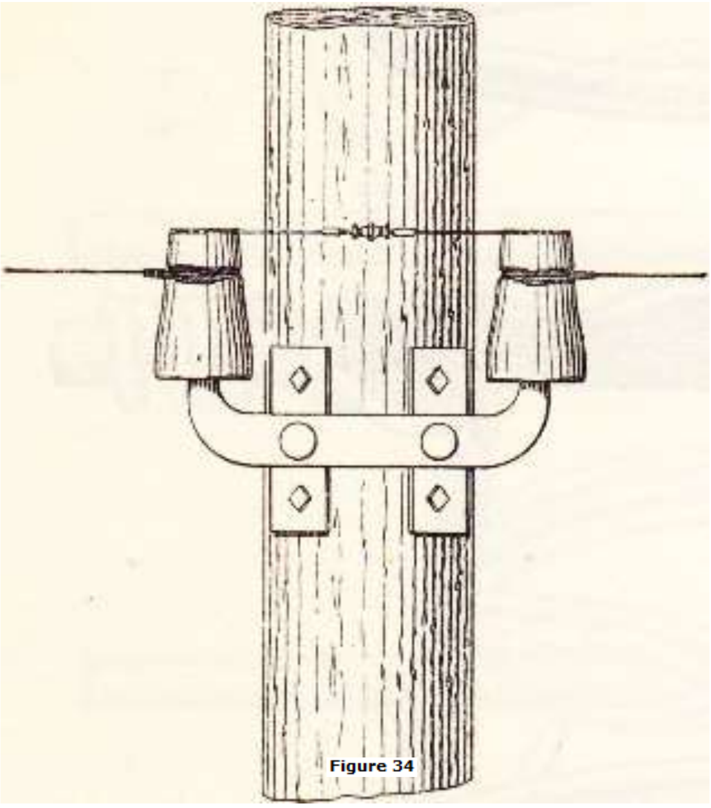

Figure 34

While the special double brackets on the pole above now serve no better a purpose than to dead-end some insulated line wires which lead to nowhere, this wasn't always so ….

In the distant past, such brackets were used to terminate wire test points, as shown in the scan. There'd have been one such double bracket for each and every circuit to be tested during preventive maintenance or for troubleshooting purposes.

The screw-type test connector was made in two different types: with or without a tension spring which prevented the body of the connector from unscrewing by itself. The type with the spring was only used on the test points of high-grade toll lines.

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Figure 35

The photograph above is another one I shot while visiting the Technical Museum in Vienna …. The demonstration mast shown is part of the display concerning itself with wire-line communications. The above is another enlargement of a portion of the original photograph.

This enlargement gives a very clear view of an inline test connector. The only difference is that here the line wires were directly soldered to the ends of the connector, while during the Austro-Hungarian Empire the ends were soldered to stiff, stranded wires which were, in turn, spliced to the line wires, as is shown on the following page.

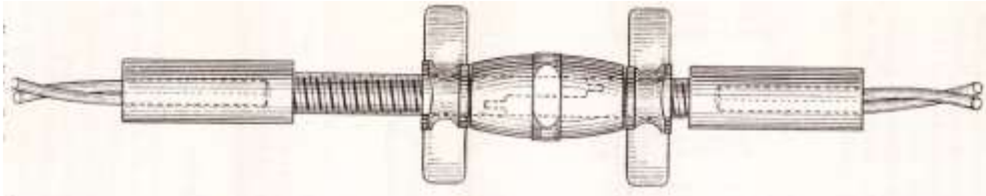
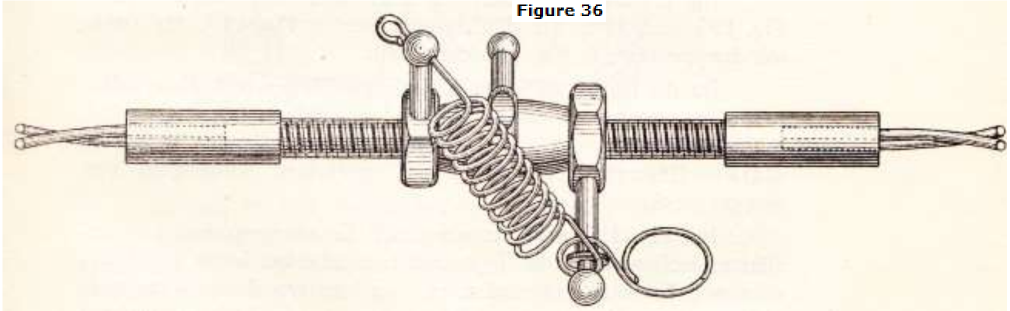


Figure 36



The scans shown above represent the two styles of open wire test connector as described two pages back. As may be seen, the end barrels of the connectors have two bare, twisted copper wires (each of two millimeters diameter) soldered in place. These twisted wires were connected to the line wires by wrapping the ends around the pigtails of the line wires and then soldering the connections, as shown in the scan below.

As can be seen, it was intended that the wires of these test connectors were to be laid over the head notch of the insulator (ones with this notch are shown on a pole on page 149[1].)

The remaining information presented in this tale has to do with the various methods employed in splicing line wires ….

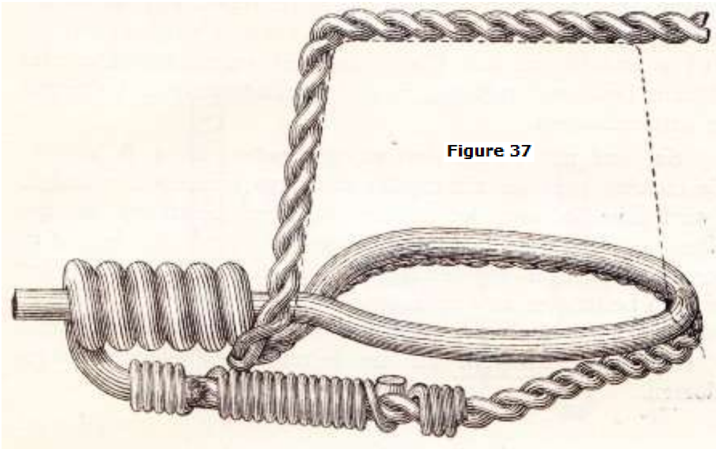


Figure 37

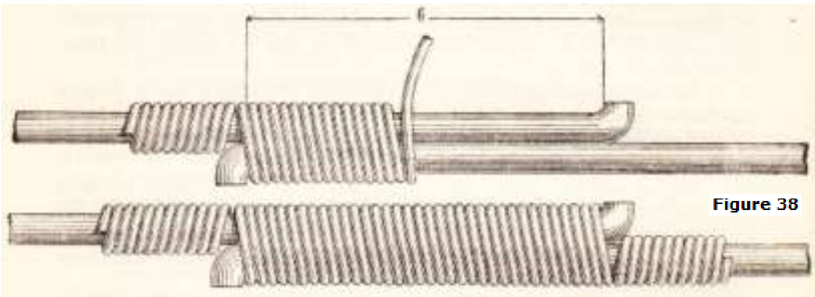


Figure 38

The scan on the left represents the oldest form of open wire splice, once known as the "Britannia." The ends of the line wires were bent to an angle of 90° and cut off so as to leave a small "hook," the length of which was roughly three millimeters.

The ends of the wires were sandpapered until bright and shiny; they were then lashed to each other with a spiral wrapping of bare copper or iron wire (depending upon what material the line wires were made of). These were then thoroughly soldered.

[1] On page 149, I wrote that insulators with a notch in the head were a type favored by the German Reichspost; they were, however, also standard with the Imperial-Royal Administration of Posts and Telegraphs and the railway administration.

The next step towards a simple and efficient splice was the style commonly known as the "Western Union" splice – the line wires are bent to a 90° angle as before, but the pigtails are left long enough to be able to wrap each one around the straight portion of the opposite line wire in at least 6 tight wraps. If such a splice is left as it is, without being soldered, it's only capable of withstanding roughly 55 percent of the strain which the uncut wire will withstand; soldered, such splices can stand circa 95 percent of the strain.

Figure 39

The nice thing about the splicing methods described so far is that they won't fall prey to dissimilar metal corrosion, whereas some of those described further on require protection against moisture in order to help prevent corrosion.

Figure 40

The photograph to the left is an enlarged excerpt from the picture on page 147. The line wires show two different types of splices.

The two fat splices are made with sleeves which are crimped to the line wires, in a manner similar to the U.S. patented "NiCoPress" system, while the slimmer splice was made with a twisted splicing sleeve.

Here is where possible dissimilar metal corrosion comes into play: while the crimped sleeves are commonly of metals similar to that of the line wires, the sleeves for making twisted splices were either made of copper (for line wires of hard-drawn copper or silicon-bronze) or out of aluminum (for galvanized iron line wires.) Iron sleeves were out of the question because they'd be next to impossible to twist – even with the aid of tools – if they were made with a wall thickness suitable to carry the strain in a satisfactory manner, while iron sleeves with walls thin enough to allow twisting could not carry enough load when compared with the line wire itself.

Twisted aluminum splice sleeves on galvanized, iron line wires are very prone to corrosion, and thus they must receive some form of protection … the answer is to paint the finished splice with an asphalt-based, pliable paint, in a similar manner as mentioned in the section concerning line transposition splices.

The scan to the right shows the tools once used in Austria for twisting copper and aluminum splice sleeves, as well as an example of a complete, twisted splice and some splicing sleeves of varying lengths and diameters.

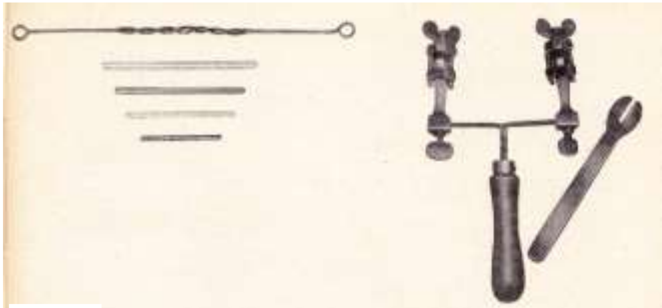


Figure 41

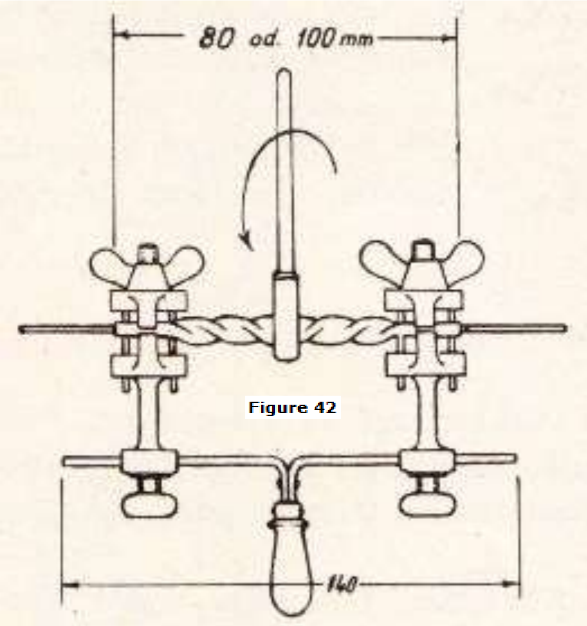


Figure 42

The splicing tool has two basic parts, as may be seen on the left.

The body of the lower part consists of a rounded, wooden handle into which two pieces of flat steel bar have been inserted. Each of the pieces carries a small vice which can be moved back and forth, along the steel bars (this is necessary in order to allow the tool to be used with splicing sleeves of all lengths).

The second portion of the splicing tool is nothing more than a type of wrench with a slot at the head end; the slot is slightly "V" shaped, so that one and the same wrench may be used on splicing sleeves of all diameters. The finished splice consists of a total of four ½ turns of the wrench.

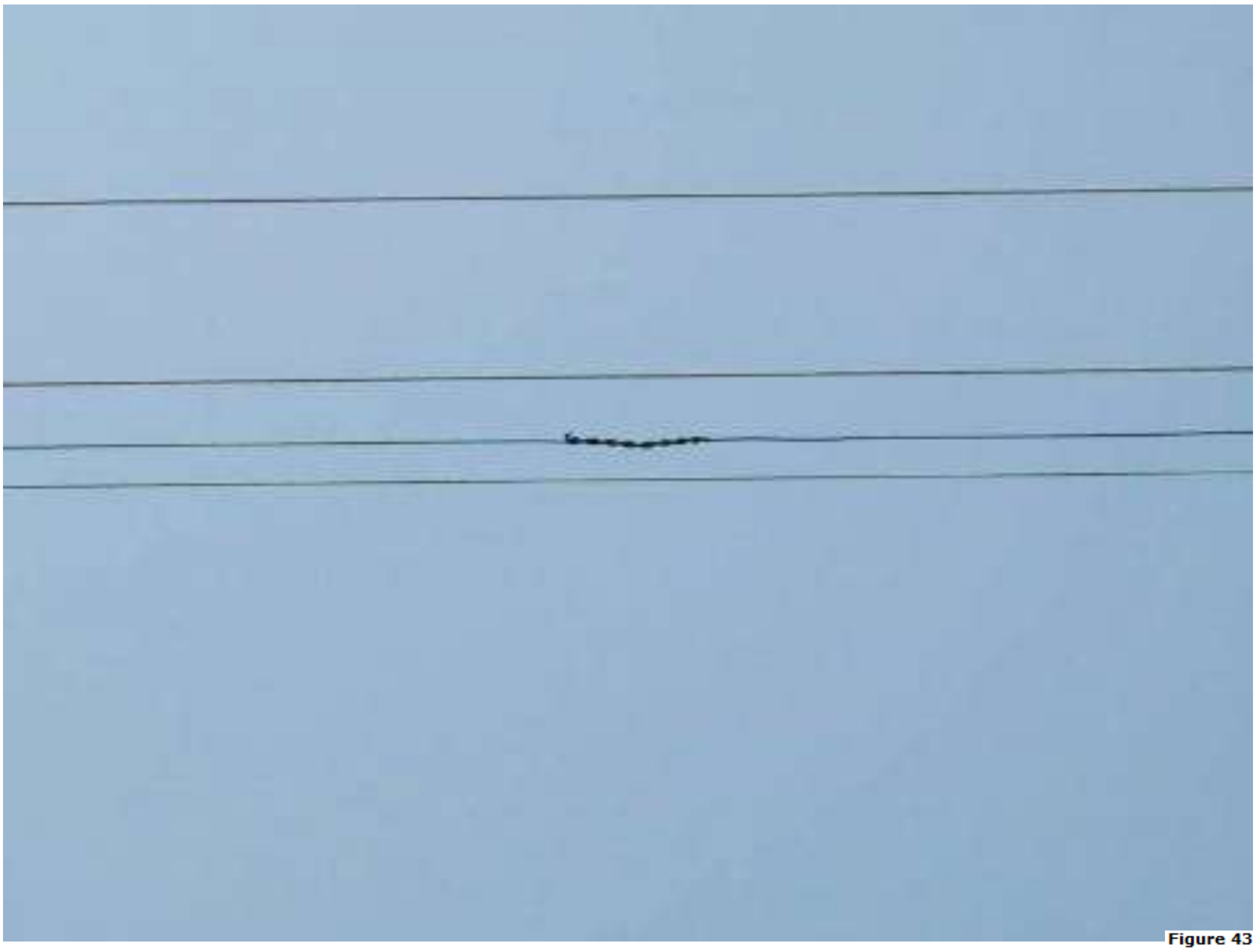


Figure 43

This photograph gives a clear view of a splice utilizing a twisted copper sleeve which was applied in the manner described. Looking at the finished splice, one problem is evident: it's bent out of shape in the middle, where the wrench was applied.

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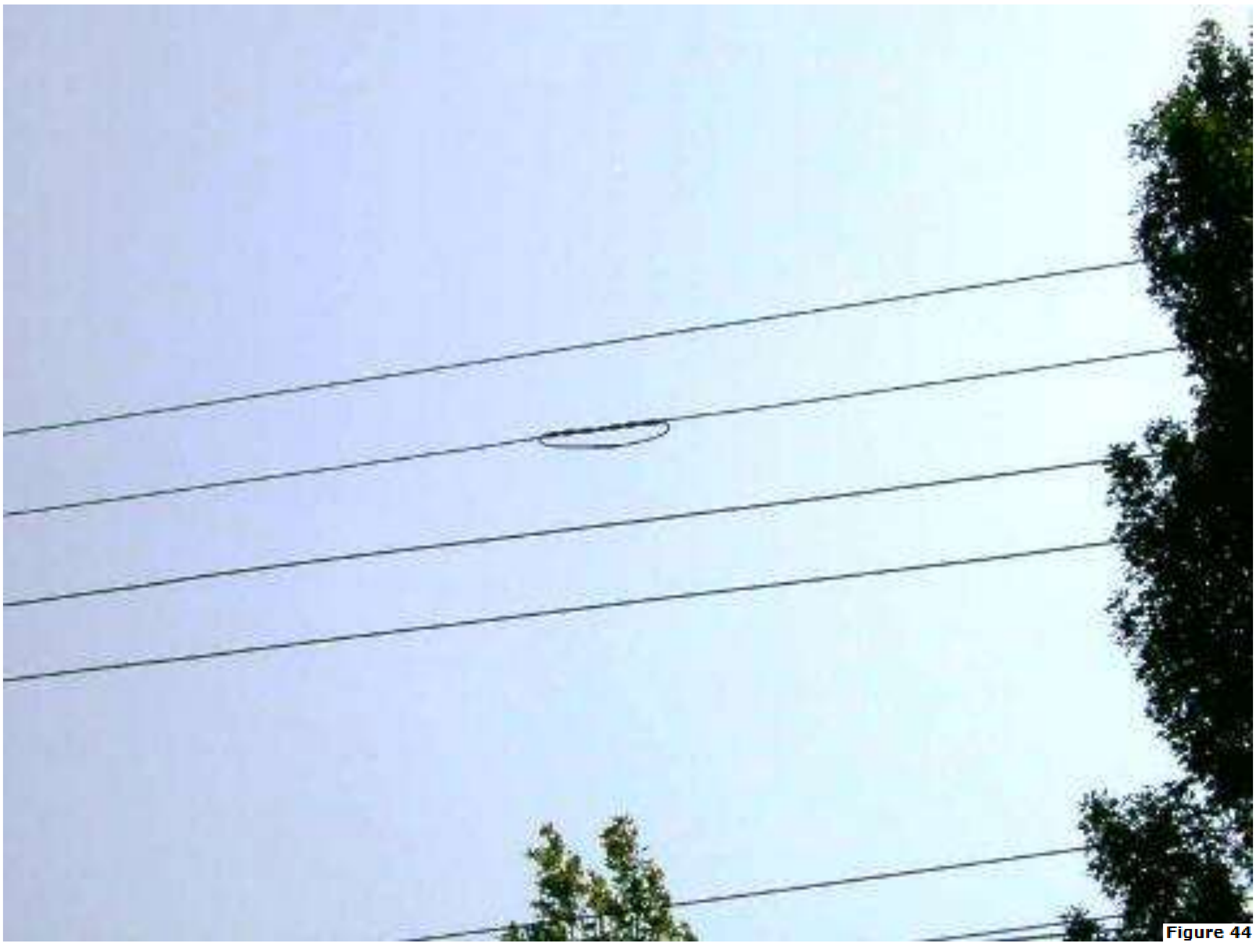

Figure 44

Some open-wire craftsman apparently didn't place all too much faith in splicing wires by the twisted sleeve method, at least insofar as conductivity is concerned … here, instead of leaving just a millimeter or two of each of the line wires peeking out from the opposite ends of the sleeve, the wires were left *very* much longer and were then spliced together with a small, crimped splice.

Figure 45

There are two different circumstances under which line wires could require splicing: 1) if line wires break due to excess strain (snow, sleet, ice formation, high winds), or 2) if the wire remaining on a spool is too short for the span concerned. In the latter case, splicing is performed on the ground … and such splices can cause problems when the wires are pulled over the crossarms, simply because the flat ends could get caught. To prevent this from happening, the ends of the splice are cut off at an angle, as can be seen above.

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Figure 46

Alas, the box of copper splicing sleeves shown on the left *isn't* from Austria – they're code number 016253 sleeves, jointing, No. 13 from England. I bought them just so that I'd have some (from anywhere) in my collection. The seller even had two of the proper GPO marked tools for twisting exactly this size sleeve – and naturally I bought the tools as well ….

I simply couldn't resist including this photograph, even though there are no splices to be seen.

What may be seen, however, is a small sortie of wasps homing in on the creosoted pole … wasps in Finland and Austria apparently share a penchant for telephone poles.


Figure 47


Figure 48

One very last thing – how did craftsmen climb telephone poles in Austria?

The scan to the left pretty much tells the tale; the climbers are more or less semi-circular affairs with several strong spikes along the inner curve. The curved arms are riveted to steel shoe soles, upon which the craftsperson stands.

Using this kind of pole climbing aid certainly requires a bit of training … I know this from personal experience. I once climbed up an abandoned telephone pole on the outskirts of Vienna in order to be able to snip off a 15 foot long segment of hard-drawn, three millimeter diameter copper line wire for my collection. It was a rather hair-raising experience because I kept slipping down the pole.

Figure 49

Here we have an old pair of climbers, as they were also used in Austria. Each climber has two leather straps; the one at the rear prevents the wearer from slipping off the steel footplate and is non-adjustable, while the one in the front is adjustable and presses the shoe and foot down onto the footplate.

Such climbers are very cumbersome to walk with while on the ground, and are extremely heavy when compared with the climbers which were formerly used in the USA – the pair shown here weighs in at a little more than four pounds.


Figure 50

The curved arm on the climber has a certain amount of freedom to rotate in the vertical plane and is attached to the footplate with a strip of drop-forged steel, which has a hole to accommodate the end of the arm. The end of the arm passes through the hole and is secured to the strap by means of a washer and rivet. In turn, the strap is attached to the footplate with three large rivets.

The arm (which is drop-forged) has a total of four large teeth which are an integral part of the arm and which bite into the pole when the wearers' weight is applied to the footplate. One has to be very careful when attempting to climb a pole with such climbers, mainly because the teeth don't bite into the wood very deeply. As I already wrote, it was a hair-raising experience attempting to climb a pole without previous training – and I don't intend to repeat it.

Telephone Plant at a Railway Museum in Schwechat, Lower Austria

I'd certainly not have looked for a railroad museum on my own, but around October in 2003 the exit ramp to Vienna International Airport (Wien-Schwechat) from the A4 (eastern highway) was under reconstruction, and a detour through the nearby town of Schwechat, routing traffic via the old Federal Road number nine, confronted me with the following sight:

Figure 1

So, among all of my other hobbies, such as collecting telephones, switching equipment, climbing down manholes, collecting historical papers, postcards, newspapers, &c., writing unusual tales and articles &c., Austrian standard- and narrow-gauge steam, diesel and diesel-electric engines, freight and passenger cars became a part of my "thing" …. Well, not *really* – I mean, how many folks have a backyard big enough to collect standard-gauge steam engines on a 1:1 scale?

However, being an adventurous soul, I decided that I'd visit the museum when I found the time to do so; my first visit was in December, 2003, and although I never became a member of the Association of Railway Fans and don't pay any membership dues, I practically have the run of the place (with my own set of keys, to boot) since I took it upon myself to become the museum's telephone plant manager.

Being a telephone plant manager might sound like fun and games to some, but at this museum it's akin to the proverbial bike ride – no matter which way you head, it's uphill and against the wind. Back in 2003, the entire "telephone plant" consisted of exactly two German type "OB-33" magneto desk telephones (more on this type of phone may be found in the next tale), with a total of about 800 feet of buried cable (in 2 segments) and about 200 feet of a cable consisting of only a single shielded, twisted pair – and even this minimal plant was in *very* poor condition.

The folks at the museum were using these two phones for dispatch services on their 600 millimeter narrow-gauge line, which runs from one end of the museum grounds to the other. One of the phones (shown below) was located in the buffet, near the ticket counter, while the second phone was located in the narrow-gauge engine shed.

Figure 2

To tell the truth, the snapshot shown above was taken in 2004, *after* I had made the very first minimal improvements to the plant … the battery/terminal box for the phone has been attached to the wall, and a third OB-33 phone had been installed directly at the ticket counter. This third phone was found to be necessary because the museum is so understaffed that the person doing ticket sales was often also responsible for train dispatching, and running back and forth between the ticketing counter and the phone was simply too time-consuming.

Since the museum had no stock of telephone materials from which I could have drawn the third phone, I donated one of lesser-quality (and thus lower-priced) OB-33s from my collection.

Figure 3

The OB-33 at the other end of the narrow-gauge railway line on the museum grounds … readers may take note of how "professionally" the battery/terminal box was mounted, and also how the "ringing code" table was attached to the phone.

This phone had a loud-ringing extension bell, mounted under the eaves of the shed – but it certainly didn't ring very loud; come to think of it, the extension bell didn't ring at all, because someone from the museum had backed a truck into the eaves, breaking both gongs off the ringer some time before I started working there.

The worst thing about the telephone plant back in 2003 was that there were all *sorts* of annoying background noises on the line – buzzing, beeping and a very odd-sounding, most unusual flutter … louder on wet days, quieter on dry ones. Naturally, I am by no means a professional when it comes to the upkeep and daily operation of any sort of telephone plant, but the cause of the trouble was more or less self-evident.

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Figure 4

One can't see it in the photograph, but this is the spot where the two pieces of cable[1] that the folks at the museum had buried at some earlier date "met" – one wouldn't dare to call it a splice … whoever originally installed the two OB-33s had simply hooked up two of the wires between the cables, using a screw-down terminal block more commonly used for electrical power connections. To top it off, the wires had lost some of their insulation and were lying directly on the ground.

Well, that certainly explained where the noise was coming from – but their buried cables are a headache in general, simply because they aren't *telephone* cables in any sense of the word, but rather have a single twisted pair in the core, surrounded by a spiral layer of 8 individual signal wires. Whoever had originally hooked up the two phones simply used one wire from the twisted pair and one from the outer layer of signal wires as his "phone line."

[1] Readers can see a total of three cables in the photograph: 2 insulated in black, 1 in slate. The black ones cause all my outside plant headaches.

The only photograph which I was able to find which shows the original phone "wiring" is shown above. The black cable snaking into the picture from the left side is the end of the buried cable inside the shed in which the standard-gauge engines and cars are on display.

As stated on the previous page, the cable has but a single twisted pair (insulated in black and blue) and 8 individual signal wires in the outer layer – one of these wires is insulated in red, the other seven in black. If readers take a good look at the photograph, they will see that a wire insulated in red, and one insulated in blue, are connected to the small, yellow terminal block in the lower right of the photo … using such an unusual "pair" is a guarantee for trouble due to line asymmetry. The microphone cable used as the phone line from here to the ticket counter is the thin, slate-colored cable looped together with the black "phone" cable and held in place with red insulating tape.

The rectangular metal box to the left, and the thicker slate-colored cable leading to it, are part of the original telephone plant dating from the time when the museum grounds were still used by the Austrian Federal Railways. All of this stuff was left in place (but disconnected), when the railway shops on-site were shut down.

The distant end of the museum's efforts at phone wiring is located in the narrow-gauge engine shed – a long coil of that ugly signal cable, bundled up on the ground, with some more microphone cable hooked up to the red and blue wires, again with an electrical terminal block.

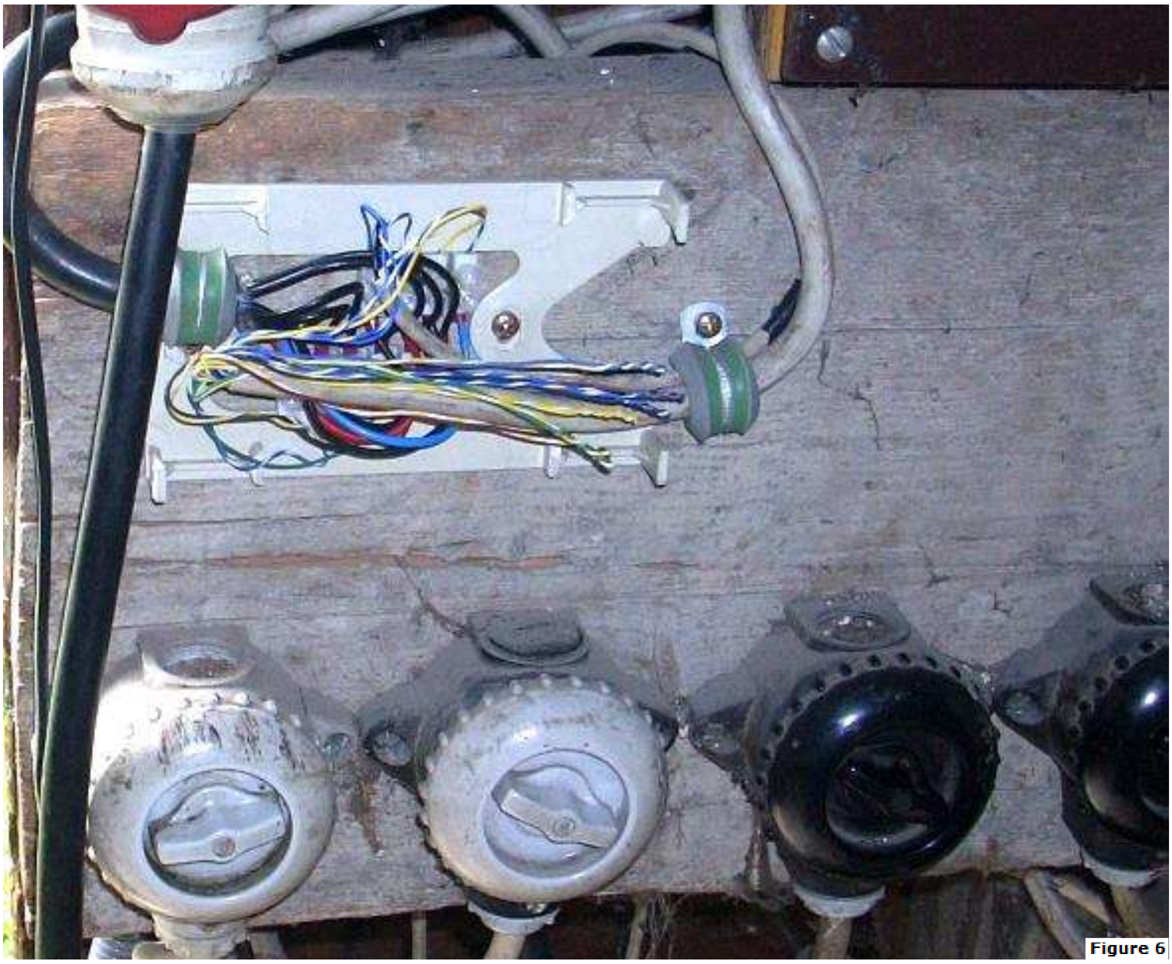

Figure 6

Of course, I wouldn't want to claim that I am a saint when it comes to the museum's telephone plant, but anything would've been better than what I found in place ….

Once again, the photograph shown is from a somewhat *later* date, after I had lain in a long segment of true phone cable, with properly twisted pairs, between the engine shed and the workshop building at the back end of the museum grounds. The getup shown consists of nothing more than a small W.E.Co. box with some electrical terminal blocks to hold the wires together.

Trying to get the folks at the museum to dig a narrow slit trench between the engine shed and the workshop, in order to be able to bury the cable and thus keep it out of harm's way was impossible, so the cable was simply laid in next to one of the tracks which terminate on the far side of the grounds … sure, if I were a millionaire, things would be different. Things *had* changed a bit as of October, 2011, because the Austrian Federal Railways buried some new conduits to serve a cell phone base station on the museum grounds, and the museum curator managed to con the railway folks into adding two ducts between the buildings. I thought I would be pulling my phone cable in after the museum shut down for the winter ….

Naturally, the folks from the museum and those from the Austrian Federal Railways didn't route the conduits in a manner in which they'd actually be *useful* for anything … the ducts are roughly two inches in diameter, made of *ribbed* plastic, similar to the stuff installed in walls nowadays, laid with as many zigzags as humanely possible and without any sort of rope or cord inside to aid in pulling cables through. They also installed the two conduits with no more than a single, small "cable-well" along a roughly 250 foot stretch; so now I need to figure out a way of running a rope through the conduit without having to dig everything back up again. And, when I'm finished with that, there is still a distance of roughly 50 feet where duct is missing, between the cable well and the narrow-gauge engine shed. So much for hoping that they'd finally do something right ….

Figure 7

The picture shows the head end of the two flexible conduits the museum folks plowed into the ground … the ends of the conduits can be seen in the lower, left-hand corner of the photo. These are supposed to be buried in the roadbed and lead to the building on the right.

The red line in the photograph shows the approximate route of the conduits as laid; the big problem with these flexible conduits is that they easily collapse when run over by a heavy truck – even when buried – and the roadbed here is one of two which such trucks use in order to deliver heavy equipment and materials to the museum.

The museum should have known better than to bury flimsy, flexible ducts because the ones they buried about twenty years ago are both crushed and unusable.

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Figure 8

The continuation of the red line shows the nice zigzag they put into both the conduits. They pass beneath one railroad track – this track is a spur line which belongs to a company which distills air into technical gases and medical oxygen, and this one track *must* meet all standards of the Austrian Federal Railways (whereas the bulk of the tracks on the museum grounds don't meet *any* standards). Thus, despite the general screw-up concerning the route the conduits take, it was good that the Federal Railway employees did the work of running them beneath the track.

The yellow line shows the direct route between the workshop building (on the right) and the narrow-gauge engine shed (off on the left). This was the route which the museum *promised* me they'd use to bury two smooth-walled, rigid ducts … nice, relatively short and straight ducts, into which it would've been easy to pull some cables.

Figure 9

Figure 10

One can see that the ballast had been removed from between four of the ties and replaced after the ducts and conduits were laid in. This segment of the ducts adds a second, heavier, zigzag to the route – and there is no cable-well to aid with pulling in any cables … a masterpiece of ineptitude.

Figure 11

Figure 12

Now we are approaching the one and only cable well allotted to the museum-owned conduits. One of them ends at the well (the one I am *supposed* to be happy about), while the second one runs on through the well and further along the spur track.

Figure 13

The lower picture on the previous page was shot while I was standing on the cover of the cable well, looking towards the narrow-gauge engine shed. There is very much heavy junk between the well and the shed – all of this stuff must be (re)moved to bury the 50 odd feet of missing duct.

The problem is that the duct (*if and when* the museum gets around to digging a trench and burying it) will wind up being a good ten feet to the right of where it'd actually have been useful. This means that I'll have to rearrange the cabling inside the shed … luckily, I wasn't rash enough to have cut the buried signal cable inside the shed, leaving only enough to terminate it; instead, I left the original coil of cable as it was, and this is long enough that it would've been possible to pull it into the duct originally planned.

Figure 14

This photograph shows the route of the second conduit after leaving the cable-well … it runs a good sixty to seventy feet, only to peter out in the middle of nowhere. By the time the museum folks come up with a sensible use for this conduit, it will have disintegrated due to old age.

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Figure 15

The object in the red circle is the end of the second conduit. There are plenty of sections of tracks to the left of the conduit – so one can be pretty sure that the museum won't be erecting any sort of shed or other building on the concrete foundation at any time in the foreseeable future ….

BTW – all of a sudden, the museum curator had the odd notion that he could boss me around. He can certainly *try* to do so, but since I am not a member of the Association of Railway Fans (and therefore don't pay any dues) he won't be getting very far with such an attitude. I *voluntarily* do my thing out at the museum, as I see fit and whenever I feel like doing anything with the outside plant, so I won't tolerate any form of bossing.

I was out at the museum a few days ago and gathered up all of the phones and other material which is my private property and dumped the stuff into my car … so that, if the curator should insist to continue bossing me around, I only have to hand him the keys and call it quits. Actually, it'd be much fun to do so, because the museum doesn't have a copy of my wiring plans, and I have no intention of handing them over.

Anyway, the magneto phone line was "upgraded" by the addition of one further OB-33 phone and by the replacement of the external ringer on the narrow-gauge engine shed around 2005. The museum curator thought it'd be desirable to have an extension in the changing room of the workshop building, so that the magneto line could also be used for business which isn't directly related to the operation of the narrow-gauge railway.

Figure 16

Wonder of wonders, the museum actually managed to come up with the OB-33 wall phone shown here – NOS, at that.

The wall-mounted and desk versions are the same electrically; however, the original design didn't foresee a wall-mounted version. Instead, it was common to mount a desk set on a small iron table which was attached to the wall, exactly as was done with the phone on page 173.

This additional phone served its purpose well; *too* well, actually, since the line was then often blocked with traffic not related to the dispatching service – which was quite a nuisance during the busy summer months.

This over-use of the magneto line prompted me to expand the telephone plant to add a museum internal, digital PBX.

Adding PBX service to the plant caused its own heap of headaches, but what would life be without any challenges?

The first order of business was to lay in a "real" phone cable between the workshop office and the narrow-gauge engine shed. Naturally, there was no money on hand to allow me to go and buy some high-grade, ten-pair phone cable so that, at least, a small portion of the outside plant would meet real-life standards. The museum had on hand several longer and shorter segments of *indoor* phone cable, of varying pair numbers, and I spent one long Saturday afternoon sorting these out and splicing suitable pieces together to form longer cables.

The next big problem was figuring out where the small conduits leading out of the office on the first floor of the workshop building (where the PBX was to live) actually ran to … and this was a real challenge, because no drawings of the conduit layout existed.

BTW: in Austria, older buildings were built of brick, and the conduits were oftentimes plastered or cemented into slits chiseled into the bricks. Way back when, these conduits were made of thin-walled, metal pipe which was lined with waxed paper inside. Later, conduits were made out of smooth, rigid PVC, while the most modern stuff for installation in walls is semi-rigid, ribbed PVC conduit.

After deciding which conduits were suitable came the problem of running some good fish wire through them and then pulling the various cables into place … I was rather miffed when I discovered that one of the cables I pulled in was a good 3 feet too short (it was, naturally, the longest of the indoor segments). The various cable pieces inside the workshop building were spliced together with some inexpensive, jelly-filled IDC connectors.

Figure 17

… again, nothing a real telephone plant manager or wire-chief would be proud of, or even tolerate, but without money, what can anyone seriously do?

The cable running outdoors, along the tracks, was spliced together out of five separate pieces – with the wires soldered together inline and protected by shrink sleeve. Since the cables were intended for indoor use, I decided to run them inside rigid and semi-rigid conduits outdoors, so as to give them a minimum of protection.

Figure 18

Figure 19

The photograph above shows the digital PBX, as *originally* installed in the workshop office. The two slate-colored boxes on the left are terminals for 20 and 50 pair cables which are railroad property … there are also two small cable terminals in the main display hall, as shown on the right, and I had hoped that a few pairs from one terminal at one end of the museum grounds might have remained patched through to one of the terminals at the other end, but when the Austrian Federal Railways pulled up stakes, they disconnected everything.

Of course, for a fee and monthly rent, they'd be more than happy to reconnect the lines ….

In case anyone is wondering: yes – the digital PBX and the phones which went with it were one of many donations to the museum. The PBX has its own little history as well … back around 1990, when this type of PBX was officially offered by the Austrian PTT, one could buy it outright (for roughly US$ 1,000.00!) Between circa 1997 and 2003, the Austrian PTT held a yearly flea market, selling off all sorts of old and unusual equipment, for the benefit of the Saint Anna Children's Cancer Center in Vienna. The PTT was then only taking 50 Euro (roughly US$ 75.00) for these NOS digital PBXs, complete with four NOS desk phones.

Figure 20

The photograph shows the next upgrade to the telephone plant – I had bought a few NOS pole cable terminals at a flea market in Lower Austria (the exact same units as previously used by the Austrian PTT) and thus had some more stuff to play with. This was certainly tidier than just running the wires and cables into the PBX … as was originally done.

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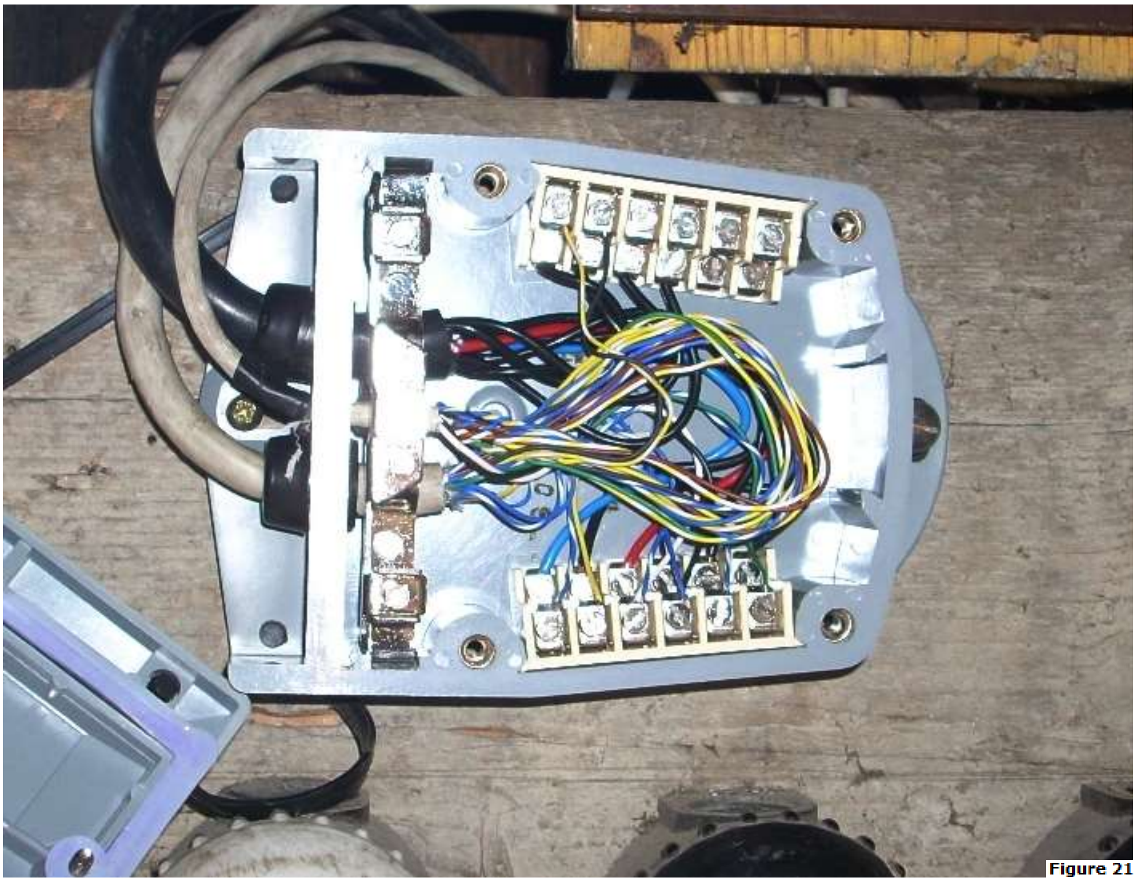

Figure 21

The new cable terminal in the narrow-gauge engine shed; also a lot more professional than my original solution, but that ugly, old signal cable is still part of the outside plant – and there is little hope of this changing at any time in the foreseeable future. To answer an unasked question: yes, even the individual signal wires are utilized in that wires 1&5, 2&6, 3&7 and 4&8 are "paired" together… after all, they're twisted around the core pair in a symmetrical manner.

The splice between the two segments of this signal cable was "upgraded" to a soldered splice, wrapped with self-vulcanizing rubber tape to make it waterproof … but this was changed to a cable terminal box when the museum curator decided that he wanted another magneto phone installed, right at the point where the two cable segments meet.

The problem was that the only terminal box left in my personal stock didn't have moisture-proof cable punch-outs; I was forced to resort to wrapping enough self-vulcanizing rubber tape around the cables to make a tight fit through the openings. In order to further prevent water from entering, the box was placed on the ground in such a manner that the cable entrance end was slanted *downwards*. In the unavoidable sequence of events, during the autumn months, someone from the museum fiddled around with the terminal and left it standing end-on, cable entrances <u>up</u>.

The first news of trouble I received the next spring was that the line to the ticketing counter was out of order … yep, the box was full of water, and electrolytic action had corroded the wires from the PBX line right off of their terminals. How does that old saying go? Never attribute to malice that which may be attributed to sheer ineptitude ….

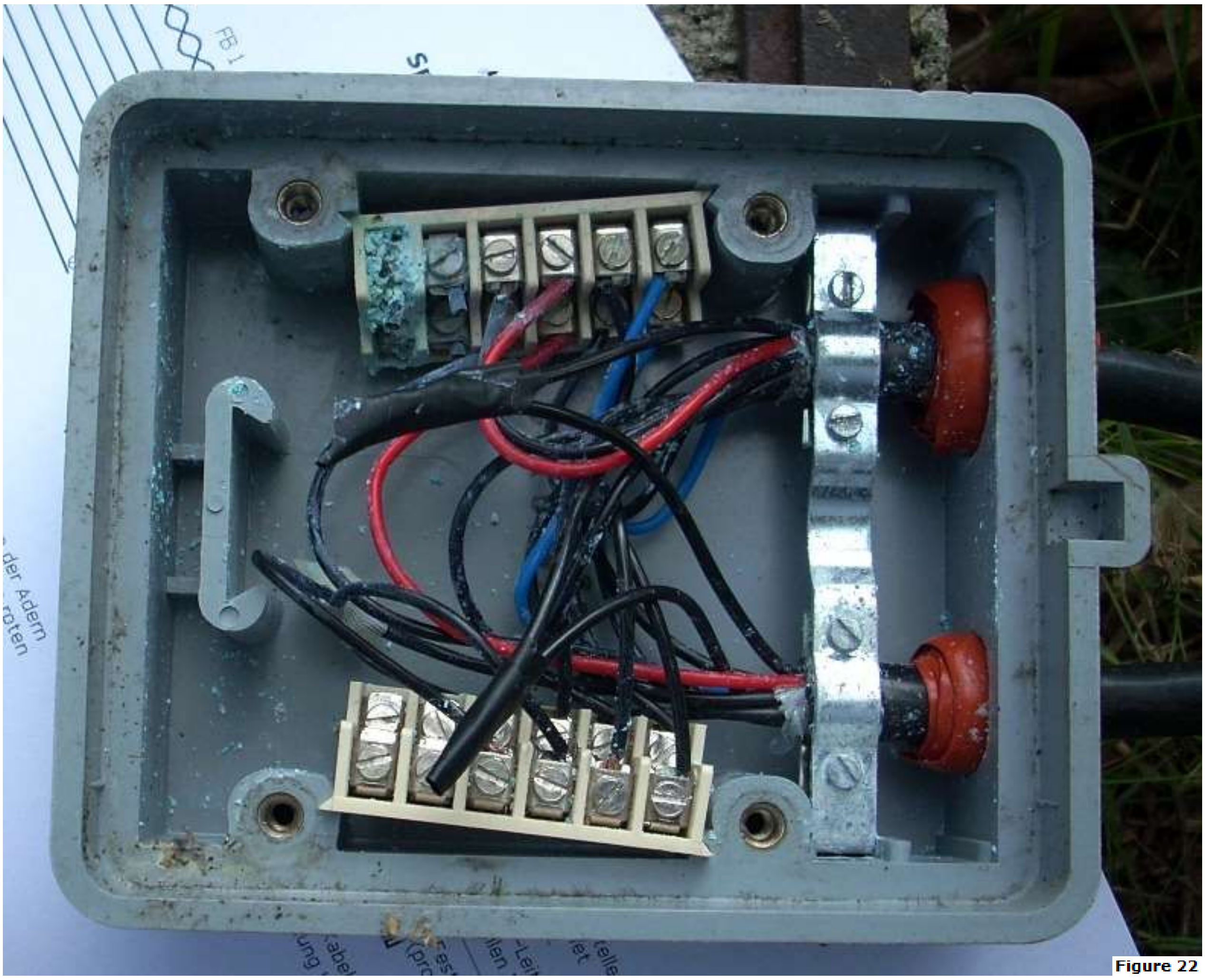

Figure 22

What to do now – with no more spare parts on hand? Simple: start reading leaflets and flyers from the hardware stores and hope to find something useful ….

Figure 23

I actually *did* discover something useful – a waterproof, re-openable splice case intended for A.C. power wiring.

The blue splices on the wires are actually "tap" style IDC units intended for automotive wiring, but they were the best bet for a quick repair, since the wires in the two cables are of a similar gauge as your average car wiring.

Some readers may be wondering about the cable end in the shed in which the standard-gauge engines and cars are on display … the last I made mention of *that* end of the line, only two of the wires were in use – for the magneto phone line. Well, referring back to page 175, there was this nice, thick, "figure 8" cable running from a railway terminal box to the front end of the building, where some of the pairs were spliced to other wires, which originally led to the cable terminals shown in the lower photograph on page 185.

This cable was chopped off at the terminal box and, ah, "spliced" to the signal cable (using those ubiquitous A.C. power screw-down terminals) and the wires at the distant end of the cable were then soldered to a newly-installed piece of used phone cable, which is terminated in the buffet, behind the green-painted, spiral stairway seen in the photograph on the second page of this tale. The three photographs below illustrate the situation at the present time.

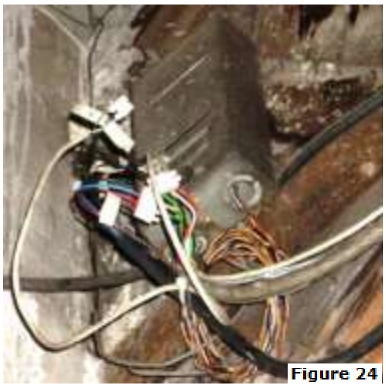
Figure 24


Figure 25


Figure 26

The largest obstacle in this phase of "construction" was that the "figure 8" cable only contained two type III spiral-four quads – four pairs – but the signal cable has ten wires in sum… so, the original segment of microphone cable was left in place and used to extend the last two wires belonging to the signal cable. At this time, the magneto phone line had four phones connected, and the internal digital PBX was in operation with three extensions and no outside line.

The railway museum is part of a large group of cultural events and museums in the province of Lower Austria, and this group (as a whole) offers various rebates to its members; some of the events and/or museums may even be visited for free by members … the membership card is a straightforward magnetic strip type, similar to those used with ATMs, &c.

Naturally, there must be some way of keeping track of who visited which museum or event – this is done with a handheld card reader which is normally docked to a cradle and is connected to a telephone line. This presented some operational difficulties at the museum, since they didn't have a telephone land-line on the premises … the museum curator had to take the reader home once a week and download the data manually.

There are no telephone cables on the museum grounds which belong to Telecom Austria, and it would've cost the museum well over US$ 3,000.00 to have a phone line installed by them. However, it turned out that there was an inexpensive alternative available: the Austrian Federal Railways were willing to install an extension phone, connected to their own national PBX system, with direct inward dialing to the extension from anywhere in Austria. The price? Roughly US$ 200.00 … so the museum opted for this railway extension phone. As such, the railway museum now has the longest local telephone number in Austria (5 digit access number to the railway PBX, a 3 digit area code and a 5 digit extension number).

One would think that it'd be easy to connect the CO terminals from the museum's internal PBX to the railway PBX line, so that potential visitors could call the museum and the calls be answered from any extension. Well, I didn't see any potential problems – until I went ahead and tried to put the idea into practice.

It simply refused to work as advertised … about 80 percent of the time, the museum PBX didn't recognize incoming calls at all, and the rest of the time the electronic ringers of the extensions would give no more than a single, wilted chirp when the railway phone rang. Curses – foiled *again*!

A few simple measurements on the railway PBX line revealed the cause of the trouble … *their* ringing voltage is a mere 24 V.A.C., while Telecom Austria phone lines have a nominal ringing voltage of 60 V.A.C.; due to this unusually low voltage, the museum PBX didn't take notice of the fact that the CO line was ringing at all – and there was *no* way to get around this, because the museum's PBX was designed to interface to a standard (European) phone line with a ringing voltage of at least 45 V.A.C.

The only workaround was to try and find some other small, digital PBX which was less picky when it came to phone ringing voltages. I found one lying in the dust in the museum's electrical equipment storeroom, sans operating instructions and power cord. It turned out to be an outdated model, but at least it was possible to find the programming/operating instructions on the internet. This little "gem" was fully programmable, and offered all sorts of cute features; the only problem was that, in order to be able to utilize them, one needed some software (which was still available) but this software only ran under Windows 3.3! The only alternative was to program the PBX via the keypad from extension number 1 – this took the better part of an hour, after having decided which features might actually be useful.

Of course, there was no guarantee that this PBX would behave properly when connected to the railway PBX line, but luck was on my side *this* time, and the PBX actually did (and still does) work properly. The only foreseeable trouble will come when the PBX eventually quits working, because there is no suitable replacement in sight … the trouble being that the railway PBX line doesn't accept dial pulses; otherwise I could simply replace it with a small, analog PBX which utilizes good old electromechanical gear for all switching purposes.

Yes, I *am* aware that I could go and buy a pulse to tone converter and interpose this between an electromechanical PBX and the railway PBX line to work around the problem, but using a electromechanical PBX would mean replacing the DTMF phones with ones with dials, and this'd mean that the museum would have to live without the combined phone/fax machine at the ticket counter … which is something they don't want to do without.

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Figure 27

One problem this PBX posed was of a mechanical nature – it was intended to be mounted upon a plastic frame (because the wiring was supposed to enter the unit from the back), but this frame was missing … which is why I mounted it on a homebrew wooden backboard (a minor technical inconvenience was that the Austrian digital PBX had single-digit extension numbers from one to five, while this one uses numbers 31 thru 36 for the extensions).

One major problem remained to be solved – what to do if the PBX quits working. There must be a provision for connecting the extension phone at the ticket counter directly to the railway PBX line … and that is what the little switch to the right of the PBX is for.

Of course, there were a few other minor difficulties to be overcome as well. One of these was that the PBX offered two options when seizing the CO line: either wait until dial tone is recognized and then connect the extension to the CO line, or else always wait three seconds and then connect the extension to the CO line, even if dial tone isn't recognized or present. Naturally, the museum PBX *doesn't* recognize the dial tone provided by the railway PBX, so that only option number 2 is available. The problem is that the museum PBX provides a *simulated* CO dial tone on the extension line in this case (until the CO line is seized), and the two dial tones sound *very* similar, so that it takes a good ear to be able to tell when connection to the railway PBX has been established.

Another problem was that the handheld card reader can only be programmed with one pause during dialing, but dialing out via the museum PBX would require two pauses; therefore, it wasn't possible to connect the card reader to the railway PBX line via the museum PBX – a direct connection to the former was necessary for things to work as intended … and, as we know, there is but a single true twisted pair available in the buried outside plant.

I was forced to rearrange things, allocating the twisted pair to the direct line for the card reader and making use of two of the pseudo twisted pairs for the museum PBX extension and magneto phones at the ticket counter. Because of this swapping, there is some noise on the lines again ….

One of these years, I intend to add some protection against lightning strikes to the outside plant by installing some Western Electric type 116C terminals – these are on hand, so it's simply a matter of being bored enough to go and install them.

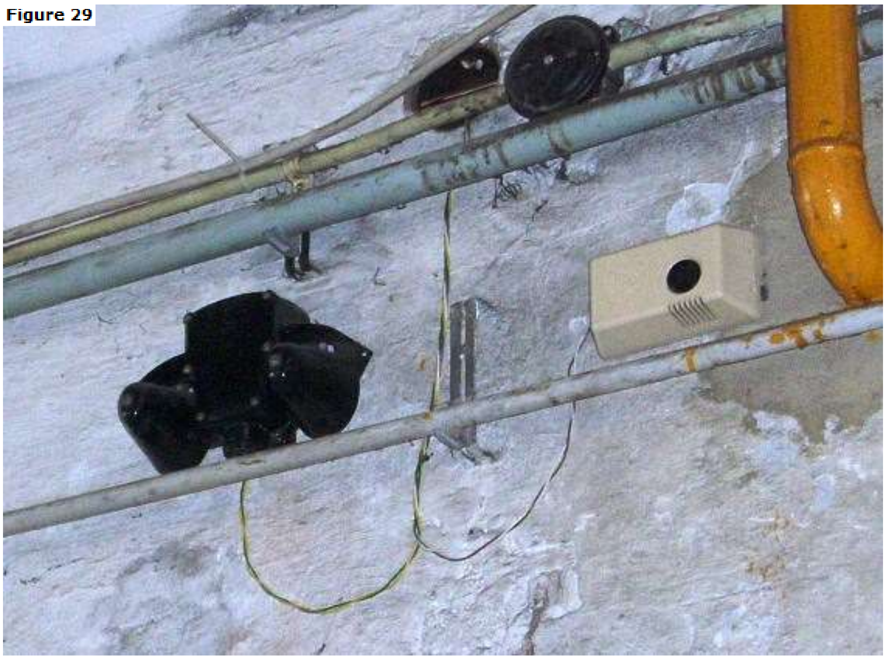
Figure 28

Of course, a few other betterments have been made in the meantime ….

One of these was to finally mount the battery and terminal box of the OB-33 in the narrow-gauge engine shed on a homebrew backboard. Enough space was intentionally left on this backboard to be able to add a power-ringing relay for the extension ringer at some later date (*another* one of those projects for when I'm bored to death).

As can also be seen, I finally did away with the original (and unsightly) ringing code table.

Figure 29



Since the OB-33 in the changing room in the workshop building might not be heard ringing if no one is in there, I added an extension ringer on the rear wall of the shop building; the beige box to the right is an auxiliary electronic ringer for the internal PBX extension, which is also located in the changing room.


Figure 30

The internal PBX extension phone in the changing room in the workshop building.

This extension phone has a second phone connected to it, which is located near the other end of the workshop building – just so that no one would have to run back to the other end of the shop if the phone was ringing its heart out.

I was smart enough to install a four-pair cable when I redid the wiring for the OB-33, long before the PBX phone was installed – otherwise, I'd simply have made more work for myself later on.

Figure 31


The photograph to the right shows a short segment of the phone cable I laid in along one of the standard-gauge tracks between the workshop building and the narrow-gauge engine shed. The cable was pulled into flexible conduit for a little bit of added protection … trust the folks at the museum to drop something very heavy onto the cable and partially crush it in the process.

At the moment, the pairs are still working without crosses or opens, but for how long?

Figure 32

The situation as it now exists at the ticketing counter at the head end of the railroad museum is shown above … from left to right, we have the extension OB-33 phone for train dispatching, a combined FAX/telephone unit which the museum curator dug up somewhere and connected to the internal PBX and, last but not least, the card reader in its cradle.

These three things have used up three of the five "pairs" available in sum (the only true pair being used for the handheld card unit) – I plan to use one of the remaining "pairs" for operating a set of electromagnetic slave clocks connected to a digital master. The clocks operate on 24 V.D.C. of changing polarity (that is to say that the clocks need pulses of one polarity to step the minute hand once, and of the opposite polarity to make the next step, and so on.) It will be very interesting to see how much interference these clock pulses will induce into the other pseudo-pairs in use ….

What about the fifth "pair?" Oh, it might be used for a primitive form of track signaling (for the narrow-gauge line the museum operates) someday – but right now, who knows (or even cares)?

Figure 33

Just a few pictures of the "great" stock of telephones currently available at the museum … most of the stuff is dinged up, rusty, dusty, dirty, incomplete and covered with bird droppings – salvaged from heaven knows where. Funny thing is, even if I don't draw anything from this nifty stock (or drag something *into* the storage room), the stock fluctuates – several older and historic phones have unaccountably gone missing, despite everyone (except the curator and his son) at the museum saying that they've never even seen the stockroom, let alone been there. It kind of makes one wonder ….

Figure 34

The grounds of the railway museum were originally used as a steam engine and car repair shop, dating all the way back to the time of the Austro-Hungarian Empire; they were also used for the same purpose by the Deutsche Reichsbahn (German State Railways) during the occupation of Austria between 1938 and 1945 – and, as such, were very important for the war effort. Therefore, the grounds were under armed guard day and night.

The photograph above shows a one-man air raid shelter, where an armed guard could take refuge while, at the same time, still keeping an eye peeled for saboteurs during Allied bombing raids. It was simply too expensive and time-consuming to remove this shelter (it weighs in at roughly 4,500 pounds) or to reduce it to rubble, and so it stands on the museum grounds to this day.


Figure 35


Figure 36

Some of the more remote corners of the museum grounds are left to Mother Nature for extended periods of time, since it’s too costly to cut back the shrubs and weeds every year, and thus one may find such sights as a well-worn freight yard shunting engine (above left) or a rusty, narrow-gauge diesel-electric engine (above right) hidden in the greenery ….

The OB-33 Magneto Desk Telephone

The German OB-33 magneto desk telephone was originally designed and first built in the year 1933 and was primarily intended for use by the Deutsche Reichsbahn (German State Railways) within Germany, but it was also used in other European countries when the Reichsbahn set up operations in territories occupied during the expansion years of the Third Reich (such as in Austria and France). The OB-33 was built by several telephone and telegraph factories, whereby Siemens & Halske and Friedrich Reiner of Germany, as well as the Austrian firms of Kapsch & Sons and Schrack, where prime manufacturers.


Figure 1

Although intended for railway use, a number of OB-33s found their way into the Wehrmacht, since they were designed to be compatible with the standard issue FF-33 field telephone. For many years, there has been a rumor among telephone collectors in Germany and Austria that the OB-33s intended for military use had thicker handset and line cords than their civilian counter-parts, and I only recently found a pair of B&W photographs which appear to confirm this rumor.

The OB-33 on the left has a braided handset cord and a thin, round line cord while the one on the right has thick, round cords in both cases.

Since railway service means harsh environmental conditions, the OB-33 was designed to withstand physical abuse and be nearly impervious to dust, as well as withstanding extremes of heat and cold. The housing and base plate were both made of relatively thick, stamped and/or drawn iron (painted to prevent rust), the number of switching contacts used was kept to an absolute minimum and the magneto was designed to deliver a maximum of ringing power for its size. Since the last of these requirements was also specified for the German FF-33 field phone and the cord boards "A," "C" and "D" of the large field switchboard, it isn't remarkable that the exact same type of magneto was used in all five pieces of equipment (when the crank is turned at a rate of 180 rpm, the rated output is 4.4 watts into a 1,000 Ohm load).

The OB-33 shown to the right, with its thick handset and line cords, was manufactured by Siemens & Halske in 1943 and is NOS. It's one of a pair of such phones which I bought at a flea market in Vienna several years ago.


Figure 2

The seller originally asked a steep price for each one of these phones, but I haggled with him until he gave in and sold me the pair for what I was willing to pay. These phones are *very* heavy for their size, and I was able to convince him that it'd be better to sell them to me, rather than to carry them back and forth for months before finding anyone stupid enough to actually pay what he wanted.

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Figure 3

Figure 4

The photographs above give an overview of the internal arrangement of the OB-33. There are a few unusual features to take note of: the gongs of the ringer are painted flat black, instead of being nickel-plated to prevent rusting (this was an economical factor, since painting is much faster and less expensive than electroplating), and the large gear of the magneto is die cast of a zinc alloy instead of being cut from a solid disk of brass (another economic measure, since brass is much more expensive than the zinc alloy). Aside from this, the switch-hook actuator is rather novel – a wide, flat piece of blued spring steel with a small, wedge-shaped Bakelite plunger attached. The handset was of a new design which found its way into public telephone service via the Siemens & Halske model 1936 & 1938 dial telephones.

Figure 5

This OB-33 was manufactured by the company Friedrich Reiner of Munich, Germany, in 1985 and is former property of the Austrian Federal Railways.

When comparing the old Siemens OB-33 with this one, the only design changes noticeable from the outside are the different color scheme, and that the handset mouthpiece is flat instead of having the small half-funnel of the original … the physical dimensions are exactly the same.

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Figure 6


Figure 7

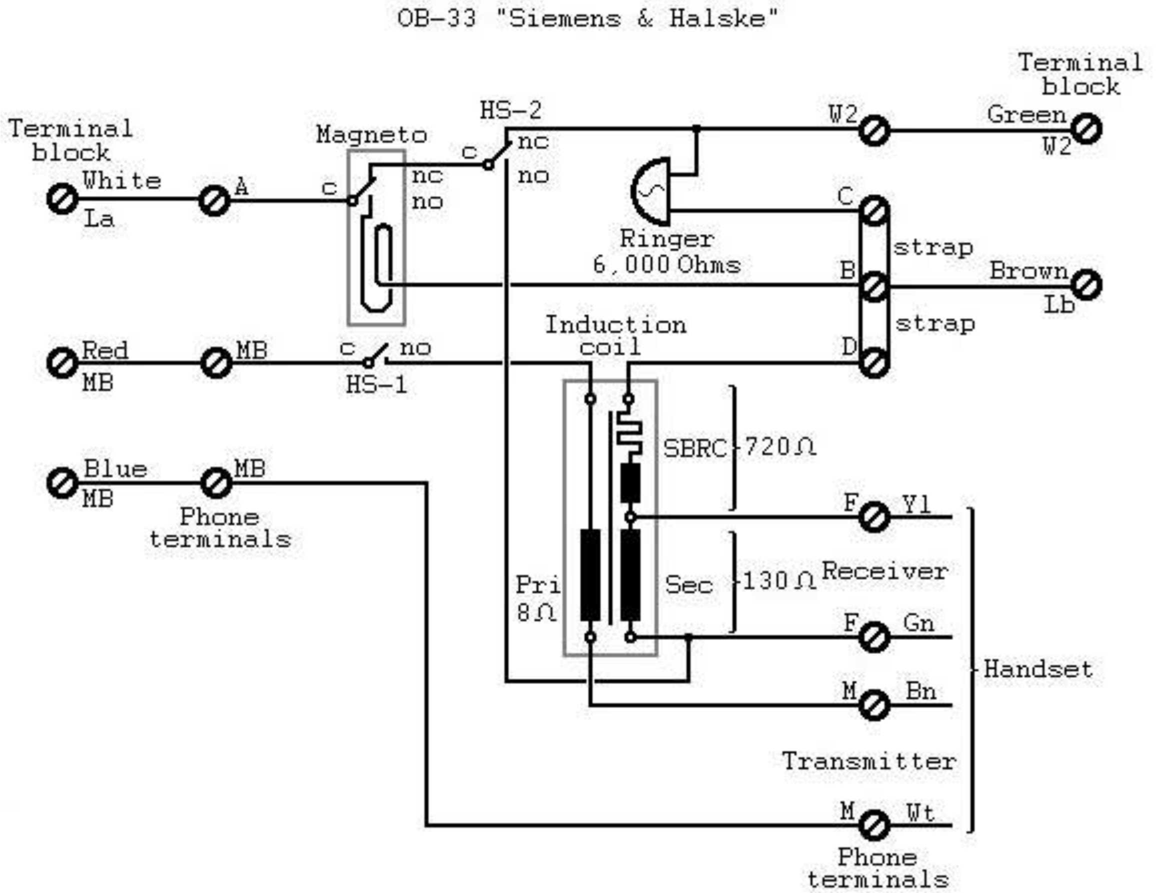
As may be seen, some things never change … the induction coil is located in the exact same spot as in the original, the vertical iron plate which carries the switchhook and the terminal strip is of the same dimensions and is located in the same spot as in the original and even the two gongs are of the same size. When one takes into account that the two OB-33s shown in this tale were manufactured over 40 years apart, it's safe to say that this is certainly one of the longest-living, *unmodified* designs in telephone history.

The OB-33s most commonly found in Austria were the ones manufactured by Siemens & Halske, Friedrich Reiner and Kapsch & Sons. Referring to the three schematics on the following pages, readers will note that the microphone circuit, consisting of the microphone, eight Ohm primary of the induction coil, normally open handset cradle switch HS1 and the microphone battery, is common to all three manufacturers. The secondary circuit, consisting of the side-tone balancing resistor/coil, SBRC, (consisting of one of the two secondary coils and a non-inductive resistive winding on the induction coil), the secondary coil, handset cradle switch HS2 and the S.P.D.T. switch (which is an integral part of the magneto), show some minor variations between manufacturers. The schematics are drawn showing the switch contacts in their non-operated positions, i.e. the handset is on hook and the magneto crank isn't being turned (the S.P.D.T. switch is actuated by the magneto crank shaft).

The variation in design is primarily the resistance the secondary circuit presents to the line (nominally 850 Ohms for Siemens & Halske, 430 Ohms for Kapsch and Sons and 785 Ohms for Friedrich Reiner) as well as the various strapping options available.

The phone made by Kapsch & Sons is by far the simplest because it offers no strapping options whatever, followed by the one made by Friedrich Reiner, which only offers the single strap shown on terminal "C" of the phone – this strap is used in connection with wiring the phone so that the ringer will only ring on incoming calls. The phone made by Siemens & Halske has a strap between phone terminals "B" and "C," which may be used to deactivate the internal ringer, as well as a strap between terminals "B" and "D." Opening the latter strap allows a second receiver to be connected between the two terminals, so that a second person can listen in on a conversation or conversely allow a single person to hear the conversation with both ears (which improves the intelligibility in high noise environments).

Figure 8

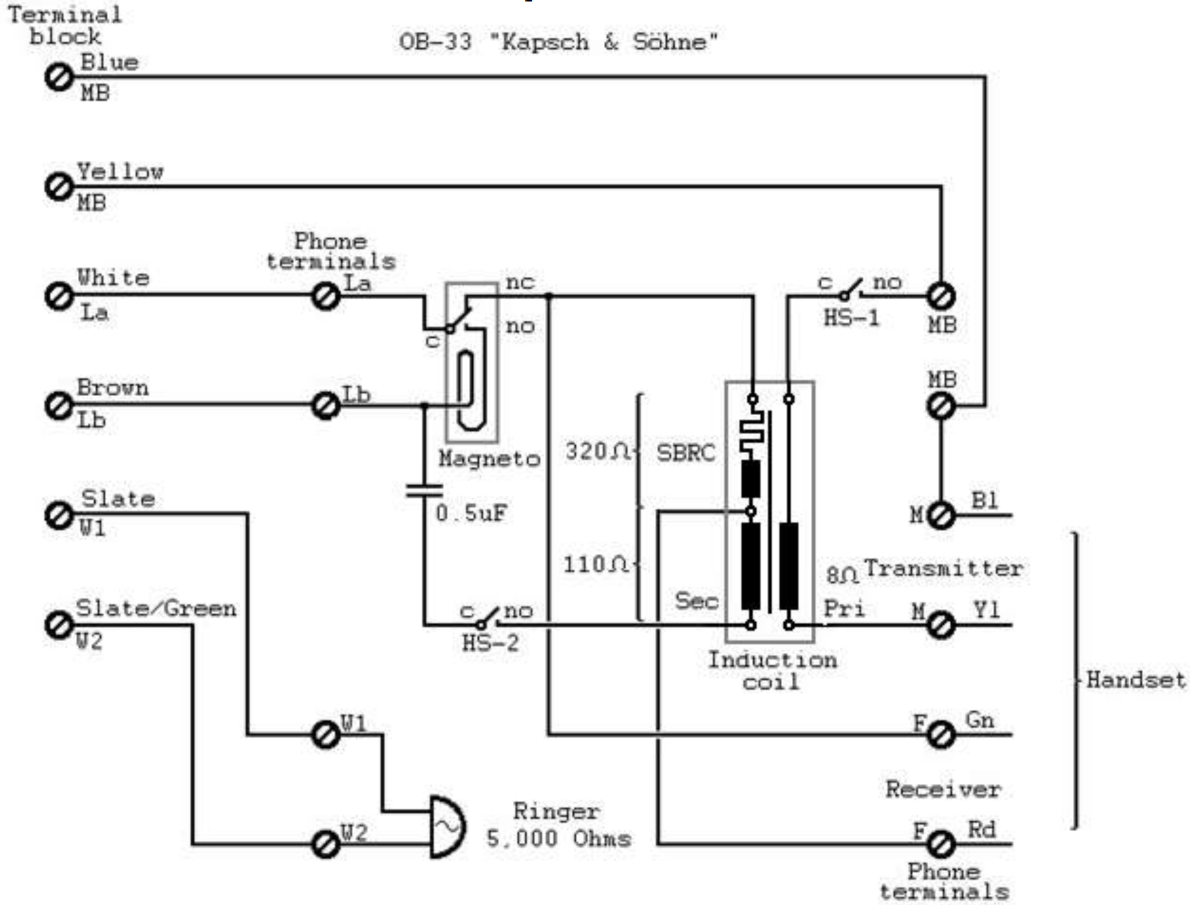


If the internal ringer is to ring on incoming *and* outgoing calls, then terminal "La" is to be strapped to terminal "W2" on the terminal block. If the ringer is to ring on incoming calls only, then the connections are left as shown. If the phone shouldn't ring at all, then the strap between terminals "B" and "C" inside the phone is to be dropped. An auxiliary ringer may be connected between terminals "W2" and "Lb" on the terminal block.

Terminal "La" is equivalent to "tip;" terminal "Lb" is equivalent to "ring." Terminals designated "MB" are the connection points for the microphone battery (between 1.5 VDC and 4.5 VDC, depending upon the resistance of the microphone circuit). The transmitter and receiver terminals of the handset respectively carry the German designations **M**(ikrofon) and **F**(ernhörer). Terminal "W2" is for the connection of an external ringer (German="**W**ecker). The wire colors are as found on the OB-33 models in my personal collection; OB-33s which have been repaired or modified may well have different colors.

The induction coil of the OB-33 shown here, as well as the ones on the next two pages, are designed as anti-sidetone coils; the portion designated as "SBRC" consist of one coil winding and a pure, non-inductive, resistance (a so-called "bifilar" coil); the abbreviation stands for "**s**idetone **b**alancing **r**esistor/**c**oil."

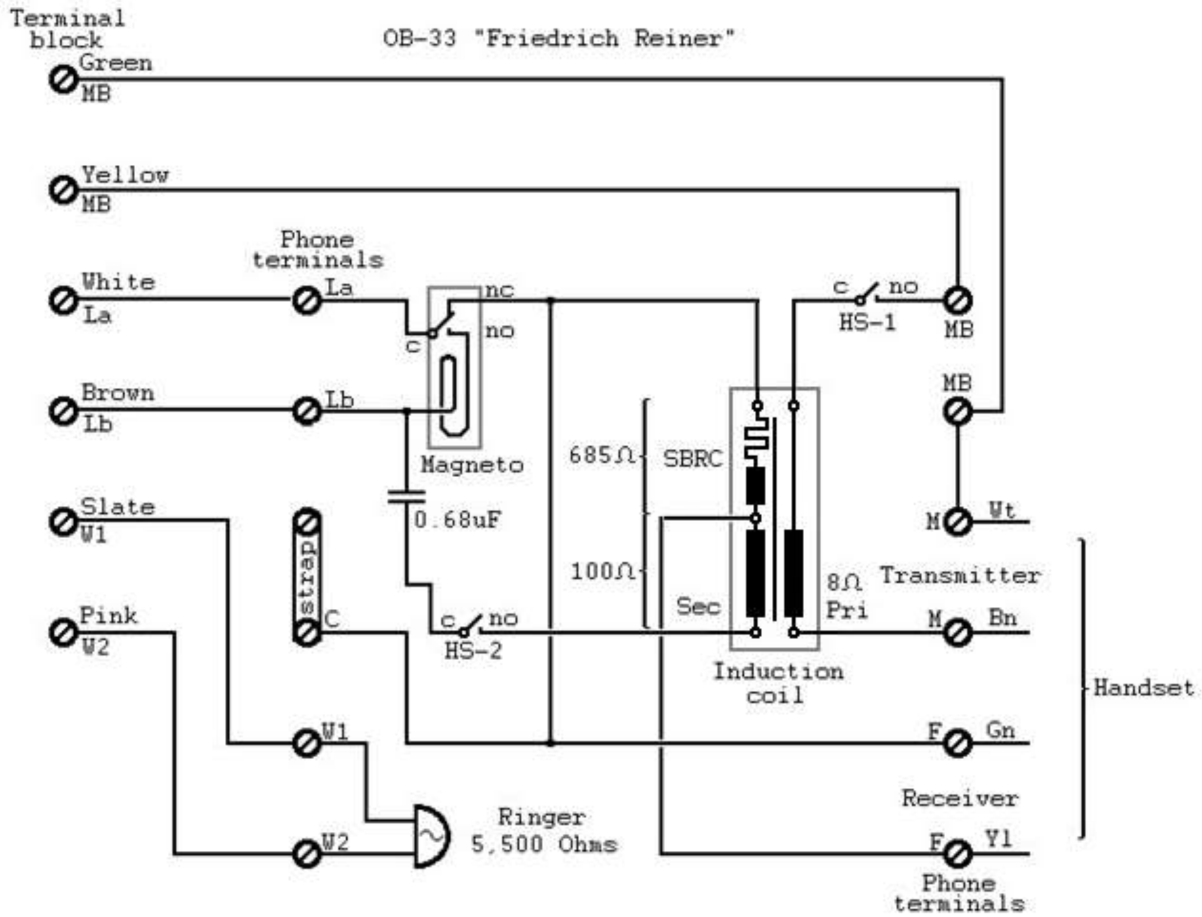
Figure 9



If the internal ringer is to ring on incoming and outgoing calls, then terminal "La" is to be strapped to terminal "W1" and terminal "Lb" to terminal "W2" on the terminal block. If the ringer is to ring on incoming calls only, then terminal "W1" is to be strapped to terminal "F/Gn" inside the phone and terminal "Lb" to terminal "W2" on the terminal block. If the phone shouldn't ring at all, then the straps between terminals "La" and "W1" and between terminals "Lb" and "W2" on the terminal block are dropped. An auxiliary ringer may be connected between terminals "W1" and "W2" on the terminal block.

The information relating to terminal designations and the voltage of the local microphone battery are the same as for the Siemens & Halske OB-33 phone.

Figure 10



If the internal ringer is to ring on incoming and outgoing calls, then terminal "La" is to be strapped to terminal "W1" and terminal "Lb" to terminal "W2" on the terminal block. If the ringer is to ring on incoming calls only, then terminal "W1" is strapped to terminal "C" inside the phone and terminal "Lb" to terminal "W2" on the terminal block. If the phone shouldn't ring at all, then the straps between terminals "La" and "W1" and between terminals "Lb" and "W2" on the terminal block are to be dropped. An auxiliary ringer may be connected between terminals "W1" and "W2" on the terminal block.

The information relating to terminal designations and the voltage of the local microphone battery are the same as for the Siemens & Halske OB-33 phone.

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Figure 11

The photograph above shows the nicer OB-33 magneto desk telephones I have on display in my living room.

The one in the lower right-hand corner is a special one with an adjunct and dial (which is difficult to see) – this type was used in conjunction with a special circuit in the PBX to allow connection of a magneto line to the (then) dial PBX of the Austrian Federal Railways. Depressing the white pushbutton on the adjunct with the handset off-hook connected the magneto line to the PBX – the dial sent ground pulses over tip and ring. If the pushbutton wasn't depressed, then the phone functioned as a normal magneto set, without connection to the PBX.

Figure 12

I've included the above photograph in order to give a second view of the OB-33s shown at the beginning of this tale. Readers can see the cords better in this particular view; one can also see an old Siemens logo on the back of the right-hand phone.

Restoring a Bastardized German WWII Field Switchboard

In the years 1933 thru 1945, the German Wehrmacht, (divided into land forces [German: Heer], the Navy [German: Kriegsmarine] and the Air Force [German: Luftwaffe]) used a total of four basic types of field switchboards: a small, fully modular type for two to nine lines, a portable type for ten lines, a portable type for 20 lines and what was known as the "groszer Feldklappenschrank" – the large field switchboard. The first two types utilized a single cord and jack for each line (similar to the WWII US Signal Corps BD-71 switchboard), while the latter ones used cord pairs.

The large German field switchboard of WWII vintage evolved from the German Feldklappenschrank 16 (abbreviated FK16), which was originally designed and built as of 1916, but with upgraded circuitry and additional components not found in the original design. The original FK16 only had two different styles of basic cord board: type "A," which had ten cord pairs and contained the entire cord/operator circuitry and the type "B," which had the same physical dimensions as the type "A" but was otherwise empty – this unit was used as the base to support a line jack multiple; in addition, the WWII version had type "C" cord boards (local battery talking, magneto ringing and common battery signaling) and type "D" for long-distance lines (using single cords). The designation "FK16" is often used by European collectors in a generic manner to designate both the WWI and the WWII models.

One thing which was common to all of the German WWII field switchboards was that the housings were made of oak instead of iron … iron was much more important for other war supplies, while oak was plentiful. With the exception of the switchboard for 20 lines, the housings were generally made out of solid wood; the 20 line switchboard had a housing of heavy-duty plywood which was painted dark gray, while the solid oak wood housings were given a coat of clear varnish.

Having written this much on the general subject of German field switchboards, I'd like to point out that I consider every nick, scrape and scratch to be part of the unique history of any telephonic item I have collected. I never disguise or repair such damage, but if anything can, for instance, be polished up without repainting, then I will do so. I am more concerned with having every piece of equipment functional from a technical point of view, and that is what this tale is all about. The equipment described here is from my next to last purchase of equipment constituting a large field switchboard – over the years, I had previously amassed enough such equipment to be able to handle at least 400 magneto lines and roughly 20 CB/dial exchange lines.

I came across this particular switchboard via an online auction house in Germany in 2007; the owner was a guy living near Rome, Italy, and he had one complete suite of field switchboard equipment up for bids. Within the item description the seller mentioned that he had a total of three such suites of equipment on hand, and that he'd be willing to sell the other two suites outside the auction. Of course, as everyone knows, online auction houses frown upon such transactions – but who am I to say no to an outright purchase at a fair price?

The twist to the deal was that the owner was offering the equipment on a "local pickup only" basis (even the suite he auctioned off), and there was simply *no* way I was going to drive all the way from Vienna to Rome and back again. We haggled over it for a while and I had the seller so far that he would've been willing to transport the switchboard and the accessories to the Italian-Austrian border – for a fee. However, even driving only as far as the Italian border was out of the question, because the equipment was so heavy that I would've been *very* hard-pressed to carry it up three flights of stairs to my apartment (there's no elevator).

As it turned out, though, the seller was a collector of German WWII military radio equipment and ground vehicles … and, for a slightly higher fee, he'd be willing to transport the switchboard all the way to Vienna and deliver it directly to my doorstep – he wrote that he'd combine delivery with a visit to some military antique dealers here in Vienna. Well, that was fine with me.

However, before paying any money, I requested him to send me some representative photographs of the switchboard and the accessories, so that I could judge whether their condition really warranted the price agreed upon – those photographs are shown here and on the next 4 pages.

Figure 1

The interior bottom of the wooden case of accessories; inside, one can see four original weatherproof terminal boxes for connecting ten pairs of field wire (each) to rubberized switchboard interconnect cables. So far, so good ….

Figure 2

The interior of one of the terminal boxes … it appears to be in very good overall condition; however, the two plastic pair designation strips are missing – these would normally be fastened to the inside of the lid, slightly above and to the left and right of the terminal designation strip seen in the upper middle of the lid.

The lid of the terminal box is self-latching, and when closed offers reasonably good protection against the elements. As can be seen, there is a 30-pin socket in the middle of the baseplate, complete with a latch to hold the plug securely in place.

The cables originally used to connect these units to the switchboard were roughly 33 feet (ten meters) in length, and, depending on the application, were either covered with black, vulcanized rubber or else brown, mercerized cotton braiding – the former cables were used when the terminals were mounted outdoors, while the latter were used whenever they were mounted indoors (both types of cable had ten twisted pairs of cotton-insulated, stranded wires).

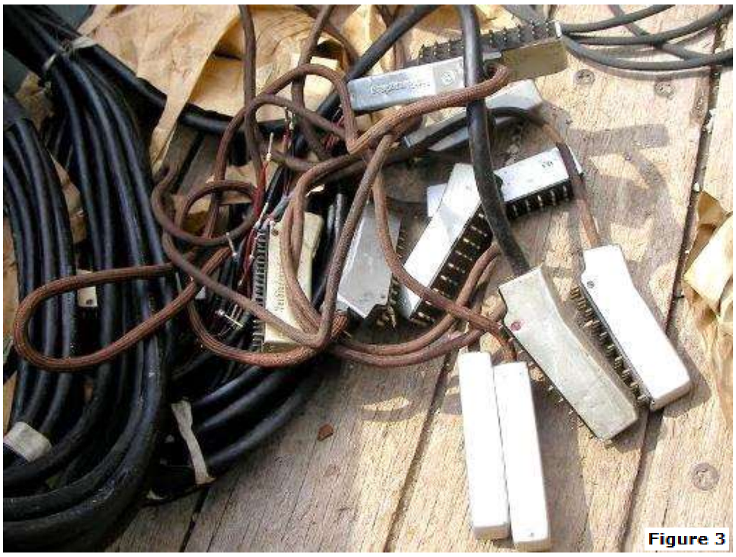
Figure 3

More accessories – four original 30-pin plug pairs with their original brown, mercerized cotton braided cords. These cords have ten twisted *triplets* inside since they're intended to interconnect the line jack multiple with the answering jack units.

Also seen are what appear to be at least three rubberized ten pair cords as required for connecting the terminal boxes to the switchboard. I intentionally wrote "appear to be" because the other end of the cables is also visible – and these ends should also terminate in a 30-pin plug, but this is obviously not the case. Instead, the individual wires are terminated on crimped or soldered tip contacts. Why did they remove the second plug and install tip contacts? At this point, I didn't know.


Figure 4

The last accessories – two operator's handsets and an A.C. power cord with a U.S. plug attached. Well, the handsets *look* like originals, but they aren't really any such thing at all; original WWII German field phone and switchboard handsets have a small Bakelite "nose" on the handset handle, opposite the receiver, and there is a small bit of iron wire, bent into a rectangle, attached to this nose. This rectangular piece of wire was used to hang the handset up on a hook riveted to the carrying strap of the type FF-33 field phone.

What rather bothered me was that A.C. power cord – what on earth would a large German WWII switchboard be doing with A.C. electrical power? Did the Italians rebuild the switchboard and add an A.C./D.C. power supply somewhere, and if they did do that, where did they put the batteries which would be necessary as a backup?


Figure 5

Ah – this looks rather interesting, but it's definitely not an original bit of *German* field switchboard equipment ….

First of all, it's painted olive drab, and secondly, there are eight US Army Signal Corps type C-161 induction coils mounted inside. According to the tag, what we have here is a BD-97 (lightning protection) panel, designed by the Signal Corps folks at Fort Monmouth, N.J., and built by Stromberg-Carlson in 1944 … very definitely *not* of German origin, but undoubtedly from WWII.


Figure 6

Here is the second half of the BD-97 panel; interestingly enough, the five rubberized cables are terminated on 30-pin plugs which match those used with the German field switchboard.

The ribbed, Bakelite box in the middle of the lid is a ringing converter – and the power cord is terminated on a standard European power plug. Well, that at least explains what the power cord in the accessories box is for.

One thing was still uncertain at this point, namely why the fuse panel has five plugs and cables (making 50 pairs in sum), when there are only terminals for 44 pairs? The answer turned out to be that the switchboard is equipped with four individual, combined jack/drop boxes (for 40 magneto lines) – the fifth cable is supposed to be connected to the CB/dial CO line interface unit (three lines). What is unusual is the fact that the terminal pairs on the panel are numbered from zero to 43, instead of from one to 44.

BTW – the fuses in the panel are originals from the firms Cook and Reliable Electric Co. and are rated at 1 Ampere; not shown in the photographs is a smallish cardboard box of spare fuses, made in Italy, which were supplied with this particular suite of switchboard equipment.

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Figure 7

When I saw this photograph, I knew that this *wasn't* the switchboard I wanted to pay for and own … too much damage from water finding its way into the storage crate at some time in the past.

At least eight of the 20 plugs on the cord board have such severe corrosion that they're beyond repair. Besides this, there should actually be 21 cords and plugs. The 21st cord, normally installed to the right of the 10 cord pairs, was used in conjunction with a service monitoring position – where someone from the Gestapo or the Secret Field Police could monitor calls.

Aside from this, it appears that the plug sleeves are all black in color, which should not be so. The back row of plugs (for answering calls) *should* have red sleeves, and the missing call monitoring plug would've had a white sleeve.


Figure 8

This photograph shows the back side of the second half of the same switchboard suite … the white splotches and stripes are further water damage, where the water dissolved some of the glue used on the plywood door on the unit at the bottom.

Plywood? Didn't I previously write that the only German WWII field switchboard to utilize plywood was the one for 20 lines? Yes, but as it turns out, two components of this half are of Italian design and manufacture – namely the type "B" cord board and the line jack multiple. The components of the first half are all originals, although the wiring was refurbished by the Italians.

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Why do I keep on writing that the Italians did this, that or the other thing to this German field switchboard? Simply because it was refurbished, modified and placed into service by the Italian Air Force circa 1963 – it was their "Unita Telefonica A 40 + 3 Linee, tipo Tedesco" (telephone unit for 40 [magneto] + 3 [CB/dial] lines, German type). I refer to this switchboard as being a "bastardized" unit for a good reason: while principally being of WWII German origin, it has some components of post-WWII Italian design integrated into it, and it utilizes a WWII vintage lightning & sneak current protection panel from the U.S. Army Signal Corps.

Anyway – after having seen photographs of all the components, it became clear why the rubberized patching cables have tip contacts on one end: the cables from the BD-97 panel plug into the switchboard, while the tip contacts of the patching cables are connected to the screw terminals on the BD-97; the plug ends of these cables plug into the terminal boxes … the Eyeties couldn't have done things in a much more complicated manner, no matter how hard they'd try.

It's the same with the switchboard line jack multiple – this multiple was to be used if (and only if) two such switchboard suites were to be set up and used side by side. However, there is no true need for it, since the cords are more than long enough to be plugged into an adjacent (second) switchboard. Aside from this, the line jack multiple isn't an original (although the jack strips themselves are) because the Germans only had two different types, namely for 50 or 150 lines, and the one used with this switchboard is for 40 lines.

The Italo-German-American switchboard suite is made up of the following components:

1 cord board type "A," rewired by the Italians with PVC-insulated wires. It's equipped with 21 cords and plugs; the plugs and cord weights are originals, the cords and plug sleeves are not (the original cords were in pairs in the colors red, white and green);
1 cord board type "B," a poor Italian copy of the German original;
4 line terminal units with ten combined jacks/drops for magneto field phone lines;
1 line jack multiple, for 40 lines;
1 C.B./dial C.O. line interface unit;
1 parallel jack unit (for conference calls) and
1 transportation crate for the switchboard as described above, which also serves as the base upon which the two halves of the switchboard are set when in operation.

In addition, there is one BD-97 (lightning protection) panel, steel-cased, with carbon arrestor blocks and 1 Amp sneak current fuses, with eight type C-161 phantom coils and associated cords, modified for connection to the German field switchboard.

The box of accessories contains four ten-pair cords, four terminal boxes, four ten-triplent cords for linking the line jack multiple to the line terminal units, two handsets, one A.C. power cord with a standard two-blade U.S. power plug and a box of spare fuses.

Anyway, after having critically reviewed the photographs the seller originally sent me, I requested him to photograph the second suite he still had … in general, this second suite looked to be in better general condition, and so I decided to buy this one instead.

Figure 9

Figure 10

This is the switchboard I bought; as can be seen, it appears as if only one of the plugs is severely corroded … this cord board actually has all 21 plugs and cords.

Again, I intentionally wrote "… it appears as if …," because it turned out that the entire back row of plugs had suffered a form of corrosion which made it next to impossible to remove the rear end of the plugs, to which the cord protection springs are attached … but it was important that I could remove the plugs from their cords so that I could replace the slate-colored (actually severely faded red) sleeves with NOS red sleeves and to polish the plugs up; this caused some headaches, as did the fact that every single jack (even the 30-pin jacks on the rear of the individual units) required cleaning and burnishing. Luckily for me that I had a small stock of original plugs for this switchboard type, as shown below. Further troubles encountered had to do with the fact that the drop circuits for ringing a D.C. night alarm run over the hinges of the armatures of the drops and also via a silver contact pill on each drop … both contacts required cleaning to allow enough current to flow to actually ring the bell.

Figure 11

For the most part, the replacement plugs I had on hand were equipped with their original Bakelite sleeves; these were replaced with thermoplastic sleeves in the course of restoration. My first choice for replacements were those which were missing their original sleeves anyway, but I only had three or four of these on hand.

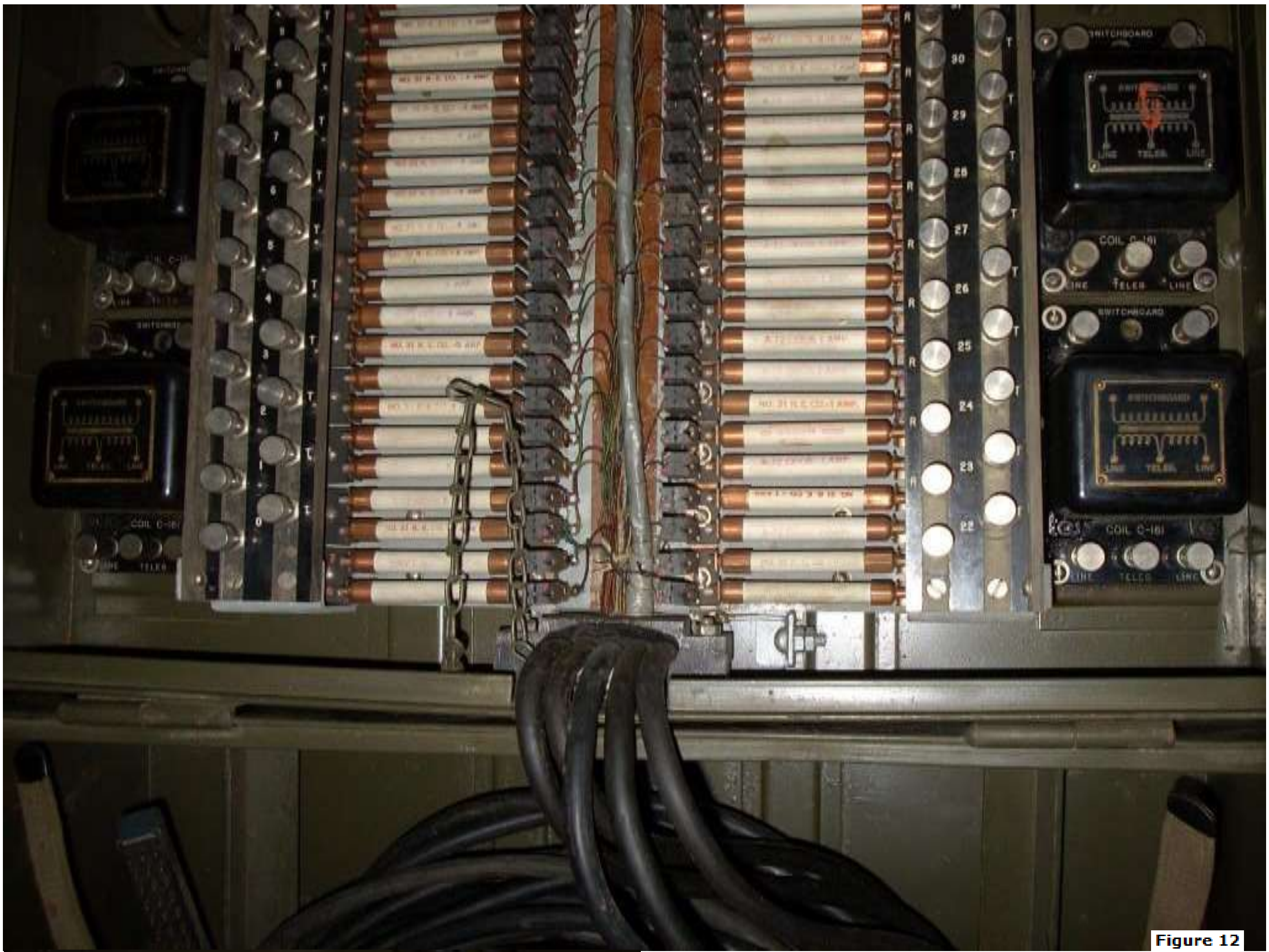

Figure 12

Figure 13

Two detail photographs of the BD-97 panel – as can be seen, the fuses come immediately after the line terminals, with the carbon arrestor blocks cut into the circuit after the fuses on the cable side. The panel even has some nice, big bridle rings for the incoming line wires. If readers take a close look at the photograph shown above, they can see that the first terminal pair on the left really is numbered as pair zero.

I never got around to examining or testing the "Telering" ringing generator inside the panel lid, so I can't say whether it's a static converter or one which uses a vibrator. It's a moot point anyway, since the converter is designed to operate on 120 Volts @ 60 Hz while we have 220 Volts @ 50 Hz in Europe.

Figure 14

This photograph shows the complete switchboard resting on top of the transportation crate before I began with restoration. As readers can see, there is fine silt on the back wall of the crate – that end was "down" when the crate was packed and in storage. The same silt was inside the back of all the units the switchboard consists of – and in the 510 individual sockets belonging to the 30-pin jacks on the back side of most of the units.

Figure 15

Silt, rust and some damaged plywood on the Italian-made cord board "B" (below); at some time in the past, all three of the switchboard suites were standing in water which was roughly one inch deep inside the transportation crates ….

Figure 16


Figure 17

In general, the accessories are in better shape than those which were originally offered by the seller; the left of the two handsets is an original (except for an incorrect mouthpiece). A special chest microphone and headset were often used in lieu of a handset.


Figure 18

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Figure 19

This photograph shows the interior of the type "A" cord board – it was of great importance in finalizing the purchase, because it shows that all of the original components are still inside. The most important bits may be seen on the key shelf – the pushbutton and wire-wound resistor on the far left, above the keys and pushbuttons in this view.

This stuff is so very important because it was often deleted from the operator's circuit when such cord boards were refurbished electrically. The pushbutton and resistor were ostensibly used to attenuate the incoming voice signals by approximately 20 dB, so that the operator could judge line quality … in reality, though, this circuit was also used to pre-monitor conversations which might be passed on to the monitoring position.

As may be seen in the photograph to the right, the back side of the individual units suffered water damage, making for rusted hinges, a multitude of dirty sockets and plywood which was falling apart.

None the less, this suite of switchboard equipment was in better shape than the one I was originally offered.


Figure 20


Figure 21

Two general views of the kind of corrosion, dust and dirt I was facing, not to mention that the sleeves on the back row of plugs should be red – not a faded slate color. There is an electromagnetic "star" indicator above the tip of the fourth plug in the back row – this was used to indicate that ringing current from the switchboard was actually flowing into the line being rung. The Kellogg switches with the red handles are combined talk/ring keys, while the white pushbuttons were used to ring back into the calling line.


Figure 22

Figure 23

The back side of the type "A" cord board; I was a bit unhappy when I looked into this area, because nine of the ten wire-wound resistors belonging to the original circuitry were missing (to be seen along the left-hand inside wall; I hadn't noticed this in the pictures the seller had provided). These 100 Ohm resistors were intended to limit the inrush current during the "click-busy" test on the multiple jacks. Since the "tip" leads of all 10 cord pairs were originally bussed together via their individual 100 Ohm resistors, the Eyeties apparently decided to simply buss them together directly and get away with using a single resistor. This was probably done because such wire-wound resistors were prone to going open, and by eliminating nine of them a major cause of failures was eliminated.

Another thing to be seen, aside from the silt and corrosion, is that some of the cords had wires insulated with PVC instead of silk and cotton… the PVC apparently suffered greatly while the switchboard was in storage, because it's cracked and peeling. Aside from this, the cord tips and their respective sockets required cleaning and burnishing.

BTW – the two pieces of wood attached to the inside of the rear door on the cord board are original. The piece on the left was used to store the magneto crank, but I haven't been able to figure out what the other block of wood was supposed to be for.

Figure 24

Replacing the ten rear (answering) plugs turned out to be tedious work; the caps at the back end of the plugs (with the cord support springs) were corroded to such an extent that removal would've required brute force which would have damaged the caps. The only workable method was to use an electric hand tool with a grinder bit to carefully cut the sleeves open and then to pry them off the plugs, in order to gain access to the screw terminals inside.

Figure 25

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Figure 26

Cleaning the various pieces of brass belonging to the 21 plugs was a job which required a bit of thought. Rotating the pieces while applying burnishing paste with a rag seemed to be a good idea, but I was worried about what might happen to my fingers if I were to use an A.C. power drill and the rag were to catch on something while I had the rag between my fingers … it looked like a good way to possibly lose a finger or two.

Instead of using an A.C. power drill, I opted for a battery-powered drill with variable torque and adjustable speed … if readers look closely at the background of the photograph, it's possible to see that ten of the plugs have already been burnished and have been supplied with sleeves of the appropriate colors. While the slate-colored (formerly red) sleeves were replaced with red NOS ones from my stock of spare parts, I was able to give most of the original black sleeves a nice luster by polishing them with the burnishing paste.

Readers may recall that the cords were all under tension from their cord weights after I'd set everything up on the crate; this naturally caused problems because some slack is needed on the cord that is being worked on. The easiest way to obtain some slack was to pull the cord up as far as necessary and then secure it with a clothes pin (the white object near the middle in the background of the pic).

Figure 27

Luckily for me, the chuck on the battery-powered drill was wide and deep enough to allow me to do the burnishing as intended – the only tricky part was when I was polishing the rear end brass caps because a portion of the cord protection spring was free to move outside the chuck. Fortunately, none of the springs were damaged during cleaning.

Figure 28

Figure 29

After the 21 plugs were restored to their former glory, it was time to start in on the most tedious bit of work, namely cleaning up the night alarm circuit for each and every drop (53 pieces in all). This meant carefully removing each and every combined strip of jacks and drops and polishing the various contact points with a small rotating sanding disk and/or with a very small steel brush.

Naturally, all of the Kellogg switch handles and pushbutton caps were removed and cleaned with the aid of mild soap, lukewarm water and an old toothbrush. It may be of interest to know that one can distinguish an original WWI FK16 switchboard from its offspring very easily: the FK16 has black handles on the Kellogg switches, while the WWII version has red handles – aside from this, the WWII variant was officially designated as the "new style" type "A" cord board.

Figure 30

This photograph shows the strip of ring-off drops belonging to the cord board after its removal. I didn't want to have to unsolder and re-solder the wires connected to the electromagnets, so the drops weren't disconnected during cleaning.

If readers take a close look, they will see that the drop armatures rest in two open pivot points on top of the electromagnets – any dust, rust or other corrosion here will prevent the night alarm bell from ringing; each and every such armature had to be removed and burnished.

Readers may also note that there is a rubber stamp on each of the electromagnets … the stamp consists of a stylized Nazi eagle (complete with swastika) and the lettering "Wa.A. xxx" The first three letters are an abbreviation for the German term "**Wa**ffenabnahme**a**mt" (literally: weapons cerification office – these offices were responsible for determining and guaranteeing that components met all the relevant specifications), while the "xxx" is a placeholder for an arbitrary three digit office identification number.

The ten jacks above the ring-off drops were used in conjunction with the single white-sleeved plug previously mentioned on page 211. These jacks didn't restore their ring-off drops – these had to be manually restored.

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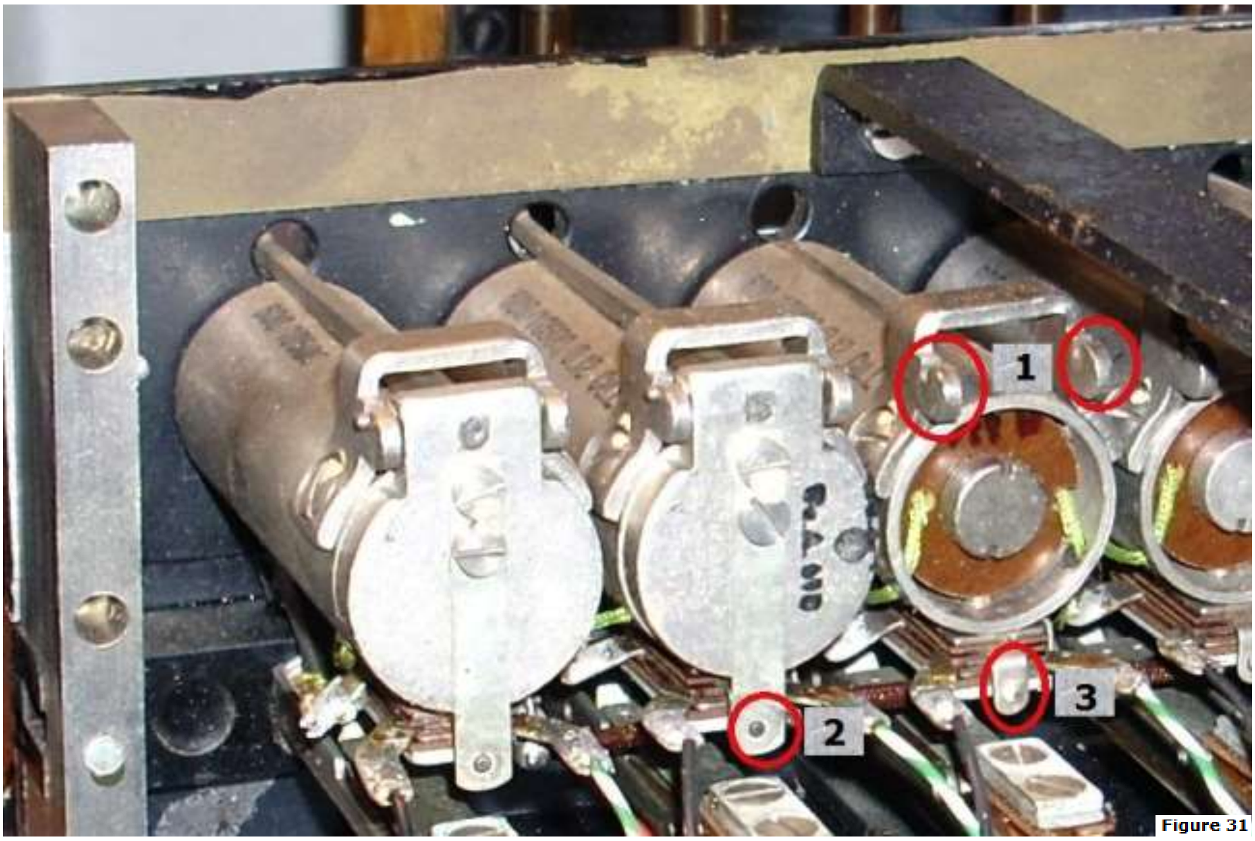

Figure 31

This photograph shows a portion of the interior of one of the combined line jack/drop units, of which there are four pieces. The pivot points (encircled in red and numbered "1") were cleaned with the aid of a small, round sandpaper disk, while the reverse side of the silver contact point (encircled in red and numbered "2") was burnished with the aid of a small steel brush, as was the silver contact point which is encircled in red and numbered "3."

The coils of the line drops have a D.C. resistance of 600 Ohms, while the ring-off drops have a D.C. resistance of 1000 Ohms; the reason that the latter drops have a higher D.C. resistance is because they're permanently bridged across their cord pairs and therefore attenuate conversations to some degree. A higher D.C. resistance requires more turns and a smaller diameter of magnet wire, which raises the inductance of the coils – and the higher the inductance is, the lower the attenuation at voice frequencies becomes.

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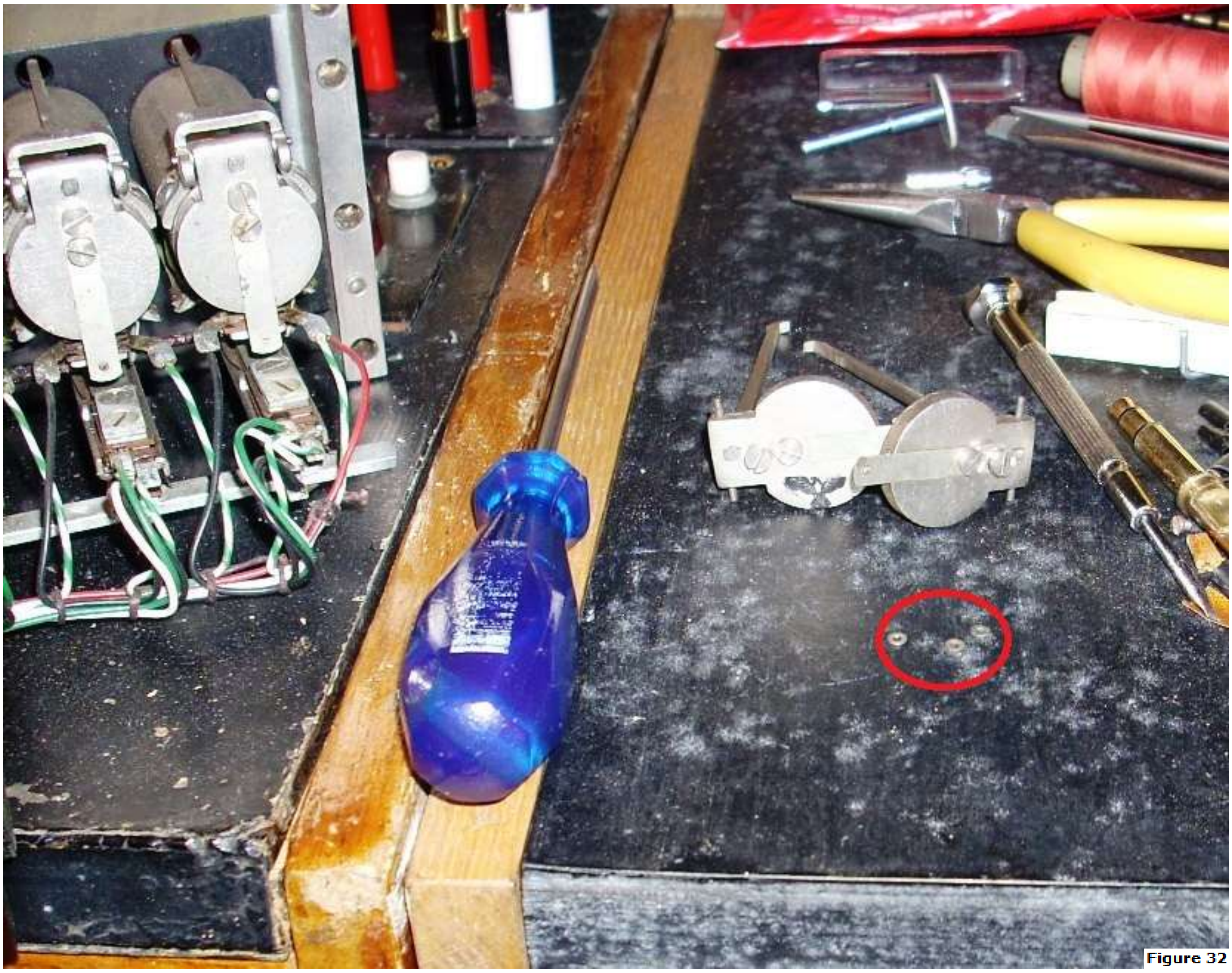

Figure 32

The snapshot above shows two of the armatures after removal from the drops. The pins on the back end of the armatures required cleaning and burnishing to remove all traces of grime and corrosion. The end where the pins are pressed in is slightly narrower than the saddle with its pivot points (number 1 in the photo on the previous page). These pins were furnished with very small washers (encircled in red in the picture above) in order to limit lateral movement of the armatures – some on both pins, some only on one of them & some armatures were missing both washers; there isn't any valid, logical, mechanical reason for some of the washers to be missing. They probably got lost when some of the armatures fell out of place during rewiring or transportation.

The flat springs on the back of the armatures, which carry the silver contacts for the night alarm circuit, were often bent backwards slightly, so that contact wouldn't be made even if the armature was pulled fully in. Bending these springs back into place was a tricky job, because the portion of the spring which rests on the armature must be straight and flat, while the small portion which carries the contact must be bent slightly towards the front of the drop … not too far, though, because the gap between the contact dimples on the armature and the de-energized electromagnet isn't much more than 50 mils when properly adjusted.


Figure 33

Even the jack sleeves were dusty, dirty and corroded on the inside. The question was how to best go about cleaning and burnishing them … I wound up using a small rotary brush and a lightweight, motorized hand tool; there were "only" 103 jacks, as well as 510 individual contact sockets (for the 30-pin plugs and the sockets for the cord tips) to clean. Each of the latter contacts is slightly smaller than 1/10th of an inch in diameter (98 mils to be exact, and they're bifurcated as well) so it took quite a while to get them all nice and clean.

As readers can see, some of the drops themselves are also slightly rusty, and some of the armature hooks slightly bent. I left the drops as found, except those which refused to drop properly – and there were plenty of those. Speaking of the drops: the ones on the line units are of the self-restoring type (i.e. the drop is pushed back up into place by a tongue and roller lever, located above the jack**,** when a plug is inserted).

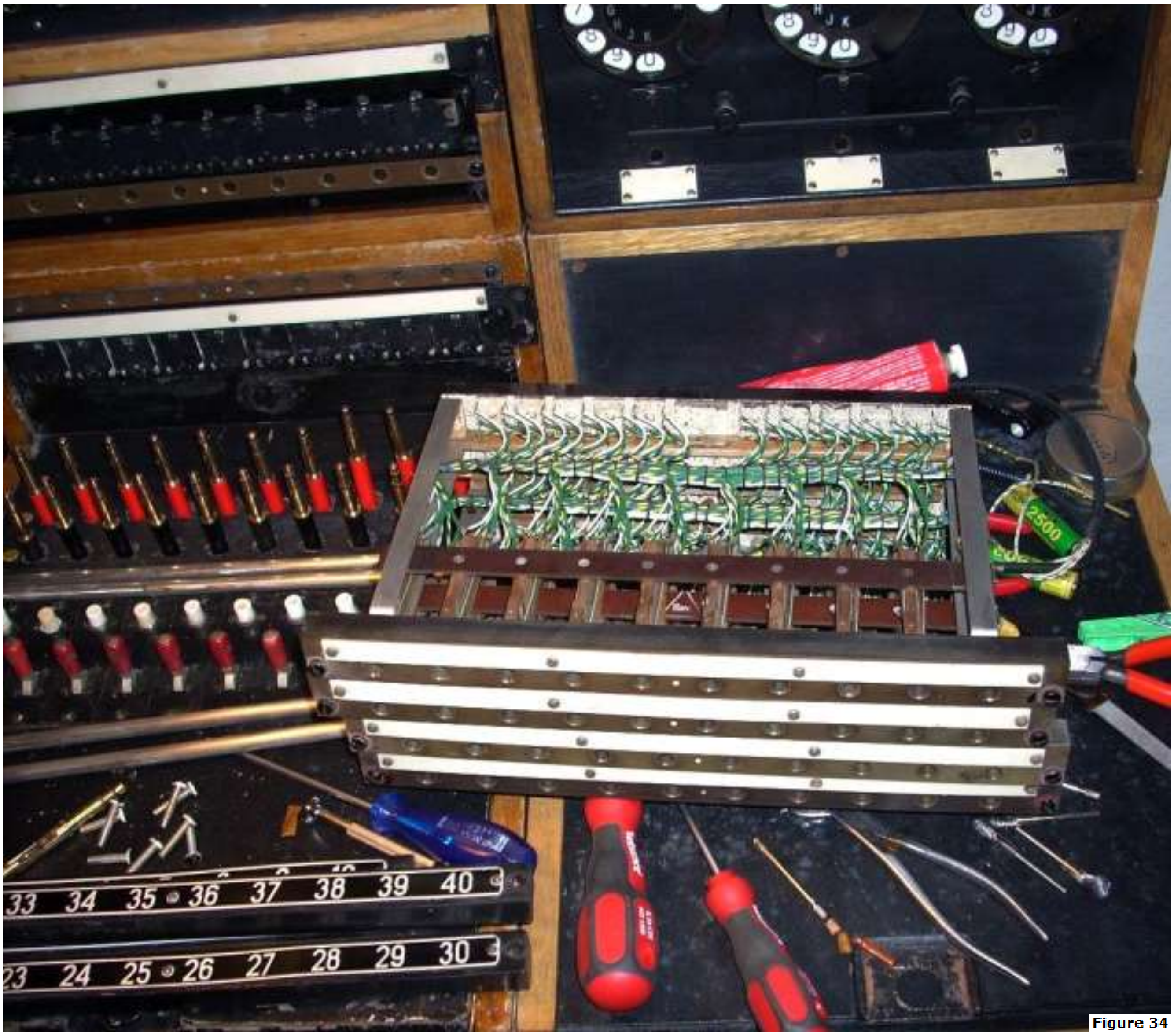

Figure 34

The next task, after cleaning and burnishing all of the jacks, plugs and sockets on the cord board half of the switchboard was to tackle the second half … the first unit to be cleaned was the line jack multiple. The four jack frames seen to the right in the picture above are original German equipment (including the line designation strips made of white plastic), while the four jack row spacers (to the left, with jack number strips made of aluminum) are of Italian origin.

As can be seen, the rear portion of the jack strips (where the two 30-pin jacks are mounted) are light brown in color – this is silt left over from the time when the entire board suffered water damage. It was necessary to wash these jacks under running water, with the aid of an old toothbrush, in order to thoroughly remove the silt. Drying was accomplished with a heat gun set to 120° F. After everything was dry again, it was necessary to clean the 60 bifurcated sockets on the rear jacks of each of the four units with the aid of a small rotary brush, to get the last bits of silt out of them and to make them bright and shiny … after all, these jacks not only patch the tip and ring leads through, but also carry the sleeve leads for the "click-busy" test as well.

Figure 35

The interior of the box belonging to the line jack multiple, complete with silt. In order to clean this mess up, it was only necessary to remove the threaded metal strips on the sides of the box and apply soap and warm water with the aid of a rough sponge. Washing the soap und gunk out was then simply a matter of rinsing the box inside and out with water from the shower head. The woodwork was then dried with a clean rag, with a bit of further drying with the aid of a heat gun.

After everything was completely dry, the line jack multiple was reassembled and thoroughly tested … it turned out that a few of the jacks didn't show proper continuity on the sleeve, so the strips were removed again and the two 30-pin jacks of each strip cleaned a second time. That did the trick in most cases, but I also discovered that two of the sleeve wires had broken off at the jacks.

If readers take a close look at the box, they can see that there are two through-holes in it (from top to bottom.) All of the individual units of both halves of the switchboard have such holes, excepting the cord board units, which have threaded metal inserts instead. The separate units are stacked up and held together with the aid of long iron rods, threaded at one end. These rods not only hold the units together, they're also the conductors for the night alarm circuit for the drops – the wing nuts of the bolts holding the left-hand portion of the switchboard together may be seen in the photograph back on page 216 (the bolts used by the Italians are not originals; those had wide, flat heads with a flat rim).

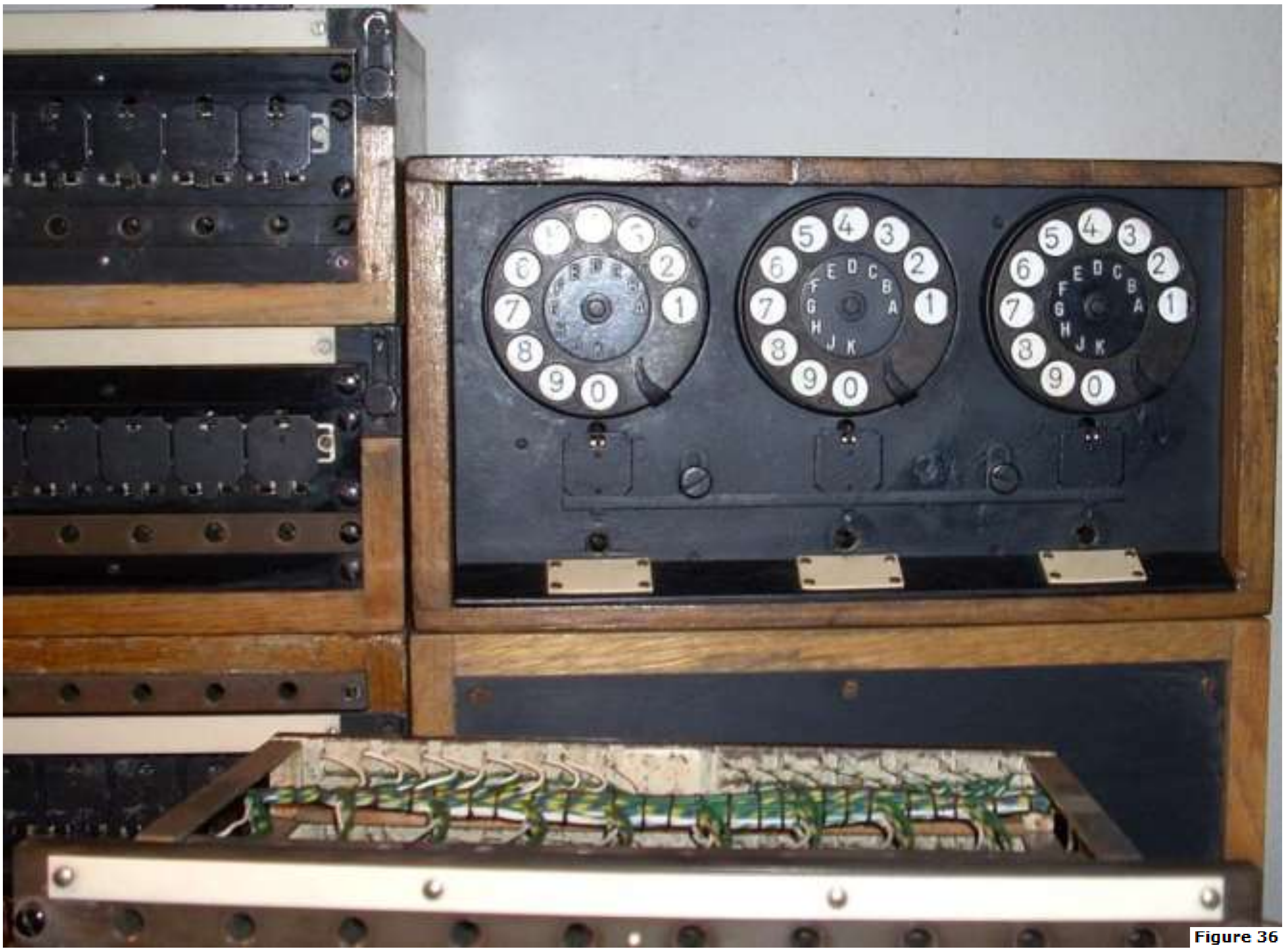

Figure 36

The next unit to be restored was the 3-line C.B./dial C.O. line interface; this type of interface was necessary to connect a field phone network & switchboard to a civilian (or military) C.B. switchboard or to an automatic dial exchange. A strapping option was available, so that this unit could be used on exchanges which required standard loop impulses, as well as with exchanges requiring ground pulses on tip and ring.

It's interesting that the finger wheels carry the letters typical of dials as used in the German city of Hamburg between 1924 and 1932 and from circa 1912 until 1937 in the city of Berlin … the dials themselves caused a very big headache, because the governors had suffered extensive corrosion. Of course, replacement dials can be found at eBay® in Germany – but the average price for a single dial (including postage) is around 40 bucks, so I'd have had additional costs of around 120 dollars.

I opted for a different method … I simply removed this unit from the switchboard and added a fully functional one from my stock, with 3 original "N30" type dials. The damaged unit was then used as the basis for repairing and saving a much, *much* more deserving (and rare!) C.B./dial C.O. line interface unit.

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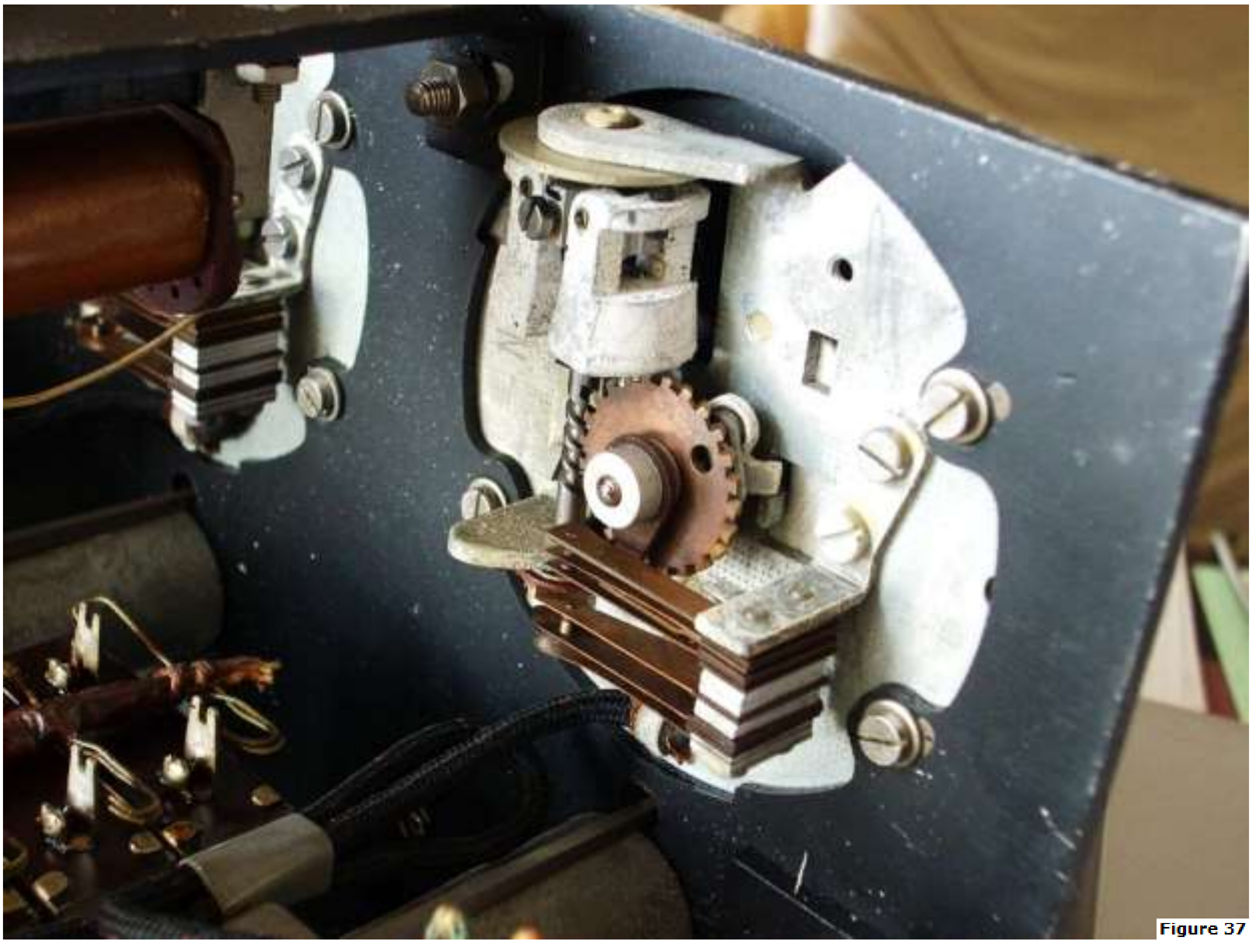

Figure 37

The two pieces of the flywheel governor on German “N30” type dials are made of die-cast zinc, and are pivot-hinged on the upper end (as seen in this view). These two pieces didn’t budge at all when a digit was dialed and the finger wheel was released to return to rest; thus, the dials ran far too fast, or else the finger wheels were stuck due to binding in the gear train – disassembling and cleaning the governors, as well as refurbishing the gear train, would’ve been very difficult, so the three dials were removed and scrapped.

The only bit of the dials which I saved were the connecting cords and the contacts; I wouldn’t have even saved the contacts if it hadn’t been for the fact that I needed to unsolder the cords from them, because cutting the cords would’ve necessitated reworking the ends, and that’d have simply been a waste of time. The dial cords were needed to repair the C.B./dial C.O. line interface unit shown on the next two pages, because the original dial cords on that unit were cut off.

The remaining guts of the original adapter were cleaned and tested and then used to rescue a very unusual and heretofore unseen C.B./dial C.O. line interface unit, as mentioned above – one with non-standard dials. Normally, I would’ve simply looked at the non-standard dials on the unit and said that some fool had gone and mounted them on the adapter at some time after WWII and that they weren’t originals by any means … but this would have been **far** from the truth.

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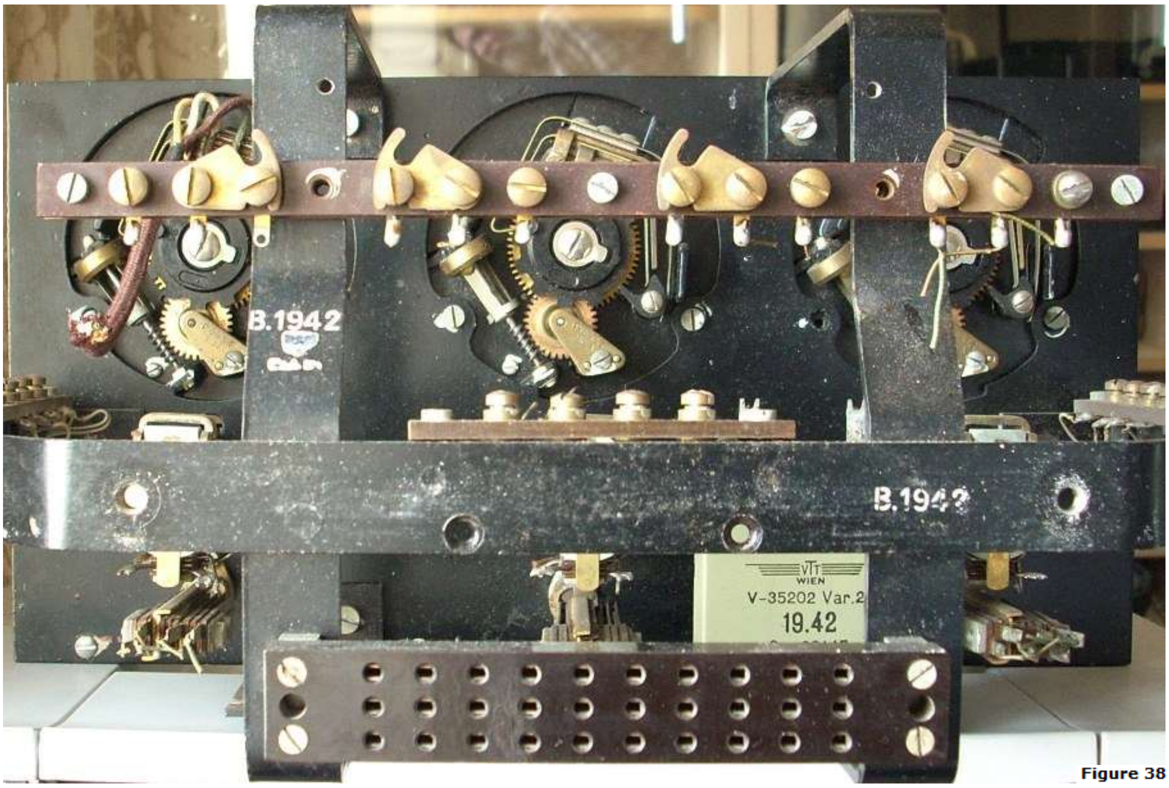

Figure 38

There it is – a stripped out C.B./dial C.O. line interface unit, with telephone dials of the exact style manufactured by the Bell Telephone Manufacturing Co. in Antwerp, Belgium. So, should such dials be found on a German interface unit? In this case, **yes**. As already mentioned, military equipment was hallmarked with a special stamp … and the three dials in this defunct unit carry such hallmarks.


Figure 39


Figure 40

The picture above shows the hallmark on the first two dials, while the snapshot to the left shows the hallmark on the third dial in the defunct unit. Since all three dials carry an acceptance hallmark and are of the BTM style, this specific adapter was obviously intended for use in Belgium only.

What makes this line interface unit so extremely rare and unusual are the three line designation tags below the line drops & jacks. These tags were always made out of whitish plastic, and they were normally *blank* when the adapters were delivered to the German Wehrmacht. In this case, though, the line designation tags have black printing on them.

Figure 41

Figure 42

Figure 43

The abbreviation "OKW" stands for the German "Oberkommando der Wehrmacht," which translates to Military High Command; the designation "III Berlin" refers to the high command of the 3rd German Army, which had its headquarters in Berlin, and the designation "IX Kassel" refers to the high command of the 9th German Army, which had its headquarters in the city of Kassel (all of which are historically correct!)

Figure 44

Even up to this point I would've *still* been willing to bet that someone had the line designation tags made up in order to "upgrade" the unit, but then I noticed that the small tags above and to the left of the 30-pin jack on the **rear** of the unit were *also* made of plastic and were factory-printed as well … although the manufacturer's tag is from the German firm "Mix & Genest" (M&G), the unit *is* of Belgian origin; BTM even manufactured telephones with the M&G logo at one time, so that an M&G tag on a piece of BTM equipment is historically correct. The tag is dated 1942, which matches the year on the frame of the defunct unit, as can be seen in the upper photograph on the previous page. The "B" before the year on the frame indicates the manufacturer as being BTM; an "A" would indicate equipment made by ATEA.

Figure 45

It's interesting to note that the dial inserts carry the letters which were *discontinued* in Berlin as of the April, 1937, issue of the phone book … despite the fact that this unit wasn't built until sometime in 1942.

The specific unit shown above was apparently used with the field switchboard of some higher echelon military command within Belgium which had direct access lines for dialing into the military telephone networks belonging to the German Military High Command, as well as to the high commands of the German 3rd and 9th Armies. This unit was an extremely rare find – *nearly* as rare as the interface unit I once bought at a flea market here in Vienna, and which is shown below ….

Figure 46

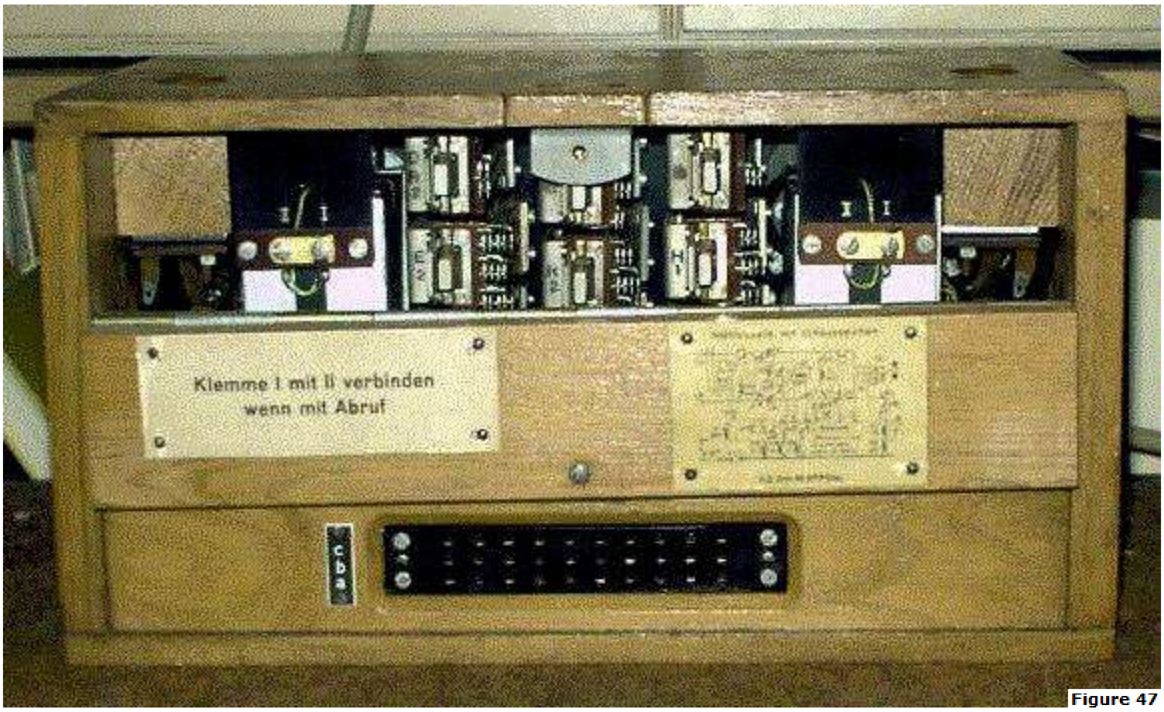

Figure 47

There is a *single*, fuzzy, black & white, photograph which shows a group of these specialized line interface units in actual use: a highly illicit snapshot taken in a top secret military telephone exchange near the city of Rastenburg in East Prussia, belonging to the Supreme Headquarters of Adolph Hitler … known as the "Wolfs' Lair." I bought this unit in the middle of 2001, and have seen exactly *one* twin in an auction at eBay® since then.

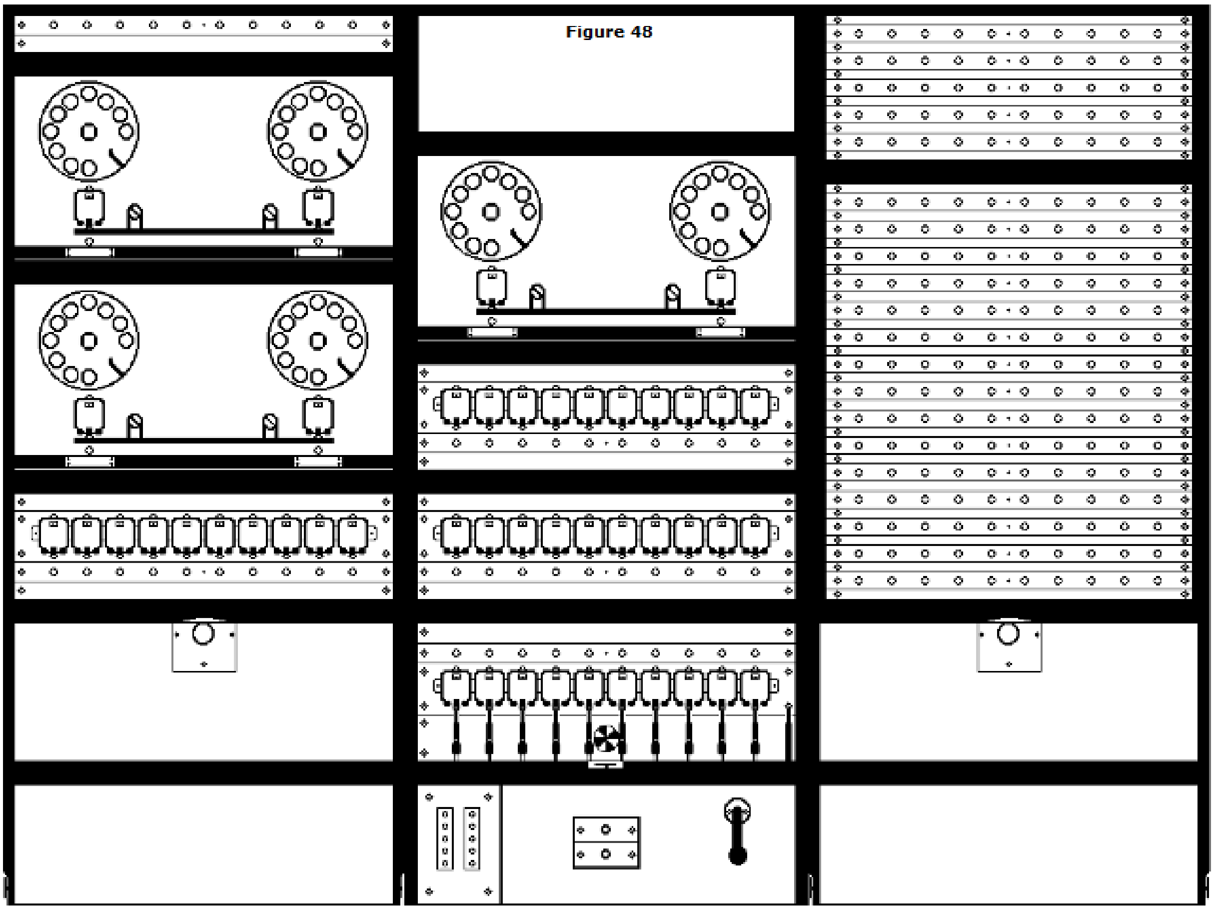

Figure 48

The drawing at the bottom of the previous page is a reconstruction of one operator's position in the switchboard room in the Wolfs' Lair, and is based on the B&W photo. A position consisted of the following components (left to right & from top to bottom): a ten line parallel jack unit, two 2-dial C.B./dial C.O. line interface units, one line drop/jack unit and a type "B" cord board on the left-hand side; the right-hand side carried a 50 and a 150 line jack multiple on top of a second "B" cord board. Between the two type "B" boards there was a unit consisting of an open "pigeon hole" box, one 2-dial C.B./dial exchange adapter, two line drop/jack units and a type "A" cord board.

Anyway, to be getting on with the restoration of my bastardized large German field switchboard ….

The *easiest* single component to restore to electrical perfection was the parallel jack unit, which allowed conference calls with up to 10 participants. This is the top unit on the right-hand portion of the switchboard in restoration.


Figure 49

There doesn't appear to be anything special about this unit – it's quite straightforward in its wiring and build. However, this unit was manufactured by the telephone & telegraph firm "VEF" in the city of Riga, in occupied Latvia, in 1943. It would've been very interesting if it had been possible to trace the route this unit had travelled in order to find its way from one of the Baltic States to Italy.

I had the bastardized switchboard standing around, ready for action, in my kitchen from September, 2009, until August, 2011 – it was a long wait until I was able to hook it up to some other magneto switchboard equipment ….

Figure 50


On the left there is another bastardized German field switchboard – in this case, however, the remodeling was done for the Austrian military.

This switchboard was bought exactly as shown here, with a single line jack/drop unit on top of a type "A" cord board. The unit is attached to the cord board with the special type of flat-head screws previously mentioned.

This particular switchboard raised a few questions which have remained unanswered to date. Among these: why were the plugs modern, but fully functional, reproductions and why are the plug sleeve colors reversed (black for answering and red for calling)?

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The keyshelf has been redone in unsightly green Formica® – typical of almost all Austrian (and German) switchboards from the mid-50s onwards. This switchboard is missing the pushbutton which would allow the operator to monitor calls, meaning that the guts, while original, were rewired and modified … and the table upon which the switchboard is resting is by no means an original – it's simply a small, rickety wooden table, where someone had hacked a rectangular hole into the top to allow the cords and weights to hang down properly.

I bought this switchboard from someone living in the Austrian province of Salzburg via eBay®, and instead of having it shipped via parcel post (which would've cost an arm and a leg), I drove from Vienna to Salzburg one fine Sunday morning, starting out around seven a.m.; I was back in Vienna by one p.m. I was more than happy to have picked it up in person, because it turned out that the seller was a fellow collector – and I managed to convince him to sell me a rather rare Viennese party-line telephone dated circa 1913 at a very fair price (I had previously been looking for one of these phones for more than ten years without success).

Of course, this newly purchased board had a few problems of its own which required solving … I had hoped to be able to simply place this switchboard next to the Italo-German-American one, interconnect a few terminals and then be able to demonstrate how the click-busy test works, but the click-busy test simply refused to click.

After unplugging and disconnecting the Austrian board, turning it around and opening up the back door, I was greeted by the following sight:


Figure 51

Well, no wonder that the click-busy test didn't work – they'd gone and cut out the ten 100 Ohm resistors required for the test to work properly.

Oh, well … I just have to strip the 20 wires, figure out which wire is which, solder them to the appropriate terminals on the resistors, reinstall the strip of resistors, and that would be the end of that.

Um, no such luck. Trust folks to really trip me up good. The two 30-socket jacks at the top of the back side of the cord board are used to link up two or more of these cord boards, so that one operator may handle two or three boards from a single position during hours of light traffic. The ones on the Austrian switchboard weren't fully wired up when the board was rewired, and two wires wound up being shifted by one column so that there was no proper interconnection between the boards.

So, I shifted the two wires back to their proper column, closed things up, turned the board around again, hooked everything up, and … no joy. The click-busy test *still* didn't work. What on earth could be wrong now? As further, tedious troubleshooting revealed, those two wires I'd shifted had originally been soldered in place without any regard for their polarity and were thus *reversed*. After I swapped those two wires back, the click-busy test *finally* worked as advertised.

Figure 52

Whichever company refurbished some of these old switchboards for the Austrian military cheated a little bit by omitting some of the wires … most notably those associated with the operation of an external ringing power generator (originally of the vibrating reed type) and for the 21st cord and plug.

It's also most unusual that the cords were distributed as they were. Normally, one would expect a cord *pair* to be of one color, the next cord pair of a different color, the third cord pair to either be of the first color again, or perhaps to be of a third color (such as red, white and green, which was the original norm for these boards), so that matching the cord pairs up when disconnecting calls is easier and the chance for unintentionally disconnecting a call would be reduced. Here, however, the calling cords are all red and the answering cords are all white … very odd indeed.

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Oh, I almost forgot: writing that the Italo-German-American switchboard *was* standing in my kitchen until August of 2011 implies that it's no longer there. It was extremely hot in Vienna around the middle of August that year, and so was my apartment. I happened to notice that the switchboard faintly smelt of shellac and plastic, and since I have asthma, I didn't think that the fumes I was inhaling were doing my lungs any good, so I dismantled everything and tucked the switchboard away in its crate – the air in kitchen and bedroom is *much* better since then.

BTW – in the last fifteen or so years, a whole slew of public and private museums throughout Austria keep their doors open until very late one night in October – the "Long Night of the Museums." A small, but very fine, private telephone museum partook of this open night for the first time in 2011, and I decided to visit, even though it's in a rather out-of-the-way town in the province of Lower Austria. Among the equipment I saw on display there was one of those large field switchboards as modified for the Austrian military…

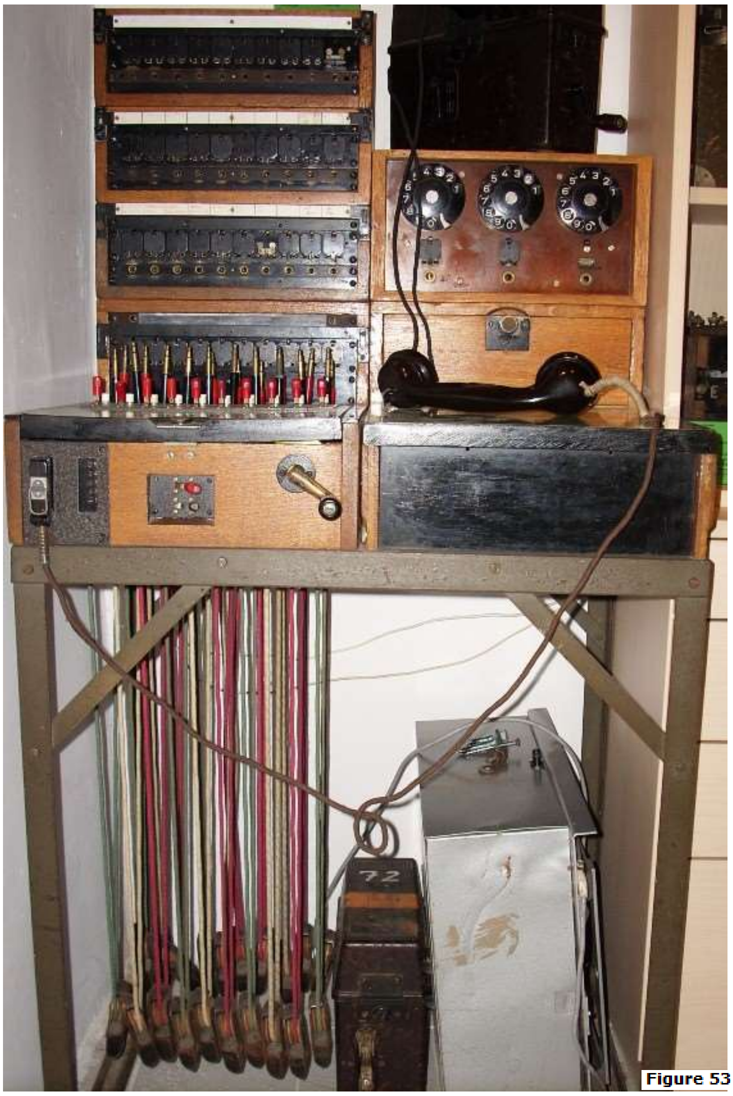

Figure 53

This specific example of a modified switchboard has cord pairs alternating in green, white and red; this was the original cord color scheme as used by the German Wehrmacht in WWII.

The frame this switchboard is standing on is a very good replica of an original, and this suite also has an original type "B" cord board (on the right).

The line interface unit standing on top of the type "B" cord board is a rebuilt unit using Austrian phone dials instead of the original German type "N30" dials. The front plate of the exchange adapter is made out of a thick board of phenolic paper – very sturdy stuff, and much lighter than the iron original.

The slate-colored metal box beneath the switchboard isn't an accessory; it's a functional, small electromechanical PBX for 1 C.O. line and 6 extensions … it was in the museum owner's way, and he was more than happy to give it away after he discovered that I collect phones and switching gear. While my kitchen switchboards were set up, this PBX was connected to the C.B./dial C.O. line interfaces belonging to the boards, so that I could demonstrate initiating and answering C.O. calls … yeah, I know – hardly anyone ever visits me at home, so it's a rather moot point anyway.

Last, but not least, two scans of some patriotic postcards from late 1916, showing a suite of original FK16 field switchboard equipment from World War I ….

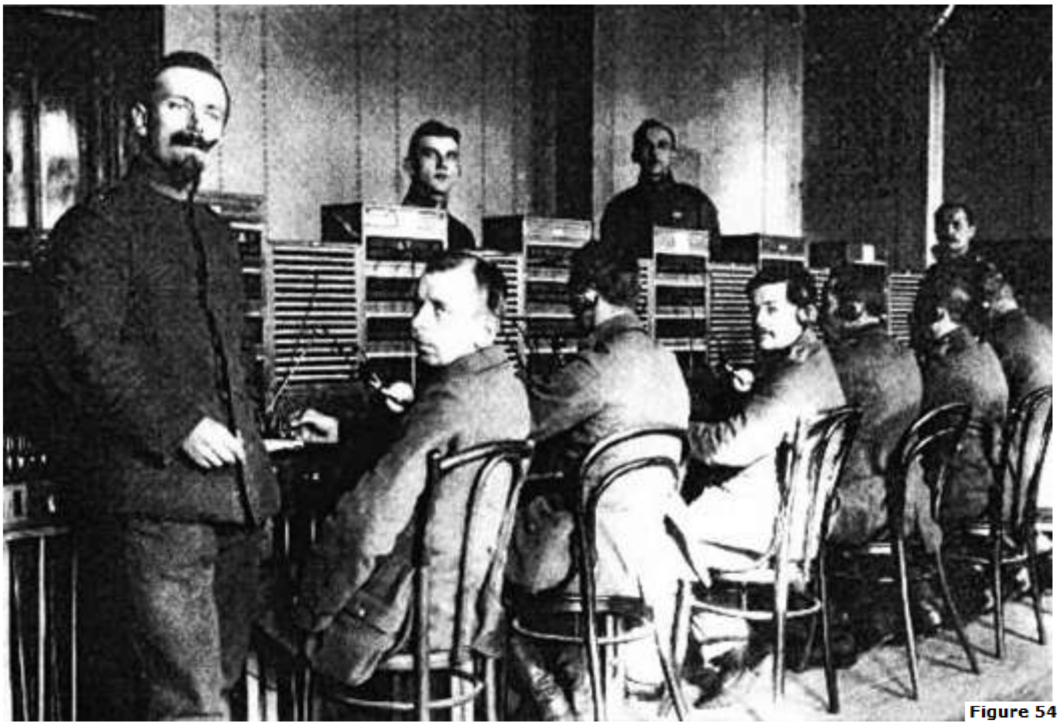
Figure 54

The front view shows at least seven operator positions, whereby each operator was responsible for 40 field telephone lines and had a conference-call jack unit on top of the 4 line units; there was a line jack multiple for 150 lines situated between operator positions – no, I don't know how they managed to get away with using a 150 line multiple to serve 280 lines ….

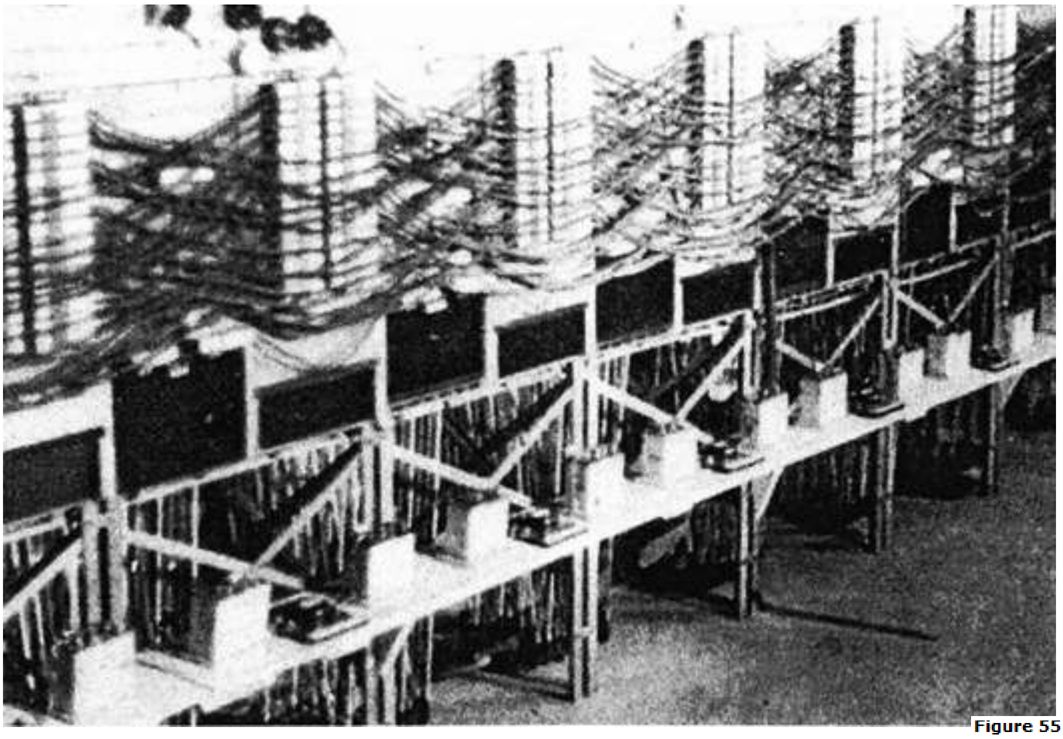
Figure 55

The rear view shows the modular cabling for the individual line units and the multiples. There are two 1.5 Volt cells and a vibrating, reed type ringing generator for every operator's position, resting on low benches for easy access.

Inside the WWII German FF-33 Field Telephone

Having browsed around and placed many a bid at various eBay® sites over the last 20 years has led me to the conclusion that most collectors who bid on a German field telephone, model 33 (Feldfernsprecher 33, referred to as the FF-33 here), are all too willing to accept the seller's oftentimes highly dubious statements as to the complete and intact state of their wares. I can only attribute this to a lack of knowledge on the part of collectors, and it's the purpose of this tale to point the prospective buyer in the right direction, as well as to provide instructions for quick tests to verify functionality.

I have some 15+ FF-33s in my collection and not one of them can truly be considered to be complete. The same applies to virtually all FF-33s I have seen at various flea markets at and around Vienna within the last 15 years (some 65+ units in all). I have only seen one FF-33 that was complete except for missing the headphone, but the overall condition of the set was so poor that I'd consider it to be no more than non-collectible scrap.

According to a vintage manual concerning the various methods of communications used by the German ground forces, a complete FF-33 weighs 5 ¾ kilograms (circa 12.5 lbs.) and consists of the following major components:

a) 1 case with a detachable carrying strap;
b) 1 telephone unit;
c) 1 field element (as a battery);
d) 1 field handset 33;
e) 1 patching cord and
f) 1 headphone 33 with accessories, in a leather storage case.

What is usually being offered as an "intact" or "complete" FF-33 only consists of the case, telephone unit and handset. Translated German text (in red color – from the aforementioned manual), comments on and informative pictures of the above components are provided in the following sections.

CASE:

The case is made of Bakelite, has a new type of latch on the front side (it opens by pressing on the upper portion and is self-latching upon closing), a sliding cover with openings for the patching jacks and protected openings front and back. On the right-hand side there is an opening for the magneto crank, on the left-hand side of the halves of the case there are soft rubber lips providing entry for the line and the handset/headset cords. The carrying strap is attached to the case on the left and right sides in such a manner that it may only be removed by pressing on the strap fittings in a certain manner – it won't come unhooked unintentionally. The carrying strap also has a hook to hang the handset on.

The case is commonly found in various shades of brown, occasionally running to near black, with widely varying surface texture, which depends on previous exposure to the elements and mechanical wear to a large extent (which will bring out the structure of the reinforcing material most markedly). Pre-WWII cases have fittings made of brass which are plated in dull nickel, while later ones will have all fittings made of iron painted flat black (to prevent sunlight reflections).

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The fittings on cases up to circa 1944 are attached with slotted screws which engage threaded back-plates, where the screws match the fittings in material and finish. Circa 1944 and on, some of the screws were replaced by unpainted flat or machine head rivets of appropriate size. The rivets usually hold the sliding covers and the covers for the "protected openings" (acoustic openings to allow the ringer to be heard) and have a washer installed between them and the inner side of the case.

Figure 1

The case shown to the left has a nice, deep luster – which is most unusual – and has the early, nickel-plated fittings.

However, there is something seriously wrong here, namely the handset. The handset shown has a "butterfly" style push-to-talk switch which is typical of the type belonging to the WWII era US Army EE-8 field phone (TS-9-AN) … and even this handset is messed up in that the mouthpiece doesn't belong to a TS-9-AN handset. This FF-33 is junk.

Another FF-33 which has an incorrect handset; in this case, it's a post-WWII German model W48 telephone handset. Aside from this, the handset cord is far, far too short and too thick to be original.

The rest of the FF-33 appears to be complete, but it's very unusual that the two captive screws which hold the telephone unit in the case don't have the obligatory red rings around them – this indicates that the frame of the telephone unit was repainted at some time. Junk.

Figure 2

Figure 3

This is another view of the first FF-33 shown on this page … here, one can see that the handset cord isn't attached to the telephone unit via the standard handset plug, but that the cord disappears inside the phone instead; the wires are probably soldered directly to the sockets inside the phone itself.

More pure junk – I wouldn't pay more than 10 dollars for an FF-33 like this one. The handset cord is modern *power* cord and what is claimed to be "an original" patching cord (an accessory which is missing 99.99% of the time) is from the German successor to the FF-33, which has *entirely* different patching jacks. The plugs on this patching cord are slightly shorter, and also thinner, than the original plugs and they're simply too small for the original FF-33 patching jacks (see pages 269 thru 271 for more information on the patching cord and jacks).

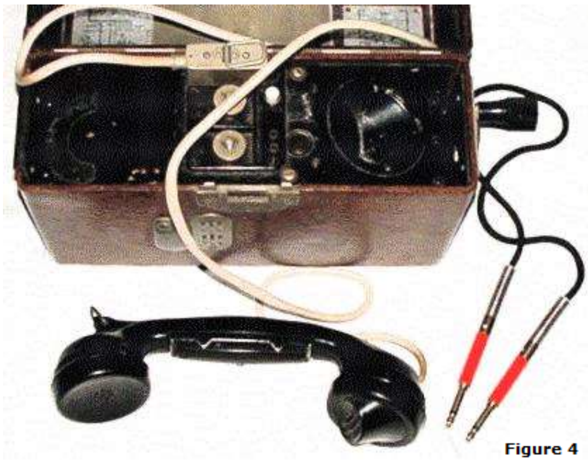
Figure 4


Figure 5

The FF-33 to the left is only scrap – the frame of the telephone unit is corroded, the case is just a bit too beat up to be nice, and worst of all, the handset belongs to a German model W28 desk telephone, but certainly not to an FF-33.

Aside from this, the handset cord is plaited and has plastic-insulated wires – this style handset cord (with plastic insulation) was common in the 1950s; the same style from the 1930s had cloth insulated wires, but it'd be just as out of place as the cord which is used here.

Figure 6


Heaven only knows what type of phone this is supposed to be … whatever it is, it certainly **isn't** an original FF-33.

Not only are the protected openings for the patching jacks and the ringer missing, but the two placards on the lid are completely blank.

The Bakelite of the case doesn't appear to contain any reinforcing material (strips of clean rags were commonly added to the Bakelite powder before pressing) but looks as if it had been polished.

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Figure 7

There are at least two things wrong with the FF-33 shown on the left: the mouthpiece of the handset is of an incorrect type, and the handset cord is by no means an original. If I had to make a guess, I'd say that the cord was robbed from a Czech field phone from the 1950s.

More junk, because an original handset cord is hard to come by as a replacement.

The field phone shown on the right was offered as an "original FF-33." Sorry – the FF-33 was *never* supplied in a leather carrying case, and it never had the coaxial plug seen on the left side of this unit.

What we *actually* have here is a railroad magneto telephone from the mid to late 1940s, with a rubberized handset cord. Although the handset has a PTT switch which looks like an original, there is a subtle difference: the one here is missing the 3 dimples on the frame which the original switch has.


Figure 8


Figure 9

There are several things wrong with this FF-33: 1) the handset belongs to the German successor to the FF-33; 2) the handset cord is correct (but only for the handset shown, and *not* for an original) and 3) the acceptance hallmark, the serial number, the manufacturer's logo and the year of manufacture have been filled-in with white paint, which simply wasn't done.

Some fool repainted the frame of the telephone unit on this poor FF-33; flat black and tan/sand were the only colors used. Besides this, the handset cord is a thin, modern cord from the 1960s, and the testing pushbutton (red here) was always white in color on an undisturbed FF-33, although it may have yellowed with age.

Figure 10


The case doesn't normally have any markings or placards on the exterior except for those mentioned further on. The only exception to the rule is the text "Achtung! Feind hört mit!" (Warning! The enemy is listening in!) or a variation thereof.

Figure 11


Figure 12


Figure 13

Figure 14

The FF-33 shown on the left, while being in excellent overall condition, *can't* be considered to be an "original" because the front of the case carries some engravings: a crown and the capital letters "CF" – I am no longer certain whether it was the Danes, the Swedes or the Norwegians who refurbished and marked their "left behind" FF-33s in such a manner for use within their own military.

As may also be seen, the fittings on the case have nice, shiny screws and rivets – these are a clear sign of refurbishment outside of the German Wehrmacht during or after WWII.

The FF-33 to the right carries the hand-painted legend "Sfm MV Perin" – definitely of civilian origin from some time after the end of WWII.

The only portion of these civilian markings which reminds me of anything at all is the "Sf," which was often the abbreviation for "Strecken-fernsprecher", which refers to a telephone used on some sort of "telephone" or "railroad" line.


Figure 15

Figure 16

The external, metal placard on this FF-33 reads as "F5a," below which there is a serial number (only partly visible in the photo-graph). This means that this particular FF-33 was refurbished, possibly with major changes to the circuitry, for use by some civilian entity such as an office of civil defense.

By no means in original condition – junk.

Figure 17

The FF-33 shown above in closed condition is one from my collection. It has some unusual writing on the placard on the left; the code name of the exchange or distant field phone was normally written here. In this case, the text reads as "Fernleitung 174" – long distance (or toll) line 174.

Since this FF-33 doesn't carry any markings showing that it was in use by the Austrian PTT (or any other civilian entity) after WWII, the writing may well date from WWII; it was standard practice within the German Wehrmacht to connect FF-33s to important phone lines when the relevant switchboard was out of commission.

Both halves of the case will usually carry an inspection hallmark somewhere on an interior surface and may also carry a date stamp in ink. The inside surface of the lid, on the hinge side, often has a decal with the phone manufacturer's logo.

Figure 18

Figure 19

The two photographs above show the inspection hallmark inside the bottom of the case, above the specification drawing numbers, and the same inside the lid (on the right). The FF-33 on the right was used by the Austrian PPT at some time after WWII, and the white stamp markings inside the lid show a portion of the 9-digit PTT part number and a portion of the year and month of refurbishment.

Note: any and all stamp markings found on an FF-33 **may** be executed in inks that are **not** indelible. Soap and water **will** remove such markings, so one should exercise extreme caution during cleaning.

The inspection hallmark exists in two variations, depending on whether the respective piece of equipment was manufactured and inspected prior to circa 1935 or later on. The early type hallmark had a stylized German eagle with drooping wings without a Swastika, whereas the later style had the classic "Nazi" eagle (with straight wings), standing on a Swastika. In both cases, the lettering "Wa.A. xxx" is below the eagle. Wa.A. is the abbreviation for **Wa**ffenabn**a**hmeamt (weapons certification office), the "xxx" is an arbitrary (but unique) three digit office identification code. This hallmark shows the equipment to meet specifications and may either be rubber stamped or embossed with a steel die.

Figure 20

Figure 21

The photograph on the left above shows an example of the older style Wa.A. inspection hallmark on a handset, while the photograph on the right gives an example of the new style Wa.A. hallmark. The former type was used during the German Weimar Republic, while the latter style was used by the Nazis as of circa 1935. As one can see, the handset on the right bears additional markings: "FR" for the German telephone and telegraph firm Friedrich Reiner, and the year of manufacture (1937 in this case).

The carrying strap is of adjustable length and invariably made of brown leather, both halves usually carrying steel die markings with the Wa.A. hallmark, the year of manufacture and the manufacturer's name and/or logo on the inside surface. A late model carrying strap is known to exist, which is made of heavy weave, olive drab cloth. The markings are usually illegible on the cloth after so many years. The exact form and material of the handset hook found on one half of the strap also depends upon the year of manufacture – early straps had a hook made of spring steel, attached to the strap with one **or** two rivets, whereas later straps had the hook made of aluminum, invariably attached with two rivets.

The attachment fittings are riveted to the strap halves through backing plates, where the backing plates also secure the flat retention springs which prevent the snaps from slipping out of their holders when fitted in place on the case. The fittings have the year of manufacture and the manufacturer's logo embossed on the outer surface. Early carrying straps will have the attachment fittings finished in dull nickel-plate, while later ones usually have all metal parts painted flat black.

It’s rumored that there are *Italian* carrying straps floating around which have the fittings painted slate color. Since the Italian field telephone model 1942 (Telefono Campale, Mod. 42) had strap attachments very similar to those used on the FF-33, this may well be true. However, Italian straps won’t normally have a German Wa.A. inspection hallmark.

There *is* one exception, though: during the war, the German Wehrmacht oftentimes used captured military equipment; such equipment was first inspected (and, if necessary, modified) prior to being integrated into the Wehrmacht arsenal and any such “booty” used by the Wehrmacht *will* have Wa.A. hallmarks.

Most of the original leather carrying straps were cannibalized for use as belts, &c., in the immediate post-war era when leather of any sort was scarce. Consequently, a large number of the *original* leather carrying straps still available today will be found in the former Allied countries, having been taken home as souvenirs.

If purchasing an “original” leather carrying strap, beware that several German firms manufactured such straps for use by the German military post-WWII – these carry an embossed stamp with the manufacturer’s name, city name and the year of manufacture. The reason why new straps were needed is simple: the post-WWII German military was equipped with much gear left over from WWII, most notably scads of FF-33s, and these required new carrying straps.

As can be seen in the photograph on the right, the carrying straps were manufactured to be adjustable in length and could, obviously, be separated into two halves.

The ones shown here are both originals in brown leather; tanned brown leather was less expensive than black, lacquered leather was (BTW – post-WWII straps are almost always of black leather).

Figure 22

Figure 23

The picture on the left is in a somewhat larger size so that the Wa.A. hall-marks and the year of manufacture can be seen.

Both of the hallmarks are of the older style, since the year of manufacture is circa 1935. The copper-plated steel spring (as seen on the right-hand strap) is intended to force the head of the fitting into the flange on the case.

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Figure 24

This photograph shows the attachment fittings from the front side. Since this particular strap was manufactured prior to the outbreak of WWII, the fittings are finished in dull nickel-plate.

The logo belongs to the Siemens Apparate und Maschinen GmbH[1] (Siemens Apparatus and Machine LLC), a subsidiary of Siemens & Halske which manufactured equipment for the German Wehrmacht.


Figure 25


Figure 26

The two photographs above show the handset hook in both variations – with one and two rivets; in both cases, the hook is of the early style, made of spring steel. Changing the method of attaching the hook from two rivets to one had a simple reason: using only one rivet allowed the hook to swivel into any position, so that the handset always hangs straight down, even if the strap were wrapped around a tree trunk, as was often the case. It was standard practice to attach FF-33s to trees at about waist height … the single rivet was changed back to a double rivet at an unknown time during the war.

Figure 27


An example of an original, woven carrying strap, although in very poor condition – the strap is torn in one place, and the handset hook is ripped out. This strap has the same type of attachment fitting as the leather straps.

Unsubstantiated rumor has it that this type of woven carrying strap was commonly used by the German Africa Corps.

[1] Siemens Apparate und Maschinen GmbH ("SAM") was formed in 1933 through the merger of the Gesellschaft für elektrische Apparate ("Gelap") and the Flugmotorenwerke of Siemens & Halske AG.

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Figure 28

As shown in the photograph on the left, the woven carrying strap doesn't have any reinforcing rings in the holes of the tongue portion, and the end of the tongue portion is steel, pressed onto the strap and held in place with a single rivet. The buckle is of the same style as on the leather carrying straps.

The fittings on the woven carrying straps fulfill the same criteria as those on the leather straps – the manufacturer's logo and the year of manufacture are die-stamped onto the attachment fittings.

In this case, the manufacturer is RB&Co, who was also a manufacturer of FF-33s, and the year of manufacture was 1944.

Figure 29

Figure 30

The woven carrying strap shown on the left is often claimed to be "an original," but in *reality*, this strap belongs to the post-WWII German field phone model OB/ZB-54.

The fittings and the handset hook are painted flat black (or else blued) on this type of strap, and if one looks closely, it's possible to see that the fittings are constructed quiet differently when compared with originals.

The two leather carrying straps shown here are of post-WWII manufacture, from the early 1950s.

They're made of *black* lacquered leather and have the original type fittings – ***but*** the fittings of these straps don't carry any logo or year of manufacture, which makes these newly made German military straps easy to recognize.

Figure 31

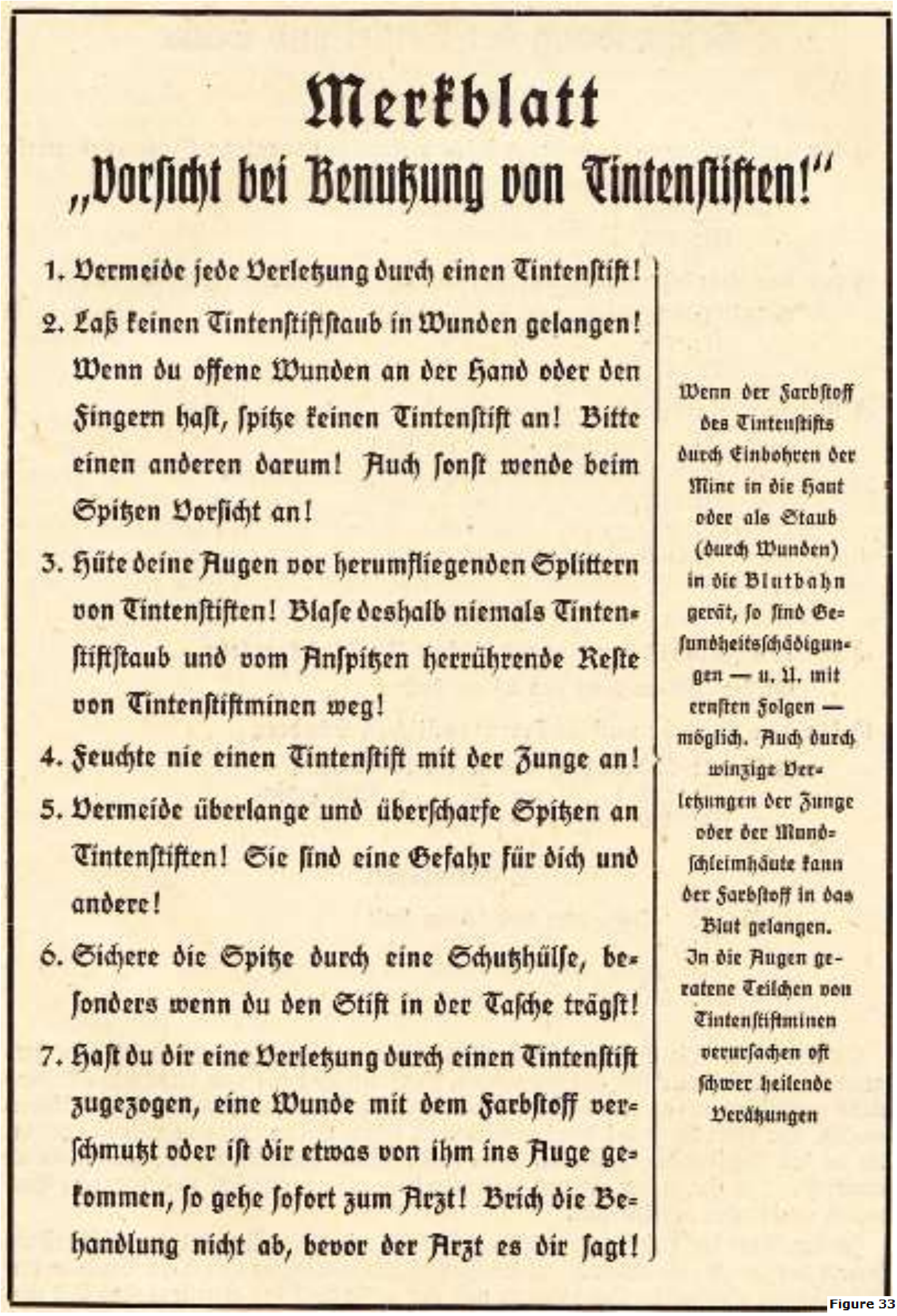
Figure 32

The manufacturer's name, city name and the year of manufacture on the inside of the tongue of one of the German military repro carrying straps – another dead giveaway that this *isn't* an original carrying strap from WWII.

A phonetic alphabet and a writing plate on which the line designation can be written (use a normal pencil – not an indelible one![2]) are attached to the lid. On field telephones of newer manufacture the writing plate has a green line[3] on it. Inside the lid there is a wide, flat spring to hold the handset securely in place during transport, as well as a schematic and a wiring diagram. Since the schematic shows the connections of the various pieces of equipment with many crossed lines and the tracing of these may prove difficult, the wiring diagram gives a straightforward view of the wiring without taking into consideration where the various pieces of equipment are.

[2] The note on not using an indelible pencil has the following background: indelible pencil leads contained finely powdered potassium permanganate in the graphite mixture (further info concerning indelible pencils is provided on the following pages).

[3] The reference to a green line on the writing plate of "field telephones of newer manufacture" reveals a little-known fact: the FF-33 we know as such today is actually the *second* issue of this field telephone. The first version didn't prove satisfactory under field conditions during the "Leadership and Signals War Games" (Führer- und Nachrichten-Rahmenübung) in August 1935, major problems having been encountered with the battery and the microphone capsule. Therefore, the FF-33 was redesigned and reissued. The official designation of this second issue was "Feldfernsprecher 33 n.A." ("n.A." is the German abbreviation for "**n**eue **A**rt", literally: new style or type).



Merkblatt

„Vorsicht bei Benutzung von Tintenstiften!"

1. Vermeide jede Verletzung durch einen Tintenstift!
2. Laß keinen Tintenstiftstaub in Wunden gelangen! Wenn du offene Wunden an der Hand oder den Fingern hast, spitze keinen Tintenstift an! Bitte einen anderen darum! Auch sonst wende beim Spitzen Vorsicht an!
3. Hüte deine Augen vor herumfliegenden Splittern von Tintenstiften! Blase deshalb niemals Tintenstiftstaub und vom Anspitzen herrührende Reste von Tintenstiftminen weg!
4. Feuchte nie einen Tintenstift mit der Zunge an!
5. Vermeide überlange und überscharfe Spitzen an Tintenstiften! Sie sind eine Gefahr für dich und andere!
6. Sichere die Spitze durch eine Schutzhülse, besonders wenn du den Stift in der Tasche trägst!
7. Hast du dir eine Verletzung durch einen Tintenstift zugezogen, eine Wunde mit dem Farbstoff verschmutzt oder ist dir etwas von ihm ins Auge gekommen, so gehe sofort zum Arzt! Brich die Behandlung nicht ab, bevor der Arzt es dir sagt!

Wenn der Farbstoff des Tintenstifts durch Einbohren der Mine in die Haut oder als Staub (durch Wunden) in die Blutbahn gerät, so sind Gesundheitsschädigungen — u. U. mit ernsten Folgen — möglich. Auch durch winzige Verletzungen der Zunge oder der Mundschleimhäute kann der Farbstoff in das Blut gelangen. In die Augen geratene Teilchen von Tintenstiftminen verursachen oft schwer heilende Verätzungen

Figure 33

This is a German safety sheet, circa 1930, concerning indelible pencils.

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The German term "Tintenblei" literally translates to "ink-lead", meaning a pencil (German: Bleistift) with characteristics of an ink (German: Tinte) pen; hence, I have chosen the term "indelible pencil" as being representative of the chemical nature of such pencils.

Caution when using indelible pencils!

1. Avoid all injuries caused by indelible pencils!

2. Don't let the dust from indelible pencils get into open wounds! If you have open wounds on your hands or fingers, then *don't* sharpen any indelible pencils! Ask someone else to do so for you! Always be careful when sharpening indelible pencils!

3. Protect your eyes against flying splinters from indelible pencils! Don't blow dust and particles, which stem from sharpening indelible pencils, away!

4. Never moisten the tip of an indelible pencil with your tongue!

5. Avoid overly long and sharp points on indelible pencils! They're a danger to yourself and others!

6. Protect the tip of an indelible pencil with a protective cap, especially if you carry the pencil in your (breast) pocket!

7. If you have injured yourself with an indelible pencil, have gotten dust from an indelible pencil into a wound or have gotten some in your eye, then seek medical assistance immediately! *Don't* stop treatment before a doctor tells you to do so!

The health hazards present if the chemicals from an indelible pencil enter your bloodstream, because you have (inadvertently) stabbed yourself or because dust from an indelible pencil has gotten into a wound can be serious. These chemicals can also enter your bloodstream through the smallest wounds on your tongue or the mucus membranes. You may suffer slow healing wounds if dust or particles from the lead of an indelible pencil gets in your eyes.

Up until a few years ago, indelible pencils were used by tattoo parlors in Austria. They were favored for tracing the design to be tattooed onto the skin; this practice has stopped – not so much for medical reasons, but rather because the last stocks of indelible pencils have dried up.

Under dry conditions, the marks of indelible pencils look much the same as those of any other, but during inclement weather or under conditions of high humidity the potassium permanganate in the pencil lead will *permanently* stain *any* material.

The photo on the right shows a sample of the natural color of an indelible pencil lead, as well as what happens when the marks of such a pencil become moist for any reason. Below the color samples is an indelible pencil, complete with its protective metal cap.

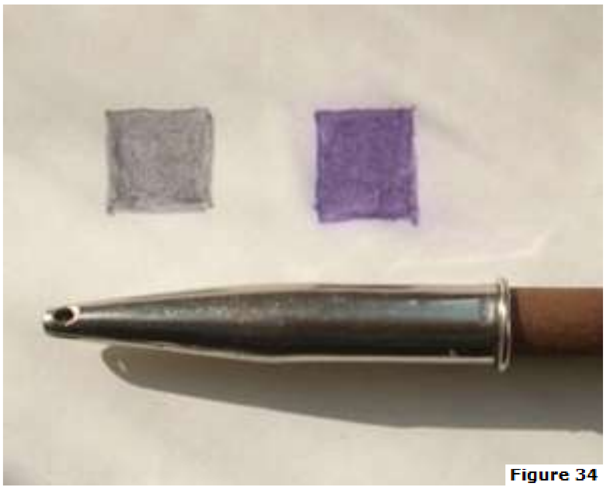

Figure 34

The placards on the inside and outside are commonly made of a whitish plastic with black printing (exception: the green line on the left-hand exterior placard). The plastic may have yellowed with age and the printing have faded quite seriously. The placards on the inside are sometimes made of aluminum, with embossed black print. On FF-33s that found civilian use after WWII, the placards on the outside are often either missing or have been defaced (or simply flipped over prior to re-installment).

The placards are most commonly riveted to the lid with small, solid shank, machine head rivets made of brass or aluminum, although rivets with a *solid* head and hollow shank are not unknown. "Pop" rivets or other hollow shank rivets with a hole through the rivet head were not used. The heads of the rivets are always on the outside of the case, with washers installed between rivet and schematic or wiring diagram on the inside.

The flat handset spring is held in place by the four rivets on the left-hand side, the schematic being riveted on top of the spring arm. If hollow shank rivets were used during installation, the washers may be missing because otherwise the shank would be too short. On early cases the spring is made of nickel-plated brass while later ones will have a steel spring.


Figure 35

The placard with the German-language phonetic alphabet is far too clean and white to be an original, but the really bad news is that the writing plate on the left side is missing, which also means that the flat brass (or steel) spring inside the lid is also missing.

More bad news: both external placards have been defaced, which means that this particular field phone saw some civilian use after WWII.


Figure 36


Figure 37

Very bad – not only has the placard been defaced, it was also removed in order to deface it (possible the placard was simply flipped over, since the back side is blank to begin with).

All four of the rivets used to reattach the placard to the case are of an incorrect type – the ones on the left are big-sized "pop" rivets, which simply weren't used on the FF-33 case during WWII.

The schematic on the interior, right-hand placard of this particular "FF-33" is *completely* different than that of an original, which means that this particular field phone was modified and rewired after WWII.

Aside from this, the rivets used are (naturally) not originals by any means ….

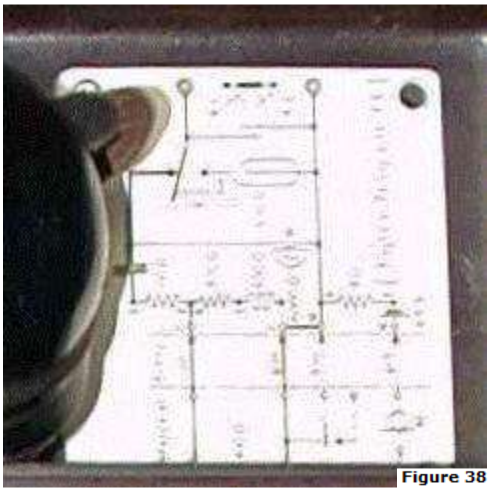

Figure 38

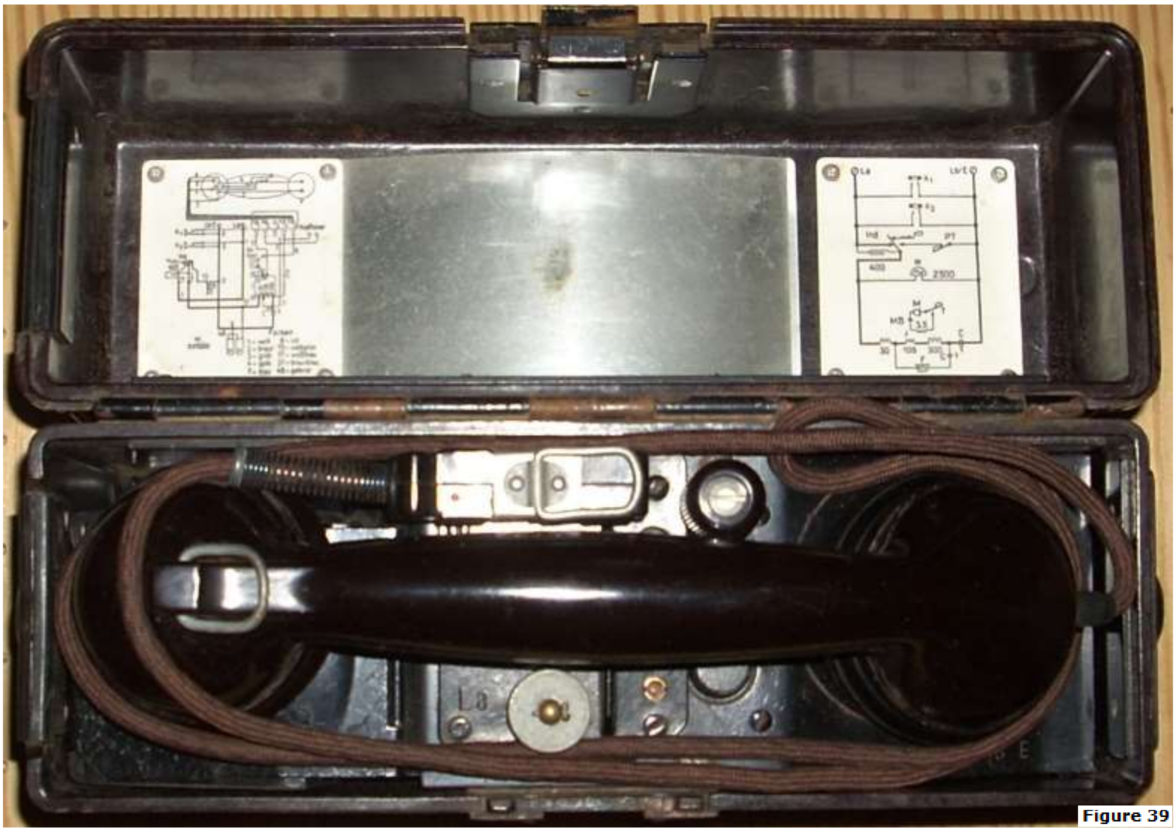

Figure 39

The photograph above shows the interior of an FF-33 from my personal collection. By comparing the two photos, it's easy to see that the schematic inside the lid of an original FF-33 is very different from that of the modified unit.

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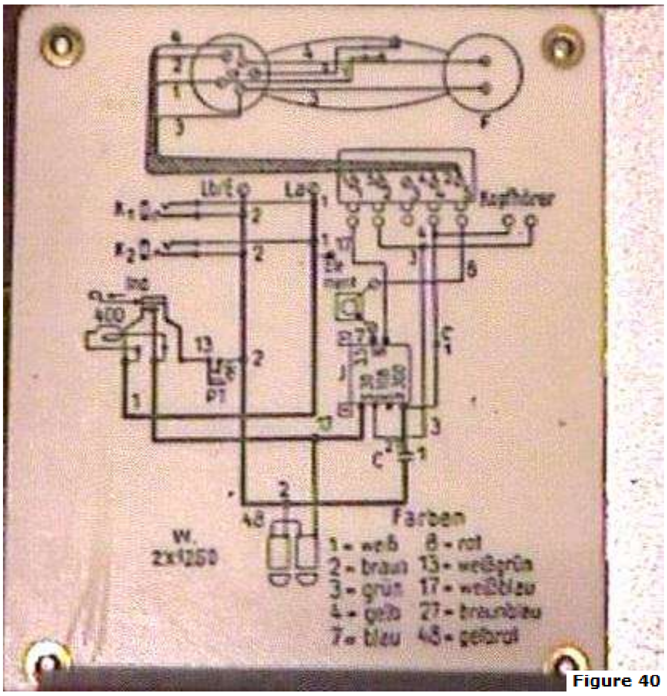

Figure 40

The original wiring diagram, on the left-hand internal placard. This photo was primarily taken in order to show how the original rivets were backed by small washers on the inside. The shiny metal to the right of the wiring diagram is a portion of the flat spring which holds the handset in place when the lid is closed.

I will refrain from also showing a photo of the schematic, since it's as fuzzy as the photo shown here, and since the rivets are of the same type.

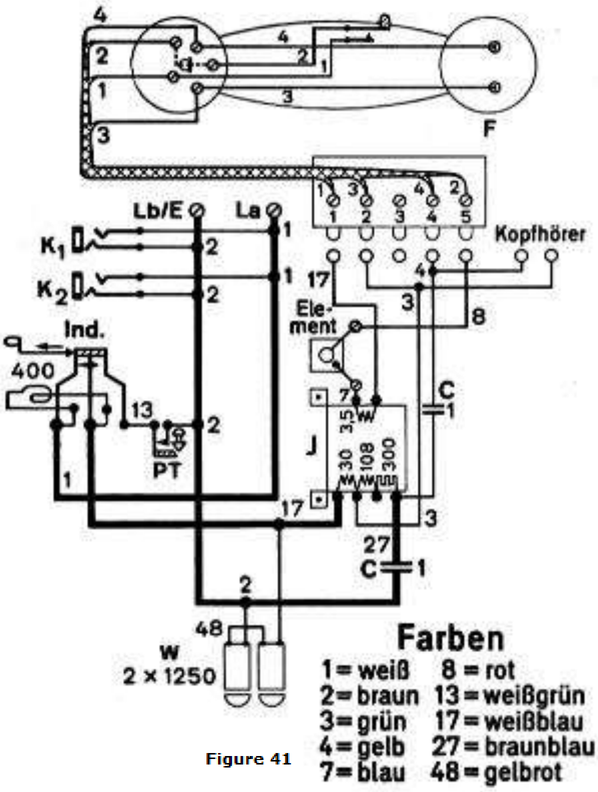

Figure 41

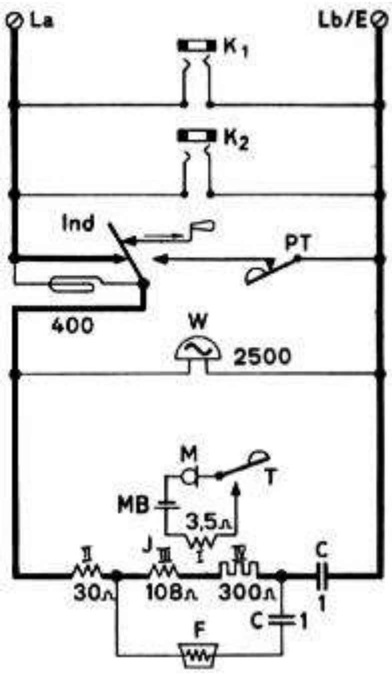

Figure 42

The above are the original wiring diagram and schematic belonging to an unmodified German FF-33 from WWII. The wiring inside the FF-33 had standardized insulation colors, the key to which is as follows: 1 = white, 2 = brown, 3 = green, 4 = yellow, 7 = blue, 8 = red, 13 = white/green, 17 = white/blue, 27 = brown/blue and 48 = yellow/red (the first of the two colors is that of the insulation, while the second one is that of the stripe).

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TELEPHONE UNIT:

After removing the magneto crank, the telephone unit may be removed from the case by loosening the two captive screws marked with red circles. The telephone unit consists of an aluminum frame with two protective covers having dust-proof openings. The protective covers may be removed after turning a steel clip aside. The telephone unit contains the magneto, the A.C. ringer, the induction coil, two condensers, two patching jacks and the terminal plate. The terminal plate carries the two binding posts La and Lb/E for connection to the line, the five pin handset jack, the two pin headphone jack and a test pushbutton. The frame has a well to receive the shaft of the magneto crank during transportation, next to the terminal plate. There is also a depression on the right-hand side to receive the handset mouthpiece. The lid of the cell compartment on the left-hand side, next to the terminal plate, is designed to fit the receiver cap. The cell compartment itself consists of the cell holder, made of Bakelite, and the associated binding posts.

At least three types of magneto cranks are known to exist: the oldest ones have an arm made of machined, die cast brass done over in dull nickel-plate and which were either furnished with a die cast aluminum handle painted flat black (rather rare) or one made of Bakelite; the second type has the arm made of die cast aluminum, while the third type has an arm made out of two pieces of steel. Both of the latter types invariably have a Bakelite handle.

Sometimes, the original crank broke or became lost and a similar crank from some other magneto telephone was used instead. The original magneto crank *doesn't* have a screw mounting hole through the end of the shaft where it's attached to the magneto, and the magneto shaft doesn't have a threaded hole to accept a screw. The oldest type of crank usually carries the manufacturer's logo (rarely the three letter code) and the year of manufacture on the inside surface of the arm.

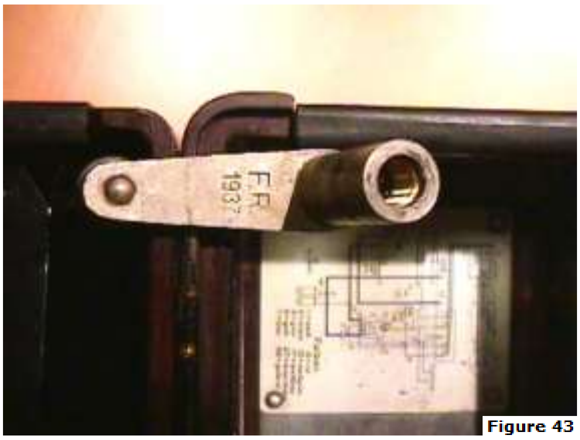

Figure 43


Figure 44

The two photographs above show the oldest of the three types of original magneto crank to be found with an FF-33. As may be seen, this crank carries the manufacturer's initials (F.R. = Friedrich Reiner of Munich, Germany) and the year of manufacture (1937).

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Figure 45


Figure 46

Of the three magneto cranks shown above, only one is an original; it's the one on the right in both pictures. Although the middle one matches the last type of crank manufactured for the FF-33, the one shown **isn't** intended for an FF-33, since it has a through-hole for a screw to fasten the crank to the magneto gear-shaft (the same also holds true for the second crank with a through-hole).

The protective covers were designed to keep dust & debris from fouling the drive gears of the magneto and from blocking the armature of the ringer (hence the reference to being "dust-proof"). Three different types of cover are known to exist at the time of writing. The oldest type has a single rectangular piece of wire mesh, soldered to the inside of the cover, to protect the holes. The next type has two separate pieces of wire mesh, which are held in place by retaining rings. The last type dispenses with the wire mesh entirely and has a series of narrow vertical slits instead. The holes or slits serve a dual purpose: to allow the telephone unit to "breathe" in the event that moisture condenses inside, and also to allow the ringer to be heard better. The covers are made of pressed steel and those of the earliest version are copper-plated beneath the paint, because the wire mesh was soldered to the cover (and soldering something onto iron isn't easy). Those belonging to the second type are sometimes also copper plated; these covers are "left overs" during the changeover in the manufacturing process from type 1 to type 2.

The photograph to the right shows all three types of protective covers which are known to have been used on the telephone unit of the FF-33 field phone.

Soldering the wire mesh to the cover was a time-consuming process and was abandoned after a brief time. The circles of wire mesh used with the second type of cover are not soldered, but rather held in place with pressed metal rings.


Figure 47


Figure 48

This is a nice example of how the flat black paint can peel off those covers which were copper-plated. The damage shown happens to be on the *outside* of the cover, but any prospective buyer should insist on pictures of both sides of both covers, in order to be certain that they're in good condition. FF-33s are often found with a non-matching pair of protective covers; such mix-ups usually happened at field repair stations.

The protective covers *may* be missing, by design, from FF-33s manufactured late in the war; this was a measure towards material and cost reduction. If the protective covers are missing by design, the retaining clip and its holders should also be missing. Early model FF-33s have screw mounted retaining clip holders, on later ones the retaining clip may be held by tangs punched out of the frame itself.

This photograph shows one end of the retaining clip for the protective covers – in this case, the early version.

The other interesting item to be seen is than the large drive gear belonging to the magneto is of a die-cast zinc alloy instead of brass.

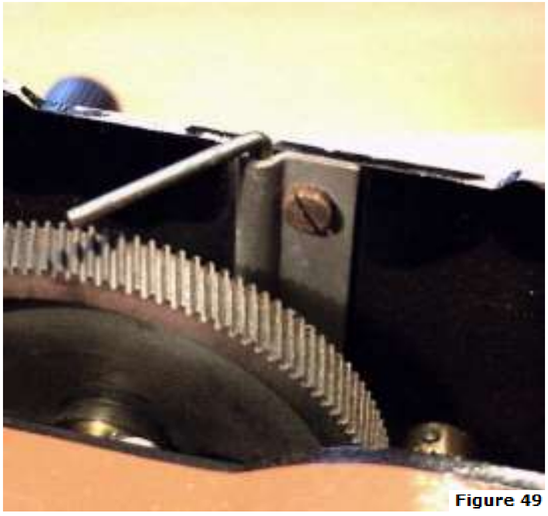
Figure 49

The aluminum telephone frame usually carries a serial number, the manufacturer's logo (or, in rare instances, the manufacturer's three letter code) and the year of manufacture in the lower right hand exterior corner, near the depression for the handset mouthpiece. These markings are usually embossed into the metal but *may* be rubber-stamped onto it instead. The frame and protective covers are usually painted flat black, although frames with black, semi-gloss paint may occasionally be found. It's rumored that FF-33s destined for use by the German Africa Corps had the frame of the telephone unit painted in tan or some sand color, but I have not been able to verify this. Any color other than black (and possibly tan/sand) **isn't** original.

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Figure 50

The markings shown above are all from FF-33s in my collection. Some of the markings diverge from the norm for unknown reasons; it's rather unusual that the aluminum frame of the telephone unit itself carries a Wa.A. hallmark – this is usually found elsewhere. It's also highly unusual that a telephone unit carries both a manufacturer's logo *and* the relevant three letter code**[4]**. Some of the manufacturer's logos are still a mystery to me, seeing as how they were most likely smaller factories, but "MT" is Merk Telefonbau, "RB & Co." is R. Bosse & Company, "VTT" is the Vereinigte Telefon- und Telegraphenfabriks AG, Czeija, Nissl & Co. (of Vienna), "SAF" is the Süddeutsche Apparatefabrik, "FR" is Friedrich Reiner of Munich and "FS" is F. Schuchhardt.

If one takes a close look at the strip with the serial number 95635, it's just discernible that the manufacturer's logo is that of "RB & Co." and the year is 1944 … "Ark" isn't the 3-letter code for RB & Co.; some German collectors have postulated the theory that "Ark" was the abbreviation for "Arktis" (= arctic), meaning that the unit was specially manufactured to withstand arctic conditions. Although there is no hard evidence to support this, I have seen the abbreviation on pieces of telecommunications equipment from various manufacturers, so that it is safe to say that "Ark" is definitely not a 3 letter code.

[4] I keep referring to a three letter code, but find that I have not really explained what, exactly, this code was all about. All manufacturers of German military equipment during the Nazi era were assigned a unique, but entirely arbitrary, three letter (rarely only two letters or a single letter) code which they were supposed to use in lieu of their respective logos or other identifying marks. This was intended to protect the manufacturing plants in the following manner: if an enemy captured a field phone with a 5 digit serial number and a manufacturer's logo, then they might be able to zero in on the factory and bomb it out of existence, because a factory able to manufacture 95,635 FF-33s is of great importance to the war effort. However, locating a manufacturer only known as "nwl" would prove to be very difficult indeed; these letter codes were used almost everywhere else, but are not common on FF-33s.

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The binding posts on the terminal plate are either simplex units, made of brass and finished in dull nickel-plate (the knurled knobs are secured by small cotter pins mounted through holes in the binding post shafts) or a duplex affair made of Bakelite; this was another measure towards material and cost reduction. Simplex binding posts of plastic or Bakelite (and similar) are no*t* original, irrespective of their color. The five pin jack for the handset may be missing the middle contact; it wasn't needed and time and money were, again, saved by omitting it. There is a blocking pin immediately to the right of the handset jack, which prevents the plug from being inserted the wrong way around; this pin is painted to match the frame.

A Wa.A. hallmark is almost always found on the terminal plate (or, rather rare, on the top of the frame itself). The cap of the test pushbutton is *always* white in color, occasionally having yellowed with age, and it may show signs of cracking. Any other pushbutton cap color, such as slate, red, black, pink, &c., or a test pushbutton that is missing completely, indicates postwar repair and/or modification.

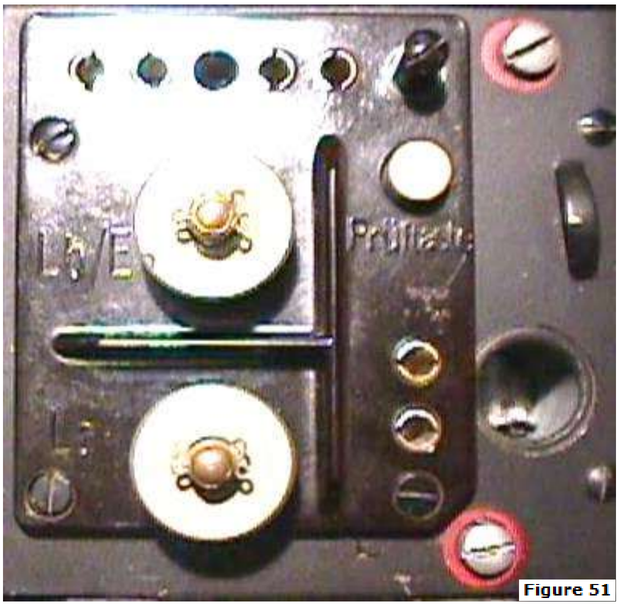

Figure 51

The terminal plate to the left has the early style binding posts. Although difficult to see clearly, there is a Wa.A. hallmark below the German word "Prüftaste" (test pushbutton).

In this instance, the five pin handset jack is missing the middle contact.

The two captive screws encircled in red are the ones to loosen in order to be able to remove the telephone unit from its case – this is a typical feature for any piece of WWII German equipment which was meant to be field-repairable.

The Wa.A. hallmark wasn't always in the exact same place on the terminal plate, and it isn't always as easy and clear to see as it is in the picture on the right.

This hallmark was sometimes defaced after WWII, and I wouldn't accept any FF-33 as being an original if *anything* is defaced.

Figure 52

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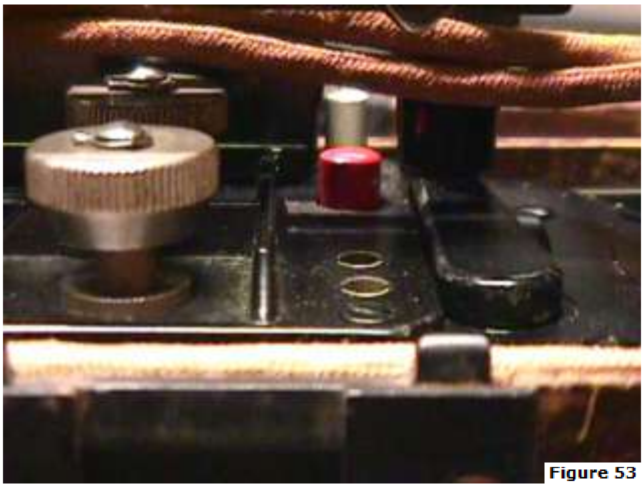

Figure 53

Although I already made mention of a pushbutton having an incorrect color, in conjunction with other very obvious faults, here is another example of a red colored test pushbutton – yuck. For unknown reasons, it appears that red was a favorite post-WWII color ….

The photograph to the right shows the late-model terminal block used on the FF-33; use of this type of terminal block required a minor redesign of the terminal plate – namely removal of the ridge between the two original brass binding posts.

The type of terminal block shown was in use on other pieces of communications equipment before it found its way to the FF-33.

Figure 54

Figure 55

Warning – the binding posts on this terminal plate are by no means originals; they're of a type which was more common from the late 1950s onwards.

If readers take a closer look, they will see that the test pushbutton is completely missing from this FF-33. This field phone can't be considered to be intact and shouldn't be bought or sold as such.

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An original cell holder will be of black or brown Bakelite and be held in place by the binding post strip. Cell holders often show vertical stress cracks along the inboard side and are prone to breakage. The binding posts themselves are rather small, and are made of un-plated brass; the *knobs* of the binding posts are usually made of brass, but can also be found made out of a zinc alloy. The binding posts are always mounted on a terminal strip of reddish-brown phenolic paper.


Figure 56

The cell compartment lid is invariably made of pressed steel and always has a narrow leaf spring attached the inside. The leaf spring was there to prevent the cell from bouncing around in its holder during transportation; it's attached to the lid either with two small solid rivets or spot welded in two places. The lid normally fits tight on the cell holder. Early version cell compartment lids usually have one or two studs to facilitate opening – if there is only one, it will be centered. It or they are usually painted to match the frame. The later version lid has a punched finger hold instead of one or two studs.

The cell holder and cell compartment lid, as well as the terminal strip, as shown above, are perfectly in order. What is wrong here are the two wires with spade lugs – these were by no means used in the original FF-33. Aside from this, the handset cord on this set is too short & kaput.

An excellent example of the stress crack typically found on the cell holder.

Since this crack is very common in units which saw service in the field, I *wouldn't* consider this type of damage to be cause to say that the relevant FF-33 was damaged goods.

As a matter of fact, the design of the aluminum frame of the FF-33 practically *invites* this type of damage.


Figure 57

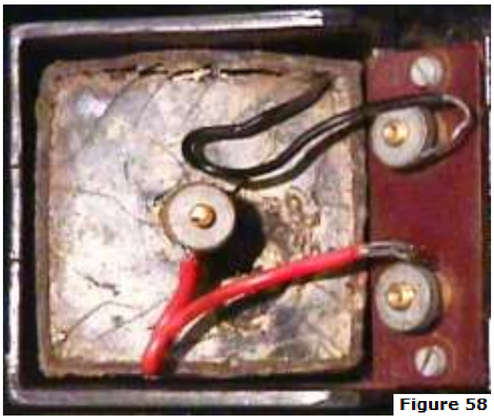
Figure 58

A cell holder, complete with what *appears* to be an original cell (aka "battery"), from WWII. In this instance, the binding post knobs are of the later (zinc alloy) type.

Possibly the only thing not original in this picture is the red wire – the little bit of wire connecting the positive terminal of the cell with the FF-33 was usually a solid wire (*not* stranded) with black insulation. And, the cell itself *should* have one or two small glass tubes coming through the pitch, but I don't see any here … (more on this later on).

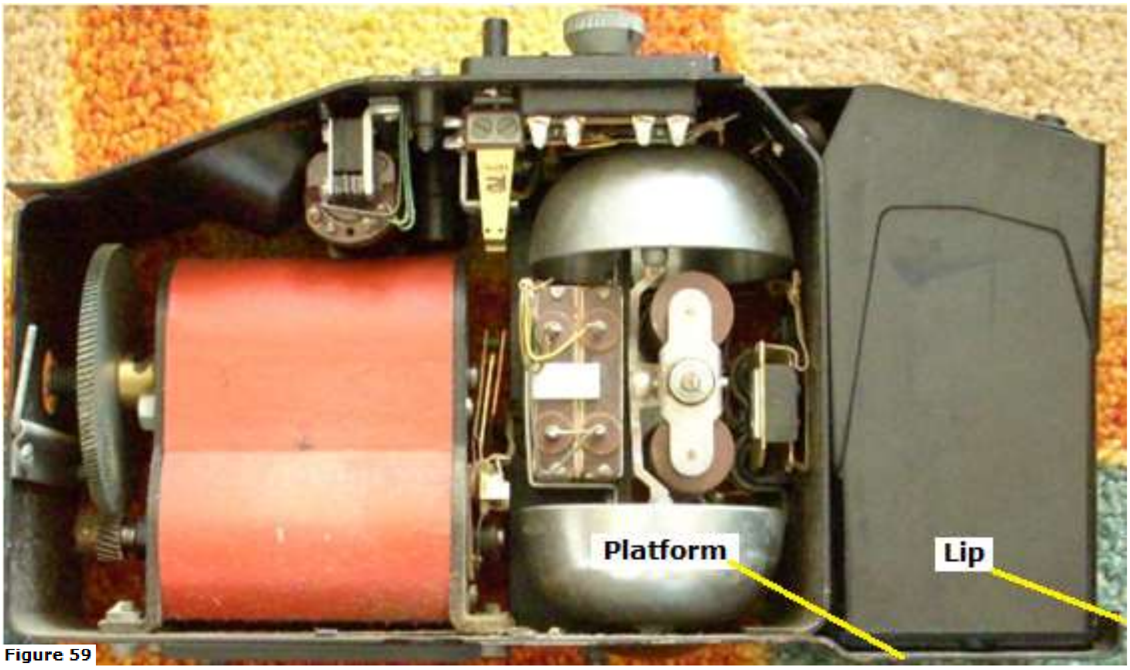

Figure 59


Figure 60

The two lower photographs on the previous page show the internal configuration of a typical FF-33 field phone. These photographs will help readers to understand how and why the cell holder commonly develops one or more stress cracks.

The cell holder is held fast by a smallish lip, which rests under the cell terminal strip; besides this, the cell holder doesn't really "touch bottom" and rest on the frame platform; there are also several millimeters of space between the lip on the *end* of the frame platform and the cell holder. If there is a cell inside the holder and the phone is dropped, then the g-forces are high enough to cause the bottom end of the cell holder to move until it hits the lip of the frame platform; this severely stresses the upper portion of the cell holder so that it cracks.

MAGNETO:

The magneto has a single permanent magnet (the rotor winding has a resistance of 400 Ohms). The magneto is protected against dust and debris from all sides. The magneto is of the short-circuiting type (all older magnetos were of the switching type) so that the speech circuit is never completely cut out, thus allowing communications even if there is a fault with the normally-closed contact.

The permanent magnet (made of a cobalt-chrome-steel alloy) was most commonly painted with glossy or flat red paint, although dark slate can also be found. The permanent magnet usually carries the manufacturer's logo (stenciled, printed or as a decal; very rarely the three letter code), a marking "400 Ohm" and a Wa.A. hallmark on the left-hand side (when viewed with the gear on the right).

Figure 61

Magnetos painted in red are by far the most common ones to be found in an FF-33; slate-colored ones are pretty rare. The magnet usually has an "N" embossed to mark the north pole.

Early magnetos will usually have the end plates made of brass or, in some cases, brass-plated steel and be unpainted. The large crankshaft gear was originally machined out of solid brass. Later magnetos have the end plates made of black painted aluminum, with the crankshaft gear being made of a die-cast alloy (such as can be seen on the magneto shown on the previous page), and these die-cast gears became thinner as the war wore on – these measures were (once again) taken to reduce material use and costs. The gear ration is 1:6, meaning that the armature makes 6 revolutions for every turn of the crank. When turning the crank at a speed of three times per second (180 RPM), the ringing frequency is 18 Hz; the power output is rated at 4.4 Watts. The exact same magneto was also used in the OB-33 (railroad) magneto desk telephone, the field switchboard for 20 lines and cord boards "A," "C" and "D" of the large field switchboard.

An original, unopened magneto will have a protective cover across the bottom (the magneto is thus more or less impervious to dust) and the through bolts that hold the end plates together (as well as practically every other screw inside the FF-33) will show an undisturbed blob of thread-locking paint. Any screws loosened or removed at an upper echelon repair station were repainted after tightening; the original paint colors used in practically all cases were black, slate or a yellowish brown.

This photograph shows one of the feet of a magneto with a blob of undisturbed, slate-colored thread locking paint.

The magneto appears to be painted in orange in this picture because the photo was taken with artificial light, which falsified the color.

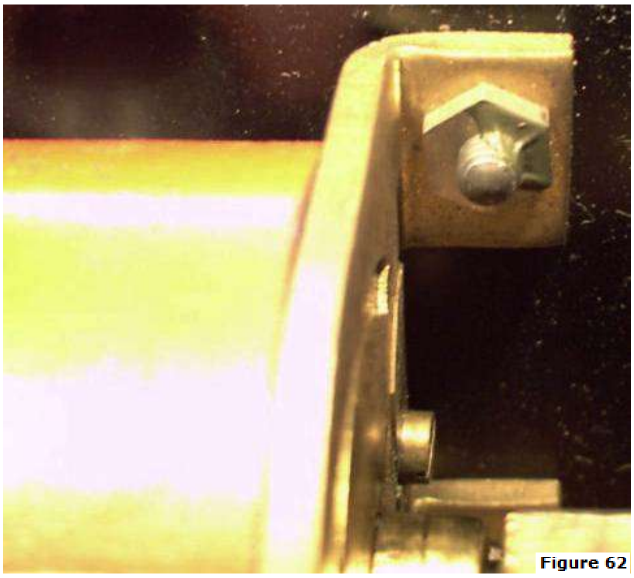
Figure 62

RINGER:

The alternating current ringer has two clappers on its armature which strike the two gongs during travel.

Not much to add to that except that the gongs themselves are of pressed steel (they were *not* painted or nickel-plated) and that they're often rusty. The gongs are of such a size that they don't need shims or stand-offs to be within reach of the clappers. The ringer has a D.C. resistance of 2,500 Ohms.

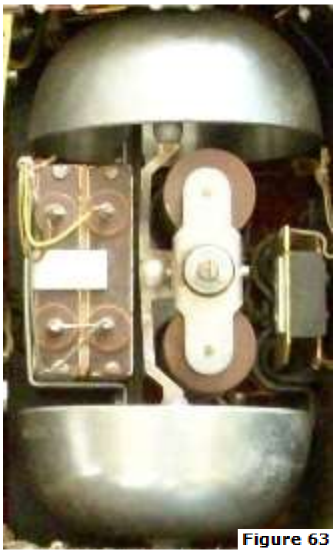
Figure 63

The photographs show an un-disturbed ringer inside an FF-33. The picture on the left shows the top of the ringer, complete with the armature and the two clappers; the items to the left of the ringer are two 1 microfarad condensers.

The picture on the right shows the bottom end of the ringer, complete with the support frame. The item to the *left* of the ringer is the dual patching jack. The patching jacks are explained on the next page, while the condensers are explained under the heading of the induction coil.


Figure 64

PATCHING JACKS:

The patching jacks are connected in parallel with the line binding posts La and Lb/E and are of the parallel jack type.

The patching jacks were intended for use in the following manner: suppose one line of communication from point "A" to point "B" with a second line from "B" to "C." If "A" wants to talk with "C" (or vice versa), then "A" rings up "B" and asks for a patch to "C." After "B" patches his two FF-33's together, "A" rings through to "C." When either "A" or "C" rang off at the end of conversation, "B" would shortly listen in and then take the connection down by removing the patch cord from one of the phones. This was the simplest form of telephone "exchange" as used by the German Wehrmacht, which was also adopted by a few other European countries after WWII.

If the jacks have been removed, then the FF-33 was definitely modified for civilian use. I have one FF-33 in my collection which is missing the jacks because it was modified by the Austrian PTT in 1965(!).

Figure 65

The patching jacks were molded in a common housing, with the contact springs being attached underneath the housing. The soldered connections to the jack contacts may be seen to the right of the ringer in the lowest, left-hand photograph on the previous page. The photo above also offers a very good view of the lower end of the ringer, complete with the round bar magnet clamped tight in the middle of the baseplate. Every visible screw is secured with a blob of slate-colored thread locking paint.

PATCH CORD:

Although the jacks will accept a standard ¼ inch phone plug and only have two contact springs, original patch cords were *not* manufactured with round-tipped plugs such as the U.S. PJ-55 type. Original cords are made of round cord stock, of brown, black or slate cloth, with 3-conductor plugs of the same type as used on all Wehrmacht switchboards. The plug shells are black in color and are held in place by brass end-caps; cord protection springs of blued steel are attached to the end-caps. The other end of the spring has a small protective collar of brass to prevent the cord from chafing (plastic or Bakelite collars were not used). The cord protection springs are often rusty after all these years, and the brass end-caps often show cracks.

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Figure 66

Of the three patch cords shown above, only the one on the right is an original which will fit into the jacks on the FF-33 field phone perfectly.

The patch cord on the left belongs to a field phone from former Czechoslovakia, while the one in the middle is from a post-WWII German field phone, the OB/ZB-54. One very obvious difference between all three cords is that the first two have cord protection springs which are of blank spring steel, while the original cord has blued springs.

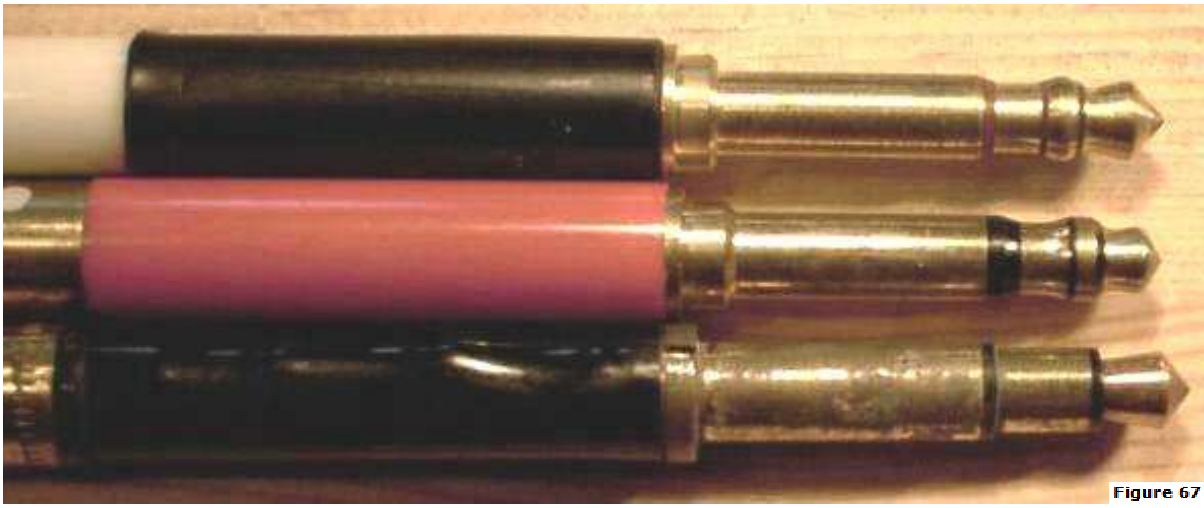

Figure 67

As can be seen in the lower photograph on the previous page, the most obvious difference between the three patch cords is the construction of the plug itself. Post-WWII plugs have an insulated guard ring between tip and ring, while the original German FF-33 cord has plugs with tip, ring and sleeve without any protective ring. The original plugs are also a tad thicker than those used after WWII – later plugs will *loosely* fit the patching jacks on the FF-33 and will wiggle around in the jacks without making proper contact.

INDUCTION COIL:

The induction coil of the FF-33 has four windings: winding I being in the transmitter circuit with windings II, III, IV in the line circuit. Winding IV is a non-inductive, resistive winding. The transmitter circuit is placed into operation by depressing the push-to-talk switch on the handset. The variations in the transmitter (direct) current, caused by speech, flowing thru winding I generate an alternating current in the windings II and III of the induction coil, which flow over winding IV and a condenser, via the connecting line, to the other station. The windings II, III and IV are wired and dimensioned so that the transmitted speech signal is partly canceled out at the transmitting station's receiver (anti side-tone circuit).

The incoming speech currents flow thru winding II, the receiver and both condensers. Windings III and IV, which bridge the receiver and condenser, are wired and dimensioned so that they don't influence the incoming speech currents.

There are two condensers of 1 microfarad capacity in the speech circuit, one of which is connected in the receiving path while the other one is in series with the induction coil. These condensers offer little impedance to speech signals but raise the impedance of the speech circuit for the 18 Hz magneto current, so that it will primarily flow through the ringer.

There isn't really a lot one can add here, the only real twist to the basic principle of a inductive-resistive anti-sidetone Wheatstone bridge being the two 1 microfarad capacitors.

The capacitors themselves are another matter, though. If the FF-33 was refurbished or modified after WWII, then the capacitors were often replaced, and it's pretty easy to determine this. Most telephone capacitors manufactured in Germany, Austria, and most other European countries from the twenties on are legibly date coded. The ones used in the FF-33 usually have the month and year of manufacture (e.g.: 7.42) stamped in the upper right hand corner of the housing, at the terminal end. Since such capacitors were usually used within a few months of manufacture, a date code *later* than about 4.45 is a sure sign the unit was repaired or modified after the end of the war. Some modified FF-33's only have one condenser instead of the usual two. In such cases, the space which was occupied by the second condenser will either be filled in by a wooden block of suitable size (often painted to match the color of the condenser), or a single condenser of larger physical dimensions was used. The capacitor housing is either made of unpainted aluminum or steel painted silver or slate.

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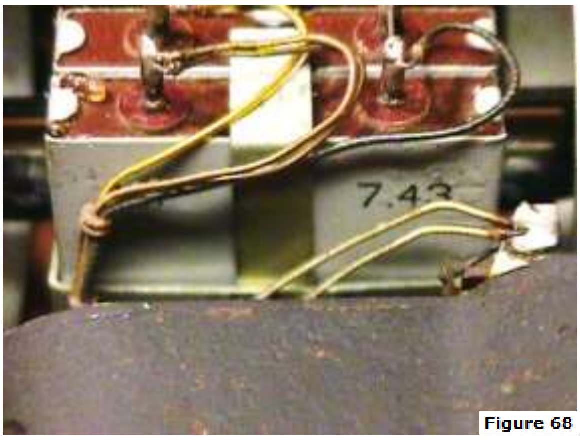

Figure 68

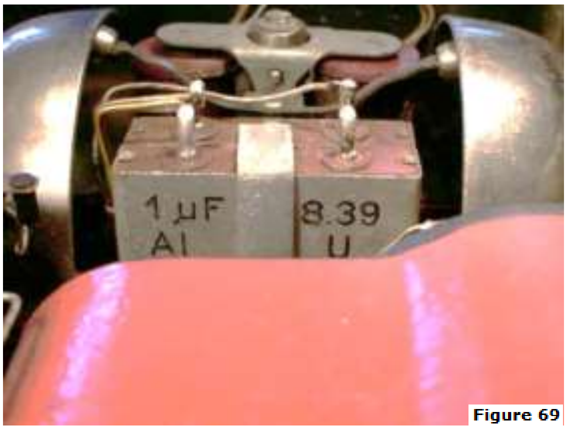

Figure 69

The above photographs show two different examples of condensers with date codes from the Nazi era (1933-1945) – these are definitely originals, despite the fact that the wiring is routed differently in both cases (normally, even something as primitive as wire routing would be rigidly specified and adhered to).

In the left-hand photograph below, it's difficult to decide whether the condensers are originals or not, since a date code isn't visible. What appears to be a portion of the wings of a big Nazi eagle is nothing of the kind – it's part of the manufacturer's logo; anyway, the condensers are originals in this case. The condensers in the photograph below and to the right are obviously from 1965, 20 years after the end of WWII. The FF-33 they belong to was modified in 1965 and used by the Austrian PTT.

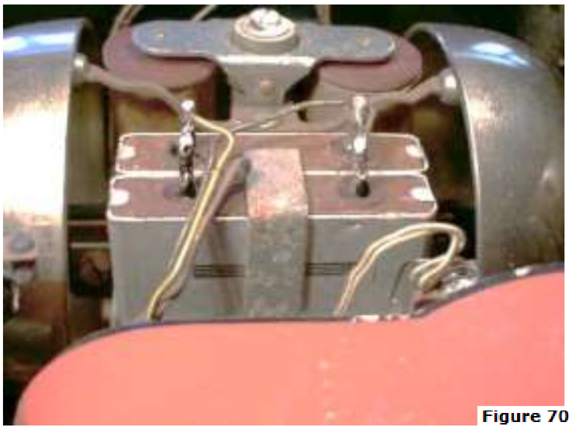
Figure 70

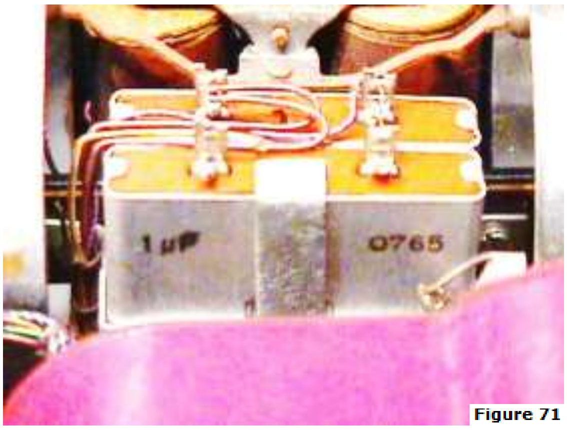

Figure 71

FIELD HANDSET 33:

The field handset is made of Bakelite, the handle being shorter in length when compared with the handle of earlier [field phone] handsets and has a hanging ring at the upper end. The upper end of the handle carries the receiver cap and receiver capsule, so that the receiver element is now replaceable (the receiver element is of the standard postal type); the lower end of the handle carries the microphone cap, its securing ring and the microphone capsule. The microphone of the field handset 33 is marked with a green cross – it is *forbidden* to use any other type.

The push-to-talk switch is mounted on the inner surface of the handle and, due to its design, can easily be depressed and operated anywhere along its length. The three dimples (2+1) distributed along the frame of the switch prevent operation of the same through the weight of the handset in case the handset is rested on the lid of the case. The four conductor cord that emerges from the lower end of the handle terminates in a five pin plug.

All parts of the handset are made of brown to black Bakelite. The handle itself is usually Wa.A. hallmarked near the hanging ring, which is attached to a molded protrusion. The hanging ring itself is made of iron wire, not copper or aluminum, and is machine bent to a rectangular shape. If the handset handle has a smooth, rounded upper end without the ring or if it's missing the hallmark, then it **isn't** an original (although the ring may be found to be missing from original, hallmarked handsets).

Figure 72

Of the three handsets shown above, only the one on the right is an original field handset 33; the one on the left belongs to a Czechoslovakian field phone from the 1950s and the one in the middle is a reproduction from the late 1960s, as used by the German forces.

In one case, handsets with a smooth upper end were manufactured for the Austrian PTT and the Austrian Army (both of which were still using some Wehrmacht communications equipment in the field) as late as 1972. These handsets were intended as replacements for broken original handsets and were made out of the handles of amplifying handsets belonging to the Austrian W48 telephone; the cutout for the volume control thumbwheel was filled in with epoxy in this specific case.


Figure 73


Figure 74

Occasionally, one can find the year of manufacture, along with the manufacturer's logo, near the hallmark. I have one handset in my collection with two different year markings and one manufacturer's logo – this is a sign of refurbishment (at a manufacturing plant) during the war.


Figure 75

The portion of a field handset 33 shown above carries two different years (1938 and 1943), the manufacturer's logo above the year 1938 and, although very difficult to see, a hallmark on the flat surface of the protrusion.

The field handset 33 was also used as an operator's handset in large and medium-sized field switchboard setups, as well as on the magneto/C.B. desk telephone 38 (Tischapparat 38) and the exchange interface set 33 (Amtsanschlieszer 33).

The information printed on the receiver capsule should state that the resistance is 2x27 Ohms (Telco standard); any higher value, such as 2x100 Ohms, is a sure sign that the capsule isn't an original. The capsule will usually carry the manufacturer's logo or initials (or possibly the three letter code) and a year of manufacture as well. This information is usually printed along the rim on the front of the capsule, the logo (or code) may also be embossed on the center contact on the rear of the capsule. The receiver capsule will usually have a Wa.A. hallmark somewhere on the side.

Figure 76

A typical and proper receiver capsule, even though I personally know that the hallmark is missing from this particular unit. The number "24aE2604U9" on the rim is the drawing number which specifies the construction methods and materials. The rest of the info along the upper rim states 2x27 Ohms, 2x900 windings of 0.13 millimeter thick copper wire which was insulated with enamel lacquer ("Kupfer-Lackdraht" in German, abbreviated as "CuL.")

Along the lower portion of the rim we have the manufacturer's abbreviation (R. Bosse & Co.) and the year of manufacture, 1944.

The microphone capsule may be considered original if it has a large green cross painted or embossed on the front side, irrespective of the manufacturer. The early style microphone has a dark green, spray painted cross and, usually, a Wa.A. hallmark stamp on either the front or back. The back side reveals that this type is screwed together – the screw ring will have a green stripe of a similar shade as the cross across a portion of it. If the stripe segments on ring and case don't align, then the microphone was disassembled at some point in time.

The early style microphone was solely manufactured by the Deutsche Telefon- und Kabelwerke (DTW) and the DTW logo is always embossed on the flat portion near the center contact, along with the type number "ASK 681" and the legend "OB" (**O**rts**b**atterie in German = local battery, indicating a magneto telephone).

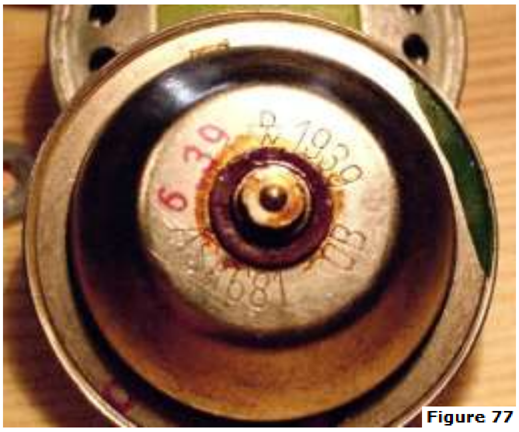
Figure 77

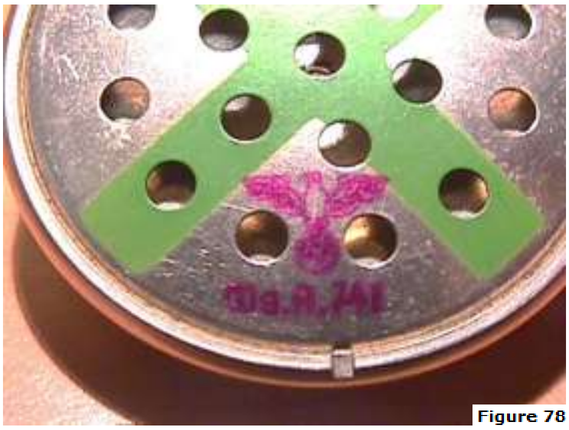

Figure 78

Microphones which lack the distinguishing features mentioned on the previous page, or having hand-painted crosses, having traces of paint on the microphone membrane, having any color circle or dot on the front, &c. may not be considered original, even if the year of manufacture is in agreement with the rest of the FF-33.


Figure 79


Figure 80

Will the real field handset 33 microphone capsules please stand up? The four on the right are the imposters in this case, having been manufactured between circa 1950 and 1970.

The handset *mouthpiece* consists of two separate parts – a clamping ring and the angled inner part (the two pieces to the right in the photograph below). If the mouthpiece consists of only a single part, or if the inner portion is hemispherical, it's certainly **not** an original.


Figure 81

The push-to-talk (PTT) switch bar is correctly attached if the sunken screw is at the receiver end. The screw which attaches the PTT bar to the switch itself is sealed with black paint or pitch. The original switch bar doesn't have any sort of locking mechanism to keep it depressed. Any sort of push-to-talk switch other than with a long switching bar isn't original. The frame of the switch is of a die-cast zinc alloy which is painted black. The paint may have chipped or flaked off to a large degree, but is usually still visible around the edge nearest the handset. If the frame of the push-to-talk switch isn't die-cast, then it isn't original.

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Figure 82

The handset cord is round, cloth covered stock with four *cloth* insulated conductors in the colors white, brown, yellow and green (cords with rubber or PVC insulated conductors and cloth outer braid didn't exist in Germany in the 30's and 40's of the last century). All four of the conductors are used in connecting the handset to its plug, and *any* wiring arrangement utilizing only three of the conductors (or a three conductor handset cord) **isn't** original.

The outer braid is some shade of brown, black or dark slate (= faded black) and *doesn't* have any stripes of contrasting color (such as green, blue, brown or white) woven into it. *Plaited* cords or coiled cords of *any* type are **not** original, nor are any with unusual colors. In the photograph above, the four uppermost cords are originals, while the last two are non-original cords from the 1950s and 1960s. The strain relief boot on the handset end of the cord is made of vulcanized rubber (not any type of PVC) as may be seen in the photograph below, which shows the strain relief boot on the same three handsets from page 273 (only the boot on the right handset is original).

Figure 83

The handset plug exists in a number of variations. The earliest version had a drawn metal cap with an embossed and (usually) painted wiring diagram showing how the handset was connected. It had 5 pins, a feed-through collar of drawn metal with the cord being protected by a tight-fitting, short rubber sleeve. The rear of the connector may carry the manufacturer's logo and the year of manufacture. Later versions were all brown or black Bakelite, the removable cover of some plugs may show the wiring diagram. Late versions are missing pin 3 (yet another cost and material saving measure). All of the Bakelite plug types have the year of manufacture on one side.

All Bakelite plugs either have a spring of (usually) blued steel or a vulcanized rubber strain relief boot for the cord. If a steel spring is used, it will normally have a small aluminum or brass collar inserted at the cord end to prevent chafing. If a strain relief boot is used, it will fit the plug perfectly *without* having been pared down or cut to fit. All versions of the plug have a metal ring on the top to aid unplugging, and a red dot painted on the upper surface, near the cord entrance.

The plug in the lowest position is original, excepting the steel spring, which is of post-WWII production, while a similar plug (second from the top) has an original, non-blued spring.

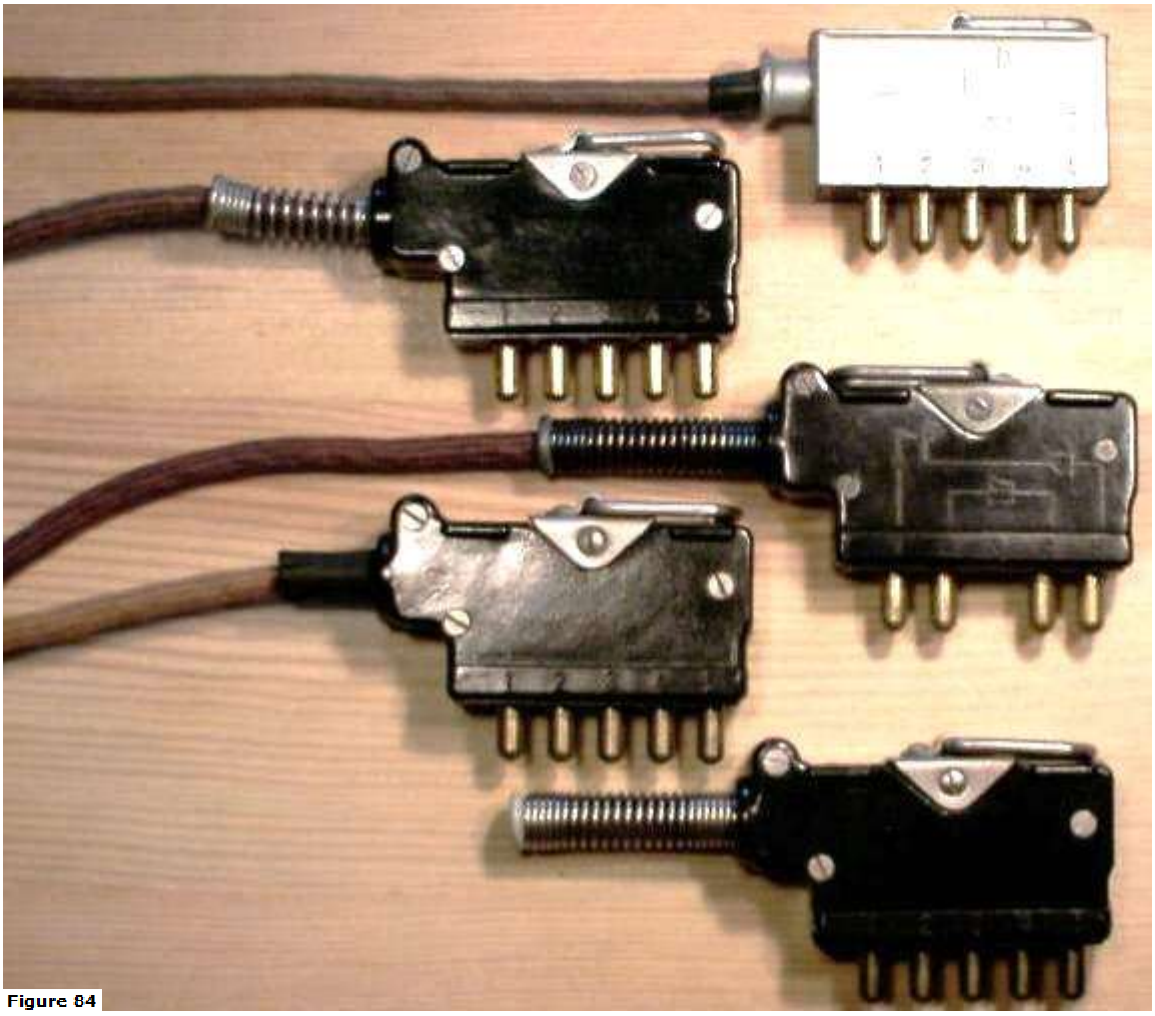

Figure 84

The type of plug shown above, as well as the plug of the headset 33 and the appropriate jacks, were also used with other communications gear.

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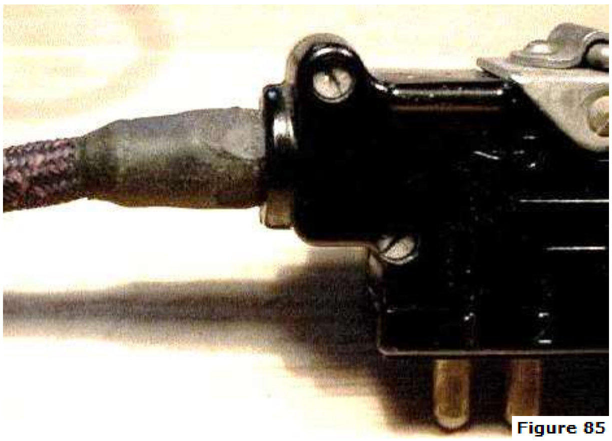

Figure 85

The cord attached to the handset plug shown here isn't an original, not only because it's striped, but also because the strain relief boot was pared down to fit into the plug.

If any form of rubber strain relief boot was used, then it was formed to fit the cable entrance on the plug *without* any sort of rework being necessary.

Speaking of things which ought not to be, here are a few more photographs of no-no's.

Figure 86

Figure 87

Figure 88

The last three pictures on the previous page are a nice kettle of rotten fish if ever there was one. The handset in the upper left-hand photo belongs to what is, once again, claimed to be a "complete and original" FF-33; the microphone capsule is certainly the wrong type – it was manufactured by the Czechoslovakian firm "Tesla" *after* WWII, and (in the original-sized picture) the year on the receiver capsule can be read as being 1954. So much for being "complete & original." The FF-33 in the upper right-hand photo has been heavily modified for railroad use after WWII, because it has a capped coaxial socket on the side of the case. Stay away from any FF-33 which has such an external jack. The handset in the bottom photograph is often passed off as belonging to the FF-33; in reality, this handset belongs to the OB/ZB-54 model German field phone (the plug won't fit the handset jack on an FF-33 anyway…).

HEADPHONE:

The model 33 headphone with connecting cord and 2 conductor plug, stored in a leather case, is part of the FF-33. The headphone is supplied with a spring steel headband and a leather head strap, the usage of either depends on whether the headphone will be worn for longer or shorter periods of time.

The spring steel headband isn't of the standard, adjustable type which is attached to an classic headphone housing with a stirrup, but is rather bent to a standardized shape and size. It's attached to the headphone with a spring clip which slips under a linking bar attached to the headphone with a small U-shaped frame which, in turn, is riveted to the receiver housing. The end of the headband opposite the receiver has a round felt pad stitched onto a round piece of metal, but this is more often found missing than not and, if present, is often very dirty.

The headphone has a resistance of 54 Ohms (2 coils of 27 Ohms wired in series, the same resistance as the standard receiver capsule), with a second type having a resistance of 200 Ohms (2 coils of 100 Ohms in series) being known. However, only the 54 Ohm version was used with the FF-33, while the 200 Ohm version was used with the model 1926 German field phone.

The receiver membrane is sandwiched between the earpiece and a threaded adapter which, in turn, screws onto the headphone case. There is a separate, threaded ring on the housing, which is used as a jamb nut; this holds the earpiece (and thus the membrane) the desired distance from the poles of the electromagnets (receiver sensitivity may be adjusted by varying the gap between membrane and magnets). The headphone housing will either have a very small Wa.A. hallmark embossed on the U-shaped frame or rubber stamped below it, as well as the manufacturer's name, logo or three letter code.

The connecting cord is round, cloth covered stock with cloth insulated conductors, of the same general colors as the handset cords. The two pin connector is known to exist in two versions: both with straight cord entry from the top, with the pin base made of Bakelite and either a metal cap or side pieces made of Bakelite. The headphone 33 wasn't only used as an accessory to the FF-33, but also as part of the Wehrmacht switchboard operator's set and as a field expedient test set by line maintenance personnel.

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Figure 89

Here we have two original model 33 headphones; the one on the right belongs to the leather case shown in the middle. The leather headband mentioned in the translated German text on the previous page is stored inside the lid of the case and can be seen in the photograph. The headphone on the left is ready for use, while the one on the right is still disassembled for storage.

The leather case doesn't carry a manufacturer's name or logo; in this case, the three letter code "cqr" was used. The case also bears the typical WWII German hallmark and the year of manufacture in the form of the two digits "41."

One wouldn't believe how very little some sellers actually know about what they're putting up for auction. I saw one of these leather cases at eBay® in Germany in 2012 which the seller described as a leather case for *spare horseshoes*!

Figure 90

This headphone 33 gives readers a good chance to study some of the finer details; amongst others the late-model, Bakelite plug, where the cord is protected by a thin leather sleeve on both ends (which was sewn onto the outer braid of the cord.) The two binding posts on the sides of the plug are electrically connected to the respective pins; line maintenance personnel took such headphones, connected wires to the binding posts and sought out breaks and other faults. In a pinch, the headphone could be used as a sound-powered *microphone*, allowing two-way communications between troubleshooter and the men at the ends of the line (either field phones or switchboards).

The upper detail encircled in red is a pear-shaped slot, while the lower one is a mushroom-headed rivet. When not in use, the headband was rolled up so that the rivet rested in the smaller end of the pear-shaped slot – this made the headband compact enough to fit into the leather case without problems.

Figure 91

The headphone 33 shown here is the one which belongs to the leather case. On the inside of the spring steel headband (which is rolled up for storage), one can see the following markings in ink: the manufacturer's logo (smeared), the year of manufacture (1941) and a Wa.A. hallmark. The headphone itself also bears the manufacturer's logo and the year of manufacture (the Wa.A. hallmark is on the side of the u-shaped piece of metal which is riveted to the headphone unit and can't be seen here).

The leather case, both headbands, and the headphone were all manufactured in the same year – it's extremely rare to find an intact and complete headphone 33, where the year is identical on all the pieces (the entire unit is also NOS).

Figure 92

This photograph shows the earpiece and the jamb nut as separate items.

Alas, these two pieces are *not* interchangeable with those found on European crystal radio headsets (such as the Telefunken type "EH333," 2x2000 Ohms, which is still easily found in Europe), so that one needs originals if they should be missing or damaged.

Caveat emptor! The headset shown on the right is often pawned off on the unwary or unsuspecting as an "original" German headphone 33.

It's nothing of the kind – this beast belongs to a *Hungarian* field phone from the 1930s. What makes matters worse is that the plug, although a tight fit, *will* mate with the headphone jack on an FF-33 field phone.

Figure 93

Figure 94

Here we have an FF-33 with an incorrect magneto crank and a late-model Hungarian headphone, which was offered to the unwary as a "complete and original" phone.

The heads of the two screws which hold the telephone unit inside the housing are painted completely in red; only the small, embossed circle *around* the screw heads should be red.

The original field headphone 33 was also used as part of an operator's set. Some period photographs exist showing the operator's set being used with a double earphone headset with a standard, adjustable headband. Currently, I don't have any further information concerning this second type of headset.

The headphone 33 is pretty rare, and if one thinks back to post-war Europe, it's no small wonder that hardly any of them are left. The leather cases were most likely cut up and used for repairing shoes, belts, &c., and the headphones were much sought after by radio hobbyists for building home-brew radios because nothing better was available.

FIELD ELEMENT:

The field element is a cell specially designed for long storage and belongs to the class of dry cells. Differing from other dry cells, though, the field element must be activated prior to use. The activation consists of filling the cell with water – for this reason the field element is also known as a "fillable element."

The field element consists of a housing in which a zinc cup is placed. A charcoal rod, whose lower portion is fitted with a gauze bag containing manganese dioxide and graphite, is centered inside the zinc cup. The empty space between the gauze bag and the zinc cup is filled with dry ammonia crystals and a gelatin powder. The top of the element is sealed with a pitch compound.

To activate the field element for use, it is only necessary to add clear water until the filler tube is full. The ammonia crystals and gelatin powder will dissolve in a matter of minutes, flowing into every crevice of the cell. The fluid level will sink somewhat as the crystals and powder dissolve. In order to make the upper portions of the cell, which thereby become dry again, usable, water should be added after a short time, an hour at the latest. Adding water any later will only cause the upper layers of the gelatin to dissolve again.

The active gel is complete after a few hours, 12 at the most. Until that time, the field element should be left standing upright and still, if at all possible, but then be tipped over briefly to drain any liquid remaining inside, so that such liquid won't spill into the FF-33 and cause damage.

The cell is capable of delivering current almost immediately, about one to two minutes after water has been added. The capacity of the field element is sufficient for about 100 hours of talking, since the cell will recover somewhat when not in use.

Exhausted field elements can't be regenerated, since it is impossible to remove the solidified active ingredients, beside the fact that the zinc cup is usually eaten through by then.

Field elements that have not been activated must be stored in a dry place. They'll gradually absorb moisture if stored in damp areas and spoil due to self-discharge. Field elements which show voltage are to be activated and be used promptly.

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I'd like to specifically point out that the foregoing text refers to a *single* 1.5 volt cell[5] and **not** a battery of 3 or 4.5 volts. I have seen one or two FF-33s up for sale at eBay® in the U.S.A., where the seller claims he is offering "an original," only to go on and write that the wiring diagram calls for a 4.5 volt battery for operation! I *politely* tried to point out to one such dealer that the FF-33 he was offering had been modified, that the original was specifically designed to operate on 1.5 volts **only**. I got some very snide remarks from these "traders" along the lines of their having "hard engineering data" (the wiring diagram in the lid of the *modified* phone) as opposed to my "informed *conjecture*" for my troubles. It was actually quite a pity to see some poor cluck suckered into paying $ 79.95 (plus postage) – *for a piece of junk worth 20 dollars at the most*.

[5] 1.5 volt cells (such as the ubiquitous "D" cell) are inappropriately termed batteries by many (even manufacturers commonly made this mistake, dubbing a number 6 1.5 volt dry cell a telephone *battery*).

By definition, a "battery" consists of 2 or more "cells" or "elements," whereas a cell or element is a single electrochemical unit, including its container, which delivers an electromotive force (EMF) usually ranging somewhere between 0.7 volts and 2.3 volts (the exact EMF depends upon the electrode materials and the electrolyte used).

I have researched which cells seem likely to have been used in the unmodified FF-33, based on photographs of intact, original field elements and their labels, as well as on the field elements in my collection.

In all cases, the field elements were built per the specifications found in DIN VDE 1210 and VDE 0807/X.39 (DIN is the abbreviation for "Deutsche Industrie Norm" – German industrial standard, VDE used to be the abbreviation for "Verband Deutscher Elektrotechniker"[6] – Association of German Electrotechnicians). "X.39" means that the VDE guidelines set forth under the number 0807 were valid as of October, 1939.

[6] Today, the abbreviation stands for "Verband der Elektrotechnik, Elektronik und Informationstechnik e.V." – literally: Registered Association for Electrical Power, Electronics & Information Technology.

The VDE guidelines 0807/X.39 give a table of data which not only reflects the lettered designation codes of the various cells and batteries, but also the number of operating hours which may be expected when the cells and batteries are operated a specific maximum number of hours a day, the voltages the cells and batteries must meet when loaded with a specific test resistance, the voltages of same under normal (operational) loading, &c. The values are given for a total of 14 single cells of the dry, fillable and air-oxygen types.

The first letter of the designation code indicates whether the unit in question is a single cell (**e**lement) or a **b**attery, the first letter thus being an "E" or "B." The second letter is a dimensional code – the further down the alphabet the letter is, the larger the unit. The third letter, finally, defines the type of cell involved – "T" for Trockenelement (dry cell), "F" for Füllelement (fillable cell) or "L" for Luftsauerstoffelement; air-oxygen cell; the latter cells relied on the free oxygen in the air to depolarize the charcoal anode, instead of the manganese dioxide commonly used in the dry and fillable cells. Air-oxygen cells were very common because they were less expensive to produce.

Tafel I

1	2	3	4	5	6	7	8	9	10
		Zustandsmessung		Leistungsmessung					
								nach Lagerzeit	
Kurzzeichen nach DIN VDE 1210	Nennspannung	Arbeitsspannung	Prüfwiderstand	Entladedauer	Entladewiderstand	Entladestromstärke	spätestens 2 Wochen nach der Herstellung	von Monaten	Betriebsstunden
*)	V	V	Ω	werktäglich	Ω	mA	Betriebsstunden		
A. Elemente									
1. Trocken-, Füll- und Luftsauerstoffelemente									
EKT	1,5	1,35	5	4 h	25	—	150 h	6	120 h
EKF	1,5	1,30	5	4 h	25	—	120 h	—	—
EKL	1,5	1,15	5	4 h	25	—	150 h	6	120 h
ELT	1,5	1,4	5	4 h	15	—	350 h	12	300 h
ELF	1,5	1,35	5	4 h	15	—	300 h	—	—
ELL	1,5	1,2	5	4 h	15	—	400 h	12	350 h
EMT	1,5	1,45	5	4 h	10	—	350 h	12	300 h
EML	1,5	1,25	5	4 h	10	—	450 h	12	400 h
ENT	1,5	1,45	5	4 h	5	—	350 h	12	300 h
ENF	1,5	1,40	5	4 h	5	—	300 h	—	—
ENL	1,5	1,25	5	4 h	5	—	550 h	12	500 h
EQT	1,5	1,5	5	4 h	5	—	1000 h	12	900 h
EQL	1,5	1,3	5	4 h	5	—	1250 h	12	1150 h
ERL	1,5	1,35	5	4 h	2,5	—	1250 h	12	1150 h
2. Naßelemente									
EX	1,5	1,35	5	4 h	10	—	300 h	—	—
EY	1,5	1,4	5	4 h	5	—	300 h	—	—
3. Stabelemente									

Figure 95

The table above is the one mentioned on the previous page. The highlighted data pertains to the three different (standard) types of cells which were used with the FF-33 field phone.

Elements of the type EL(x) have the proper dimensions to fit the cell holder in the FF-33, namely 55 x 55 x 125 millimeters. Type EK(x) elements are too small (38 x 38 x113 mm), while EN(x) are too large (80 x 80 x 200 mm.) Aside from their size, the type EL(x) cells are the only ones designed specifically for operation with a 15 Ohm load, which corresponds to the switchable 15 Ohm test load in the Wehrmacht field test instrument (Feldmesskästchen) used for testing single field elements or batteries made of two or three such field elements (among other things).

Figure 96

The small, slate-colored arrows at the points 0.8, 1.5 and 2.1 Volts of the Volt/Ohm scale of the Wehrmacht field test instrument mark the lowest voltages allowed for a single cell and batteries made of 2 and 3 cells when tested with a 15 Ohm load.

All of the period literature in my archive (dating from between 1937 and 1944) only makes specific reference to the fillable element (ELF) as being used in the FF-33, while all the pictures of period elements, as well as the ones in my collection, are all of the air-oxygen type (ELL). From the information available, it's safe to say that the fillable type was originally meant to be used during manoeuvers and such during times of peace (when stocks might be stored for considerable periods of time), while the air-oxygen type was used during the war, owing to its simpler construction (requiring less manganese dioxide in manufacture and no water for operation) and longer service life (350 hours for the ELL type vs. only 300 hours for the ELF type).

It's very likely that the literature wasn't updated to reflect the exact type of element used in either situation, since such information isn't relevant to the principle of operation of the FF-33 as taught in the signals sections of the Wehrmacht.

Figure 97

All four of the field elements shown above are originals from my collection. The one designated as an "Element TMO" was manufactured in occupied France – the German text immediately below the designation reads as: "Feldelement-Bauart: Luftsauerstoff, Abweichende Masze[7]"; to wit: "field element construction: air-oxygen cell" and "off size," since the element is a bit smaller than normal. The field element with the purplish label is from civilian stock from 1940, which carries a proper but somewhat faded Wa.A. hallmark.

[7] The French printer who printed the labels for this specific type of element didn't have the German "sharp-ess" (ß) among his printing letters, so he was forced to resort to the less common, but still correct, usage of the letters "sz" instead.

Figure 98

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Of the three elements shown at the bottom of the previous page, only the one in the middle is an original. The one to the right is from the early 1960s, while the one on the left is from 1971. Of these two, only the one on the left is useable to *forge* a field element (yes, there *are* people around who do this, because original field elements are very rare), because the external housing was exclusively made of thick, black cardboard – the only exception I have come across to date is the element from France; it appears that a black thermoplastic was used in this specific case.

Figure 99

A very distinguishing mark of *original* German field elements, one which no one has yet been able to forge, is shown to the left; the **raised**, embossed German-language legend "Behörden - Eigentum."

Translated, Behörden-Eigentum means as much as "property of the authorities" or simply "government property." The front side of the label of original elements also carries a similar notice: "Behörden-Ausführung und -Eigentum"; literally: "manufactured for, and property of, the government." The reason that the message "government property" was embossed onto the bottom of genuine German field elements was that if some scoundrel were to steal some of these elements and rip the label off, the text would be missing; theft of government property would be impossible to prove without the text embossed on the bottom … the Germans carried this labeling of government property so far as to even emboss the same text onto pencils, &c. Faked or forged elements are invariably missing this text on the bottom of the housing, because in order to have the text **raised** on the outside, the cell case needs to be *empty* prior to embossing. Of course, it'd be possible to stamp the relevant text into the bottom of forged elements, but in this case the lettering would be *pressed into* the bottom, and *not* be raised.

Figure 100

The four shots at the bottom of the previous page show a genuine German field element dated April, 1945. It's interesting to see that even such mundane things as black cardboard and sufficient paper for manufacturing full-sized labels were lacking at that late date.

Now, we will take a look at a few of the more common forgeries floating around out there in cyberspace ….

Figure 101

Figure 102

There are two dead giveaways concerning the element shown above: first of all, the label is far, *far* too clean to be from WWII and secondly, genuine German field elements *never* had a logo imprinted in the pitch layer on the top, and they also didn't have a date code in the pitch (in this case "591" – month 1 of the year 1959). The pitch is far too clean, and it shows more or less severe cracking on old, original field elements.

Figure 103

Figure 104

More pictures of the same "original" – date markings were commonly executed in *purple* stamp ink, not blue. Again, the paper is far too unblemished to be original and, in the right-hand picture, the rectangle is *empty*, although this is the space where the Wa.A. hallmark is found on originals.

Figure 105

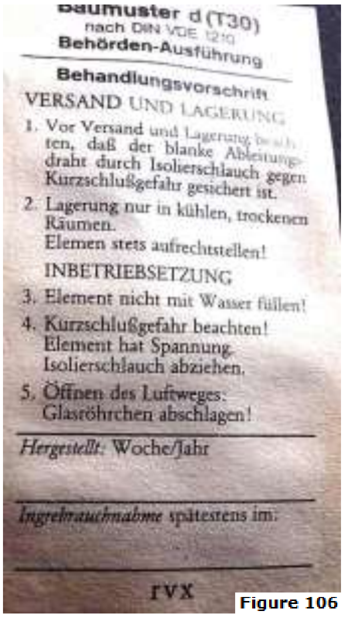

Figure 106

Another odd thing is that *almost* every single faked German field element I've ever seen claims to be from the firm named in the photo to the left (these are some more pictures of the same forged element as shown on the previous page).

The first date given on the label segment on the left is the date of manufacture (in 1938), while the second date gives the date of acceptance (5 *months* later, in 1939!) Sorry, it just ain't so … first of all, the dates were normally given in the form of a number between 01 and 52 for the week of manufacture, followed by a slash and the last two digits of the year (as shown below). The loose label shown to the right *supposedly* belongs to a packing carton for a German field element – nope, certainly *not*. If one sees such a label being offered along with "an original," then beware! There are two typos on the label on the right, which is something the highly efficient German military wouldn't have accepted under any circumstances … no, I am *not* going to reveal what and where the typos are, because that'd be helping the forgers, which I don't intend to do.

Figure 107

Figure 108

Figure 109

Another forged German WWII field element … in this case, the label looks to be a bit older, but it's still far too well-preserved to be genuine. A few more tips: here, too, the pitch on the top of the element is far too shiny, and the brass fittings belonging to the positive pole are *far* too clean to be 70+ years old. And, if that weren't enough, the dates of manufacture and of acceptance are *missing*. Aside from this, the two glass tubes on the top of the cell are undamaged, while these would've been broken open on a used, original cell. These glass tubes are intended to let air reach the innards of the cell, so that the oxygen in the air helps depolarize the cell.

Figure 110

This segment of the label belonging to the element shown above has two major faults: first of all, original labels have a "dash" in front of the German word "Eigentum" (property), and the rectangle which should sport a Wa.A. hallmark – the letters seen here are simply the abbreviation for the German term "Wehrmacht Heer", military forces, army. This was *never* stamped onto any field element because field elements *weren't* produced for the separate branches of the German military establishment.

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Figure 111

Figure 112

The "original" field element shown above left is an especially *inept* forgery, since original field elements only had *one* wire, and that was insulated in black, <u>not</u> in red or blue. The photo on the right shows the core used for this particular forgery – an element manufactured in former Czechoslovakia!

Figure 113

The element from Czechoslovakia (shown in the right-hand and lower pictures on the previous page) is from my collection, as is the forged label (one of four I bought from someone in Montreal, Canada, who claimed that they were "originals"). One dead giveaway for such forged labels is that the lowest bar, or row of feathers, on both wings and the uppermost row on the right-hand wing of the Nazi eagle are slightly thicker and/or darker than the rest. This happens when such labels are printed by any rotary offset method in which the offset printing foil was made with the help of a photocopier. Original labels were printed from frames of individual letters, with the Nazi eagle as a separate item, which were set by hand. Such direct printing is much crisper than that produced by any multistage process ….

No comments will be added to the following section, since it only concerns itself with very basic testing and operation of the FF-33.

Operation & Field Expedient Testing of the FF-33:

Operation –

1. An activated field element must be installed in the FF-33; the instructions for activating the field element are printed on its label. The element must be connected (connections must be tight).

2. Connection of line: if a wire *pair* is used, one wire is connected to La, the other to Lb/E; if a *single* wire is used, then connect it to La, and connect a *solid ground* to Lb/E. Tighten binding posts well. Clip off excess wire.

3. If possible, always connect the headset. Handset, headset and line wires are run out of the phone between rubber lips on the left side. Close lid, rest handset sideways across lid.

4. Screw magneto crank on to shaft on right side.

Testing –

1. Check that everything is present: field element (activated and connected), handset, magneto crank, patching cord.

2. Shake phone and check that all parts are secure, verify that the protective covers don't bind and that no debris or dirt has entered, for instance, into the patching jacks.

3. Test speech circuit: don't connect line, operate push-to-talk switch and blow into transmitter. Result: loud rushing sound in receiver. Rushing sound should soften when: 1. binding posts La and Lb/E are shorted together or 2. when magneto is operated. When push-to-talk switch is released, rushing sound ceases.

4. Test ringing circuit: short circuit binding posts La and Lb/E, turn magneto crank and press test pushbutton. Result: ringer operates.

5. Test the patch cord and jacks: insert one of the patch cord plugs into one of the jacks, test speech circuit as under 3. above, while touching sleeve of the second patching plug to binding post La, then touch the tip of the second patching plug to binding post Lb/E. Repeat with the other patching jack. Result: while touching the binding post with the plug, the rushing sound should soften.

I'd like to round this tale out with three relatively rare accessories belonging to the German field phone FF-33: a special ring-through, talk-through, induction coil, the "SB-33" accessory (the designation "SB" doesn't *literally* refer to any German WWII switchboard) and the field lightning arrestor.

The WWII German military made it standard practice to construct field phone lines within a range of at least three kilometers behind the front as full metallic circuits, while phone lines beyond this zone were often constructed using a ground return circuit, in order to save on field phone wire. This is why the field expedient instructions given on the previous page state that "if a wire *pair* is used, one wire is connected to La, the other to Lb/E; if a *single* wire is used, then connect it to La, connect a *solid ground* to Lb/E."

Of course, it could happen that a metallic circuit from the front wasn't terminated on a switchboard, but rather on a second FF-33 at some small command post, where a further FF-33, using a ground-return circuit, would connect the command post to a switchboard still further away from the front. In such a case, any call from the front passing through the command post would be handled by patching the two FF-33s together. The problem in this case is that a metallic line would be directly and electrically connected to a ground-return line, thus forfeiting the secrecy of wire communications afforded by the full metallic circuit.

In order to prevent this from happening, the two FF-33 field phones at the command post would be patched together using a special ring-through, talk-through induction coil as shown below.

Figure 114

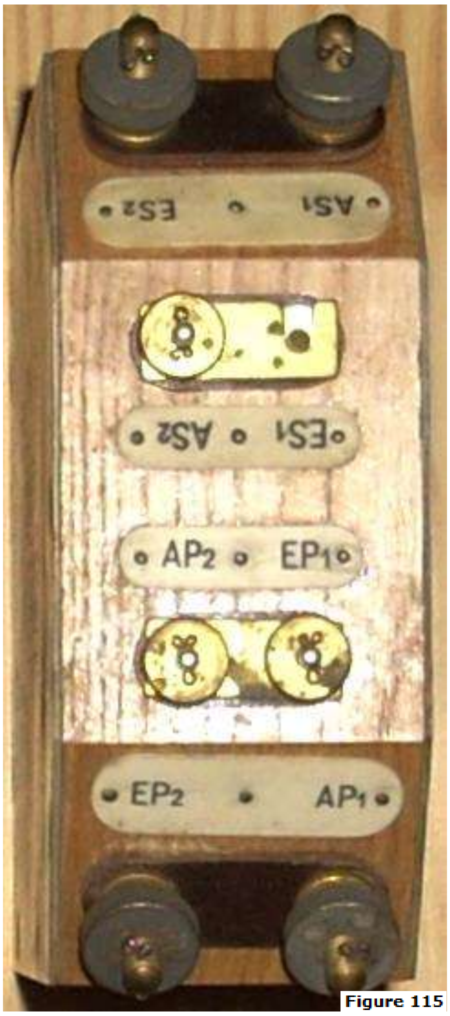

Figure 115

As readers can see, the front side of the field induction coil has two jacks marked "P" and "S", denoting primary and secondary, while the top carries a total of 8 binding posts.

The letters "A" and "E" are the German abbreviations for "**A**nfang" (beginning) and "**E**nde" (end); the designations "AP_1", "EP_2", &c. refer to the beginning and end of the two 21 Ohm primary and the two 21 Ohm secondary windings.

In daily operation, the four smaller binding posts remained screwed down tight, so that there was but a single primary coil of 42 Ohms and but a single secondary coils, also of 42 Ohms resistance.

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Since each and every FF-33 was supplied with a patch cord, the signals specialist at the command post would take the cords from the FF-33s and plug one end of each cord into one of the jacks on the front of the induction coil, leaving the remaining plugs free until it became necessary to patch a call through from a fully metallic line to a ground-return line (or vice-versa). In such a case, the two free plugs would be inserted into a patching jack on both FF-33s, thus electrically isolating the one circuit from the other, and so preserve the secrecy of wire communications afforded by the fully metallic line.

One of the covers of the induction coil carries a schematic of the coil and jacks.

The coil in this case is of pre-WWII vintage, since both covers are made of sheet zinc, instead of aluminum.

Figure 116

While I did write that “the designation “SB” doesn’t *literally* refer to any German WWII switchboard” in connection with the SB-33 accessory, this unit was used to link an FF-33 field phone to a large field switchboard equipped with type “C” cord boards.


Figure 117

I already mentioned that … ”a type “C” cord board (local battery talking, magneto ringing to call up the operator and common battery signaling to indicate the end of a call) …” was used by the German military. This is exactly what the SB-33 is all about.

The SB-33 was attached to the lid of an FF-33 via a wide spring steel clip on the bottom, while the two cord tips were attached to the terminals La (white) & Lb/E (brown) of the FF-33 and the line wires were connected to the terminals on the rear of the SB-33.

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The SB-33 consists of a molded Bakelite cradle for the handset of the FF-33, a simple hook-switch which is *closed* when the handset is on-hook, a blocking condenser of 4 microfarads capacity and a choke with a D.C. resistance of 300 Ohms.

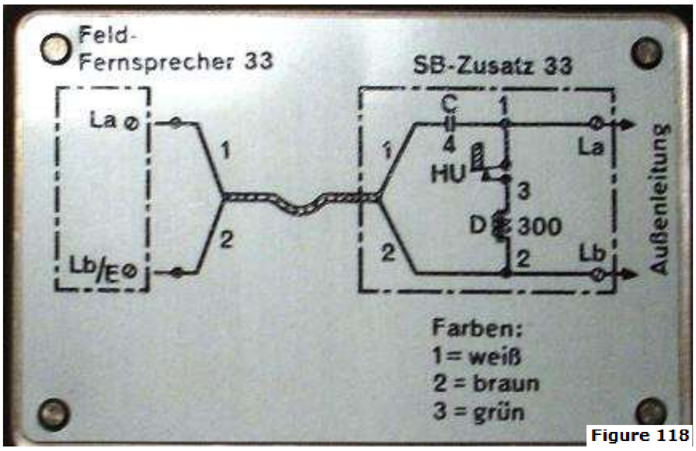

Figure 118

It's obvious that the condenser will prevent the end-of-conversation D.C. signaling current from finding a conductive path through the FF-33, while the choke will provide a good conductive path when the handset is on-hook, without attenuating ringing currents all that much. To tell the truth, I have only seen two photographs of a type "C" cord board, and only a single one of a type "D;" I only happen to know that they existed at all thanks to an ancient Wehrmacht signals training manual which gives schematics for both types, as well as a very brief description of their operation.


Figure 119

This photograph shows the underside of a field lightning arrestor. I chose to show this side by itself, since the closed unit is boring to look at from the top.

There are two spring steel clips folded back onto the housing at the top and bottom. It was normally intended that these clips be folded down and the arrestor clipped onto the closed lid of an FF-33; however, this wouldn't be possible if an SB-33 were already clipped to the lid, so there is a notch at the top of the housing which allows for the arrestor to be hung up on a nail – indoors or out, since this unit is completely weather-proof.

The housing of the field lightning arrestor is made of the same material as the case of the FF-33 field phone and the SB-33 accessory.

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Figure 120

One thing can be said about the German military establishment during the timeframe 1933 through 1945 – they were *very* consequential in everything they did … such as designating one line terminal on the top and bottom blocks (on the faceplate) as La and the other one as Lb/**E** (**!**); *not that it'd make very much sense* to run a grounded wire over a lightning arrestor made up of a spark gap (500 V), a carbon block arrestor (350 V) and a sneak-current fuse (3 A). The *protective* ground wire was connected to the single terminal in the middle of the faceplate. The arrestor has a similar setup of rubber lips as the FF-33, except that here we have a total of *three* pairs: one set for the wires entering the unit at the top, another set for the protective ground wire exiting at the right-hand side and a third pair for the wires exiting at the bottom.

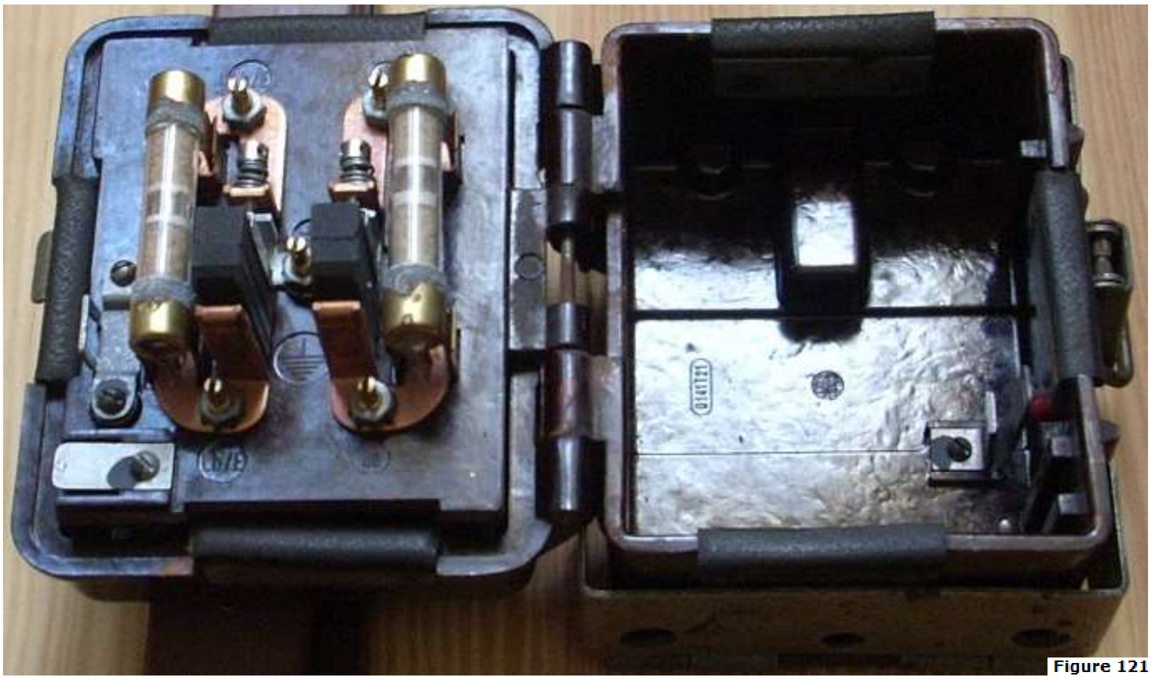

Figure 121

The field lightning arrestor is even rarer than the SB-33 accessory; in all my years of collecting German FF-33 field phones (20+), I have seen at least a dozen SB-33s on auction at eBay® in Germany (at prices between 90 and 140 Euros – circa 105 to 160 dollars at the time of writing), but only one field lightning arrestor (and I only know of a total of five in collector's hands).

<u>Addendum:</u>

In this article, I only wrote of the newer model field phone 33, and gave some reasons for the need for a new type (problems with the microphone capsule and the 'battery' being given – refer to footnote three on page 253). This specific information was found in a contemporary text used to train communications soldiers but, as it turns out, this info was incomplete.

A quite severe problem had been encountered: the *original* FF-33 had extremely loud sidetone on short lines, which dwindled away as the line got longer, until it *completely disappeared*. The interesting thing is that the original circuit design was kept and used up until 1939, when the induction coil circuit was completely re-designed; FF-33s with the old induction coil circuit were almost universally reworked to match the new design.

Any FF-33 field phone lacking the green strip on the writing tab could, theoretically, be one of the original design – a certain sign would be the following schematic diagram ….

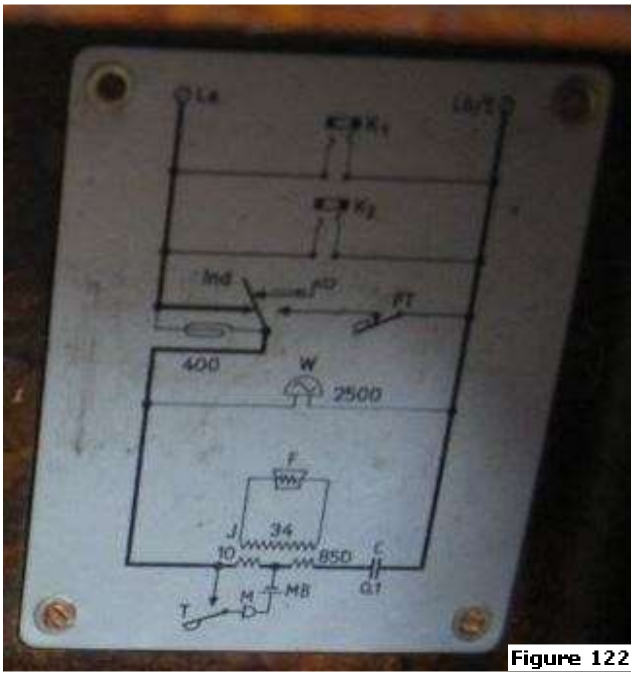

Figure 122

The German Navy had their own version of the FF-33, with yet again a different induction coil – this was necessary because the navy wanted to be able to use their own headset/chest mike setups with the phones.

Navy FF-33s have a yellow stripe, instead of one in green – but these (as well as unmodified, original FF-33s without the green stripe) are as rare as hen's teeth, so I will not cover them any further here.

I may write a separate article, with all three schematics, one of these years; however, this is not a high-priority item.

Of course, one would also require detailed photographs of the innards of a prospective "old" FF-33, in order to be able to verify that the field phone is equipped with only one capacitor, and that its capacity is only 0.1 uF – and, of course, the date stamp would be between 1933 and 1939.

Observations & Corrections Concerning Issues 1-4 of "Telecom History"

Caveat: the author owes up that he didn't re-read *every* single word in all four issues of "Telecom History," so it *is* possible that he missed something or other … but, after all, this collection is free of charge so that, while every effort has been made to only include verified information, omissions *may* have crept in.

Issue # 1 – 1994

Article entitled "Earliest Telephone Service."

Page 48, exhibit 3-4D – "Other manufacturers outside the USA also produced a number of switchboards influenced by early telegraph design and/or similar to the Bell switchboards described here. The very early switchboard in this picture was developed by Otto Schäffler in Austria-Hungary prior to 1881. It first went into service 1 December 1881 when the first exchange was opened in Vienna. Operated by the Wiener Privat-Telegraphen Gesellschaft (Vienna Private Telegraph Company)".

By having chosen the wording "The very early switchboard in **this** picture … **it** first went into service 1 December 1881 …" the author of TH *inferred* that the switchboard shown (which was for 10 lines) was the one which went into service on December 1st, 1881. This is partly incorrect, since the first public telephone exchange in Vienna had 154 subscribers – so it wasn't a *single* switchboard that was placed in service, but rather several units.

Page 66, in the body of text, under the heading of "French Phones," second paragraph of text: "The German Army also used handsets during World War I." Well, the Germans weren't the only ones … the armed forces of the Austro-Hungarian Empire used field phones with handsets as well (as did the armies of several other European countries).

Figure 1

The picture to the left shows a typical Austrian WW I field phone handset, with an integrated push-to-talk switch and a buzzer pushbutton.

This style of handset was plugged into a separate battery box, which only supplied the power for the microphone and the buzzer. Everything else, including the induction coil[1], was integrated into the handset.

[1] The induction coil wasn't a separate unit; instead, it was an integral part of the buzzer. This was done in order to save space and weight.

Figure 2

The handset shown here was a component of a different field phone as used by the military forces of the Austro-Hungarian Empire during WW I. While of a similar design as the previous handset, the buzzer/induction coil unit was mounted inside a wooden carrying case which also housed the handset during transportation. The wooden battery box was normally bolted to the back of the carrying case. Design features common to both handsets are the large, foldaway "trough" mouthpiece and the leather-padded earpiece ring, which was commonly filled with horse hair.

Figure 3

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Page 70 – while factually correct as far as the texts go, the exhibits on the page require some additional information; foremost being that the telephones shown in exhibits 3-9G and 3-9H were used for *intercommunications*, and were not connected to any sort of private or public exchange, since they both have a pushbutton for buzzer signaling – a very *uncommon* mode of operation for anything *but* intercoms. Sad to say that the book (from which the photos used in the exhibits were taken) doesn't specifically state that either model was truly used anywhere within the Austro-Hungarian Empire.

It may also be of interest to know that, as far as telephony was concerned, Austria and Hungary went their own separate ways … any time that an administration was independent in both halves of the Empire, the Austrian half was known as the "Imperial-Royal" such-and-such, while an administration common to both halves was referred to as the "Imperial *and* Royal" such-and-such. Thus, the telephone administration for the Austrian half of the Empire was the "Imperial-Royal Administration of Posts and Telegraphs", while the army (Heer) was the "Imperial *and* Royal Army."

Issue # 2 – 1995

Article entitled "The American Automatic Telephone Company."

Page 32, the second full paragraph of text in italics. The sentence "Other vendors like Couch, Clark, Globe, Dietl and others, are now mostly forgotten, except among collectors of old telephone instruments" is misleading. The "Dietl" referred to is Gottlieb Hubert Dietl, who was a high-ranking employee of the Chief Technical Department of the Imperial-Royal Administration of Posts and Telegraphs.

While it is true that he and a team of engineers modified the original Strowger system to meet the specifications of the Austro-Hungarian PTT, Dietl was *not* a manufacturer of automatic telephone exchange apparatus in any sense of the word.

Issue # 3 – 1996

Article entitled "Why Bell was the last major company to provide handsets."

Page 79, figure 5 – "The Austrian Army made very early used of handsets. The field activity of the Signal Corps unit shown in this picture took place around 1900. The phones used by the soldiers in the picture all have handsets."

Alas, there are several historical problems here. To claim that "the phones used by the soldiers in the picture all have handsets" is a bit dubious, since the quality of the picture is so poor that this statement can't be verified. The uniforms don't appear to be "Austrian," either. Until the demise of the Austro-Hungarian Empire on November 11th, 1918, there certainly was *no* "Austrian Army" – the military entity was known as the Imperial and Royal Army (k.u.k. Heer).

Last, but certainly not least, the Imperial and Royal Army did <u>not</u> have any unit or formation known as the "Signal Corps" anywhere around the year 1900 – the closest things were the "k.u.k. Eisenbahn- und Telegraphenregiment" (Imperial and Royal Railway and Telegraph Regiment), which was formed on August 1st, 1883, and the "Telephon-Abteilungen des k.u.k. Heeres" (Telephone Sections of the Imperial and Royal Army) circa 1894. However – the caption quoted above doesn't appear to be an opinion of the author of TH (readers may wish to refer to the L/H column of text on page 3 of the June, 1995, issue of "Singing Wires").

Page 79, figure 7 – "This very early handset went into service in 1900. It was probably manufactured by Mix & Genest. The instrument in the picture may have been used on a PBX in Vienna."

The original German-language text belonging to the phone reads as: "Es handelt sich um ein als Tischapparat konstruiertes Mikrotelephon für Haus- und Nebenstellenanlagen, das um die Jahrhundertwende herum erzeugt wurde."

The English translation of the above text is: „It is a microtelephone[2] constructed as a desk set, intended for intercom and PBX[3] use, and was manufactured around the turn of the century."

[2] The age-old German/Austrian term "Mikrotelephon" refers to what is otherwise known as a handset, and not to a complete (miniaturized) telephone.

[3] The type of "PBX" referred to is nothing more than a large intercom system which relied on some sort of primitive switchboard to interconnect the phones; these "PBXs" were *not* connected to the public telephone network.

Anyway, the original text makes no mention that this specific intercom telephone was ever used in Vienna, or in Austria, or anywhere else within the Austro-Hungarian Empire. Besides this, neither of the two "telephones" has a hook-switch (or a switch-hook), which would be necessary to open and close the microphone battery circuit – instead, both have a push-to-talk switch, which is much more reminiscent of an intercom telephone than of one connected to a public exchange. The original text also makes no mention of the fact that "this very early handset went into service in 1900," but rather only states that it was "… *manufactured* around the turn of the century …." Since the book from which the picture was scanned was published in 1981, the "turn of the century" refers to circa 1900.

Page 83, figure 10 – "This early handset went into public service in Germany and Austria in 1908. It is model OB 05. The instrument in the picture has the Austrian state insignia."

Really? The German-language designation "OB05" refers to a magneto telephone designed in 19**05**; it was usual for such equipment to be placed into general service within a year or so of being designed, so that writing that this specific type of magneto desk phone went into service in 19**08** is a bit off-target, as is the claim that the German OB05 was in general public service in the Austro-Hungarian Empire. As a rule of thumb, the Imperial-Royal Administration of Posts and Telegraphs *didn't* import telephones for public use from any other countries. That the OB05 is a magneto desk *telephone* is obvious, rather than its being a *handset* as is stated in the original text.

That "the instrument in the picture has the Austrian state insignia" is, alas, patently untrue. The Imperial-Royal Administration of Posts and Telegraphs *never* placed any sort of insignia on any of their phones. The telephone & telegraph administration, being a sub-department of the Imperial-Royal Ministry of Trade, didn't really have its own insignia. *If* any sort of insignia had been used, it would've been the double-headed Imperial eagle of the Austrian half of the realm, complete with a postilion's horn with lightning bolts, as shown at the top of the next page.

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Figure 4

Readers should compare the scan above with the logo shown on the phone in figure 10 – does anyone truly see even the slightest family resemblance? The author certainly doesn't.

Figure 5

The scan on the left shows the Ericsson AC351w "state type" magneto desk set of 1906 as used by the Imperial-Royal Administration of Posts and Telegraphs.

Although there are some physical similarities between the AC351w and the German OB05, they were dissimilar from an electrical standpoint, which is exactly why the German OB05 wasn't in general use in "Austria."

Article entitled "Dialing the letters Q and Z."

Page 105, "10. Dialing the letter Z in Austria," the first full paragraph of text in the middle column reads as: "The numeric portion of the Vienna dial reflected the relative positions of the numbers as they were on the operator's keypads, used on the semi-automatic system. On these pads, the zero was located before the 1, not after the 9. This layout was continued on the dials used in Vienna.

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And before the dials could be added, the system had run out of 5-digit numbers, and these were changed to 6-characters, by adding a letter as the first number to be dialed. One of these letters, on the nine dial position, was the letter Z. To my knowledge there never was an office letter Z in Vienna, but when party lines were first offered in 1935, Z was one of the letters used for that purpose."

There is quite a lot to be said about that; although it *is* true that the arrangement of the digits 0 thru 9 on the dial face was chosen in order to remain consistent with the arrangement of the keys on the former semi-automatic operator's keypads, it isn't explained why zero wound up on top in the first place.

When defining the system specifications for the modified Strowger system which Mr. Gottlieb H. Dietl and his team of engineers had developed for use in the Austro-Hungarian Empire, some unsung engineer decided to define the first contact on the three 100 contact arcs of the *final* selector as being at coordinate zero-zero on a linear x-y graph, with the wipers being at coordinate -1/-1 while at rest. It was therefore quite logical to dial 00 in order to reach this first contact – actually much more logical than denoting this first contact as being at position 1/1 and having the contact fingers at position zero-zero on the x-y graph while at rest.

Nummernbereich	Bezeichnung des Amtes	Anschrift
A-10000 bis A-19999	Berggasse I	IX., Berggasse 35
A-20000 „ A-29999	Hebragasse I	IX., Zimmermanngasse 4
A-30000 „ A-39999	Dreihufeisengasse II	VI., Dreihufeisengasse 7
A-40000 „ A-49999	Treustraße	XX., Treustraße 22
A-50000 „ A-59999	Hietzing	XIII., Wenzgasse 10
A-60000 „ A-62999	Floridsdorf	XXI., Nordbahnanlage 4
B-10000 bis B-19999	Döbling	XIX., Würthgasse 6
B-20000 „ B-29999	Dreihufeisengasse I	VI., Dreihufeisengasse 7
B-30000 „ B-39999	Zollergasse	VII., Zollergasse 31
B-40000 „ B-49999	Hebragasse II	IX., Zimmermanngasse 4
B-50000 „ B-59999	Rasumofskygasse II	III., Rasumofskygasse 29
F-22000 bis F-22999	Stadlau	XXI., Erzherzog Karlstraße 131
R-10000 bis R-19999	Favoriten	X., Columbusgasse 58—62
R-20000 „ R-29999	Krugerstraße	I., Krugerstraße 13
R-30000 „ R-39999	Meidling	XII., Arndtstraße 81
R-40000 „ R-49999	Afrikanergasse	II., Afrikanergasse 1
R-50000 „ R-59999	Berggasse II	IX., Berggasse 35
R-60000 „ R-69999	(Gersthof)	provisorisch an das Fernsprechamt Berggasse angeschlossen
U-10000 bis U-19999	Rasumofskygasse I	III., Rasumofskygasse 29
U-20000 „ U-29999	Neutorgasse	I., Neutorgasse 7
U-30000 „ U-39999	Fünfhaus	XV., Loeschenkohlgasse 23—25
U-40000 „ U-49999	Taubstummengasse	IV., Taubstummengasse 7
U-50000 „ U-59999	Wattgasse	XVII., Wattgasse 56—60
Atzdf-400 bis Atzdf-899	Atzgersdorf	Atzgersdorf, Wienerstraße 11

Figure 6

For unknown reasons, the author of TH was long of the opinion that the letter prefixes to the numbers in Vienna were *office letters* – this simply wasn't so. The letters were chosen for phonetic uniqueness in German and spread around the dial in an arbitrary manner. As is obvious from the scan on the previous page[4], the letter "A" was used by 6 different exchanges, spread throughout Vienna. From this, it's clear that the letters were *not* office designators …. The roman numerals preceding the addresses of the various exchanges under the heading "Anschrift" (address) on the right side of the scan identify the administrative district of Vienna in which the relevant exchange lies.

[4] The scan shows the allocation of subscriber numbers to the individual exchanges, the exchange names and their addresses in the Viennese phone directory from 1938.

Strangely enough, exactly one of the ten letters on the Viennese telephone dial from between 1928 and 1957 could, by a stretch of imagination, actually be viewed as being an "office letter," although it wasn't *defined* as such in Vienna – namely the letter Z. How so? Well, if a subscriber in Vienna dialed the letter Z all alone and then waited, (s)he was connected to an operator; however, contrary to the time-honored practice of having subscribers dial "0" to reach a *local* operator in the USA and elsewhere, in this case, the subscriber reached an outward operator in the Vienna *toll* exchange. In the early days of telephony, the German-language term for a telephone exchange was "Telephon-Zentrale", so "Z" could *possibly* be interpreted as being the abbreviation for "Zentrale."

The author of TH was also gravely in error in stating that party-line service was first offered in Vienna in 1935; in this case, he was off by exactly 30 years. Secret-service, party-line telephones were something else which Mr. G. H. Dietl developed (with the help of telephone mechanic's apprentice Friedrich G. Koch) – 40 such telephones were placed into trial service in the manual suburban exchange of Meidling in the year 1905 and were in widespread use throughout all of Vienna by 1909, as the scan below shows.


1305/röm. II **Briess Arthur**, X., Senefelderg. 1.
12408 **Brik J. H.**, Spezialarzt für Harnkrankheiten, I., Rathausstr. 19.
3856/röm. IV **Brings Julius**, XVIII., Währingergürtel 107.
17557 **Brodsky Leo**, IX., Dietrichsteing. 10.
12408 **Brünauer Adolf**, II., Rembrandtstr. 32.
3538 **Brunner Julius**, VI., Blümelg. 1.
1179/röm. IV **Brunner Max**, V., Reinprechtsdorferstraße 29.

Figure 7

The phone number at the top of the scan is a perfect example of how party-line numbers were written at the time: 1305/röm II. The "top level" or "common" number of the party-line was 1305, with the four individual parties being identified by the roman numerals II, IV, VI and VIII. Thus, to reach the party, the caller would have told the operator that phone number 1305, roman (numeral) II was wanted. The trick of forcing subscribers to specify the party by using roman numerals was necessary in order to prevent the caller from requesting subscriber 1305, number 2 – because (s)he would possibly have been connected with subscriber 13052 in error.

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Fact of the matter is that, as of the year 1934 (not 1935), party-line phone numbers were issued with ending letters B, U, L and Z. Up to 1934, the party-line designator was an infix within the phone number, namely the 100s digit (whereby a 100s digit of 0 or 5 always identified a single-party [private] line). Why this was so is beyond the scope of this tale; more information can be found in "A *Closer* Look at Telephone Levers, Dials and Pushbuttons in Vienna," which is planned to be published at a later date.

Issue # 4 – 1997

Article entitled "Structures of the switchgear manufacturing industry …," beginning on page 44. There is a bit to be said about the role Western Electric, International Western Electric and ITT played in Austria. Western Electric held part interest in the Viennese firm of Czeija, Nissl & Co. (aka CN**[5]**) per March 1st 1896, as did International Western Electric later on; the contract of association foresaw a mutual, royalty-free exploitation of patents and equipment, which actually came about in some cases.

When ITT bought out International Western Electric in 1925, CN was renamed along the classic ITT lines of giving the acquired company the name "Standard" this, that or something else – in the case of CN: "Standard Telephon & Telegraphen AG**[6]**."… which later became ITT Austria and, subsequently, Alcatel Austria (Alcatel-Lucent Austria AG at the time of writing).

[5] CN is definitely the firm alluded to in endnote 5 on page 51, where it is written that "These included: - in Austria, a company formed in 1884 …" (CN was founded in that year).

[6] "AG" is the German-language abbreviation for the term "**A**ktien**g**esellschaft," which is commonly known as a joint-stock company (JSC) in the USA.

Although it received the name "Standard Telephon & Telegraphen AG" (aka STT), CN was one of the few companies which were allowed to retain their original name in any form; it is historically correct that the full company name was written as: "***Standard Telephon & Telegraphen AG***. Czeija, Nissl & Co." (including the use of the Hawthorn font).

Page 72, Exhibit D – The Gustloff Catastrophe, left hand column of text, 11th paragraph:

"The German torpedo boat Löwe (Wolf) was unaware of Russian U-boats …." The English translation of the German word "Löwe" is "lion", *not* "wolf."

A Most Unusual AUTOVON Telephone

It was in February 2011 that I placed a bid at eBay® in Germany and won the AUTOVON telephone shown on the following pages … yes, I am well aware of the fact that the U.S. military still has bases strewn throughout Germany, but I'm pretty sure that the AUTOVON phone in this tale isn't from any U.S. government or military installation anywhere on the planet.

As any collector of AUTOVON telephones knows, the automatic voice network of the U.S. government resp. military establishment not only consisted of 2-wire and 4-wire land lines, but also foresaw and implemented long wave, short wave, VHF, UHF and microwave radio links. The AUTOVON telephone I bought was neither built by Western Electric, nor was it intended for connection to any sort of land line – instead, it's a radio adjunct, built by Collins Radio. I believe this Collins Radio AUTOVON phone to be a prototype from the early 1970s (the integrated circuits carry date codes from 70xx thru 72xx). The phone itself carries the serial number 3, the highest serial number found inside the phone is 014, and one of the printed circuit boards is heavily stamped with the text "ENG. USE ONLY" and carries the serial number 001. The housing is from ITT, as is the handset, which is equipped with a "confidencer" microphone.

Lest anyone think I'm the last of the Dodos: I emailed requests for help to folks at the Collins Collector's Association, namely to the person responsible for public relations, as well as to the president of the CCA – and never received a reply from either of them. I also attempted to contact folks at the Collins Radio Association with the same measure of success.

Mr. Paul Fassbender of TCI was kind enough to offer to check with some folks he knows to see if they might have some information, but none was to be had; I seem to recall that one of his suggestions was to write a brief article for the Journal and wait & see if anyone within TCI possibly has any further information. So, this is what I am doing here and now. The rest of this tale is mostly dedicated to large-size photographs of the phone in various states of disassembly, so that all parts can be seen.

So – *has* anyone seen such an AUTOVON phone before or know anything about it, such as: what the red and white colored indicators with the number "325" were supposed to signal, what radio set(s) was it intended for, did it get past the prototype stage at all, does anyone have any wiring diagrams or schematics for this phone, &c?

Figure 1

The moment I removed the housing from this phone I saw that this was no ordinary AUTOVON unit, but rather something *quite* different. The discrete R-L-C network the handset is connected to is already something unusual … just as unusual as the fact that there is no strain relief for the handset cord – it's simply wedged between the thermoplastic housing and the aluminum chassis.

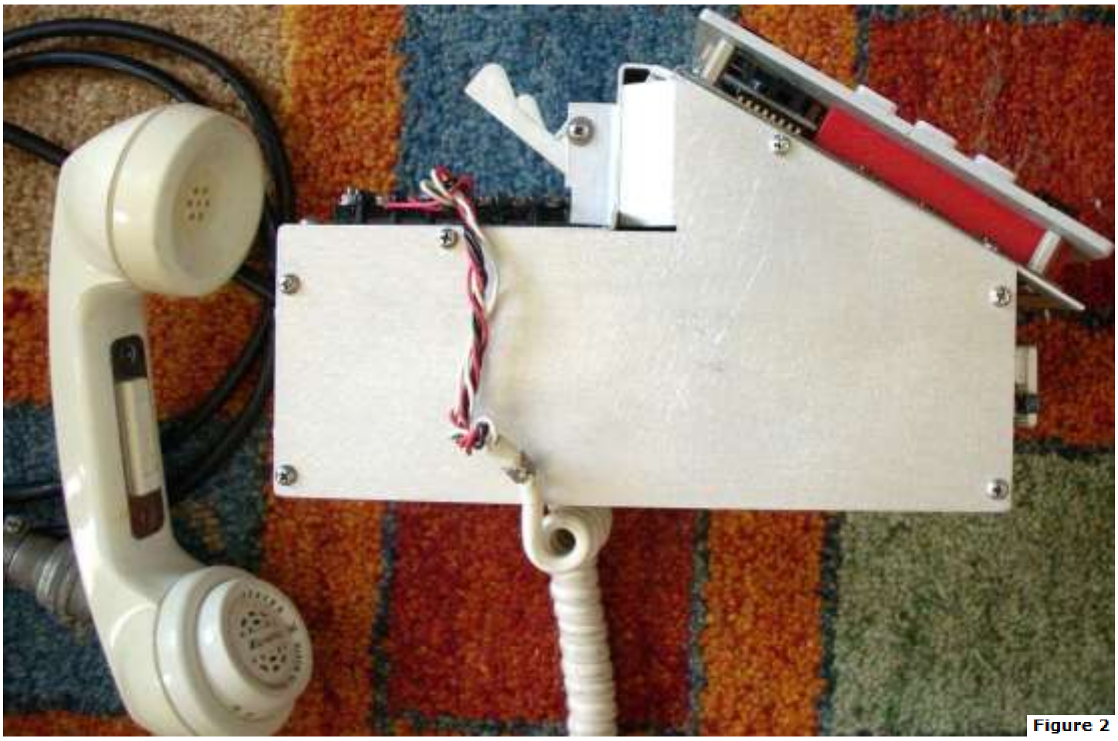

Figure 2

Figure 3

The keypad is a discrete unit, unlike any DTMF pad I've ever seen; it was manufactured in week 16 of 1972.

The phone doesn't have an electro-mechanical ringer; instead, the crystal mike on the left-hand side appears to be used as a kind of loudspeaker to reproduce some sort of electronic ringer tone(s).

The chassis offers very good shielding from electromagnetic radiation; it also serves as a card cage for a total of 4 PCBs.

Although not easy to see, the hook-switch is no more than a simple S.P.D.T. microswitch with a small roller at the end of the switch leaf.

As can be seen, the 2 "325" indicators are socketed on a small, separate PCB (located near the bottom middle of the picture.)

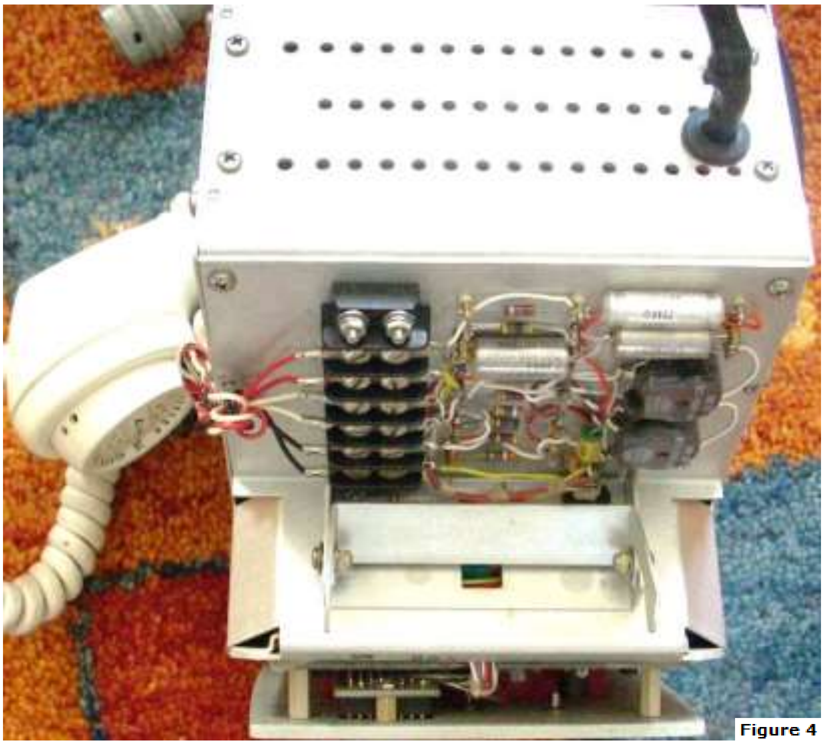
Figure 4

Figure 5

The internal arrangement of the chassis simply screams “high-tech,” “military,” “bomb-proof,” &c. It appears that the upper two PCBs are concerned with low-frequency signal processing, while the other two, with their additional shielding, may have to do with high-frequency signal processing; some sort of analog speech scrambling *may* have been involved as well.

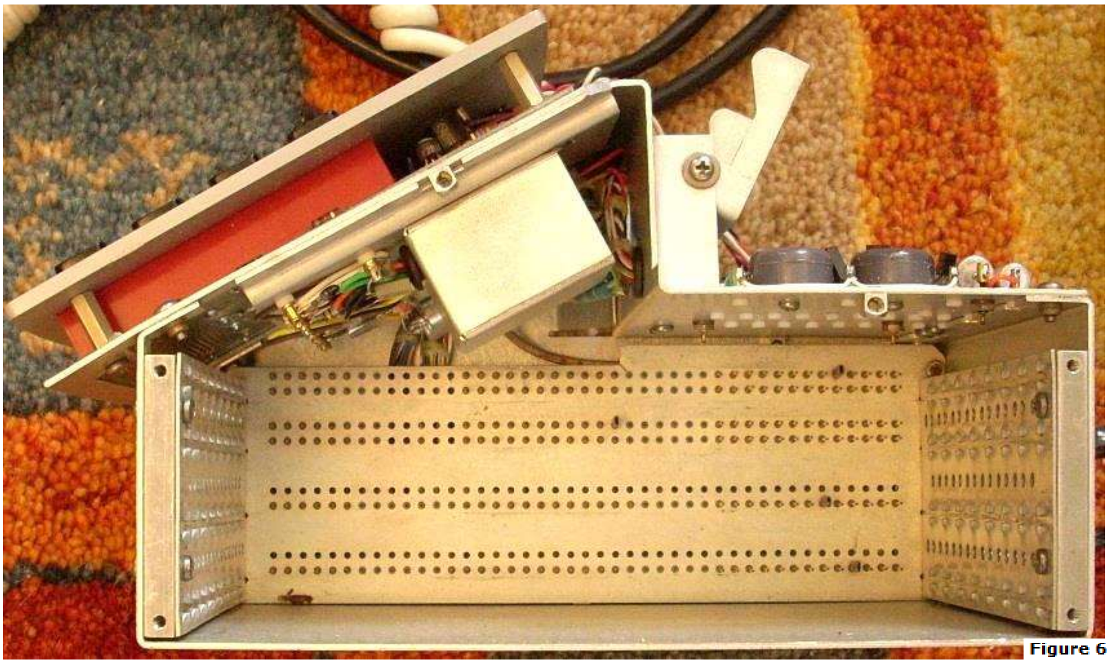

Figure 6

This is interesting: there are no individual card edge connectors in use here, but rather, apparently, some sort of prototyping setup where individual contact pins were inserted wherever required & each of the double contact rows has one pin insulated with a small bit of shrink sleeve. Those pins prevent the PCBs from being inserted into the wrong slots.


Figure 7

There is some more interesting point-to-point wiring, using individually placed, Teflon insulated stand-offs with gold-plated pins, hidden beneath the keypad.

If readers look closely, they can see a light-brown coaxial cable snaking its way out from behind the PCB connectors. This stuff has a stranded core of silver-plated copper wires, and the woven shield is of the same material. Such coax cable is 50 Ohm material and is good for frequencies up to 1 GHz.

It's also interesting that the card edge guides are made of punched aluminum sheet instead of being made of plastic, as is normally the case.

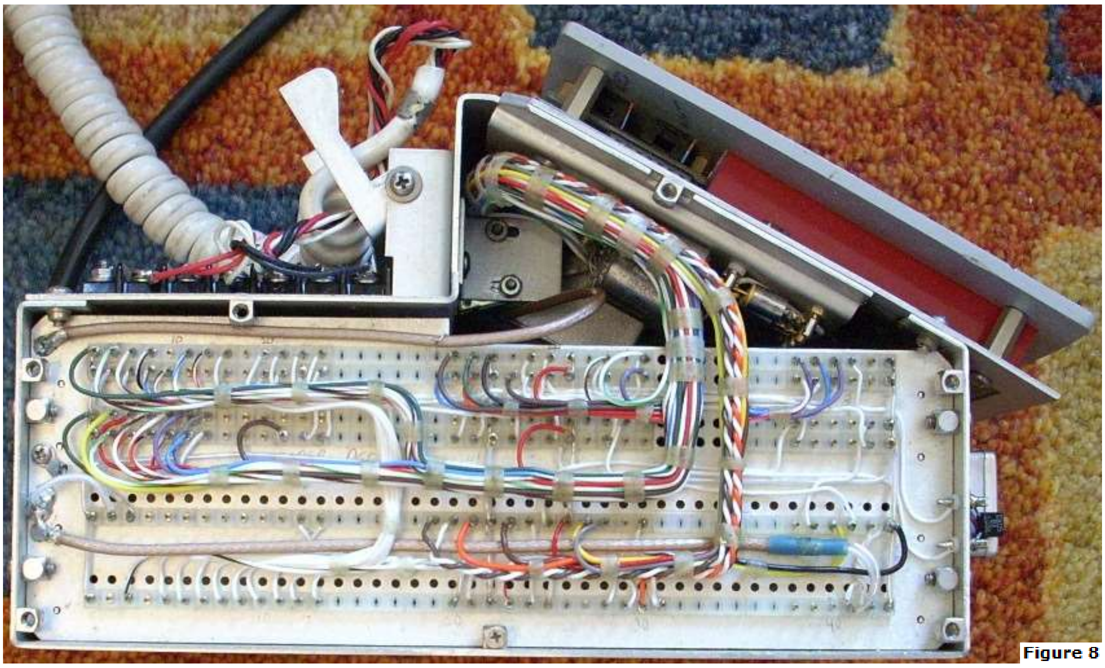
Figure 8

The wiring on the rear side of the PCB connectors, including a second segment of coax cable, is very neat. The hook-switch microswitch is mounted on the tongue seen immediately below the thick wire bundle beneath the keypad baseplate.

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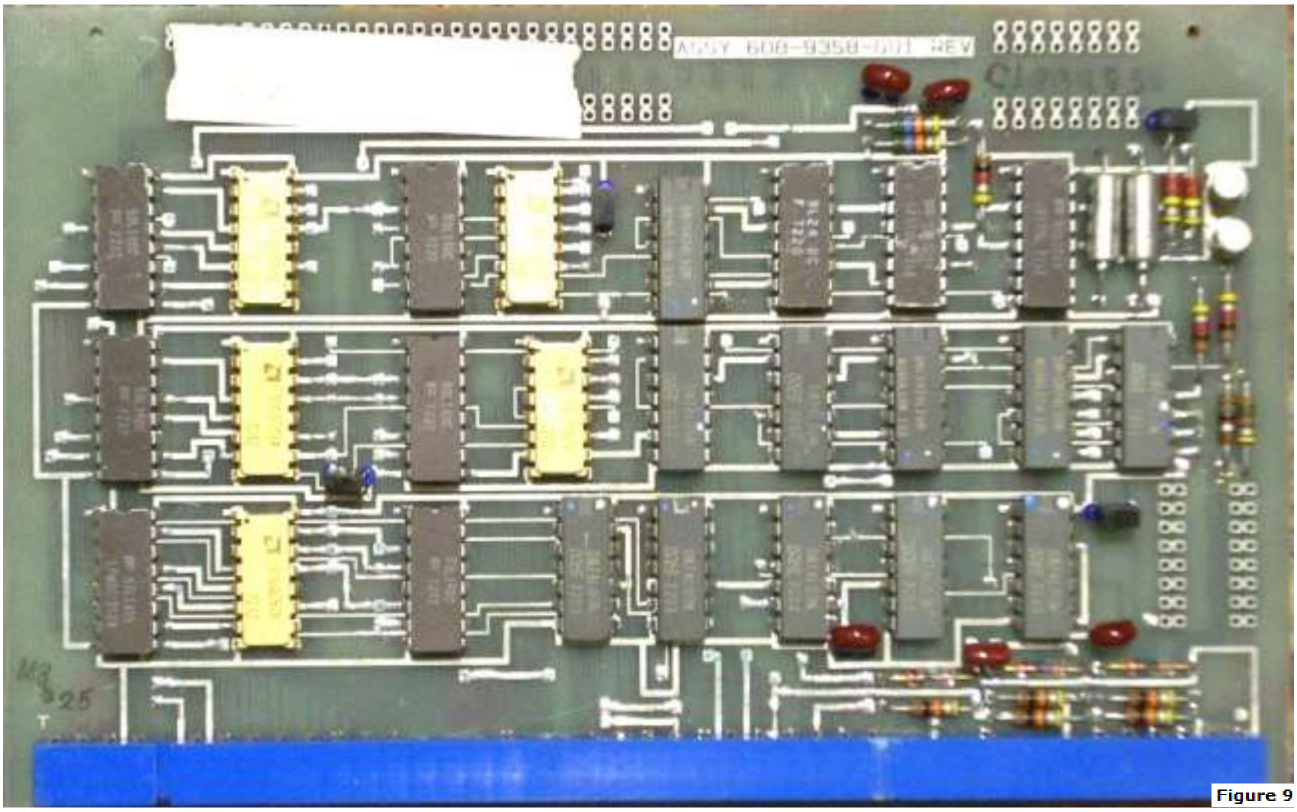

Figure 9

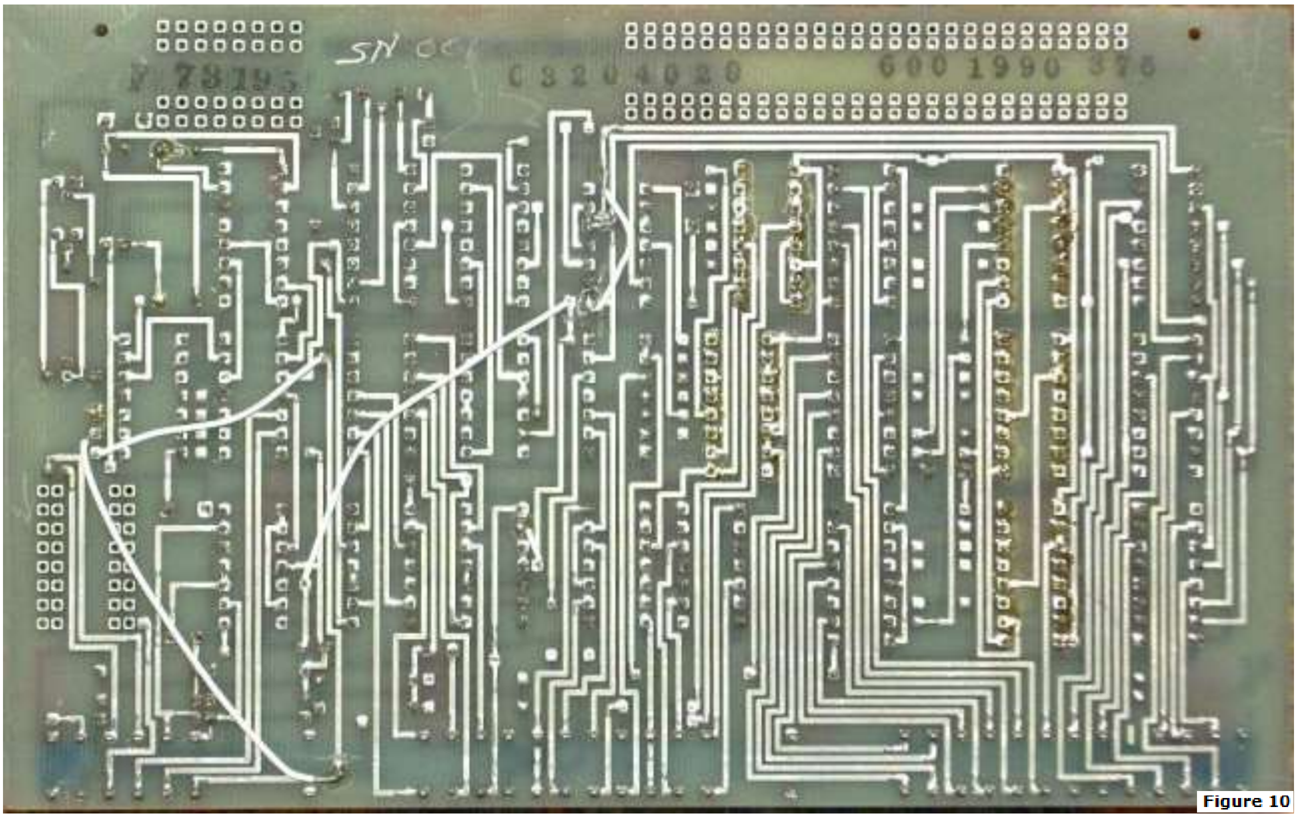

Figure 10

This is the first of the four PCBs in the card cage, hand-written serial number 004. I wonder whether some sort of analog speech scrambling was used, since the PCB has 5 analog integrated circuits on it.

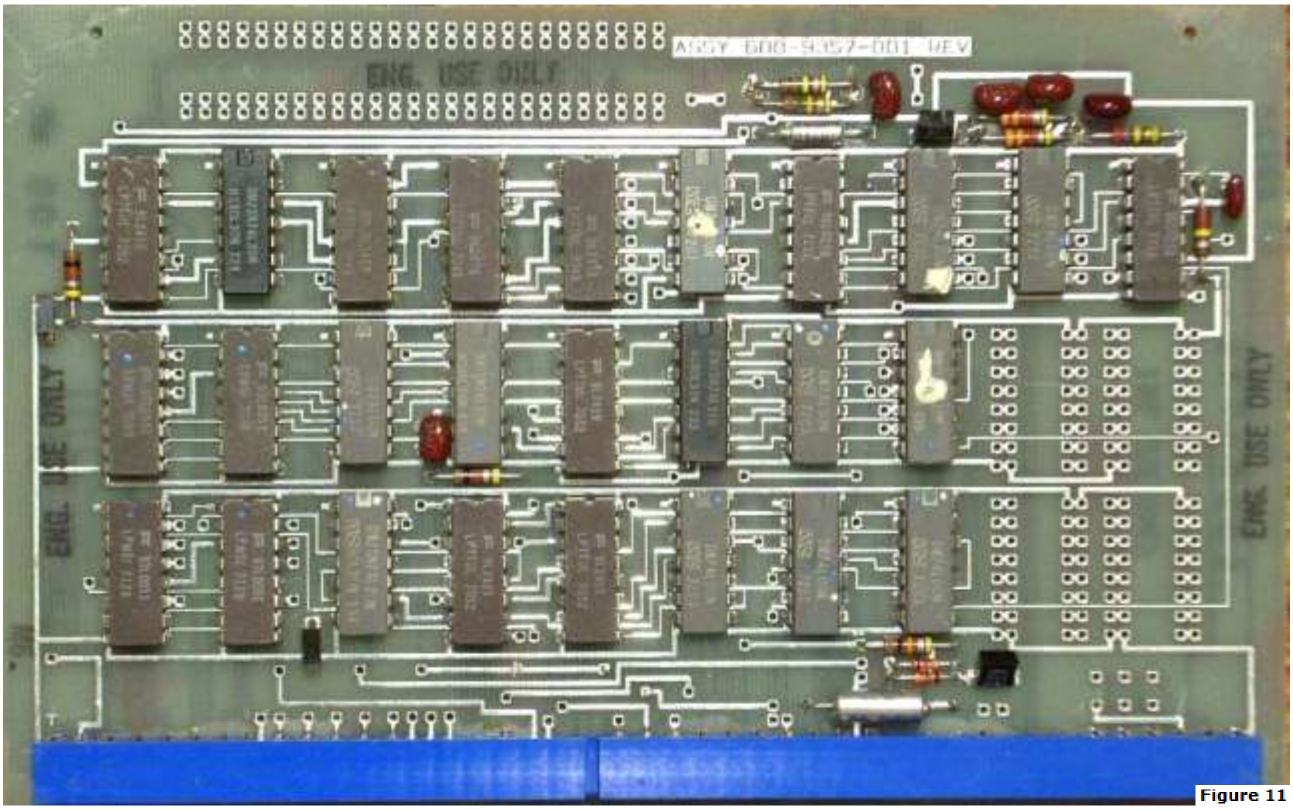
Figure 11

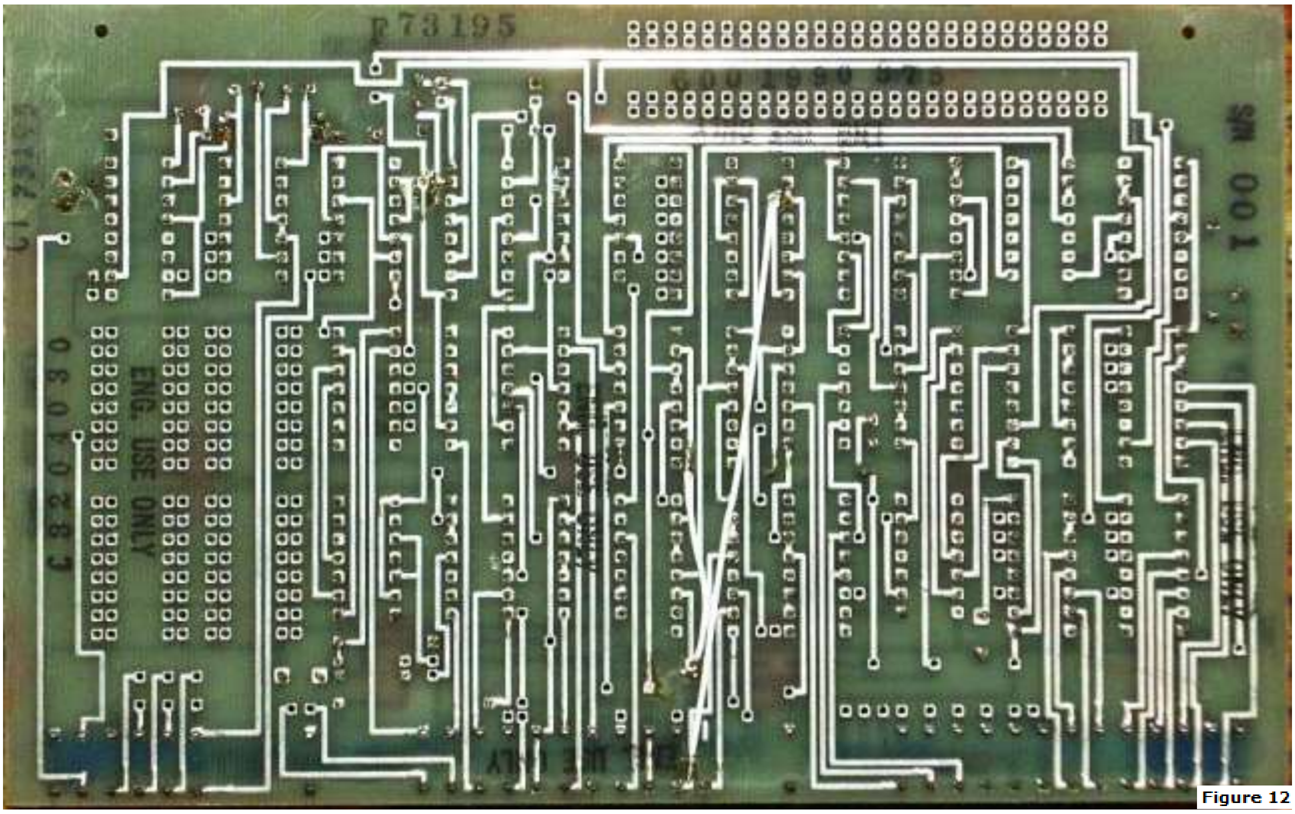
Figure 12

The second PCB from the top, stamped “ENG. USE ONLY” at least 6 times, carries serial number 001.

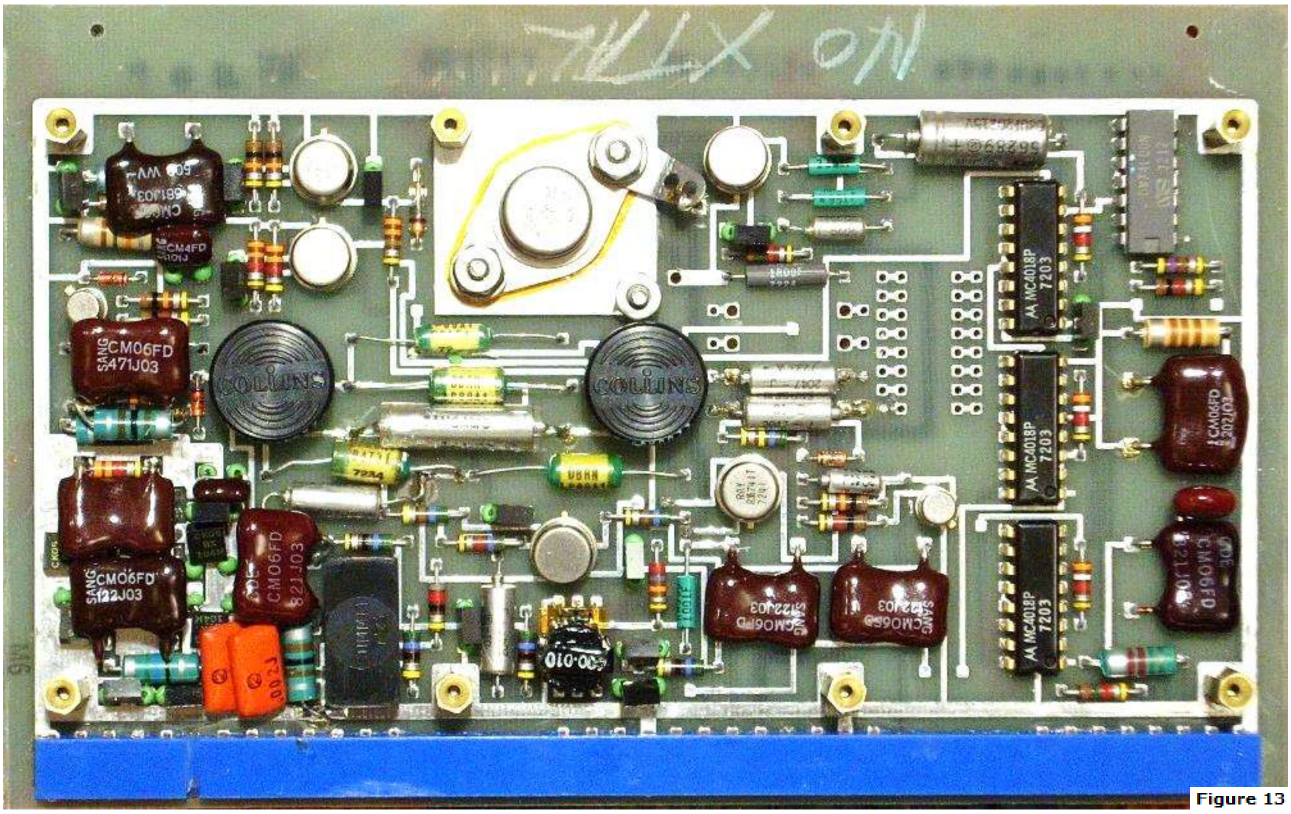

Figure 13

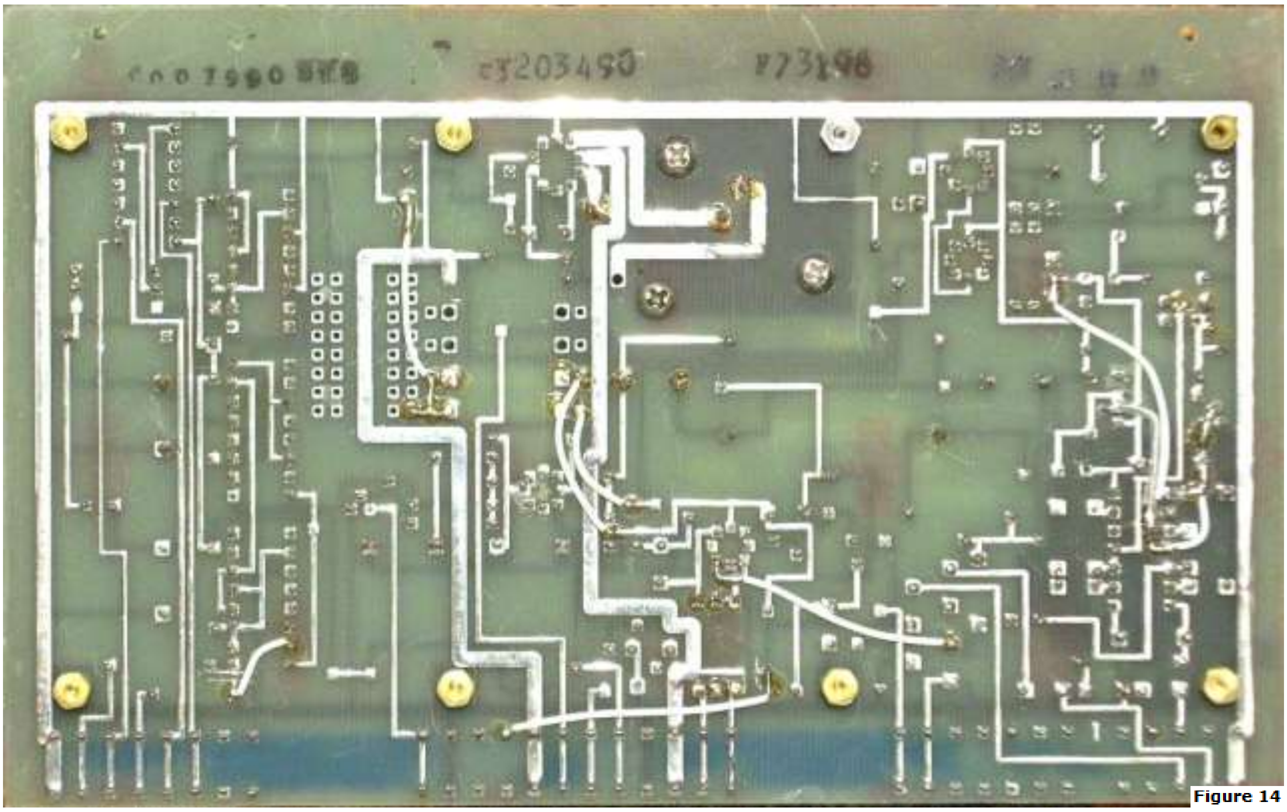

Figure 14

The third PCB from the top, the first shielded one, serial number 009. There isn't much spare "real estate" for prototyping on this card, but if one follows some of the jumper wires it can be seen that 2 small condensers were added as an afterthought. The handwritten note "no xtal" ("no crystal") lends weight to the assumption that this AUTOVON phone was a (non-functional?) prototype.

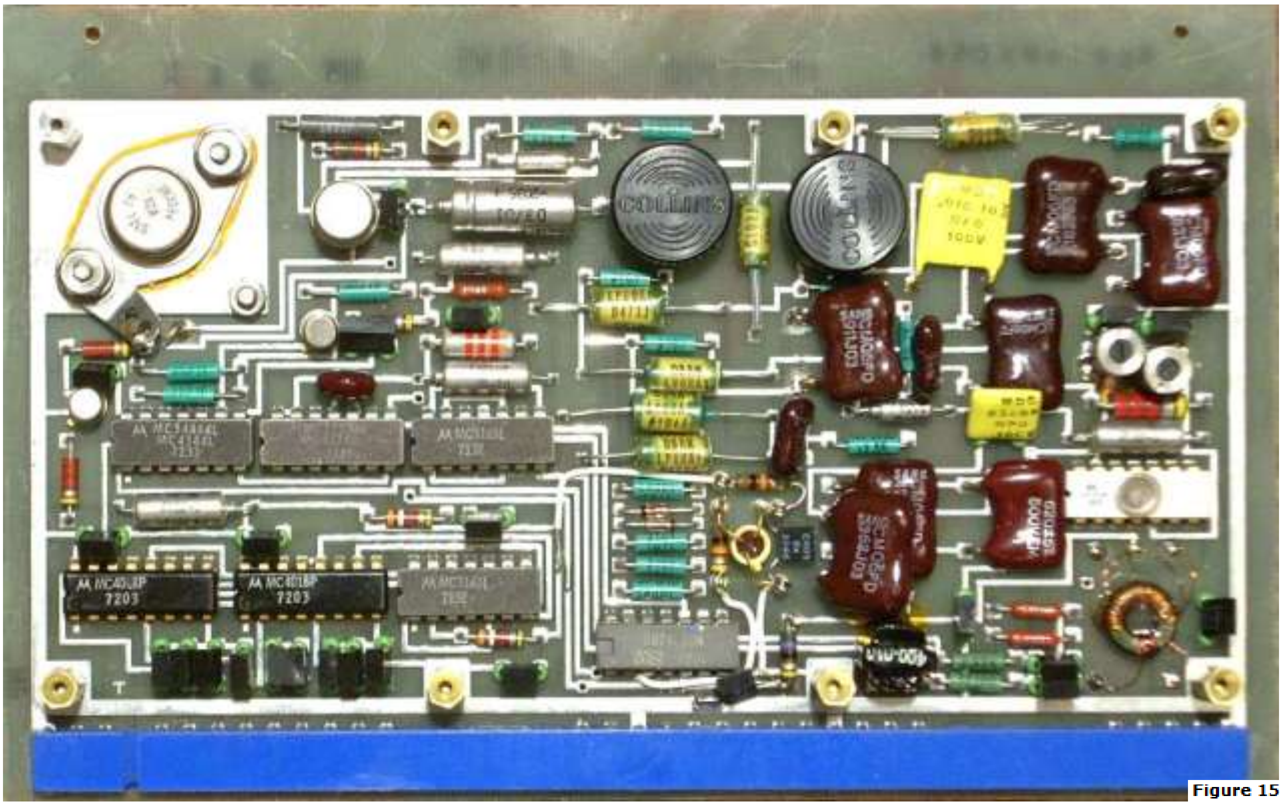

Figure 15

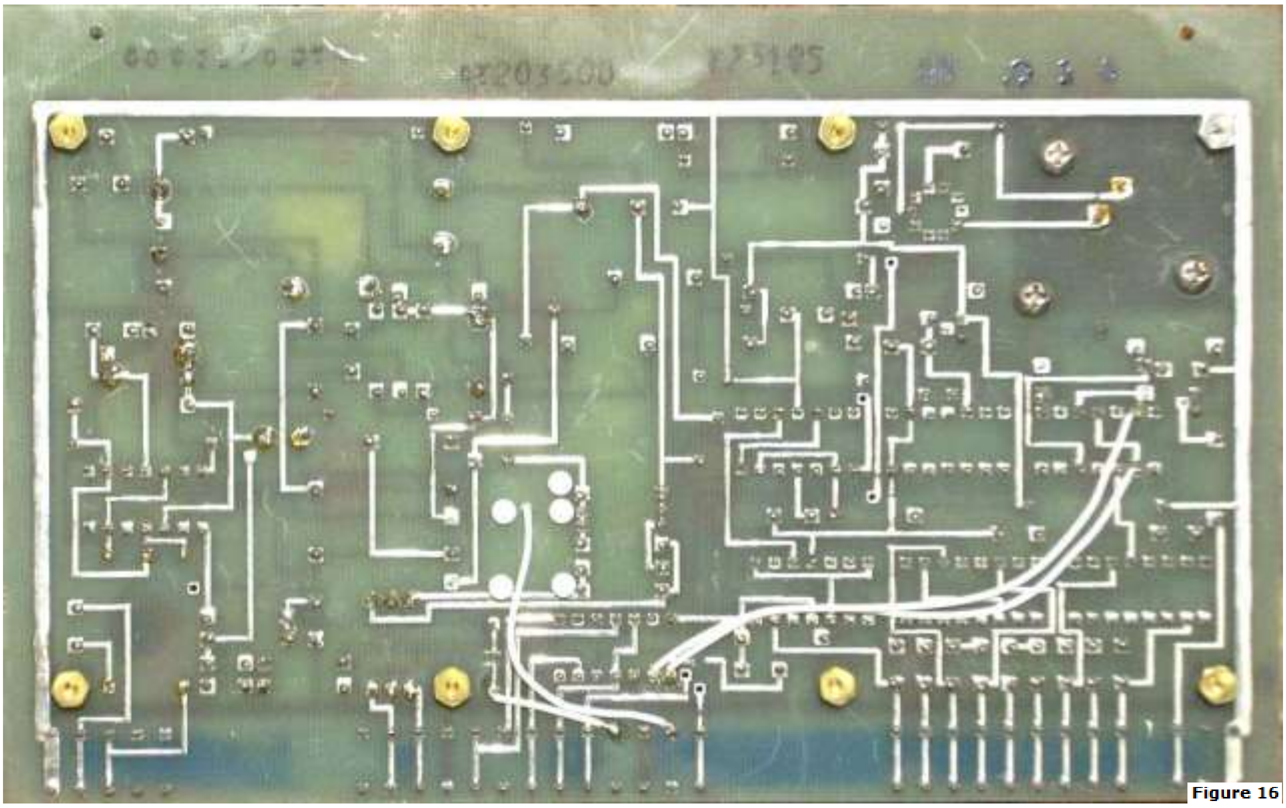

Figure 16

The last of the four PCBs and the second shielded one, carrying the highest serial number in the entire phone – 014. All four PCBs have errors in the circuit layout, as witnessed by the hand-soldered wires. These last two PCBs have many analog integrated circuits as well.

Well, so much for that. *Has* anyone ever seen (or at least heard of) such an AUTOVON phone before? Any and all information available will be greatly appreciated.

Some food for thought: since the exterior of the phone is definitely "civilian" in design, rather than of reinforced materials (such as would be used on any type of field phone), might it be possible that this phone was intended for use in an airplane, where cosmetics could matter? Perhaps used in the "Air Force One" of the day? After all, it is a known fact that "confidencer" microphones were used on crew interphone handsets (in the passenger cabin) on Boeing airplanes around that time.

My special thanks go to Mr. Lawrence Robinson of the Rockwell Collins Museum for his time and efforts in trying to dig out any relevant information on this phone. Apparently it *is* a prototype, because neither he himself, nor anyone he contacted, had any hard data concerning it.

Two Austrian Village Switchboards

After having already written about my British CB 873 switchboard ("A Switchboard Adventure," published in the July 2006 issue of Switcher's Quarterly) and Swiss H-48 military switchboard ("Hasler Swiss Military Switchboard," published in the July 2011 issue of Switcher's Quarterly), as well as about my German WWII large field switchboard and some others (further on in this collection), I figured that I might just as well write something about the two remaining switchboards in my collection ….

It was in November of the year 2006 that Telecom Austria set up a public display of telephones and switching equipment (magneto and CB switchboards, a demo Austrian-type Strowger switch (1948 model), defunct pieces of a Nortel DMS 100 digital switch, &c.) in their headquarters in Vienna's 2nd district, in commemoration of 125 years of telephony in Austria.

I saw one type of switchboard on display which I had always wanted *very* badly, but which I believed that I'd never, ever own ….

Figure 1

Here we have it: a cordless Austrian switchboard for 15 subscribers, in very good condition. Previous to seeing the one above in the Telecom Austria display, I only knew of the existence of such a switchboard from a description and woodcut in a PTT technical training book from 1953.

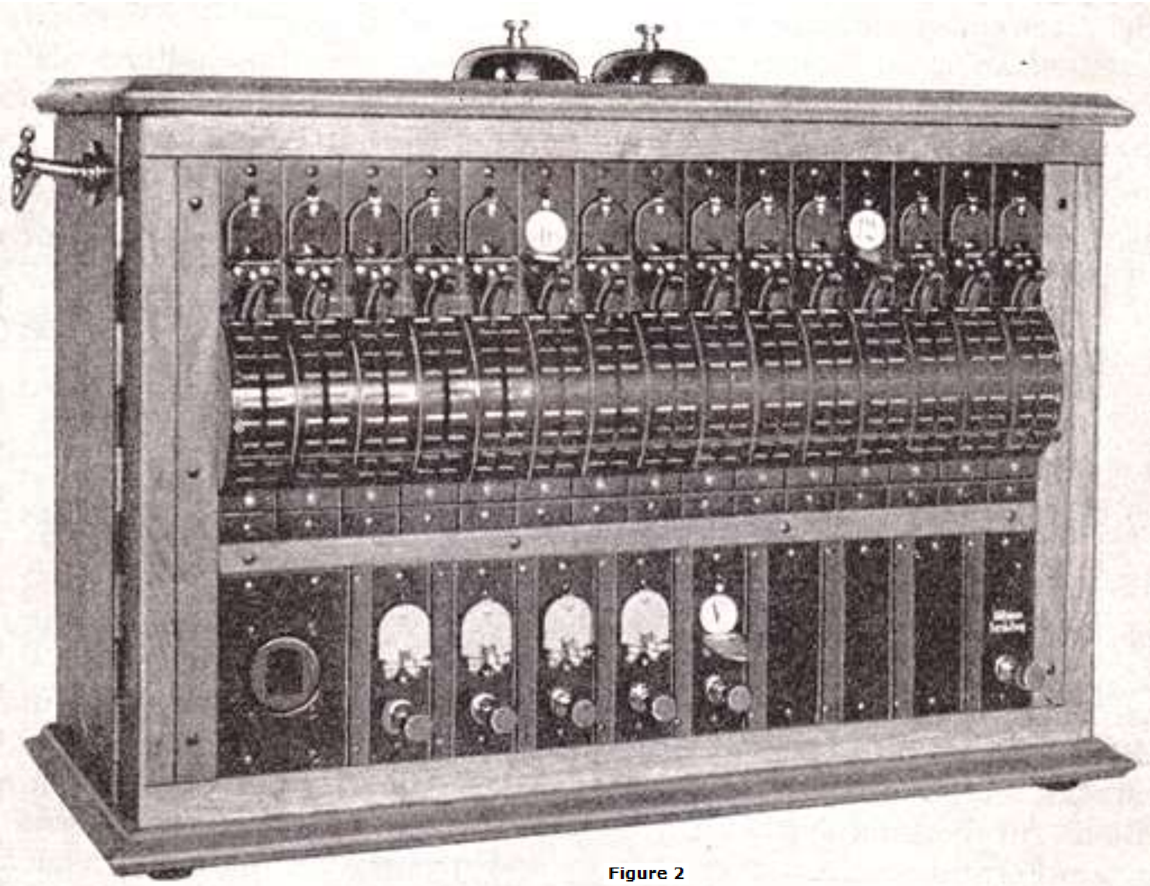

Figure 2

This is a scan of the woodcut I mentioned; it shows such a board in its *original* form (circa 1915), with an A.C. ringer mounted on top. The A.C. ringer was wired in series with the magneto, so that it'd ring to indicate that ringing power was, indeed, being sent out over the selected line; this was later replaced with an electromagnetic "star" indicator (more information re. such indicators may be found on page 450). It's hard to tell from the photo and scan exactly how big the board for 15 lines actually is; it's 22 inches wide, 15 inches tall and 9½ inches deep and *very* heavy.

This type of cordless switchboard was only built in two sizes: for 15 or 30 lines, the last two lines of both types could either be used as regular local magneto lines or as magneto toll lines.

Of course, some (or all) of the local magneto lines could be used for rural party-lines with *non-secret* communications (known as a "Landanschluss" – literally land connection – equivalent to farmer's lines in the USA), with up to eight subscribers sharing one line … these subscribers had to sign a special contract for such service, signing away their right to guaranteed secret telephone service.

A fellow phone collector here in Austria gave me a call a few years ago and asked me whether I'd be interested in buying a cordless switchboard for 15 lines, intact and in relatively good condition, but sans handset. Well, of course I was very interested, and – yes, *yes*, **yes**! I *want* this switchboard.

Figure 3

Well, there it is, fresh from being lugged up into my apartment (the cords dangling down from above belong to the second switchboard covered in this tale). The 15 drops painted black, way up on the top of the front panel, signal incoming calls, while the five drops at the bottom are the ring-off drops for the five possible links … yes, I know that there are nine positions on the individual rotary switches, but the levers are mechanically blocked from being moved beyond position six.

As can be seen, three of the ring-off drops are in the operated position; this is a major fault with this particular switchboard – the armatures are slightly bent out of shape, and the drops are built in a rather complicated manner which means that repair will be a bit difficult. *More* work for when I'm truly bored out of my skull … and I'm not otherwise engaged with oddball projects, such as writing a collection of telephone tales.

Obtaining an appropriate handset is, in itself, no big problem – I probably have one in storage somewhere. What will be a big problem, though, is getting hold of the very special plug needed to connect the handset to the switchboard (the jack can just be seen in the lower left-hand corner on the front of the board).

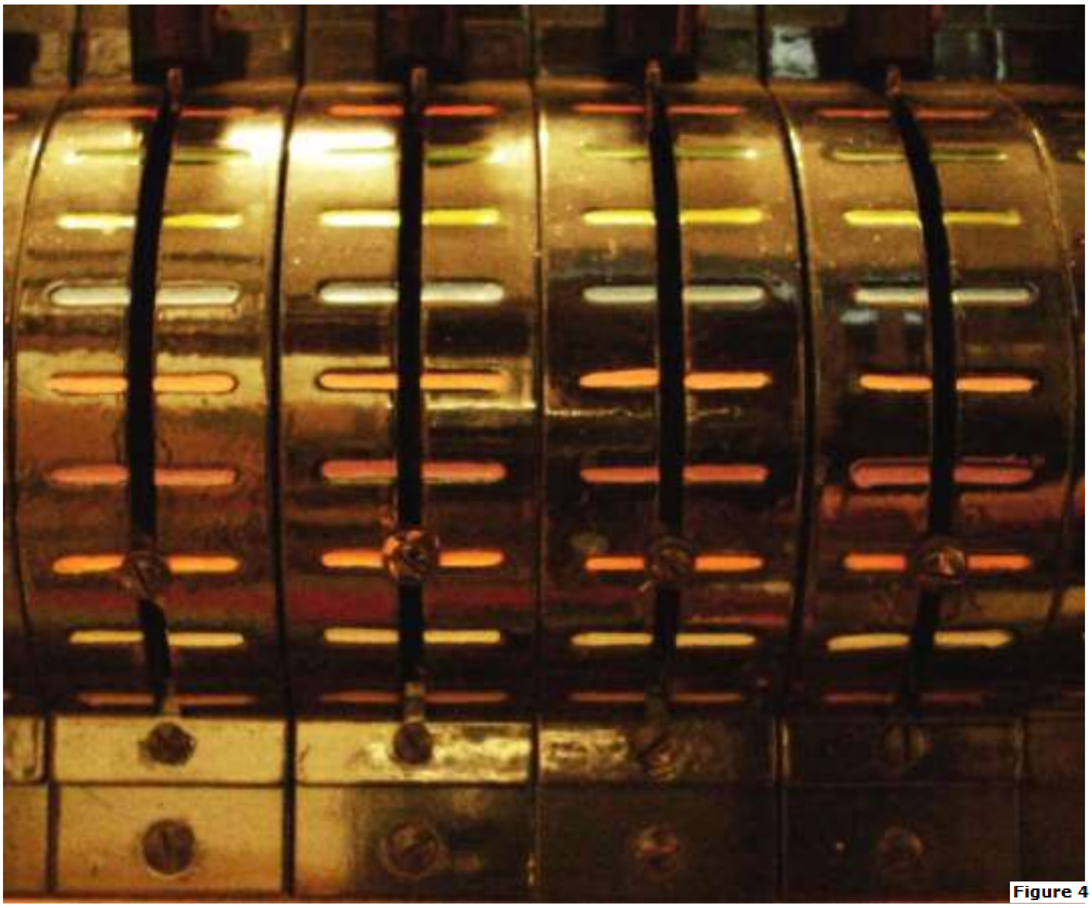

Figure 4

The off-color close-up above shows the stop-screws at what appears to be switch position seven (orange colored); in reality, the screws are at position six … position one (red) is used to connect the operator's speech circuit to any calling line, while positions two thru six are used to link up two (or more) subscribers. Oddly enough, the rotary switch levers are at rest at position *zero*, as may be seen in the close-up to the right.

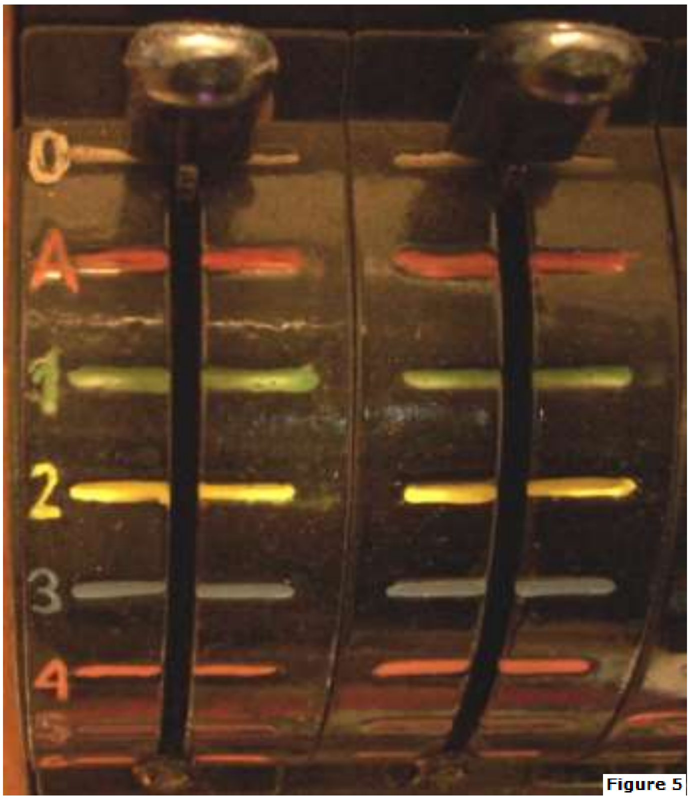

Figure 5

Switch position "A" is used to answer incoming calls; the "A" is the abbreviation for the German word "**A**bfragen." The individual switching paths are color coded across all 15 switches, so that operation of the board is simplified … it's quicker and easier to align two of the levers on the color pink than to have to look for the digit four on the relevant switches.

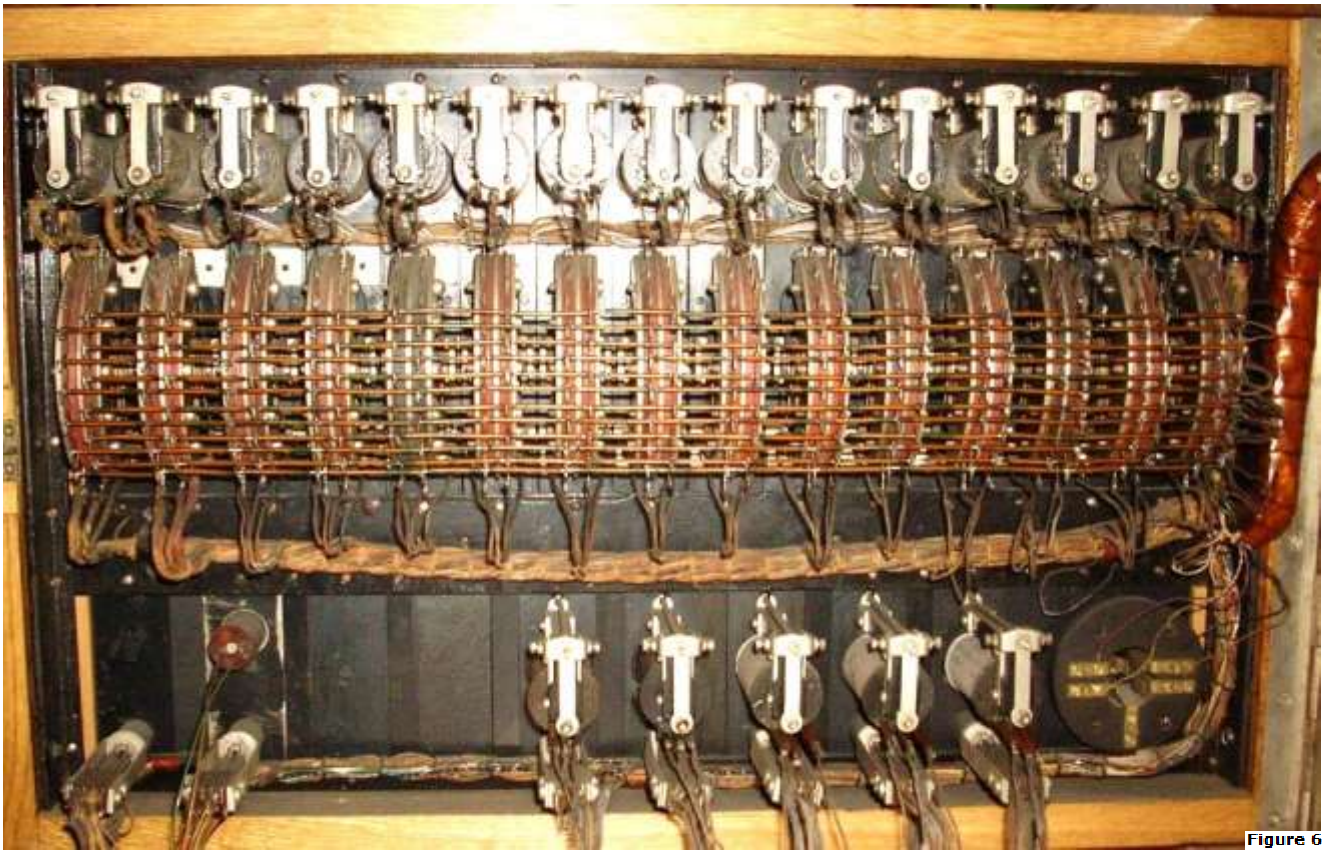

Figure 6

The photograph above (obviously) shows the wiring on the rear of the front panel. Almost all of the wires are simply enameled and given two wraps of cotton thread for additional insulation, except for those leading to the first two rotary switches on the *left* (which are for lines 14 and 15 when viewed from the front of the board). Keeping in mind that the last two lines were intended for use either as local magneto **or** as magneto toll lines, the wires leading to and from these two switches (not to be confused with the bussing wires) were first given a thick layer of rubber insulation before being wrapped with cotton thread – this was a measure to help keep the insulation resistance of the toll lines as high as possible.

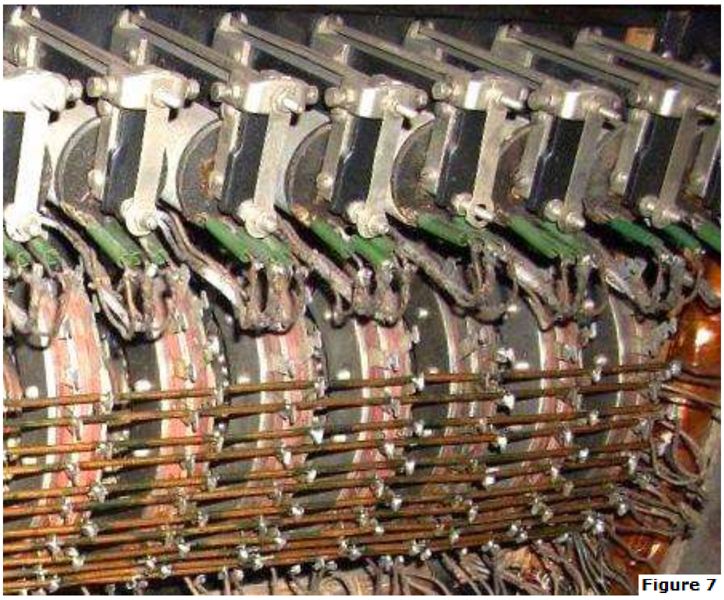

Figure 7

As can be seen in the detail picture to the left, the drop armatures are attached to their frames with two setscrews which have jamb-nuts; the armatures are moved via the flat, vertically mounted springs … more nuts and jamb-nuts.

Lucky for me that I once purchased four strips with five each of these old drops for use as spare parts.

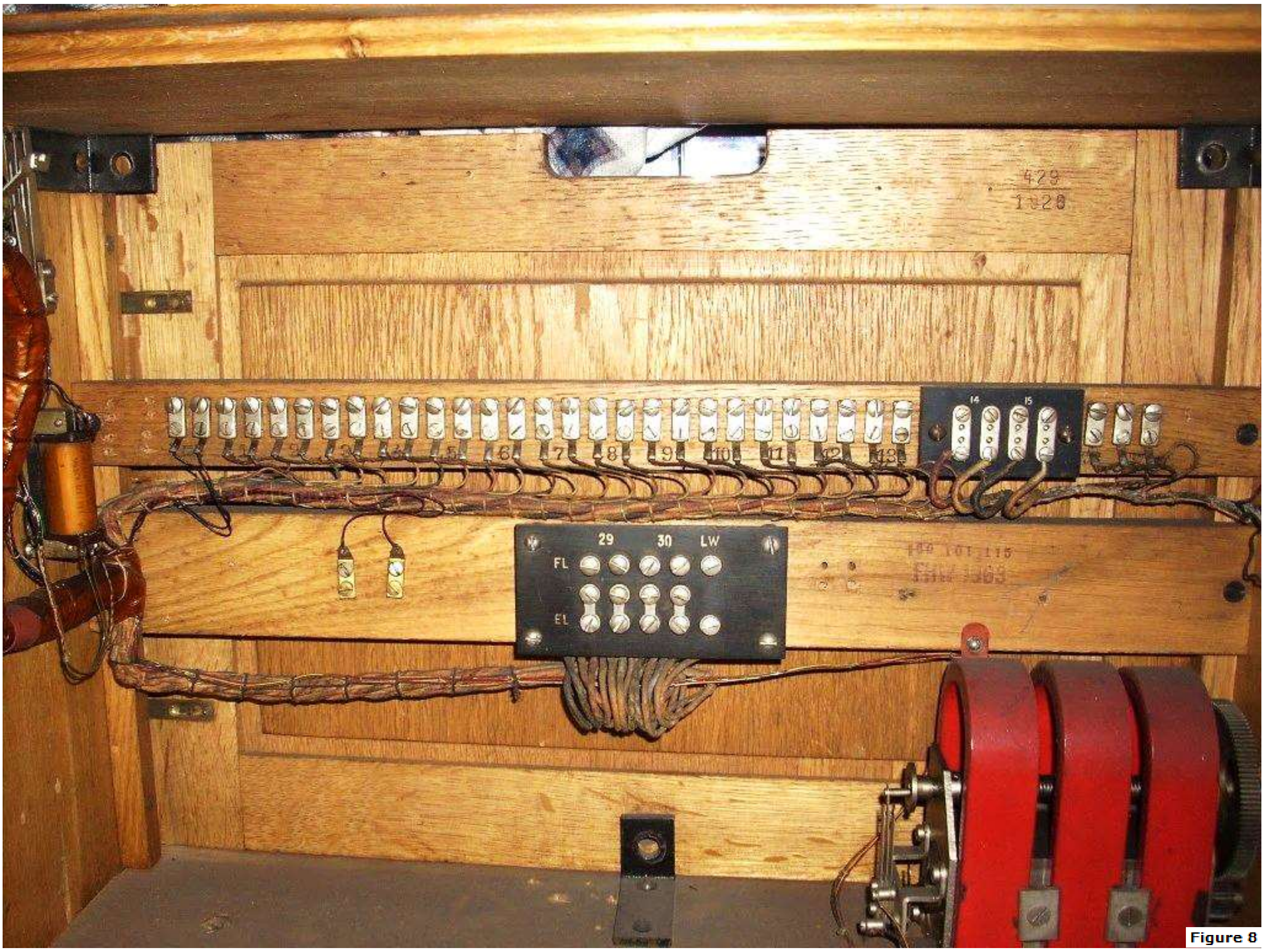

Figure 8

The terminals for magneto lines 1 thru 13 are simply attached to a wooden terminal strip, while those for lines 14 and 15 are first mounted on a piece of ebonite for additional insulation. The ebonite terminal strip in the *center* is for strapping lines 14 and 15 either as local magneto phone lines (position "EL") or as magneto toll lines (position "FL".) Interestingly enough, this particular terminal strip was intended for use with the larger of the two sizes of switchboard, in which lines 29 and 30 were strap selectable.

This particular switchboard was originally built in 1926 and has the serial number 429, as may be seen near the upper right-hand corner of the backboard, and was refurbished in 1969, when the purple-colored rubber stamp above the left end of the magneto was added; the abbreviation "FHW" equates to "**F**ernmeldetechnische **H**aupt**w**erkstätte – central telecommunications workshop. 1969 may appear to be an unusually late year to be refurbishing magneto switchboards for new installation somewhere in Austria, but the very *last* magneto board in Austria was taken out of service on December 14th, 1972 – three years after this particular switchboard was refurbished ….

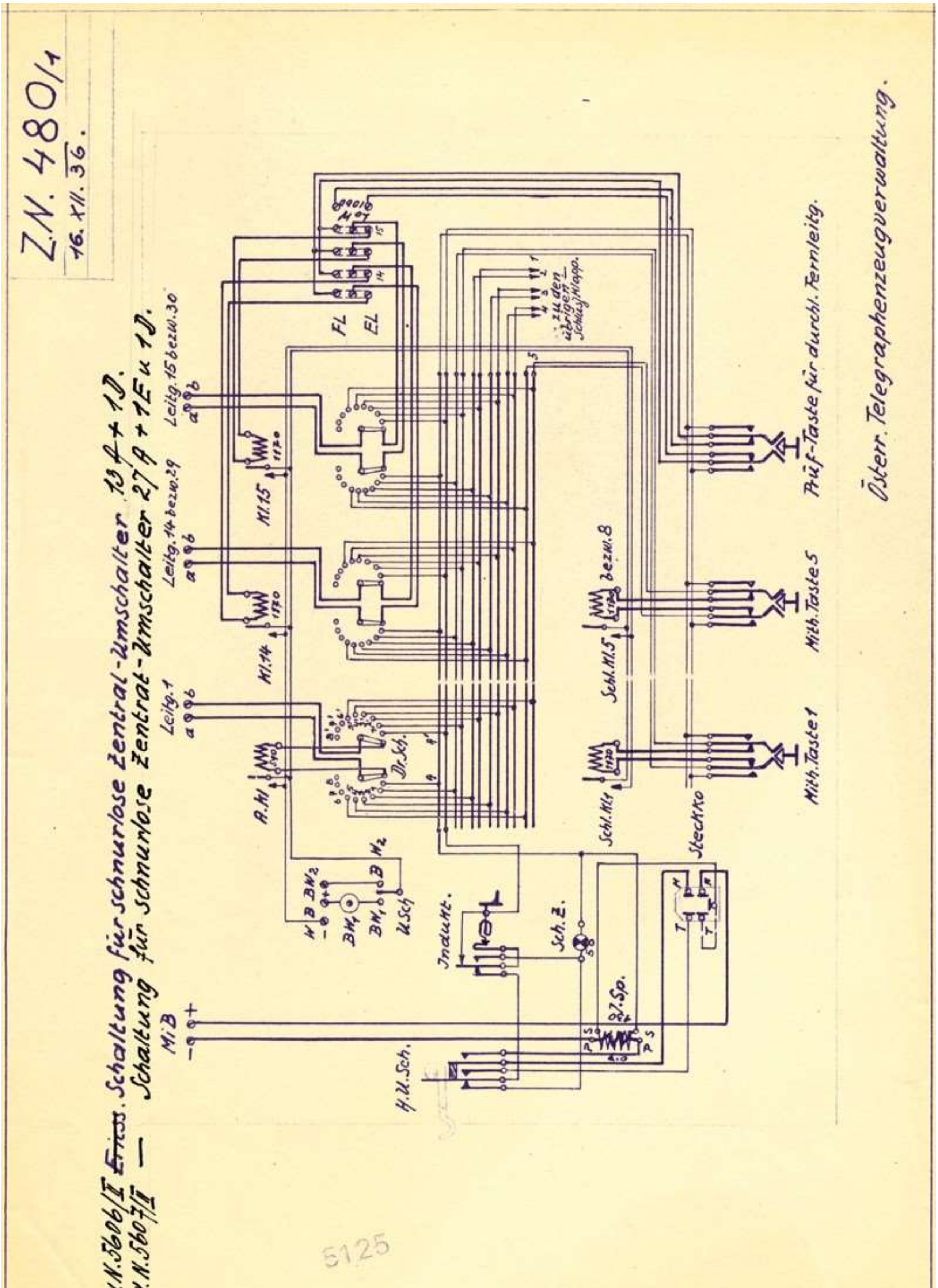
Z.N. 480/1
16. XII. 36.
W.N. 5606/II ~~Ericss.~~ Schaltung für schnurlose Zentral-Umschalter 13 A + 1 J.
W.N. 5607/II — Schaltung für schnurlose Zentral-Umschalter 27 A + 1 E u 1 J.
Leitg. 1
Leitg. 14 bezw. 29
Leitg. 15 bezw. 30
Kl. 14
Kl. 15
FL
EL
Prüf-Taste für durchl. Fernleitg.
Mith. Taste 5
Mith. Taste 1
Schl. Kl. 1
Schl. Kl. 5
Steckko
Indukt.
Sch. Z.
Mi B
H. U. Sch.
Österr. Telegraphenzeugverwaltung.
5125

Figure 9

The scan on the previous page is of a blueprint from December 16, 1936, which shows the circuitry for both sizes of switchboard … my cordless switchboard was originally manufactured by Ericsson of Vienna, as was the one shown below.

The second type of village switchboard is a wall-mounted unit equipped for 20 local magneto lines (of which one or more could, again, be used for farmer's lines), five terminal magneto toll lines and two magneto (toll) thru-lines. This board has a total of 30 drops: 20 for the local lines, 5 ring-off drops for the cord pairs (painted silver) and five high-resistance drops for the terminal toll lines. This one is in excellent condition for its age, so I feel that it was worth every single penny I paid for it.

Figure 10

This particular village switchboard was originally built by L.M. Ericsson of Vienna in the year 1915 and was last refurbished in the year 1960, after which the Austrian PTT placed it into storage, where it remained until disposed of – and somehow found its way into a collector's hands. Possibly, it went through more than one pair of hands before I was able to buy it for my collection.

I previously wrote that there are five ring-off drops, and if one looks at the photograph, there are also five Kellogg switches below these drops … however, this board has six cord pairs. One plug of the first five pairs has a red sleeve while the other one has a black sleeve – but the sixth pair has two black sleeves. How very odd. What could this sixth pair of plugs have been used for?

I bought this village switchboard just a few weeks after having bought the cordless one, and it wasn't until spring of 2011 that, by pure chance, I happened to buy a whole packet of old PTT blueprints; one of these was of a wiring diagram for a similar, but larger, switchboard of this type (for 50 local magneto lines). The sixth "pair" actually consists of two separate cords, which were intended to be connected to a test cabinet.

There are no drops for the toll through-lines, so how were calls indicated on these? Very simple – these lines each have a total of three break-jacks … one side of the through-line is terminated on the outer springs of jack number one, of which the two break contacts are wired to the break contacts of jack number three, where the other side of the through-line is terminated on the outer springs. The outer springs of jack number two are wired in parallel with the two wires connected to the break contacts of jacks one and three, while the break contacts of jack number two are connected to a high-resistance A.C. ringer, as shown below. While jacks one and three split the toll line when used, jack two is used for line monitoring purposes. In order to be able to tell the lines apart, the ringers had different sizes and styles of gongs.

Figure 11

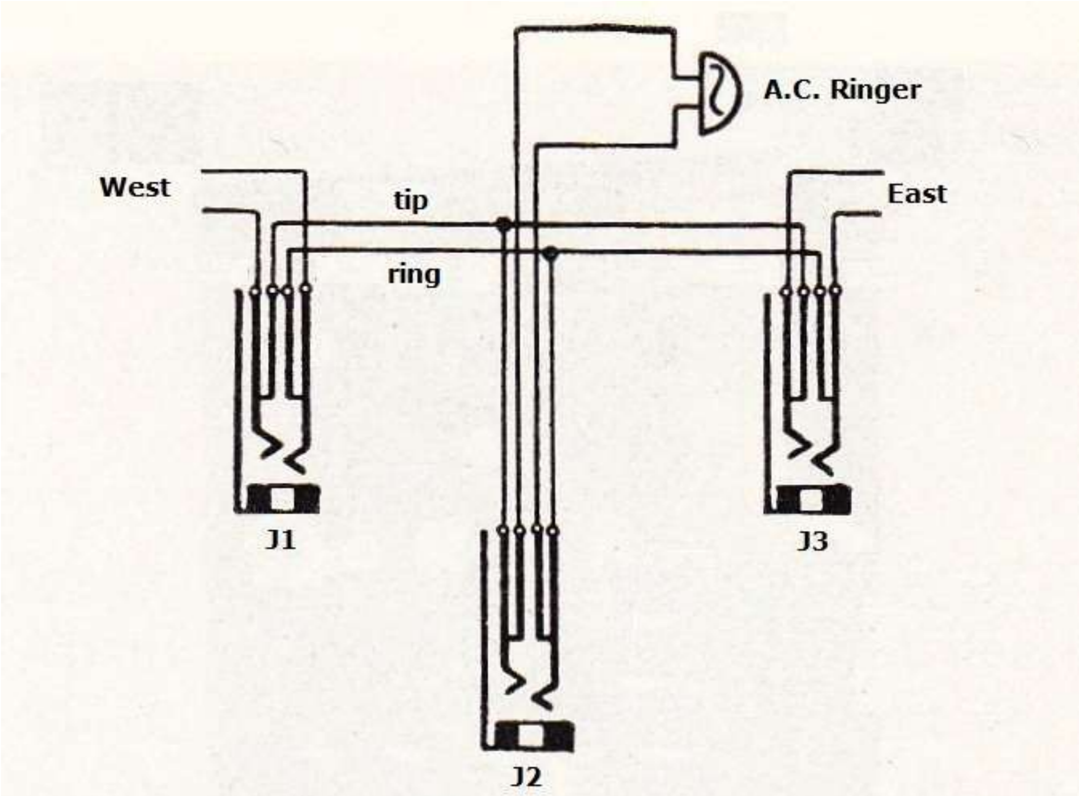


Figure 12

The two terminal strips on the top are for the 20 local lines, while the ebonite terminal strip in the middle is for the five terminal toll lines.

The first of the *long* ebonite terminal strips serves several purposes: 3x4 terminals for the two toll through-lines, 2x2 terminals for the two test cords, one terminal pair for the D.C. night alarm battery and one terminal pair connected to the line terminals of the operator's magneto telephone.

The lowest ebonite terminal strip has 2x2 terminals for the insertion of induction coils in the five terminal toll lines in order to provide isolation between the jacks and the toll lines; these coils were necessary if it was possible that crosses between toll and power lines could occur.


Figure 13

This photograph reveals two interesting facts: 1) the ring-off drops and the drops for the five terminal toll lines are shielded in order to prevent stray magnetic fields from any of these drops from inducing currents in any of the other drops and in order to prevent magnetic cross-talk between toll and local circuits. 2) not all of the drops are originals from 1915 … those with a wrapping of slate-colored cloth are from 1915, while those with a wrapping of brown paper are units which were refurbished in 1960.

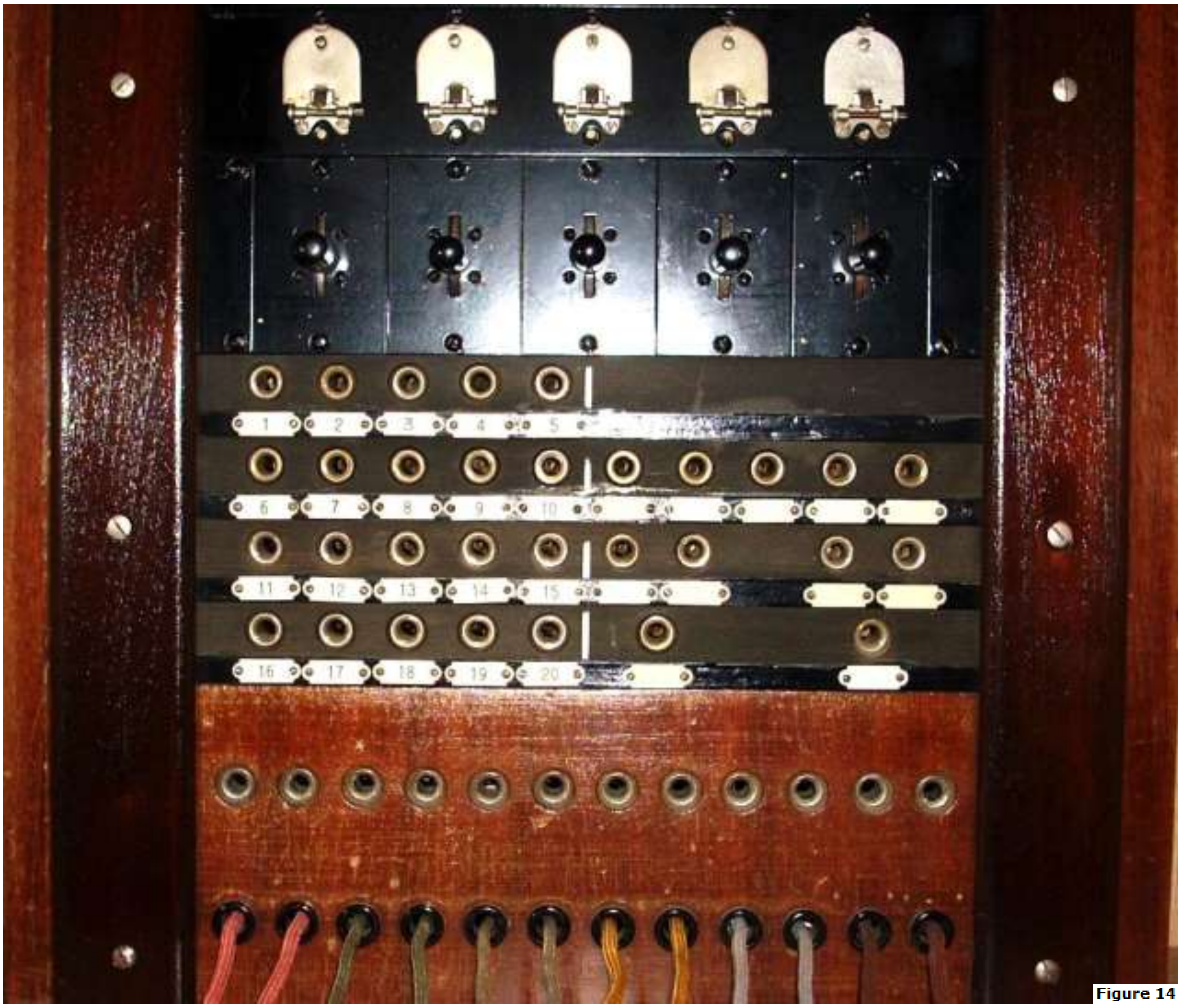

Figure 14

As can be seen in the photograph above, each cord has an unwired jack into which its plug was inserted when not in use.

An unusual feature is that the five Kellogg switches latch in both directions, while they'd normally be latching in the "talk" position and momentary in the "ring" position … they latch in both positions simply because these switches were a bit less expensive to manufacture than those commonly used.

While the jacks for the terminal toll lines are in a straight row, just the same as the local line jacks are, those belonging to the toll through-lines are arranged in a "V" shape, so that it's immediately obvious which jack is number one, two or three.

Miscellaneous Butt Sets

Over the years, I somehow managed to wind up with a bunch of butt sets without having consciously worked towards such a collection, possibly excepting butt sets from the Austrian PTT, since I mainly collect Austrian telephones. As in my other tales, I will be showing the instruments without much thought being given to showing circuit diagrams or schematics; all the same, the last tale in this collection is on interpreting European schematics, for those who want to give it a try.

I acquired my very first butt set way back when I was still living in California – a 1011 type from a friendly craftsman from Pacific Bell Telephone & Telegraph. Unfortunately, this butt set shared the fate of the rest of my smallish collection of phones and other paraphernalia from back then: it magically disappeared while our house in California was being tended by "good friends."

I bought my next butt set while in Seattle, Washington, where I was taking a course in aviation electronics (aka avionics) for the Boeing 767 series of airplanes, back in 1993. This one was of the same style as the later Bell System ones (those with the Trimline® dial), but it has an inventory sticker from GTE Northwest.

I collected more butt sets over the years, including ones from France and communist Czechoslovakia, and even one which the Austrian PTT was considering for issue to all craftspeople, but which didn't make the grade. They'd purchased circa 200 of this type of butt set from the German Telecom for evaluation purposes, and were in the process of scrapping them when I managed to lay my hands on one. At the end of this tale I will show what I consider to be the rarest Austrian butt set ever to be found ….

Figure 1

The picture to the right shows the top of a very old field phone/test set made by LME.

This specific unit was used by the Austrian PTT to test and troubleshoot magneto phone lines way back in the day when ….

Yes, I know that this unit isn't a butt set in the traditional sense of the word, but it is a telephone test set – so I have taken the liberty of including it in this tale; the really neat thing about this test set is that it's equipped with LMEs famous collapsible handset. It's most unusual that, while this set carries an ownership mark from the Austrian PTT, the mouthpiece is marked "Ericsson Telephones Ltd. – England" … why was this phone imported despite the fact that Ericsson owned and operated a factory in Vienna at the time?

Figure 2

A side view of the LME field phone/test set, showing the handset in its fully extended position.

This particular set was, very literally, branded with the letters “ÖPT,” which was the German-language abbreviation for the Austrian PTT, which was known by this abbreviation from circa 1920 on until the German Reichspost took over in March, 1938 and again after 1945.

LME offered this type of field phone/test set as of circa 1902 (the scan shown below is from the 1902 LME multilingual catalog). It’s easy to believe that the Imperial-Royal Administration of Posts and Telegraphs used such sets in the construction and maintenance of magneto lines, although this specific phone doesn’t have any marks of ownership dating back to the time of the Austro-Hungarian Empire.

Figure 3

AKTIEBOLAGET L. M. ERICSSON & Co.

STOCKHOLM

No. 392.

Portable Telephone for terminal stations.

This instrument is similar to No. 390 but is of lighter construction, and fitted in a leather case with strong leather strap, so that it can easily be carried by a man.

It is fitted with a telescopic handmicrotelephone No. 496 with cord No. 2159, generator, bell, two line terminals, and a dry cell No. 603. The instrument is especially suited for inspectors of telephone and telegraph lines. Weight with battery 3,58 kn.

Transportabler Telephonapparat für Endstation.

Dieser Apparat hat denselben Zweck wie No. 390, ist aber leichter gebaut und mit einer ledernen Umhüllung versehen, wodurch er für Transport sehr geeignet ist. Er enthält zusammenschiebbares Handmikrotelephon No. 496 mit Schnur No. 2159, Induktor, Wecker, zwei Linienklemmen und ein Trockenelement No. 603. Der Apparat ist besonders zum Aufsuchen von Linienfehlern zu empfehlen. Gewicht 3,58 Kg. mit Batterie.

Appareil transportable pour station terminale.

Cet appareil a le même but que No. 390, mais il est plus léger et muni d'une couverture en cuir, ce qui le rend très propre à transporter. Il contient un microtéléphone à main téléscopique No. 496 avec cordon No. 2159, inducteur, sonnerie, deux vis pour les lignes et un élément sec No. 603. Cet appareil est surtout employé pour faire des recherches en cas de défauts aux lignes. Poids 3,58 kn. avec batterie.

Figure 4

38

While the LME test set is obviously a commercial product, the Austrian PTT commonly used butt sets which were more or less cobbled together from parts from older telephones taken out of service – thus, the design of most butt sets lagged behind that of the relevant phone model by at least one generation.

The oldest Austrian PTT butt set that I have in my collection utilizes a handset from a C.B./dial telephone from the teens or twenties of the previous century.

Figure 5

The only component belonging to this old butt set which isn't of the same period as the rest is the hemispherical mouthpiece, which is from a Siemens & Halske dial desk set model 1928. The reason that such a mouthpiece was used, instead of an original, was because the carbon microphone in this butt set was repaired (!) in 1957.

As readers can see, the membrane of the receiver was given a coat of red paint; this wasn't done because it looked pretty, but rather to indicate whether the receiver coils were wound to the resistance necessary for use with a C.B./dial or with a magneto telephone. Red paint meant that the handset was intended for C.B./dial phones, while blue paint was used for magneto phones. The latchable push-to-talk bar is a copy of the one which LME used with the early handsets on their Eiffel Tower magneto desk sets; the only difference here is that the push-to-talk bar is latchable when operated.

The butt set has two separate test cords: one which ends in two alligator clips, and one which ends in a test prod. When testing a single-party (private) line, only the two alligator clips are used, but party-lines required a brief ground on tip to activate the party-line equipment in the CO; the test prod was used to supply this ground. The test prod is built of two pieces: the cord portion and the prod itself. Unplugging the halves of the test prod opened the loop and put the test set in an on-hook condition.

Figure 6

Figure 7

This capsule was originally manufactured by the firm of Kapsch & Sons in 1931 and was intended for use with a C.B./dial telephone (the German abbreviation "ZB" stands for **Z**entral**b**atterie – a central or common battery).

According to the black, stamped markings, this capsule was repaired in February of 1957, by the firm D. J. Zelisko of Vienna.

The stamped marking on the top lists the 9-digit part number that the PTT assigned to this type of microphone.

Figure 8

This close-up shows the special ring slipped over the microphone screen to hold the same in place after repairs. The mouthpiece which was used with this particular butt set had a thick rim which applied enough pressure to keep everything in place during use.

The close-up below shows the push-to-talk switch bar in detail. The small, round knob was pushed fully down (in the direction of the microphone) so the push-to-talk switch functions in the conventional manner. Pushing the knob all the way up (with the push-to-talk switch bar depressed) latches the switch bar in the talking position.

Figure 9

The next butt set is also a lineman's test set, dating from the late 1940s. When I found this butt set at a local junkyard, it was incomplete and rusty; the push-to-talk switch was missing, the dial cup was severely rusted and pitted and the cords were very tatty.

I found the correct push-to-talk switch in one of Vienna's oldest radio & electronics shops (my father bought stuff there way back in the 1930s and 1940s, as I did later on. Unfortunately, the owner closed shop several years ago …), I simply gave the dial cup a good sanding down and then repainted it, and I replaced the cords with ones of a similar style.


Figure 10

Viewed at this distance, the repainted dial cup doesn't look half bad, and the cords look nice as well. Of course, the wire insulated in black should be insulated in brown, so that we'd have the classic brown/white pair, but I didn't have a proper cord at the time, and I wanted to finally get finished with this restoration project.

The handset, sans the dial cup and dial, should be familiar to those who have read the tale about the FF-33 German field phone, because a field handset 33 is exactly what was used to build this particular butt set shortly after WWII.

Such butt sets, made from leftover FF-33 handsets, were common in wide parts of Europe after WWII, and some collectors (who should really know better) claim that such butt sets were used by the signals specialists of the German Wehrmacht before and during WWII. This is pure fiction, because the Wehrmacht didn't fool around with the public switched telephone network (PSTN) in any German country, occupied or not, and most certainly not within Germany itself.

The only folks who worked on the PSTN anywhere were employees of the German Reichspost. Many of them were specially recruited for the Wehrmacht signals sections, and they used quite a different style of butt set, which will be shown a bit later on ….


Figure 11

The push-to-talk switch is that of the FF-33 field handset, but with a twist, since it's often necessary to keep the switch in the talking position for extended periods, and the original switch bar didn't have any provisions for latching. What the Austrian PTT did was to punch a not too neat hole into the switch bar, insert a leaf spring below the bar and solder the winding knob from some defunct watch onto the leaf spring in order to make the switch bar latchable.


Figure 12

This picture was taken in order to show that the two test cords didn't exit from the handset, but rather from the dial cup, and that the original cord exit on the handset was plugged up to prevent water or dirt from getting inside.

Since this butt set was from shortly after WWII, and I found the remnants at a junkyard in Vienna, it was only natural that the dial would be the old Viennese dial. I opted for a numeral ring and a well-worn finger wheel, both made of an inexpensive thermoplastic, which would've been more readily available after WWII.

Figure 13

The FF-33 field handset used for this butt set even still had its iron hanging loop attached; I had to remove it in order to sand the rust spots off, and it was rather difficult to re-attach the loop afterwards, so – collectors beware of removing the loop for cleaning.

I included the photograph below just to prove that the butt set *was* made out of a wartime FF-33 handset, and not from some leftover without the Wa.A. hallmark.

Figure 14

Figure 15

The butt set shown to the left is a sound-powered one left over from the U.S. Army occupation of parts of Vienna and Austria between 1945 and 1955.

After the victors of WWII pulled up stakes in Austria, the U.S. Army sold very much military equipment to the budding Austrian military, including scads of EE-8 field phones, switchboards and, of course, testing equipment.

This butt set is labeled as "Handset TS-10-M" and was manufactured by Western Electric in 1945.

The handset handle and the rings which hold the earpiece and the mouthpiece are made of sturdy brass painted black, while the earpiece and mouthpiece themselves are made out of a composition of Bakelite and cloth strips (these make the Bakelite practically indestructible).

This photograph was simply taken to show a close-up of the Signal Corps acceptance stamp.

Figure 16

The alligator clips on the line cord are of a type very similar to those found on the 1011 W.E.Co. butt set; however, the clips shown here are marked "TL-137."

I had always assumed that the rubber line cord was the original one, since the stay cord is professionally attached, but careful examination revealed that the cord was manufactured in Vienna. This more or less proves that this particular handset was used by the Austrian military.

Figure 17

Figure 18

This butt set uses a dial from the Austrian W62 desk telephone and was used throughout Austria during the 1960s and 70s. It was purpose built, and is just about as moisture-proof as the Bell System 1011 style butt set. As can be seen, this unit doesn't have the two-piece test prod some of the earlier Austrian butt sets had; instead, there is just a ground wire (green) which serves the same purpose. However, this ground wire was simply clipped to some local ground and left attached. Any brief grounding of the "tip" lead (necessary in order to activate party-line equipment in the CO) was accomplished by briefly depressing the grounding button (inside the red circle in the picture above).

Figure 19

The "talk/monitor" switch is rather difficult to see; this type butt set has one, though, located within the red circle. The switch positions are simply labeled as "on" and "off" in German.

Instead of listening in for ringing current by setting the "on/off" switch to the "off" (= monitor) position, this particular butt set has an electronic ringer; the transducer can be seen within the red square.

I picked the following butt set up on eBay® in Germany; it was (and is) practically in NOS condition, excepting the earpiece, which was very marred by sweat … I replaced this with a NOS German earpiece. I attribute the excellent condition of this butt set to the fact that it was most likely used for troubleshooting within some CO or other, instead of being mishandled by linemen.


Figure 20

The finger wheel has the lettering which was typical in communist Czechoslovakia, and that is where this particular butt set is originally from. This style of butt set is certainly the most impractical I have ever come across – very difficult to hold in the hand, and when one manages to get a grip on it, the finger wheel will leave an imprint on ones cheek if the butt set is held at an angle which would allow one to speak.


Figure 21

There is a red dot on the dial cup which indicates the “talk” position of the slide switch.

On the previous page I mentioned the fact that I replaced the earpiece with one from Germany … the reason it fit on this butt set is because the handset itself is an exact copy of the one used with the German W48 type dial telephone.

The following butt set is another one I picked up on eBay® in Germany; it's certainly the oddest-looking one in my collection, apparently having been cobbled together out of odds and ends laying around in a workshop somewhere in France (which is where this one was originally from), but I *didn't* buy it for its looks, but rather for the dial used.

Figure 22

This odd little butt set stands exactly 7½ inches tall from the finger wheel to the lower edge of the mouthpiece; the distance between mouth- and earpiece is so short that the only people capable of using it with comfort are the pygmies of Papua New Guinea. Since the housing is painted battleship gray, I'd guess that this butt set is another one which started out in life as a handset belonging to some field phone or other.

From the look of things, the dial was added at some later point in time. One thing is certain, however, namely that the receiver isn't the one originally installed, because the one now in place comfortably fits inside the housing, *earpiece included*.

Figure 23

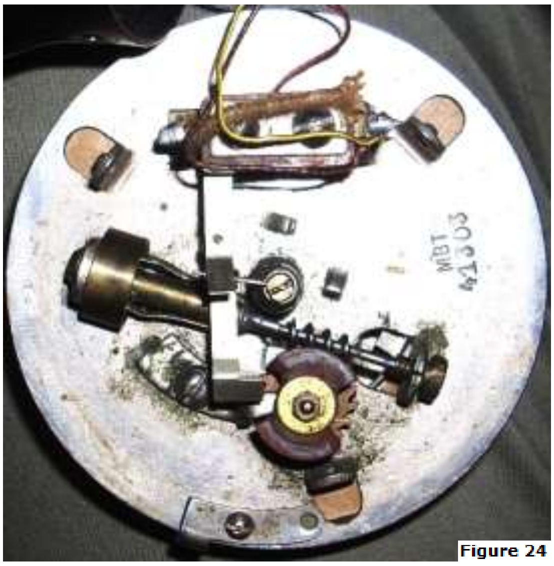

Figure 24

This is why I bought this particular butt set: the dial appears to be a "Mercedes" dial, as manufactured by Automatic Electric, although it's wholly unmarked except for the letters "MBT" and the (serial?) number 41303 on the baseplate.


Figure 25

This is the other French butt set that I have in my collection. As usual, I let other people do the travelling and then buy up what they themselves bought elsewhere – so this is yet another eBay® find.

As far as I know, the type of handset this butt set was made out of was popular in France circa 1920. Anyway, this unit is also cobbled together out of pieces of old telephones which were taken out of service, as the loop on the receiver proves; the loop was originally used to hang the handset on its hook-switch.

This butt set saw lots of use by linemen, seeing how dinged up the various bits and pieces are … the dial has been exposed to enough moisture to allow rust to form, the cord is frayed at the end, and the springs inside the alligator clips are broken (one of the clips has a broken "jaw" as well).

Figure 26

There isn't a lot more I can write about this butt set and its dial, except to mention the fact that the dial is a typical product of the Bell Telephone Manufacturing Company in Antwerp, Belgium, and was their model number 7002B.

Since the dial is from BTM, it's relatively safe to assume that this butt set was used in conjunction with the 7A rotary switching equipment at Paris.

I previously mentioned the fact that the German Wehrmacht didn't mess around with the PSTN, and that personnel from the German Reichspost used an entirely different butt set ….

First, though, a bit of background information as to just how long it took until I got hold of this one … I found it at the flea market here at Vienna, but I wasn't very happy with the price tag the seller had on it (if I recall correctly, the seller wanted more than double what I was willing to pay). I made the following deal with the guy: I'd give him 2 months' time (8 Saturdays) to try and sell it for his asking price and, if he didn't find a buyer, that he'd sell it to me for what I was willing to shell out.

With such a limited number of potential buyers on hand, the seller didn't really stand a chance; of course he didn't manage to find anyone crazy enough to pay him what he was asking. As a matter of fact, he didn't even find a second potential buyer who was willing to even pay as much as I had offered him, so I wound up buying this butt set – and I considered it my best buy for quite some time, because this unit was original property of the German Reichspost and is NOS to boot (except for a rather minor scuff mark on the receiver earpiece).

Figure 27

As can be seen in the photograph on the previous page, the butt set consists of the following components: a phenolic baseplate upon which the microphone, dial and banana jacks are mounted and wired up, a single headphone (complete with the head band with a leather cushion) and the test cords.

The baseplate was worn with a leather strap hung around ones neck, adjusted so that the microphone was as close to the mouth as possible, while the leather tongue at the bottom of the baseplate was attached to one of the buttons on the shirt, in order to prevent the unit from banging around and getting caught while climbing up or down a pole.

The headphone is interesting in that the "talk/monitor" switch is mounted on the back end of the receiver housing. This switch has a small mushroom head and was depressed in order to be able to dial and talk. Depressing and rotating the switch latched it in the "talk" position.

As can be seen, the dial on this specific butt set is the Viennese dial from the era 1927-1957; both the letters and the digits are to be seen through the holes in the finger wheel (normally, the letters were on the inner ring of the finger wheel), and one can see just how important it actually was to have the letter "i" (next to the digit zero) written as a small letter, while all the other letters were capitalized, so that the letter "i" can't be mistaken for the digit 1.

Figure 28

While having been built in May, 1941, this type of butt set was the Reichspost model "Strf. 30." The abbreviation "Strf" stands for the German word "**Str**ecken-**F**ernsprecher," literally "line telephone," while "30" identifies the year this unit was designed and/or first placed into service.

Figure 29

The little case below the dial cup carries the four banana jacks required to connect the test cords and the headset. The test cords are connected to the jacks "a" and "b" (equivalent to "tip" and "ring"), while the headset is plugged into the two jacks marked "F" (for "**F**ernhörer," literally "distant listener").

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Figure 30


Figure 31

The photographs above show the two leather straps and the carrying case as supplied with this butt set. The leather strap on the left side above was worn around the neck, with the two snaps clipped onto the "D" rings on the baseplate of the butt set, while the one on the right was used to convert the short carrying strap of the leather carrying case into a long one, so that the case could be slung over a shoulder.

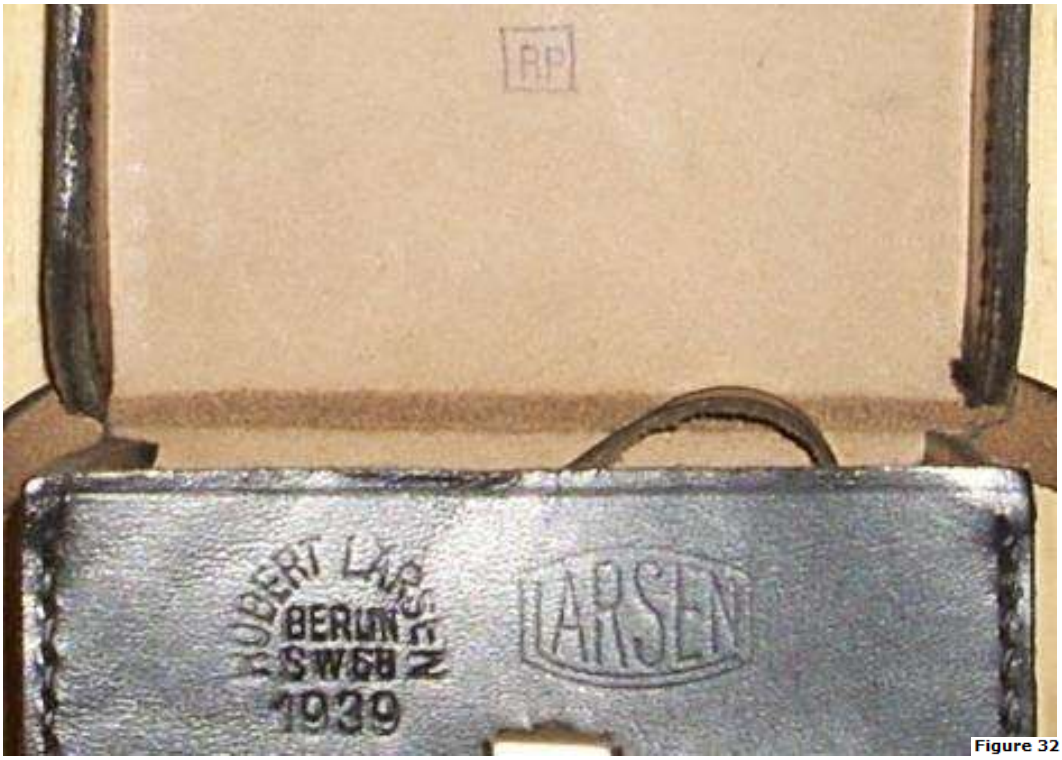

Figure 32

The close-up shown above reveals the name of the manufacturer of the carrying case, the company location and logo, as well as the year of manufacture. The pale purple stamp with the letters "RP" inside the lid identified the case as being property of the **R**eichs**p**ost. The phenolic baseplate has an identical stamp on the back side, but it's so faint that it was impossible to take a picture of it.

I wonder if my fellow collectors are aware of the fact that the one or the other telephonic item from the USA was also used by the Deutsche Bundespost (even if in a modified form). One item immediately comes to my mind: the type 1011BW butt set from Western Electric.

The following pictures give a side by side comparison of both the German and the American unit, as well as of the U.S. Army Signal Corps version of the 1011BW butt set, known as the "TS-365/GT" (manufactured by Western Electric).


Figure 33

The upper butt set in the photo to the left is the Bell System 1011BW, the one in the middle is (obviously) the one which was used by the Deutsche Bundespost (German Federal Post [Office]) and the lower on is the TS-365/GT from the Signal Corps.

The dials of all three butt sets are the same size and are of the same design – right down to the small pins for dialing using ones finger nails and the dimples for dialing with a pen or mechanical pencil.

As can be seen on the right, the West German butt set is a bit longer than the ones from W.E.; the handset handle bears the legend "Post" so as to indicate ownership.

The West German butt set sports an earth (or ground) pushbutton, which is located immediately above the microphone. Another major difference is that the test cord exits the handset handle at the bottom and isn't easily replaceable.

The test cord colors are as follows: tip (a) = slate, ring (b) = black & red = ground.

Figure 34

Figure 35

The caps for the microphone and receiver capsules are made of Bakelite in the W.E. butt sets, while those on the West German model are molded from a thermoplastic. The big difference here is that the German one has the cap over the microphone hemi-spherical in shape and has vertical slits through which sound enters.

Figure 36

The "talk/monitor" switch of the West German butt set is simply labeled as "on/off;" the "off" position is the equivalent of the "monitor" position on the W.E. butt sets.

Although a bit hard to see here, the West German butt set bears the manufacturer's name ("ELMEG" seen upside-down) on the right-hand side of the handset handle.

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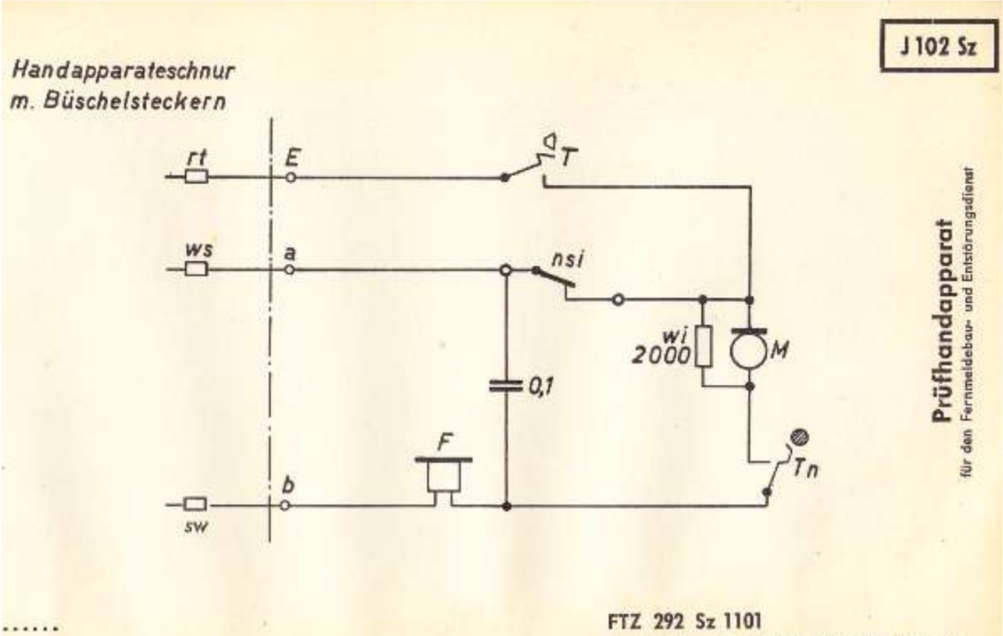

Figure 37

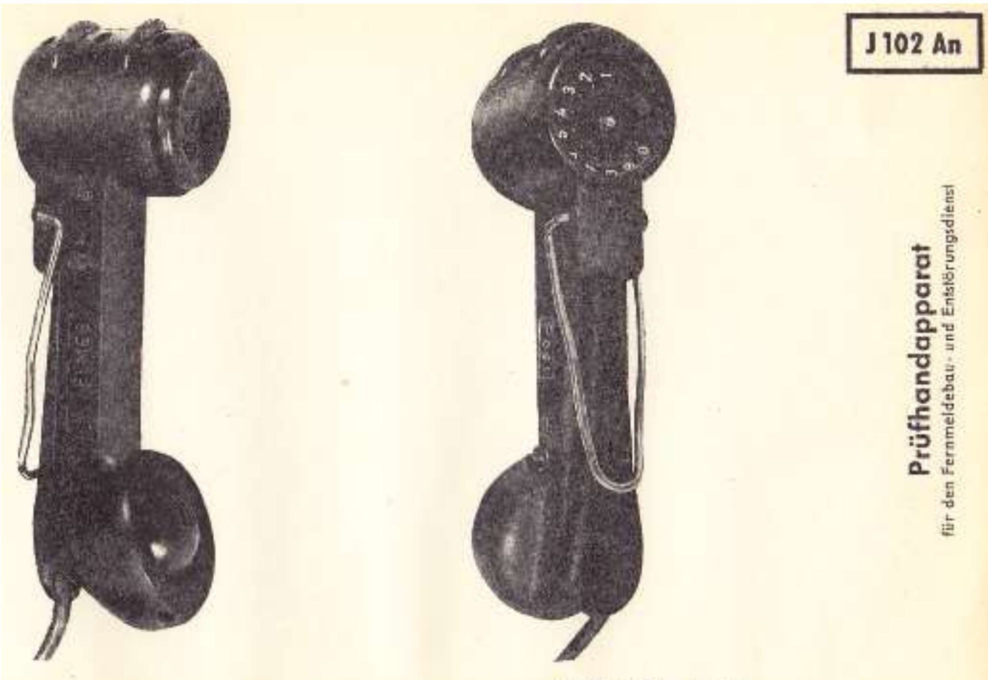

Figure 38

The two scans shown above are taken from a handbook of the Deutsche Bundespost which was published in the year 1953. When one compares the two views of the butt set as shown above with the photographs on the previous pages, it becomes obvious that the design didn't change during the intervening decades.

Although it's NOS, the West German butt set was dead on arrival … the problem seemed to be a dead carbon microphone, but removal is next to impossible because the lowest of the three screw holes which close the split portion of the housing is filled with a hollow shank rivet. I managed to drop this butt set onto the floor some time ago, and: hey, presto! it works just fine now.

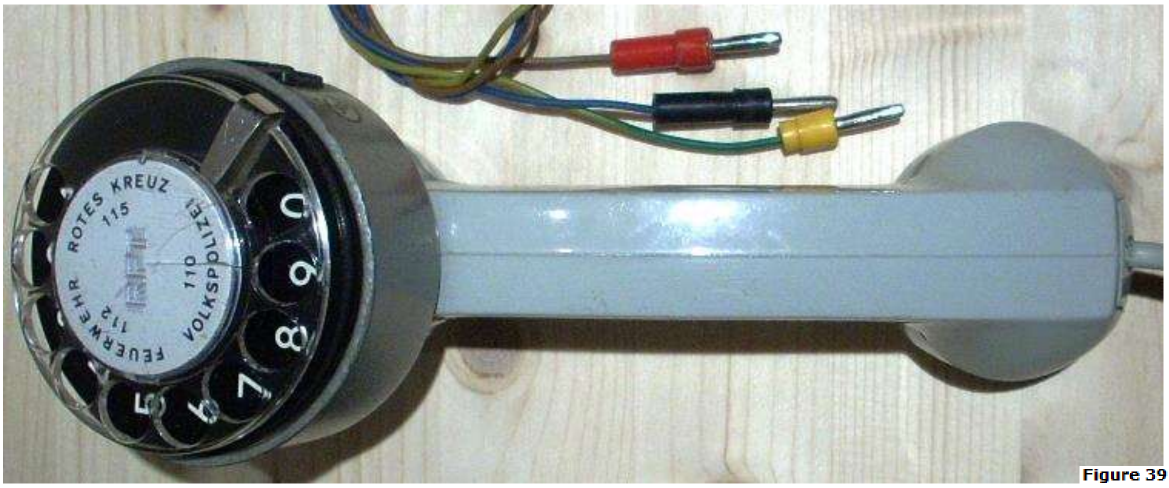

Figure 39

This particular butt set is from the "other" Germany, namely the former German Democratic Republic (GDR, otherwise simply known as communist Germany). Although not easily recognizable, the "test cord" is simply a roughly five foot long piece of electric power cord with the standard European wire colors: brown (phase), blue (neutral) and yellow/green (ground). To be sure: this cord *wasn't* a "replacement" which someone cobbled together – all the GDR butt sets I have ever seen have this same type of "test cord." The handset and the dial are from the standard GDR desk telephone, which was known as the "VARIANT®" (or simply "TW 70"). The VARIANT® was named so because it was designed to be very flexible: it was available with either a dial or a dial pulse keypad, with or without a grounding pushbutton, with a lock which shorted circuited the dial, with an internal impulse meter to count tariff pulses, &c.

The dial cup is made out of pressed steel and has a removable cover on the bottom.

As can be seen, there are two S.P.S.T. slide switches on the dial cup, one of which is equal to the "talk/monitor" switch, while the second one (labeled as "S2" in the photo) is used to cut a standard silicone diode in or out of the circuit. This diode was necessary in order for an installer/troubleshooter to be able to simulate either of two subscribers who shared a special type of party-line in which diodes played a most important part. The specific circuitry used with such party-lines is, alas, rather convoluted and won't be covered here.

Figure 40

The drawing to the right shows the schematic of the GDR butt set. The unit is set to "monitor" the line if switch "S1" is open and "S2" is closed. In this case, voice currents flow between the blue and brown wires via the normally closed dial pulse contact, the 0.33 uF condenser, the receiver, the voltage dependent resistor "VR" (which is designed to limit the volume in the receiver to a comfortable level) and switch "S2."

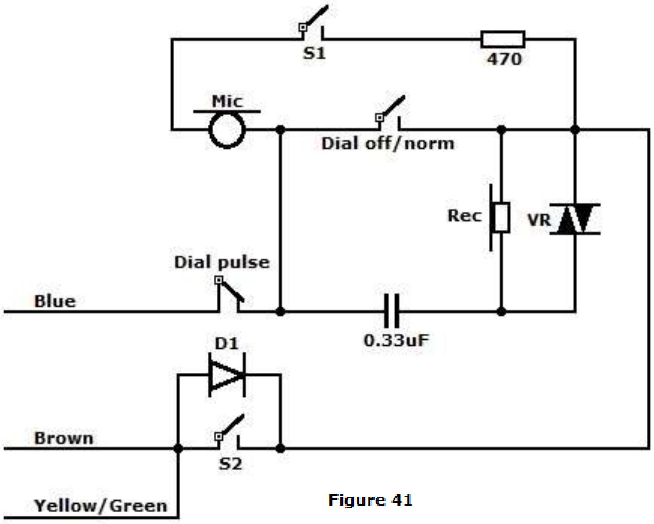

Figure 41

If both switches are closed, then the unit is in "talk" mode; voice currents then flow between the blue and brown wires via the normally closed dial pulse contact, the microphone, "S1," the 470 Ohm resistor and "S2." Sidetone is provided thru a rather convoluted circuit which can't be properly described in the space remaining on this page (so I won't even try to do so). Opening "S2" with "S1" closed sets the unit up to mimic the phone of one party of the two-party party-lines; reversing the blue and brown leads will allow the unit to mimic the other party's phone.

Figure 42


The butt set on the left was one used in connection with central battery (as opposed to dial) offices. It was manufactured by Stromberg-Carlson, and carries the Signal Corps acceptance stamp "SC3962A." The line cord is a SC "Duratex" MC-2-C, and the testing clips are the good, old ones from the Frankel Connector Co. Inc. in New York.

Now we come to four Austrian PTT butt sets which were used for troubleshooting and call tracing in central offices. The first one shown was used in tracing phone calls; it didn't have a dial, because it wasn't used for testing the various switching stages of Strowger type exchanges.


Figure 43

The push-to-talk switch is depressed for talking and rotated while being depressed in order to latch; this is the later of two types of push-to-talk switch which were commonly used by the Austrian PTT.


Figure 44

I have previously described a lineman's butt set which was made out of an *original* field handset 33; the butt set shown above was also made from the same type of handset, but the one here *doesn't* have a Wa.A. hallmark. The reason is that there were numerous such handsets still in the factories, but which had not yet passed inspection and thus lack the typical German WWII hallmark.

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Figure 45

The push-to-talk switch bar on this butt set was modified in the same manner as that of the lineman's butt set mentioned on pages 334ff. The knob of the latch is from some type of wristwatch, because it's ribbed in the same manner as the one on the other unit and this type of knob was simply most common on wrist and pocket watches.

Figure 46

This CO butt set was made out of a handset belonging to an unusual variety of party-line telephone and shows two interesting details: the push-to-talk switch is of the earlier type; it was depressed to talk and was latched by depressing it and pushing it sideways at the same time. The other neat thing is that the sleeves of the plugs are made of Bakelite, instead of a thermoplastic.

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Figure 47

Austrian PTT lineman's and CO test butt sets were often built by simply using parts from older phones which were removed from service. This not only applies to the handset itself, but also to the dial cup.

Figure 48

The photograph to the left shows the dial cup in a close-up.

There is nothing spectacular about it – I just wanted to include this picture so that readers may compare it with the one on a dial phone from 1928, which is shown below ….

Figure 49

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Figure 50

In some cases, the dial cup was purpose-built to fit a particular style of handset; this is the case with the CO butt set shown here … it's a very late model, built circa 1980, using the handset type which belonged to the Austrian model 1972 dial telephone.

As can be seen, the test cords were wrapped around the handset handle for quite some time before being unraveled for taking the pictures.

Figure 51

The rear side of the dial cup used was formed to fit the handset at the microphone end. In this case, the dial cup wasn't attached to the handset with screws, but was rather glued to it with epoxy.


Figure 52


Figure 53

A limited number of butt sets as shown above were tested by linemen of the Austrian PTT, before they were junked as being impractical. Referring to the picture on the left, one can see that there are three pushbuttons above the keypad … "FL" was a "flash" button, "P" was depressed in order to test the polarity of the line (the LED is located above and to the left of the microphone grille; green indicated correct polarity, red reversed polarity) and "ET" is the grounding pushbutton for testing party-lines.

There is a rotary switch to the right of the line cord, as shown in the picture on the right-hand side. This switch has three positions (off, dial pulses, DTMF tones) and was one of the bones of contention because it became noisy within a short time. If I recall correctly, the Austrian PTT only bought roughly 200 or so of these butt sets; anyway – the one shown here was one of the last ones to be found. This type of butt set was simply known as "Issue 4" in Germany.


Figure 54

The yellow butt sets in the cardboard box to the left are the type which A1 Telecom Austria finally adopted as their newest butt set. This unit's commonly referred to as either the "Test Handset 90" or by the abbreviation "PrHAp 90."

The ones shown here were for sale at the (back then) yearly flea market for the benefit of the Saint Anna Children's Cancer Research Center in Vienna. I recall having found & bought one which was absolutely NOS, while the rest of them were sorted-out duds.

Figure 55

The PrHAp 90 has two LEDs: "SL" (= "**S**ch**l**eife") and "PL" (="**P**o**l**aritaet"). SL lights up whenever there is a loop circuit through the test set, while PL only lights up when the latching pushbutton "P" is depressed. PL will show green if the line and test set are connected properly and will show red if polarity is reversed (it doesn't matter whether the line pair is crossed out somewhere or if the test set is connected backwards).

The pushbutton "DT" (="**D**aten**t**aste," data pushbutton) is used in conjunction with a test jack (shown below on the right) on the back of the handset and is used to test antiquated modems, FAX equipment and the like, which require an external signal to connect them to the phone line.

"ET" has nothing to do with "ET phoning home," but is rather the German-language abbreviation for the word "**E**rd**t**aste" (grounding pushbutton).

"FL" is simply a switchhook "flash" pushbutton as found on many modern-day telephones.

I won't bother describing the remaining cryptic pushbuttons, as their functions are not commonly used.

Figure 56


Figure 57

The PrHAp 90 may be connected to standard dial exchanges or to digital switches (some of which only accept DTMF tones). "MFV" = DTMF, while "IWV" = dial pulses. The unit is in "monitor" mode when the rocker switch is set to zero. The black steel ring may be folded out so that the butt set can be attached to a belt clip.

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I have already hinted at what I consider to absolutely be the rarest Austrian PTT butt set – made in the 1960s, using a handset pressed in **red** Bakelite. Just as the model 1948 (W48) Austrian desk and wall telephones were offered in five colors (black, ivory, burgundy red, grass and dark green – the red and green ones were *very* rare); butt sets were made from the handsets of these W48 phones, whereby ones in red or green Bakelite were previously not known to exist. The butt set shown here was made using a NOS handset, and the rest of the components are in pristine condition as well ….

Figure 58

Figure 59

Figure 60

Figure 61

Figure 62

I've been collecting telephones, butt sets, other phone test gear, switchboards, paper telephone paraphernalia and the like for nearly 25 years – but I have *never* seen a second Austrian PTT butt set in burgundy red (*or* in green), no matter in what condition, in all those years. It may have been a specially-made retirement present for a PTT employee.

P.S.: I mistakenly termed the red, thermosetting plastic of the last butt set as "Bakelite;" however, true Bakelite is *only* available in dark colors, such as black or brown. Chemically, Bakelite is a *phenolic*-formaldehyde composition, while "Bakelite" in colors such as red or green is technically made of *urea*-formaldehyde, since the latter easily lends itself to dying in a multitude of colors. Refer to https://en.wikipedia.org/wiki/Urea-formaldehyde.

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Common Austrian Magneto Telephones Between 1910 and 1918

While I was researching info in back issues of "Singing Wires," I came across an article entitled "Telephony in Austria from 1881 to 1938 – Part 1: Local Battery Systems" (Singing Wires Volume 21, Number 5, of May 2007; written by Austrian TCI member Mr. G. Fuchs and his Austrian co-author, Mr. N. Dulosy), and I thought it might interest readers to take a closer look at the telephones shown in figures 6 and 7 of the article.

The common wall magneto telephone which originally entered into service circa 1890, and which was officially known as the "state type III"[1], saw a number of modifications and alterations during its service life.

[1] The designation "state type" was used to help differentiate between telephones owned and operated by the Imperial-Royal Administration of Posts and Telegraphs and those which had previously belonged to the Vienna Private Telegraph Company.

Personally, I don't know of a completely intact and original early version of the state type III existing in any private or public collection of telephones (the Technical Museum here at Vienna probably has one stashed away somewhere, but I can't recall ever having seen it on display), and I only recently came across a drawing of one in a book on telegraph and telephone service in Imperial Austria from 1893.

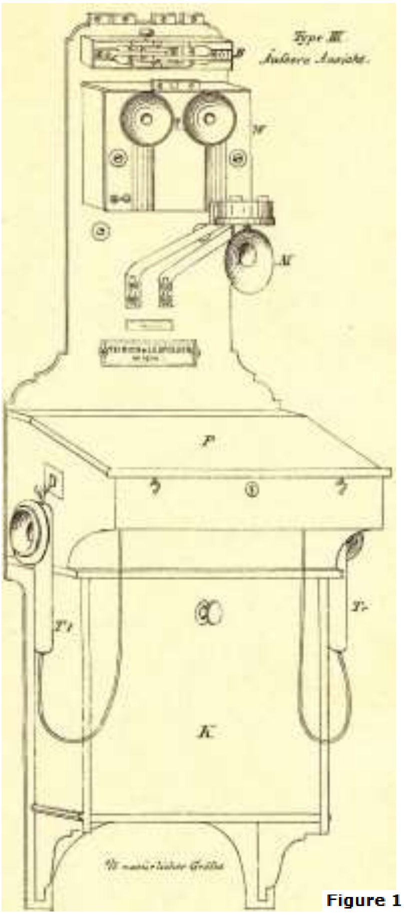

Figure 1

What **I** understand as being a complete and original state type III is the very early version shown here.

This version had a silk ribbon lightning arrestor above the ringer and usually had two large-sized "paddle" receivers, as shown here.

The funny thing was that I was offered a late variant of this type of wall magneto set shortly after I began writing this tale; of course it's now part of my collection ….

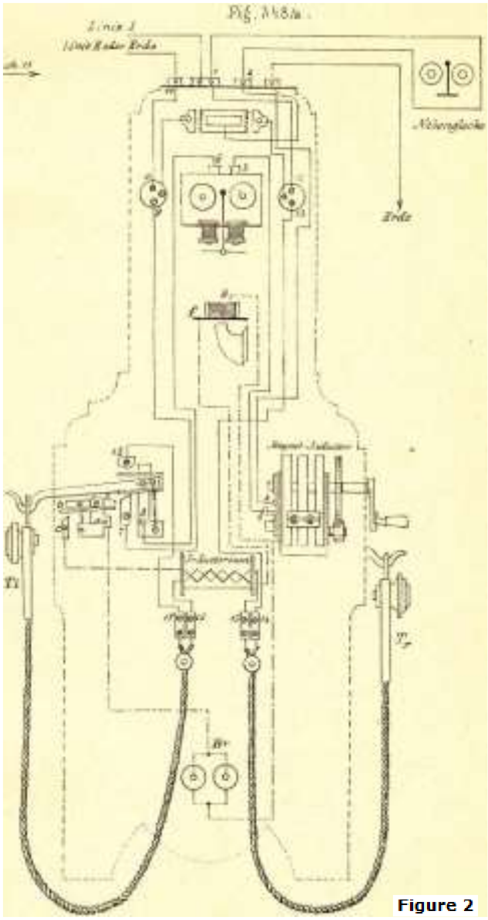

Figure 2

Figure 3

Figure 4

This is the late model state type III magneto wall phone as bought. The major differences to the earliest model are that the silk ribbon lightning arrestor was deleted, as was the second receiver (although the phone has the wiring provisions for a second one).

The transmitter is the famous "universal transmitter" from J. Berliner, complete with the original horn (not to be confused with the one from E. Berliner, who was the brother of Joseph). Alas, the microphone is deaf – at some time in the past, it lost its entire filling of carbon granules. The two parts of the microphone housing are held together with four small screws – but I wasn't able to open it after having removed these screws. After I got the housing open, I saw that there was enough corrosion between the lid and the case to keep the two pieces tightly jammed together, even without the screws.

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The successor to the state type III, the first truly "common" magneto wall phone (*sometimes* referred to as the state type IV), is shown to the right.

It has a carbon *ball* microphone capsule, mounted in a housing which is attached to an adjustable arm. An interesting design feature of this magneto wall set is that the wires running to the microphone housing are equipped with small, un-insulated, banana-type plugs on both ends; this allowed for easy replacement of these wires, without having to disassemble anything at all.


Figure 5

Figure 6

This magneto wall phone existed in two distinct types: the model 1906 and the model 1907. The receiver of the model 1906 is a largish, "paddle" type with a relatively hefty permanent magnet, which is equipped with a Bakelite cap, while the receiver of the model 1907 was of the type introduced concurrent with the Ö10 magneto desk set (more about this desk set later on), which could be styled as a "wand" receiver due to its smaller size and lighter weight.

Anyone with access to the very first issues of "Singing Wires" might want to compare the phone, as shown above and to the right on the next page, with the one shown on page 7 of the complimentary first issue, where it's described as being a "circa 1891 *Belgium WE* walnut fiddleback …." (S*orry, it just* isn't *so*.)

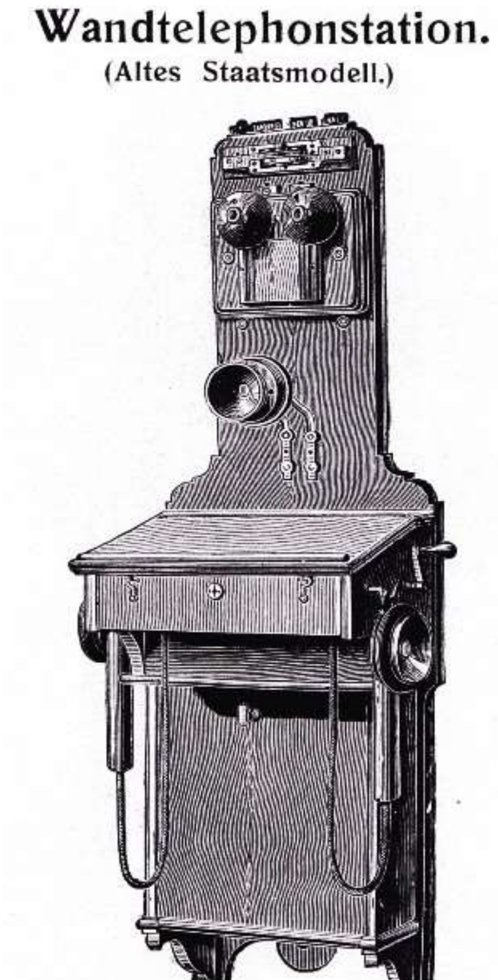


Figure 7

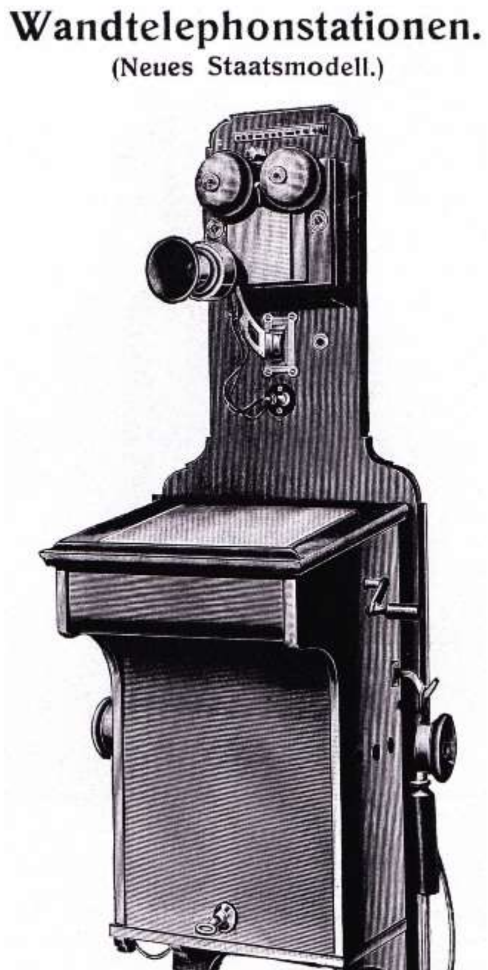


Figure 8

The two scans shown above are a side-by-side comparison between the “old” and the “new” state types, as shown in an Ericsson (formerly Deckert & Homolka of Vienna) catalog circa 1910; the scans below (taken from the same catalog) show some of the types of microphones and receivers available from Ericsson at the time.

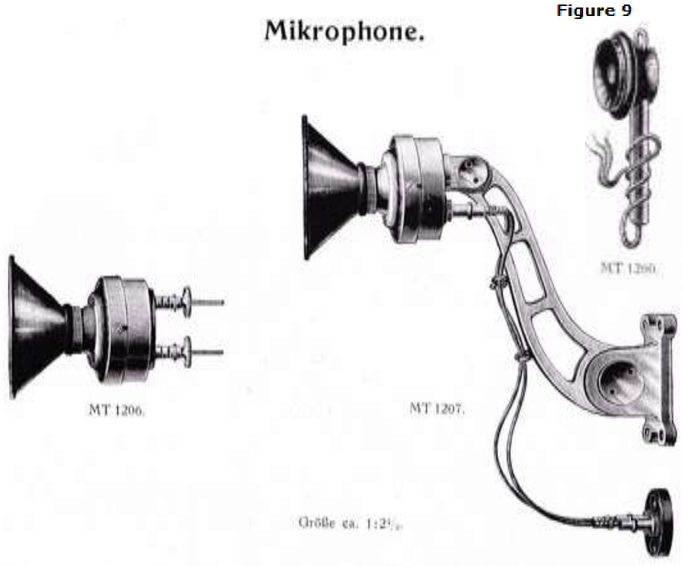
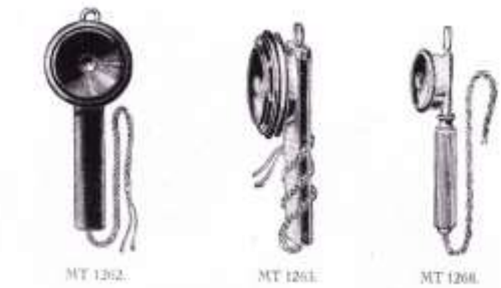


Figure 9



The first three of the receivers are listed as “Deckert” models, while the one on the far right is listed as the “new Austrian state type.”

The microphone on the right-hand side of the scan to the left is also dubbed the “new Austrian state type.”

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The "new state type" shown in the right-hand photograph two pages back is from my collection, and is officially known as the model 1906 because it has the older-style receiver (which was also used on the state type III), while the model 1907 had the "new Austrian state type" receiver, which was smaller and lighter.

From what little information is available, it appears that both models were produced with either a flat mouthpiece (such as the one on my phone) or with a mouthpiece to which a small funnel is attached – as can be seen below.

Electrically, both models (and the Ö10) are the same, excepting possible minor variations concerning the exact winding ratio and resistances of the induction coil (which didn't provide any sidetone attenuation); the same holds true for the receiver and ringer coils (except for the ringer of a *special* version of the Ö10, which will be described later on in this tale). Both of the wall phones and the Ö10 could be equipped with a second receiver, which was intended to improve the intelligibility of speech if the phone was operated in a location with high background noise levels.

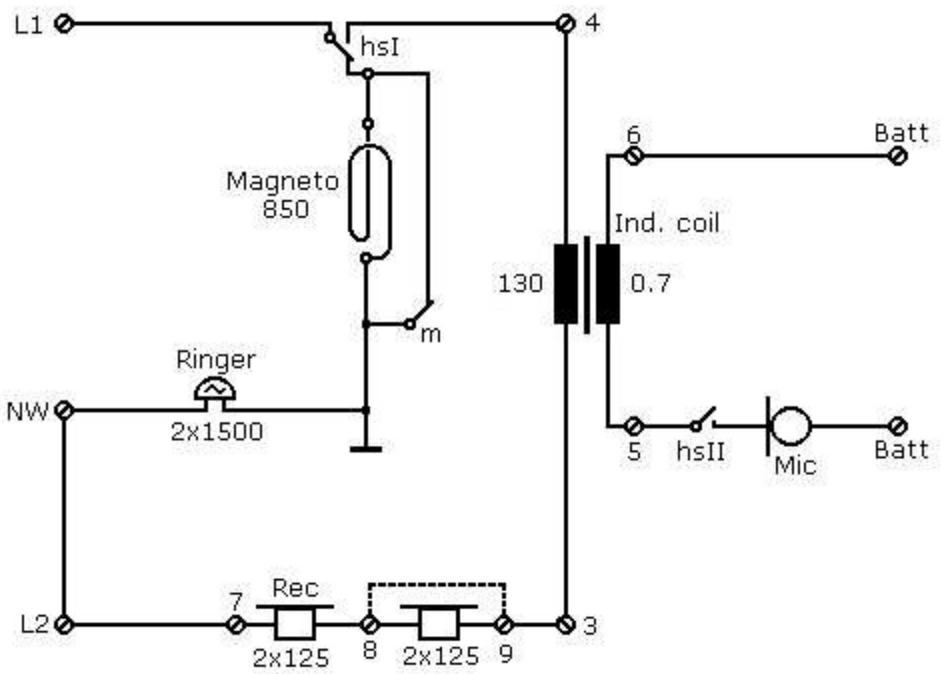
Figure 10

A number of years ago, Telecom Austria celebrated 125 years of telephony in Austria with a public exhibition. The 1906 magneto wall phone (as shown to the right) was described as having been manufactured in the year 1888 – which is patently *incorrect*.

The description given by Telecom Austria is also the *only* source of information which claims that this type of wall phone was known as the state type IV.

I would've liked to be able to include a close-up photograph of the tag containing the data mentioned above, but since Telecom Austria refused me royalty-free use of copyrighted material I find it safer to not do so (the phone on the right isn't the one from the public exhibition anyway).

Figure 11



Wall magneto phone, # 5701/I - schematic derived from a functional original. Initially designated the model 1906 wall phone, it was modified into the model 1907 the following year. Designated as the state type IV in one instance, possibly to fill the gap between the old state type III and the state type V.

The drawing above is the schematic for the model 1906 magneto wall set from my collection.

The last known variant of the magneto wall telephone was an officially “upgraded” version, in which the original microphone and receiver were replaced with a Bakelite handset and the original induction coil was replaced with a simple, anti-sidetone coil of smaller size – both changes were made in order to enhance speech quality without having to design and build an entirely new magneto wall phone. A black & white photo and the schematic for this phone are shown below.

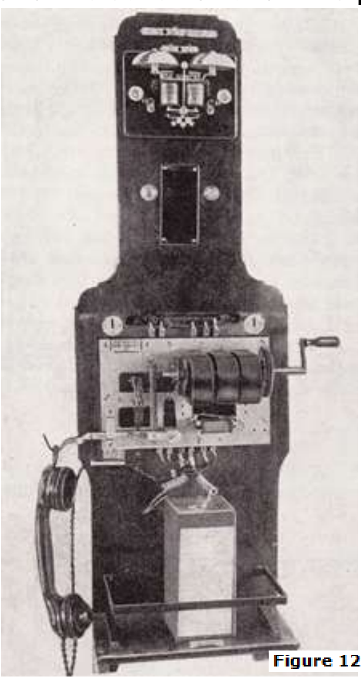


Figure 12

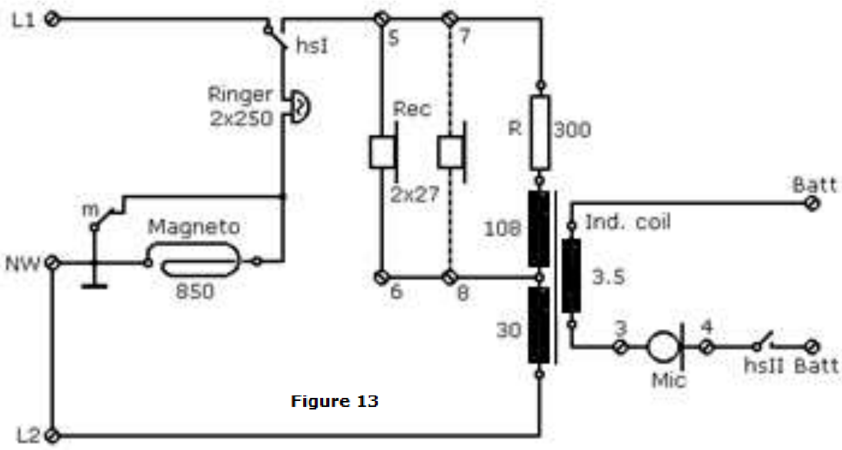


Figure 13

Magneto wall telephone W.-No. 5701/III. This was the last version placed in service and used a handset instead of separate transmitter and receiver elements. This version utilizes a primitive anti-sidetone circuit.

As to the general workmanship with regard to the magneto wall phone, one can only say that the Imperial-Royal Administration of Posts and Telegraphs knew what they were doing when designing and building this phone. The wiring with which the ringer, the line terminals, the microphone and the chassis (which carries the hook-switch, magneto and induction coil) are interconnected, is run inside slots cut into the backboard, the entire backboard then being covered by a thin, second backboard which protects the wiring. As may be seen below, all the connecting wires run through the backboard and are terminated on spade lugs; there is plenty of spare wire in case one of the lugs were ever to break off ….

Figure 14

Personally, I especially like the easily replaceable microphone wires – the idea predates the modular handset and line cord concept that Western Electric cooked up by nearly a century.

As to the woodwork – I can't tell the difference between various kinds of wood once they've been stained, so I can't write anything about what wood the parts of the phone are made of, but from what I have been able to gather from various sources, it appears that walnut was commonly used in Austria. The metal parts, such as the cover for the ringer coils and armature, and the lower front portion of the housing, are sheet iron painted to simulate wood grain.

Figure 15

The model 1906 and 1907 magneto wall sets are next to impossible to find on the open market, and if found, are usually defective from an electrical standpoint, are usually missing some parts (large or small) and the milk-white glass writing plate is normally broken to pieces, which means that it's *missing*, leaving an unsightly hole which is often "repaired" by someone having glued a bit of green felt in place of the original glass, as may be seen here.

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More often than not, a piece of wood is broken out of the housing – the bit right behind the hook-switch; this happens when one attempts to remove the housing while having the receiver hook in the wrong position. By this I mean that some manufacturers appear to have made the slot for the hook such that the receiver must be left on hook in order to be able to remove the front (left picture below), while on others the cutout is such that the receiver must be taken off-hook to be able to do so without damaging the wood (right picture below). BTW – the model 1907 phone on the right still has its original milk-white glass writing plate ….


Figure 16


Figure 17

The model 1906 in my collection fits the description well – small mechanical bits are missing inside; notably the flat iron band which held the Léclanché cells in place, and the nickel-plated brass feed-through for the receiver cord(s), as well as having the glass plate missing (although in my case, no one was stupid enough to glue that ugly bit of felt onto the wood), being electrically defective as bought and having some bits of Bakelite missing from the receiver cap. At least the wood is pretty much in its original condition and undamaged.


Figure 18


Figure 19

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The electrical defects were relatively simple to repair – the primary side of the induction coil had a small, sharp ding in it, which caused the coil to break at the point of contact. The paper wrapping was carefully removed, the break in the wire (which was in the outermost layer) soldered and the wrappings carefully glued back in place (from the front, the coil looks as if it had never been touched). The receiver cord was intermittent, so I replaced it with a more modern, 4 conductor, handset cord from circa 1920 – this is the best I can do until I find an original 2 conductor cord.

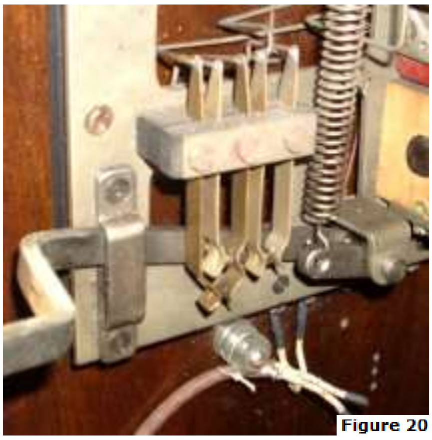

Figure 20

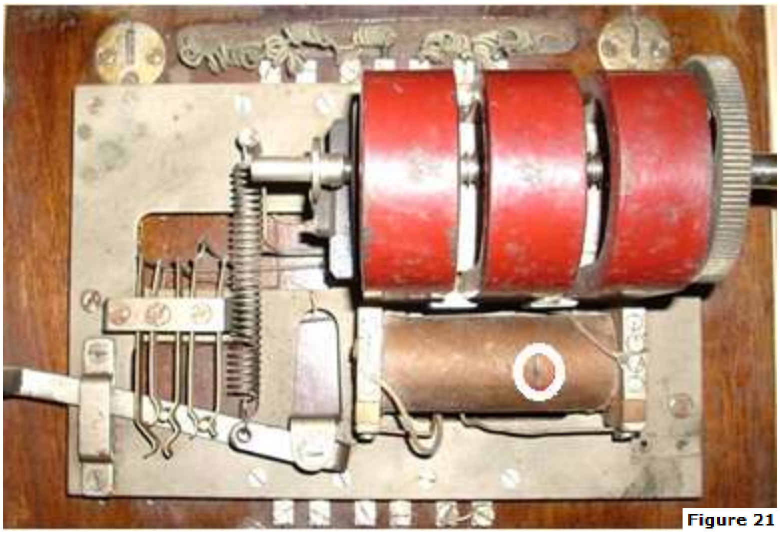

Figure 21

The left-hand photograph shown above is a close-up of the hook-switch; one can also see the manner in which the strain relief for the receiver cord was realized. The right-hand photograph gives a general overview of the baseplate which carries the induction coil, the magneto and the hook-switch. The area encircled in white on the induction coil shows where the small, sharp ding was prior to repair.

The missing or damaged pieces will remain so until I happen to find originals at the flea market (I'm often surprised by the odd, small telephonic bits which occasionally turn up at Vienna), and the milk-white glass writing plate will be replaced whenever I finally find the time to go and buy a piece of the correct size ….

A common feature of the Imperial Austrian magneto telephones (wall and desk sets as described in this tale) was that the ringer didn't *bridge* the phone line (as was and is common practice in numerous other countries in the world), but were rather wired in series with the line and magneto. This offered a distinct advantage over a bridged ringer: having the ringer in series with the magneto and the line allowed the subscriber to judge whether his call was reaching the exchange or not. If the bell on his phone rang while he was cranking the magneto, then there was a good chance that the line to the exchange was intact and that the ringing current was actually flowing into the switchboard. If the bell didn't ring while cranking, then there was definitely a fault somewhere.

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In official PTT literature from 1908, the first common magneto desk set (known to European collectors as the "Ö10") was designated as the model 1906 – which is cause for confusion, because European telephone designations, such as OB05 (a German magneto desk set), W28 (a dial telephone used in Germany and Austria in the 1930s), OB33 (a German magneto desk set commonly used in railway operations), etc., normally give the tens and ones digits of the year in the 20th century in which the phone was either designed or first placed into service. Thus, the Ö10 should actually be known as the Ö06 (and be called so), although no European telephone collector actually does so.

In fact, the designation Ö10 is a generic catch-all for Imperial Austrian magneto desk telephones that more or less look the same from the outside, but which may have subtle differences in construction. For instance: the original model 1906 had the contacts of the cradle switch mounted beneath the bell-shaped cover at the base of the cradle, outside of the housing, while later versions had the contacts attached to the underside of the top plate, on the inside.

Figure 22

The magneto desk phone to the left is a model 1906, complete with an ornate, art-deco design which was silk-screened onto the housing using gold-colored paint.

Most of the late-model Ö10 desk sets were painted using black crinkle paint; some, however, were painted glossy black and had similar art-deco designs ….

The picture to the right shows a typical Ö10 magneto desk set from before November, 1918, when the Austro-Hungarian Empire came to an end; this one still has the original lead seal in the base, with the ownership mark "KKTV" (kaiserlich-königliche Telegraphenverwaltung; Imperial-Royal Administration of Telegraphs). This mark was usually defaced before the phones were sold for scrap.

Figure 23

Figure 24

The Ö10 magneto desk set (and its much less decorative successor, built circa 1925-1940 by the firm of Leopolder & Son [L&S] in Vienna – the picture below gives a comparative view of both) was a very long-lived telephone, having seen service from circa 1906 until the demise of magneto service in Austria on December 14th, 1972.

Figure 25

The Ö10, and its successor (to the right), were built in two types: those which have a "standard" magneto circuit, with the magneto and ringer wired in series, and those which short-circuited the ringer (which, by the way, also had coils of a higher resistance, and thus of higher impedance, than the standard magneto desk sets) when the magneto was cranked, as shown below.

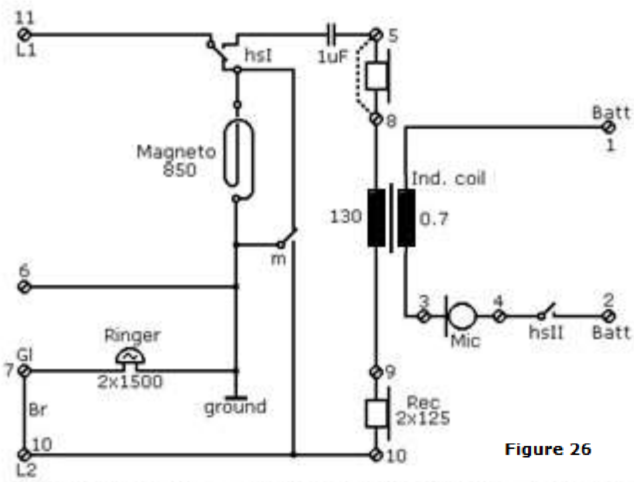

Figure 26

Oe10 desk magneto phone, # 5710, built by L&S circa 1931, which uses a S.P.D.T. switch on the magneto crankshaft (designated "m" in the schematic above) to short-circuit the ringer whenever the magneto was cranked. Such phones were used on rural party-lines and on lines having a nightly through-connection to a magneto exchange other than the local one. This schematic was taken from an original blueprint dated June 2, 1931.

Note that the schematic is drawn to show the switch contacts in their non-operated positions, i.e. the handset is on the cradle and the magneto crank isn't being turned (the S.P.D.T. switch "m" is actuated by the magneto crank shaft).

The former type (with the common magneto/ringer circuit) was used on single-party telephone lines, while those which short-circuit the ringer were used on party-lines with non-secret service (the so-called "Landanschluss" = rural connection[2]). The scan below shows the directory listings for a small rural Austrian exchange from 1942; where several subscribers share a non-secret rural party-line. Phones with short-circuited ringers were also used for a rather special telephone service explained at the bottom of the page.

Eisgarn
Handvermittlung. D: W 8–12, 14 bis 18: So u. F 9–10 ✕
Gemeindeamt, 63 — 6
– Gr. Radischen, 53 — 8
– Reichenbach, 5 Landanschluß 7 C
– Wielings, 2 Landanschluß 7 E
Gendarmerieposten Eggern — 2
Glück I. u. Söhne Handschuh- u. Strumpffabr. — 1
Kaufmann Anton Versand- u. Großverteiler Obst Gemüse, 76 — 4
Kössner Franz Fleischbeschauer, 13 — 5
Löffler Ferdinand Gastwirtschaft u. Fleischhauerei, 53 — 3
NSDAP:
Ortsgruppe Eisgarn Zelle Gr. Radischen Loidolt Franz, 26 Landanschluß 7 A

Figure 27

[2] Until the demise of true party-line service in modern Austria around 1990, all Austro-Hungarian, respectively Austrian PTT, administrations insisted on giving the subscriber *secret* party-line service (there was no easy, undetectable method by which a party not involved in a phone call could block, disturb or listen in on a conversation in progress). The only exceptions to the rule were rural magneto party-line connections and nightly permanent connection magneto service – but in order to obtain such service, the potential subscriber had to sign a waiver, giving up his or her right to secret telephone conversations absolutely and completely.

As an interesting sidelight on modern-day Austria: to this date, A1 Telecom Austria insists that multiple telephones on a single premise may not simply be bridged across the line (as is common practice in the USA), because this allows eavesdropping. Multiple phones on a single premise must be wired in a special fashion, so that taking the handset off-hook on any telephone on the premises automatically cuts off those phones "downstream," so that only one person may talk and listen on the line at any given moment (more on this in another tale in this collection).

The special telephone service referred to above was related to the following fact of life, concerning folks connected to small, rural exchanges up until the late 1950s: larger towns and cities which had manual service usually had switchboards which were operated 24/7, whereas many small places only had switching service from between 8 a.m. and noon, resp. from 2 p.m. until 6 p.m. on weekdays and Saturdays. Switching service on Sundays and public holidays was between 9 and 10 a.m. – naturally excepting emergency calls (the scan to the right was taken from the subscriber directory for Lower Austria from 1942, where the switching hours are listed underneath the town name).

Michelhausen
Handvermittlung, D: W 8–12, 14 bis 18: So u. F 9–10 ✕
DV (allgem. benützbar):
Nr. 1 Bürgermeisteramt mit Fernamt Wien
Nr. 4 Hermann Schüller mit Fernamt Wien
Ableidinger Rudolf Bau- u. Masch.-Schlosserei, 62 — 10
Bahnhof — 8
Bürgermeisteramt, 37 — 1
Hiller Peregrin Dr. Gem.-Arzt, 85 — 2
DV mit Fernamt Wien
Kunesch Hans Stadtmaurermstr., 110 — 9
Landwirtschaftliche Genossenschaft Tulln Filiale Michelhausen — 3
März Katharina Restauration mit Fremdenzimmer, 64 — 7
NSDAP.:
Hitler-Jugend Gebiet Wien (27) Gebietsführerschule 1 Plankenberg — 5
Reif Karl Fleischhauer, 3 — 11
Schüller Hermann Mech. Reparatur-Werkst. f. Autos Motorräder Hilfswagen Streithofen 32 — 4
Wilhelm Rudolf Streithofen 36 — 6

Figure 28

Against payment of a stiff fee, subscribers in such small, rural places could have their phone lines patched through (via a toll line) to a town with 24/7 service outside of the normal switching hours of their local exchange. Known as a "**D**auer**v**erbindung" (DV, permanent connection service), this service was mostly used by doctors, important businesses, mayors offices and police outposts; up to a total of seven subscribers could be patched through to a distant exchange on a single toll line. In the scan to the right, subscribers 1 (mayor's office) and 4 had permanent nightly connections (with the Vienna toll exchange) which any subscriber was allowed to use.

The reason for shorting the ringer when ringing up the exchange was simple: the normal desk set ringer was designed to ring whenever the magneto was cranked, but on the permanent connection magneto service, there might be three, four or more phones patched into a single toll line to a relatively distant exchange. Naturally, under these conditions, it's desirable to send most of the ringing power to the distant exchange, and not be wasted ringing one's own phone, or those the other phones patched into the same toll line. Although there was no technically feasible way to prevent the ringers of other phones on the same line from ringing under the original scheme of permanent connection service, the Ö10 phones intended for such service had a ringer with higher impedance than normal, so that less ringing power would go to waste; the same reasoning also held true for rural party-line service.

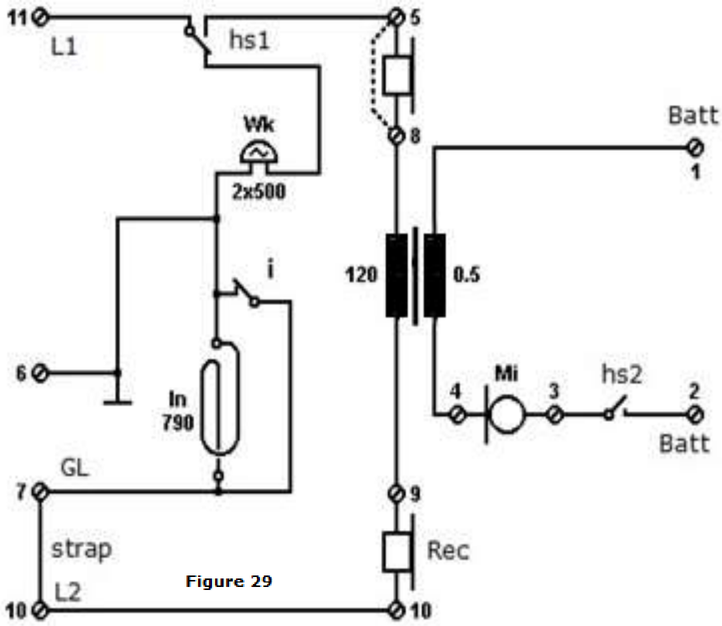

Figure 29

Standard Ö10 schematic, for a single-party (private) magneto phone without the contact to short-circuit the ringer. The schematic was drawn after ringing out an Ö10 from my collection.

The schematic to the left belongs to the standard Ö10, while the schematic two pages back is for one of the Ö10 variants for party-line or permanent connection service. In addition to a ringer with a much higher resistance than normal (D.C. resistance of 3,000 Ohms instead of only 1,000 Ohms), the phone also had a 1uF condenser in series with the receiver. This capacitor was used to prevent the ringing current from passing through the receiver in the event that the subscriber had the receiver to his ear when either another subscriber or the exchange rang the line.

Some telephone collectors from Germany believe that the condenser was used to prevent direct current from flowing while the phone was in use, but allowing it to flow when the handset was on-hook. This type of circuit arrangement on magneto lines was intended to indicate the end of the conversation automatically, so that the subscribers wouldn't have to "ring off" when finished. However, only two magneto exchanges in all of Austria ever used this system, and the D.C. path would require a *much* lower resistance than the 3,850 Ohms afforded by the magneto and ringer in series – the D.C. resistance is normally in the range of 200-250 Ohms for use with such a system. It isn't very likely that the condenser was used for the imagined purpose, but rather as indicated in the previous paragraph.

There is no obvious reason why versions of the desk set with the ringer-shorting circuit were constructed with and without the capacitor and with ringers of divergent coil resistance, nor have I come across any literature suggesting a reason. However, it may be surmised that the latter ringer, while having a lower D.C. resistance, had an A.C. impedance equal to the higher resistance ringer used in the other version of this desk set, because otherwise the intent of getting most of the ringing power to the distant exchange would've been negated.

When an Ö10 (or its successor from L&S) was removed from service from circa 1950 onwards, it was refurbished. The Ö10 was upgraded with a new induction coil and a new handset, these being of the same physical design as used in the Austrian W48 dial telephone. The photograph below shows the bottom of one of these refurbished sets, complete with the markings of the refurbisher (ELFA), the delivery date (December 22, 1961), the ownership stamp ÖPT (Österreichische Post- und Telegraphenverwaltung – Austrian Administration of Posts and Telegraphs) and the modern-day, 9-digit, part number under which it was carried by the ÖPT (note that the old ownership mark "KKTV" wasn't defaced on this set).

Figure 30

When refurbished, the L&S type only received a Bakelite handset of the same type as used on the upgraded original Ö10s, but the original induction coil was left in place. This is because the coil used by L&S (shown on the right below) was of a more modern design than the one used in the original Ö10 – the L&S coil has a closed magnetic circuit by virtue of its laminated, iron-alloy core, while the original induction coil (shown to the left below) had an open magnetic circuit because the core only consisted of a bunch of annealed iron wires stuffed into the wooden bobbin the coil was wound on.

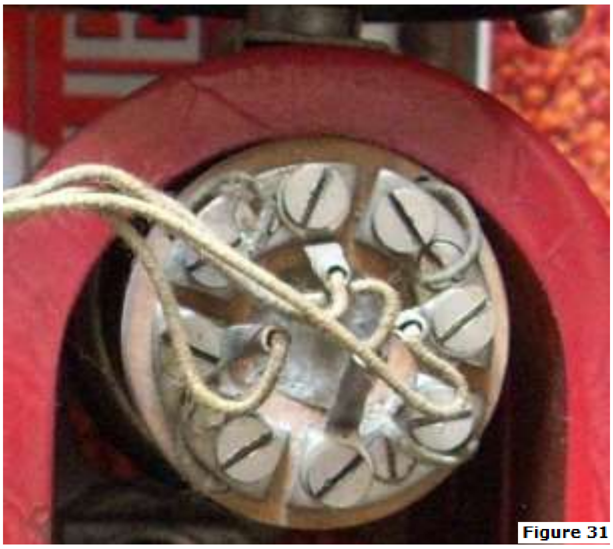
Figure 31


Figure 32

Along the same lines, and as of approximately the same year, wall and desk sets with defective microphone capsules were repaired by replacing the old, larger-sized capsule with a more modern (smaller) one, using a special adapter ring to keep the new capsule centered in the mouthpiece – refer to the pictures below ….


Figure 33


Figure 34

The pictures on the next few pages show the interior layout of an original Ö10 desk set very well, so I won't waste any words on describing the construction. The only truly noteworthy points are that the induction coil is clamped to the inside of the large horseshoe magnets of the magneto (which, by the way, is of the same size and design as the one in the magneto wall phone) in order to save space, and that the ringer is of a single-gong construction, albeit with two clappers, so that the sound of the ringing is similar to that of the wall set. A variant of the ringer existed, where there was but a single clapper – which didn't tap the gong from the outside, but was rather extended into a slot in the gong, thereby tapping the gong at the same rate as with two clappers (this style was adopted by L&S; both types of ringer are shown on page 375).

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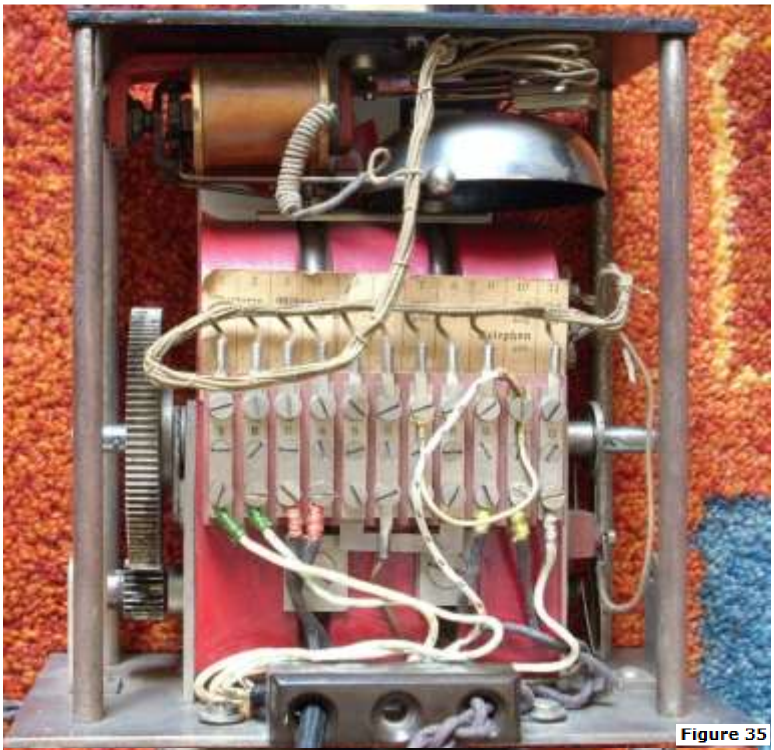

Figure 35

Figure 36

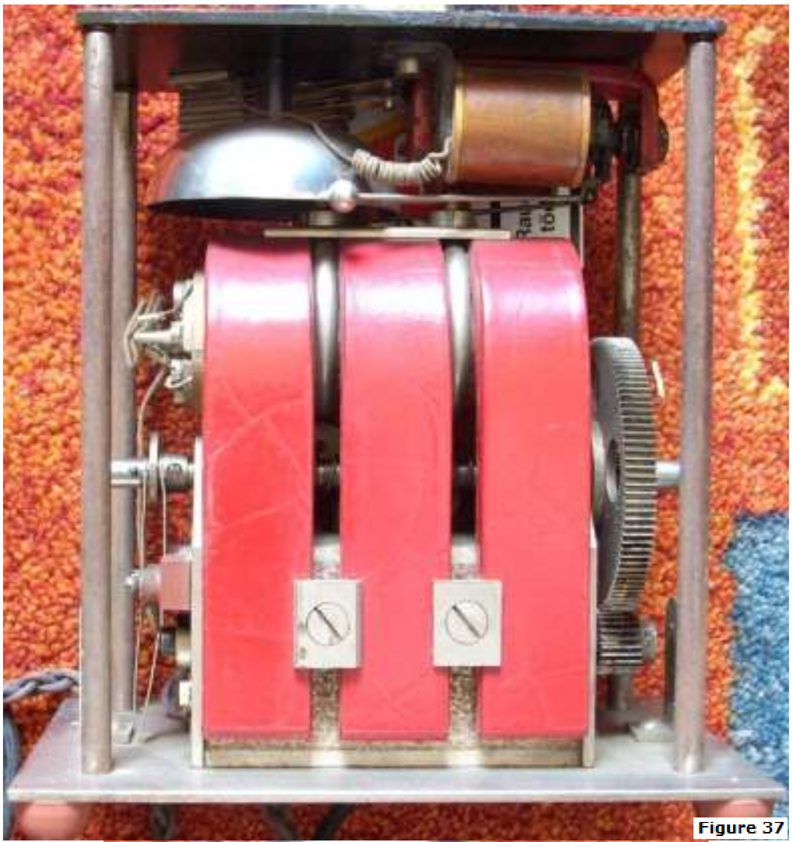

Figure 37

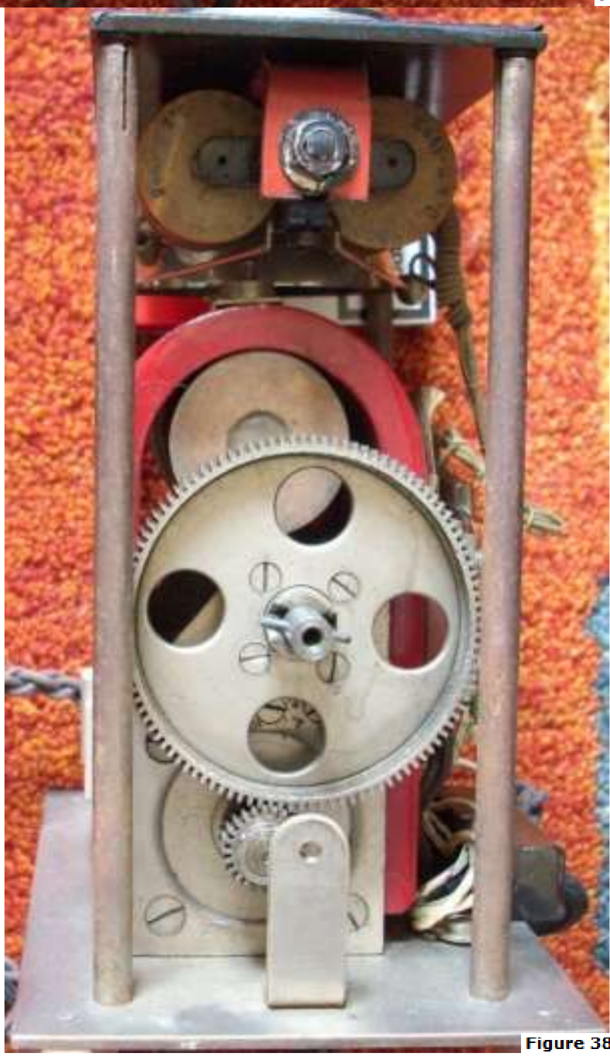

Figure 38

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Figure 39

Figure 40

The original Ö10 handset cradle is a bit classier than that of the L&S type, but it's much more susceptible to damage if the phone should fall onto the floor. It's pretty difficult to come across an original Ö10 these days, but it's especially difficult to find one with the original handset cradle[3] and handset; even the later version by L&S isn't really easy to come by with an intact, original handset. And: one should watch out that the handset guts are original as well (I have seen a few of these phones where the original handset was either gutted completely or "modified" with modern parts).

[3] Whenever the cradle of an Ö10 became damaged beyond repair, it was simply replaced with a cradle of the type produced by L&S.

The photograph on the next page shows two Ö10 magneto phones which were upgraded with Bakelite handsets; the one on the left has the original, more ornate cradle, while the one on the right has the typical L&S handset cradle.

Figure 41

The Ö10 and its successor from L&S were scrapped in *vast* numbers in the 1960s, when Austria was slowly crawling towards full subscriber dial service.

Scrap metal dealers very literally bought theses sets by the metric ton, disassembling them for the brass and copper they contained (not to mention the small amount of silver in the cradle switch contacts). This accounts for the relative scarcity of the Ö10 desk set, especially ones with the original handset, because these contained a very high proportion of brass by weight.

For some odd reason, the Ö10 and the L&S versions are cropping up for sale at eBay® in Germany (and are being offered by German collectors, not by Austrians) at the moment, but they're either only good for use as paperweights (i.e. scrap metal) or have been replated, re-painted and polished to death. The latter phones certainly *look* good, but they aren't really my cup of tea at all, because I believe that every ding and scratch a phone has is part of its own unique history, and it is exactly this history which makes every telephone in my collection distinctive. On rare occasions I *will* buy a phone that has been thoroughly restored, if I feel that the scarcity of the phone outweighs its misfortune of having been restored.

Figure 42

Here we have a demonstration model of the Ö10, which was once used as a teaching aid. It has three plates of glass so that the innards may be seen; the bell-shaped cover on the base of the cradle is also cut open so that the cradle shaft and the cradle return spring are visible.

I made mention of a "silk ribbon lightning arrestor" on the first page of this tale, and just recently purchased an old magneto wall phone which has such an arrestor, which is shown below.

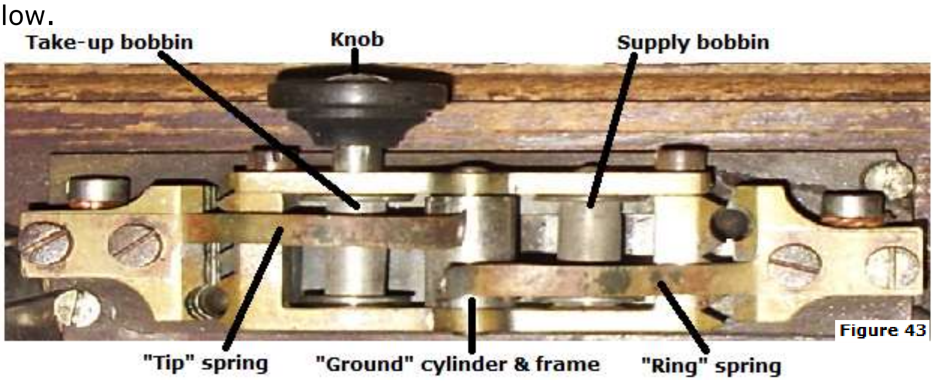

Figure 43

A silk ribbon of suitable width is wound up on the supply bobbin; it spans the "ground" cylinder and is wrapped up on the take-up bobbin. The "tip" and "ring" springs are insulated from the "ground" cylinder by the silk until lightning strikes and an induced current burns a hole thru the silk, thus allowing the relevant spring to ground the line. Turning the knob moves the ribbon to a fresh spot and clears the ground condition.

A Telephonic Time Capsule

While browsing around at eBay® in Germany, I came across the train dispatcher's phone shown below.

Figure 1

Judging from the photo, I gathered that the phone was in very good condition for its age and decided to bid on it, hoping that such phones wouldn't be in very great demand in Europe.

I had all but forgotten about it until I received an invoice from the seller, advising me that I had won the auction. I specifically requested the seller to pack the original box and the phone in a larger box for shipping, and I was very glad that I had done so later on.

After it had arrived, I found this dispatcher's phone to be absolutely perfect new old stock – there isn't so much as a single scratch or chip to the paint or on the Bakelite, and even the W.E.Co. Decal is in perfect shape (refer to the two photographs on the next page). I unscrewed the receiver cap and took a look at the unit inside … yep, a type "HA2," just as it should be. The date of manufacture was interesting: 5-27-44 (just 11 days before D-Day).

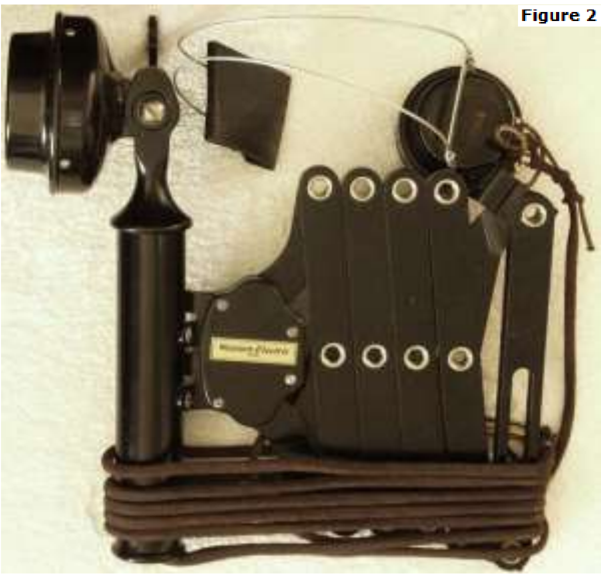

Figure 2

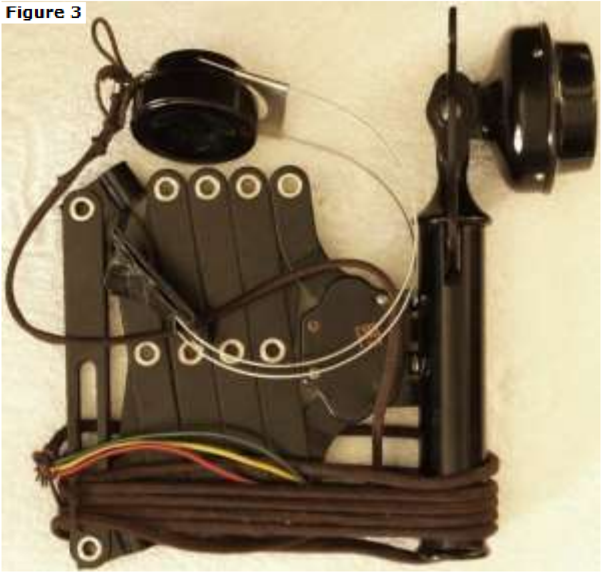

Figure 3

The original shipping box (marked "Western Electric" in the typical Hawthorn font) was first neatly wrapped in a layer of thick, waxed cloth, which was then apparently coated with a layer of brown wax, this then being protected by one or more layers of relatively thin, white paper (refer to the picture below; most of the white wrapping paper is gone, including the portion which bore the description of the contents). This is just the way one would package anything destined to be carried by ship across the Atlantic; such packing well implies "U.S. Army," and if that weren't enough, the scissor gate carries a boxed, red numeric stamp which is typical for U.S. Army Signal Corps equipment.

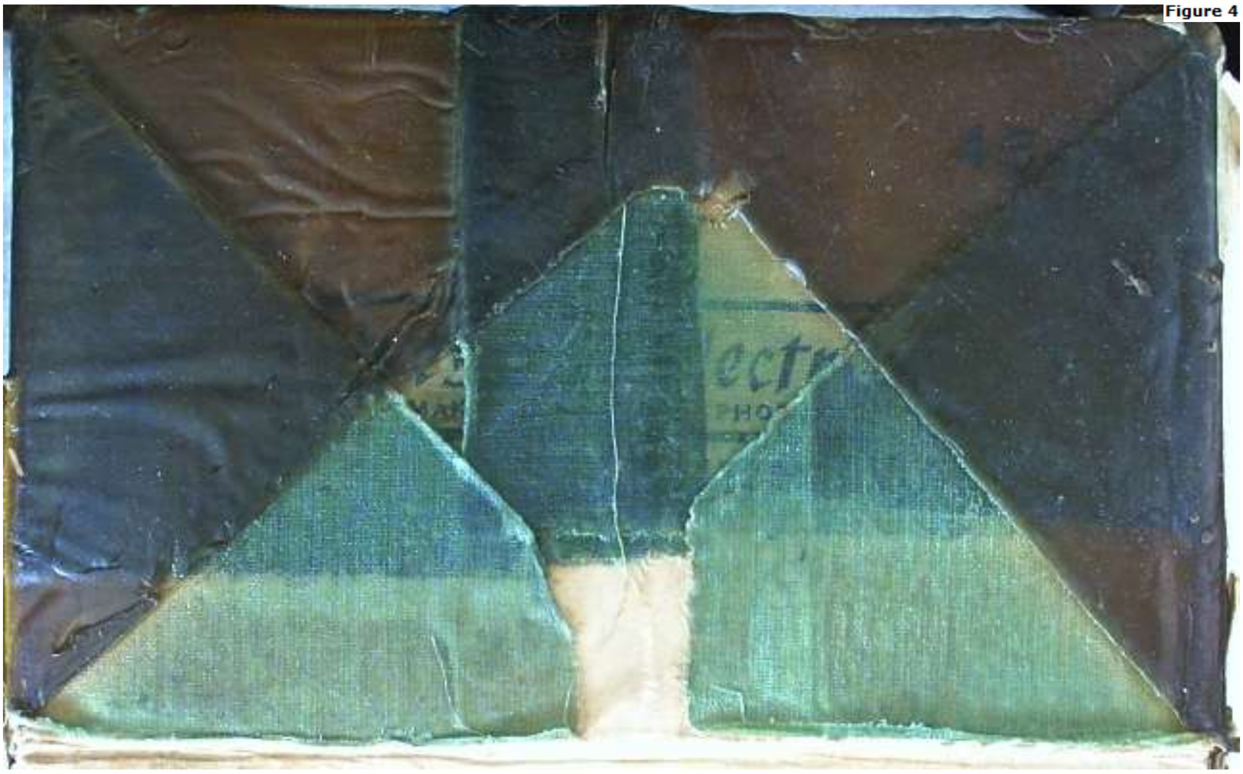

Figure 4

Fact is that the U.S. Military Railroad Service (MRS) repaired and operated the major railroad lines in occupied Europe from circa D-Day plus five onwards, even going so far as to transship steam, diesel and diesel-electric engines, as well as rolling stock of all sorts, from the States. It seemed quite reasonable to believe that the MRS would also have used American train dispatching methods and equipment, and that this dispatcher's phone found its way to Europe courtesy of the MRS.

The problem with this theory is that the MRS was already disbanded to a great extent by December, 1945, and the operation of the railroads returned to the individual national institutions, who'd obviously want to resume operations according to their own, time-proven methods, without any want or need to adopt American train dispatching methods (readers may wish to refer to the book "United States Military Railroad Service – America's Soldier-Railroaders in WWII," ISBN 1-55046-021-8 for more information).

Although it isn't known how and when this dispatcher's phone first fell into civilian hands, one could speculate as to whether or not it sat around in some U.S. Army depot in Germany until someone (maybe only recently) decided to clean up or went through the property books and weeded out some obsolete equipment. Maybe it just happened to "fall off the back of a truck" on its way to some European depot in 1944?

Owing to the exceptionally good condition the phone was found in, I believe that the original waxed packaging had remained sealed these 70+ years, only to be opened in order to shoot the photographs used in the auction. All the original paperwork is present, as is a sealed envelope with the cord clips, and even the large cloth bag of desiccant is still there.

Figure 5

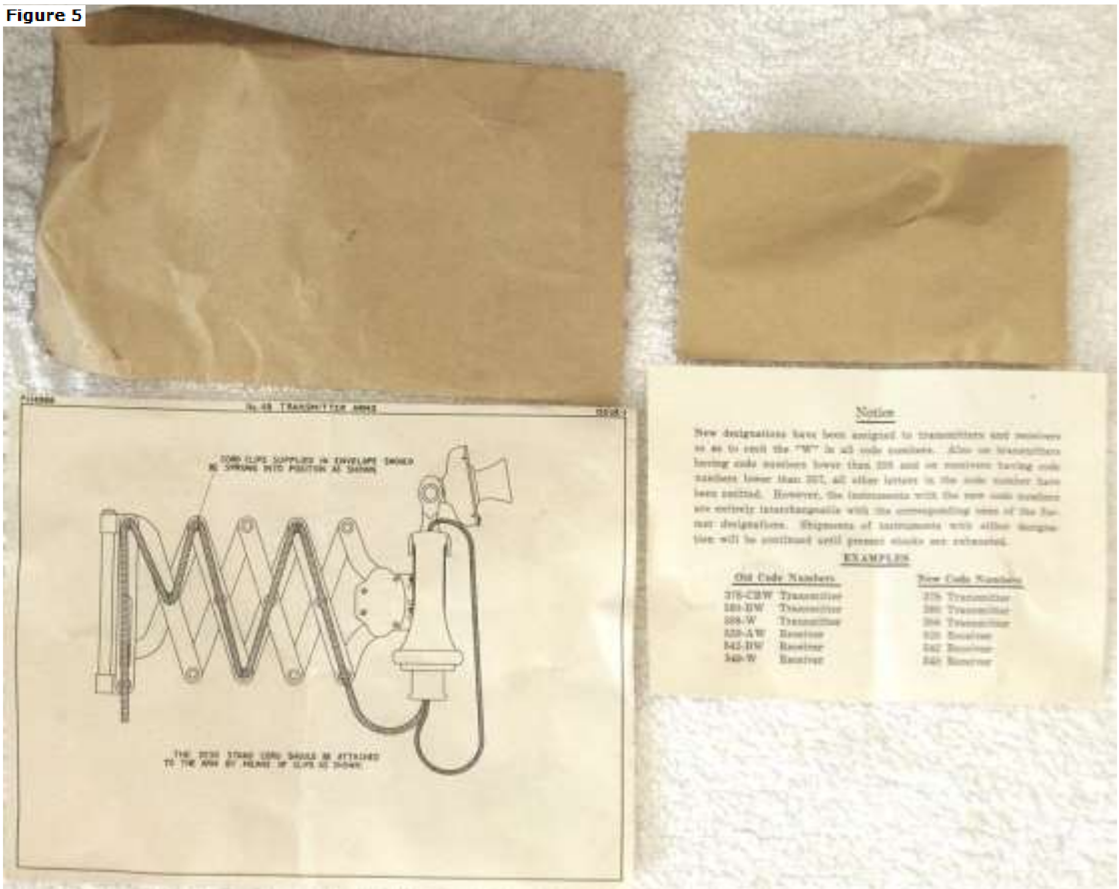

Figure 6

Notice

New designations have been assigned to transmitters and receivers so as to omit the "W" in all code numbers. Also on transmitters having code numbers lower than 395 and on receivers having code numbers lower than 557, all other letters in the code number have been omitted. However, the instruments with the new code numbers are entirely interchangeable with the corresponding ones of the former designations. Shipments of instruments with either designation will be continued until present stocks are exhausted.

EXAMPLES

Old Code Numbers		New Code Numbers	
378-CBW	Transmitter	378	Transmitter
380-BW	Transmitter	380	Transmitter
388-W	Transmitter	388	Transmitter
539-AW	Receiver	539	Receiver
542-BW	Receiver	542	Receiver
549-W	Receiver	549	Receiver

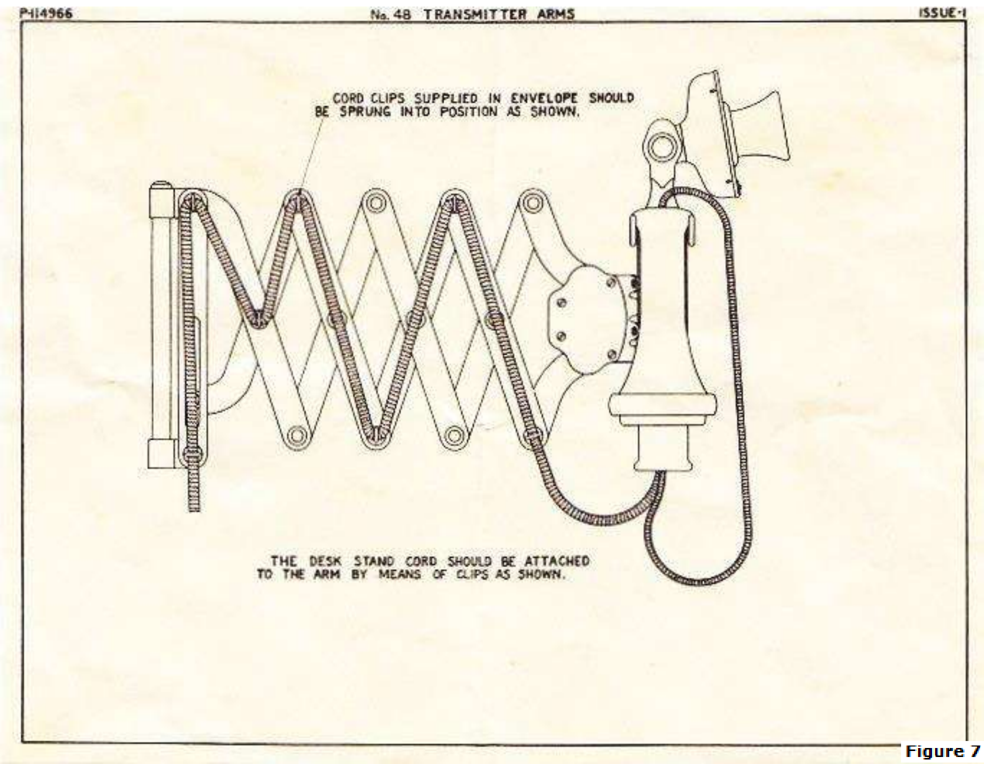

Figure 7

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The original type “2C” transmitter arm bracket was also included; the rod end of the bracket is the only component showing any signs of corrosion or other damage.

Figure 8

Funny thing is that I had bought a suitable type 501B subset at the flea market here at Vienna a few years ago (the price was right – and it’s a rare occurrence to find original W.E.Co. stuff hereabouts). The subset was missing four of the terminal screws, the four screws which hold the cover and also the foot switch, as well as being well-worn as far as the wood goes, but at least it was a basis from which to build up a complete and functional train dispatcher’s set one of these years.

On the other hand, I have been very lucky a while back because I came across a NOS 501**A** subset (this one has a pushbutton instead of requiring a foot switch) which I was able to buy for a fair price. I am most pleased because it, just like the phone, has a red Signal Corps acceptance stamp on it, thus making it a perfect match for the phone.

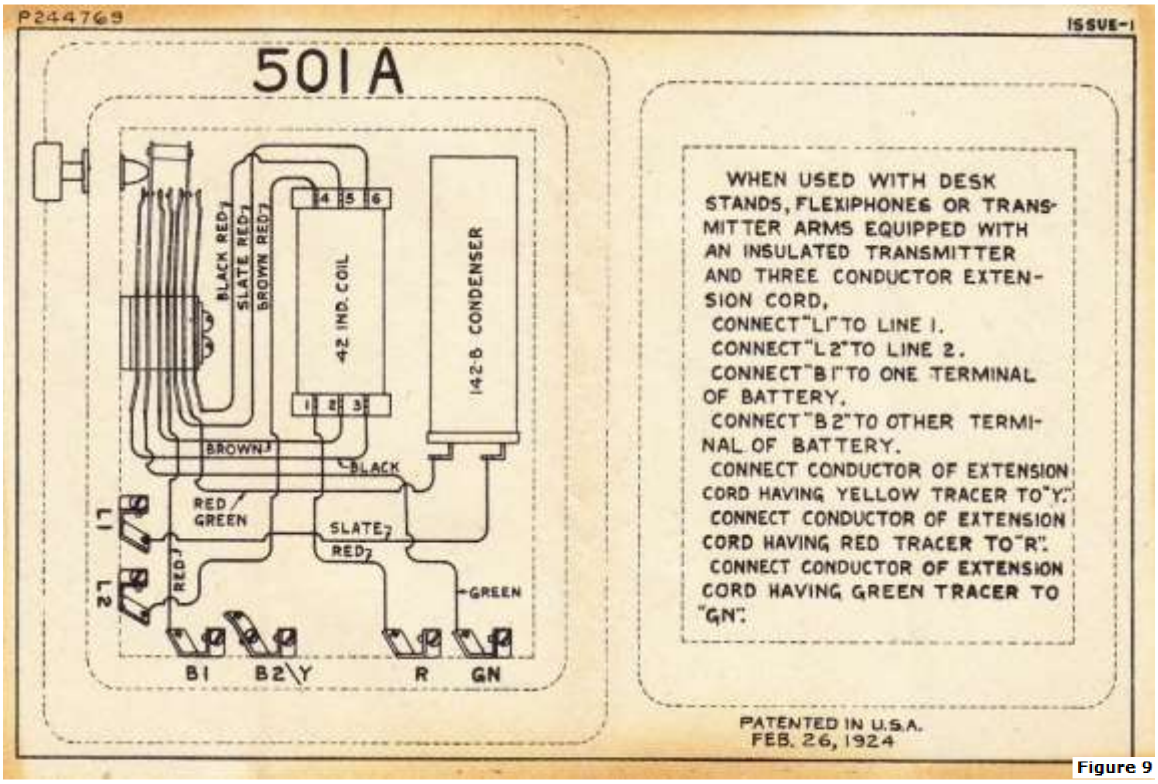

Figure 9


Figure 10


Figure 11

From the USSR – a True Lend-Lease Field Phone

I chose the word "true" in the title because, although I have seen a few *purported* lend-lease field phones up for auction at eBay® in the USA, not one of them really *was* a lend-lease field phone – their schematics and wiring diagrams had English designations and markings, while *true* lend-lease field phones sold or otherwise handed over to the USSR all had the diagrams, schematics and binding posts with **Cyrillic** lettering. Personally, I doubt that any lend-lease field phones sent to the USSR via convoy ships during WW II ever really found their way back to the States.

I bought the EE-108 lend-lease field phone that this tale is about from a dealer at the largest flea market at Vienna; the dealer is a citizen of Lithuania (which was part of the former USSR) and he (supposedly) bought this phone from a retired major of the Soviet army and brought it to Vienna in order to make some money ….

I searched the internet for the term "EE-108" and only had 3 hits related to this field phone within the first 500 suggested links, so there isn't too much information available out there in cyberspace.

What rather bothers me is that the United States not only sold sound-powered field phones to Soviet Russia, but also standard Signal Corps EE-8 and EE-8A, as well as IAA-44 field phones (these are all battery-powered). The reason this bothers me is the obvious waste of shipping space which was required to ship hundreds of thousands of size "D" cells to the USSR to keep these three types of field phones running … imagine the immense logistic problems caused by having to transship and distribute these "D" cells all the way down to the lowest field units of the Soviet military. Dry cells will freeze at arctic temperatures and stop supplying current, which is certainly very counterproductive. This speaks against using battery-powered field phones in Russia (or anywhere else very cold) ….

Sound-powered field phones seem to be a much neater solution … and yet, from the scant information available, it appears that only circa 75,000 EE-108 field phones were shipped to the USSR between 1942 and 1945 (out of the 80,771 units which were manufactured).

Anyway, it appears that the EE-108 field phone was specially designed and manufactured for sale to the Soviet Union, because it *isn't* listed as standard equipment in Technical Manual I 11-487, entitled "Electrical Communication Systems Equipment" dated October, 1944. However, the EE-108 *was* listed in a War Department document, entitled "Lend-Lease Shipments, WWII," which was printed in December, 1946 … it's to be found under the heading: "EE-108, battery less." I believe it's safe to say that the EE-108 was never U.S. Army Signal Corps equipment – this is also borne out by the fact that the leather carrying case of the EE-108 only has the embossed text "Telephone EE-108", while the EE-8, -8A and -8B carry the additional text "U.S. Army Signal Corps."

Figure 1

While the U.S. Army experienced problems with the original leather case of the EE-8, -8A and -8B gathering mildew and then rotting away under conditions of high humidity, such as those in the Pacific Theater of war (this was the reason for the subsequent move to canvas carrying cases), those destined for Russia had a leather case.

One source on the internet claims that the leather cases were originally made out of kangaroo hide (of all things), but that this was later changed to cowhide due to a supposed shortage of kangaroos …(?)

I don't know whether or not my EE-108 has a case made of cow or kangaroo hide, but I do know that the leather was so heavily cured that verdigris still forms around the various brass fittings and screws after all these years… which means that one mustn't forget to wash your hands with soap and warm water well after handling such phones, because verdigris is *very* poisonous.

Figure 2

Although only barely visible in the photograph above, the inside of the cover is embossed with the text "Connecticut Telephone & Electric Corporation" (which was originally in silver color). This field phone was built under order number 4044-PHILA-43; hence, this specific unit was built in 1943.

Figure 3

Figure 4

All of the screws which secure the telephone unit inside the case are in the exact same spot as they're on the EE-8 &c. type phones … even the metal plate surrounding the magneto crank is of the same size and in the same location. The most obvious differences between the EE-108 and the EE-8 are that the EE-108 has a different handset, has a handset cord with only two conductors (instead of three) and that the Bakelite binding post plate doesn't have a L.B./C.B. switch screw. As may be seen, the *back* of the leather case is very splotchy – I wonder if any of those stains are ancient, dried blood?

Figure 5

The EE-108 has a separate screw-down terminal for a ground wire as well as a push-to-test switch for the ringer.

What I find most unusual is that the Bakelite plate has a red acceptance stamp on it, just as any other bit of U.S. Army equipment would have … why on earth would a non-Signal Corps phone, destined for the USSR, have a U.S. military acceptance stamp? Beats me … it was probably stamped by mistake.

The leather case has a cutout for the 3 prong jack found on the EE-8, so the case was probably originally intended for EE-8s.

The size and shape of the housing for the telephone unit itself is the same for the EE-108 and the EE-8, and even the internal arrangement of the components is very similar. The major differences here have to do with the lack of an induction coil (the empty space above the magneto) and the use of the space where the "D" cells are in an EE-8.

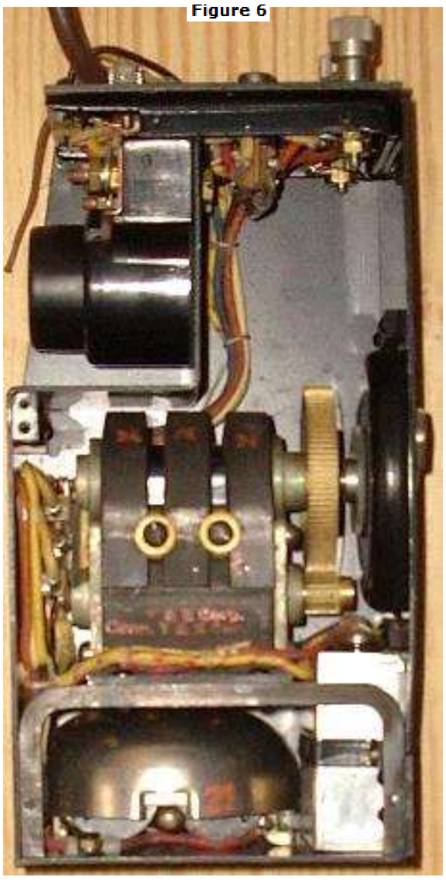
Figure 6

The unit in the "battery" space is a carbon block lightning arrestor; this is the reason why the EE-108 has a binding post for a ground wire.

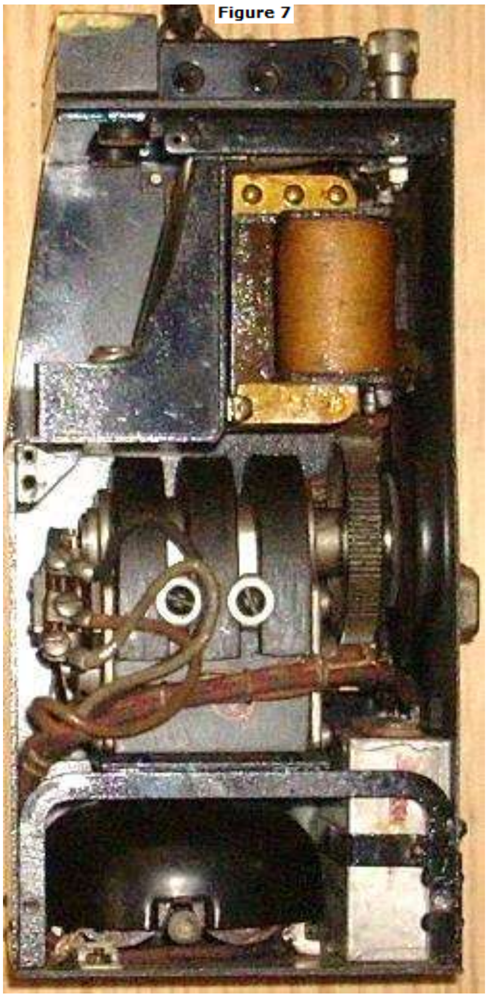
Figure 7

The EE-108 doesn't have the 3-pin handset jack of the EE-8, and the cradle switch is also missing. The latter is obviously not necessary in the EE-108, since there is no talking battery to be switched on or off.

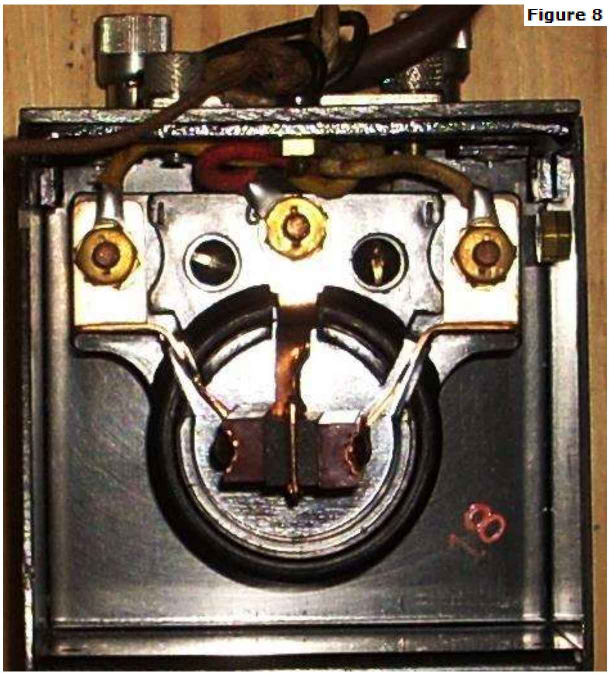
Figure 8

The lightning arrestor is mounted in a relatively deep Bakelite well and is normally covered with a brass cap painted flat black. One half of each arrestor is a carbon block, while the other block is an insulator which has a recessed copper strip which forms part of the spark gap. The outer side of this block is copper.

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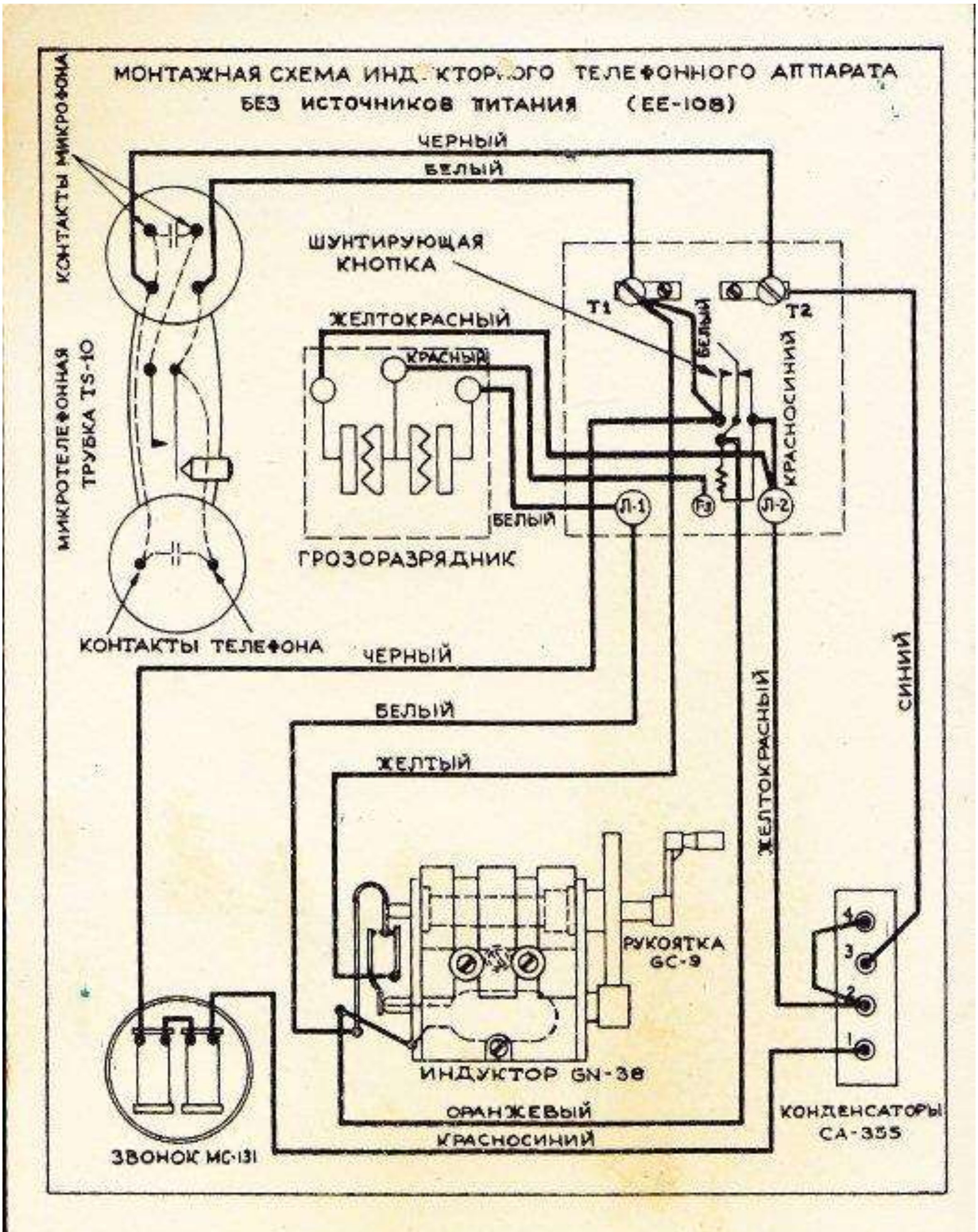

Figure 9

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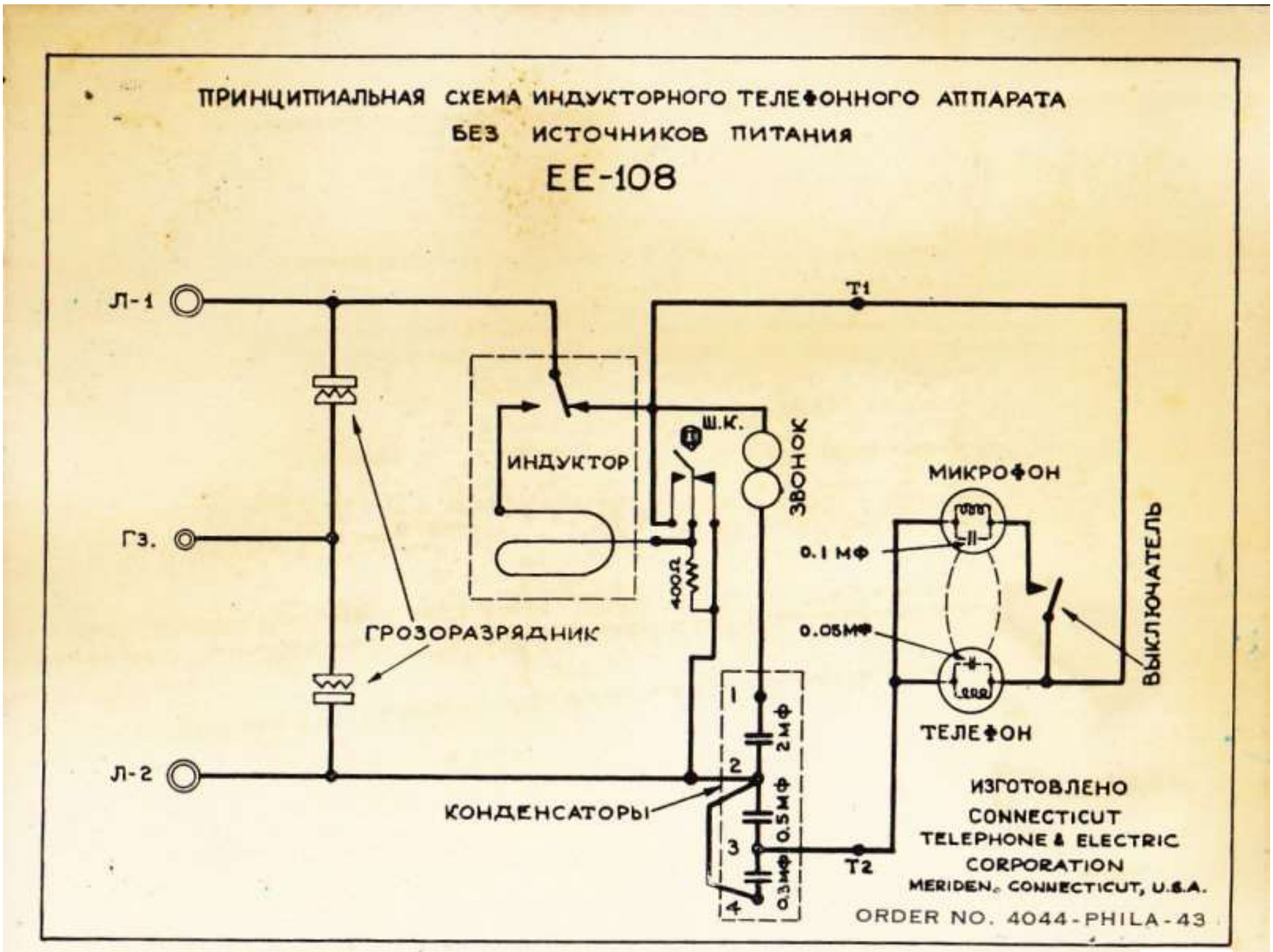

Figure 10

Supposedly, the U.S. *Army* supplied the USSR with over 300,000 EE-8 &c. field phones under the lend-lease program, while the U.S. *government* provided circa 75,000 EE-108s under the same program. Considering how many of both types were provided during WWII, it's rather surprising that not all too many of the various types have apparently survived to date. At least, I have not seen an EE-108 field phone (excepting the one in my collection) for sale on any eBay® site, nor at any flea market at or near Vienna since I started collecting telephones. The only other EE-108s I have ever seen were on the 3 web sites I found while researching this field phone.

In the year 1940, I.T.&T. set up a telephone division in Newark, New Jersey, in order to replace manufacturing capacities which were lost when associate companies in Europe were occupied by Axis forces. The telephone product line was almost exclusively engaged in producing portable field telephone equipment for the U.S. Army Signal Corps and became the largest producer of the EE-8 field telephone sets in the USA. *The telephone division also designed and manufactured a Russian type field telephone set which used many of the components of the EE-8*. The original information may be found on page 229 of Volume 23, number 2 of "Electrical Communication," dated June 1946.

The World's Most Complicated Dial?

It's a few years back that I bought myself a nifty, desktop, local-calls-only German pay phone, known by the German Bundespost (German Federal Post [Office]) designation TlnMü55b (**T**ei**ln**ehmer **Mü**nzapparat **55b** – subscriber pay phone model 1955b); its predecessor, whose dial could only block long distance calls and calls to the operator, was designated as the TiMü33 (**Ti**sch **Mü**nzer **33** – desk pay phone model 1933). The TiMü33 accepted one 10 Reichspfennig coin for local calls, while the TlnMü55b required two coins of 10 Pfennig each. The TlnMü55b was in service until circa 1975, when metering of local calls was introduced by the German Bundespost. This type of pay phone was most commonly used in bars, bistros, coffee shops, guest houses and the like.

This pay phone has two separate locks – the one on the front of the phone keeps the coin drawer shut, while the one on the right-hand side is used to bypass the coin collector, so that the proprietor could place calls without having to insert coins.

Figure 1

The handset cradle is damped by a dashpot (it takes roughly one second for the handset cradle to move from the on-hook to the off-hook state and vice-versa), so that adept jiggling of the cradle can't be used to dial a telephone number; this method of "dialing" would've bypassed the special dial this pay phone uses.

The special dial is referred to as a "Sperrnummernschalter" in German; this literally translates to "blocked number dial." The term refers to several special features, among which is an inertial switch which will short-circuit the impulse contact and thus prevent the dial from sending pulses if one retards the speed with which the finger wheel returns to rest. This inertial switch will then remain closed until the handset is hung up and the dial physically reset. Another feature is that the dial is mechanically blocked and can't be operated as long as the handset is on-hook.

The blocked number dial has two independent "blocking banks." Each of these consists of a stack of three contact arcs (the lowest arc is defined as decade 1), in which two-part wiper arms are moved. The wiper arms for both contact banks are mechanically linked together, but are electrically isolated from each other.

These are used to program the dial to reject specific prefix numbers by shorting out the impulse contacts. Contact bank number 1 is used to block phone numbers *not* beginning with zero (such as 9, 113 & 114) while contact bank number two is used for blocking long distance codes (such as 0 and 010; refer to the drawing & text on the next page).

Dialing the first three digits of *any* phone number causes the 3 wiper pairs to individually move to the appropriate contacts which correspond to the digit dialed. If any one of the 3 wiper pairs comes to rest on a set of arc contacts which are shorted together by a blob of solder, then the corresponding series of dial pulses is shorted out. Short-circuiting the tenth contact pair in the first level of bank number two effectively prevents anyone from dialing a leading zero (national long-distance access digit); this is a highly effective method of ensuring that the pay phone is "for local calls only," without requiring any special circuitry in the CO.

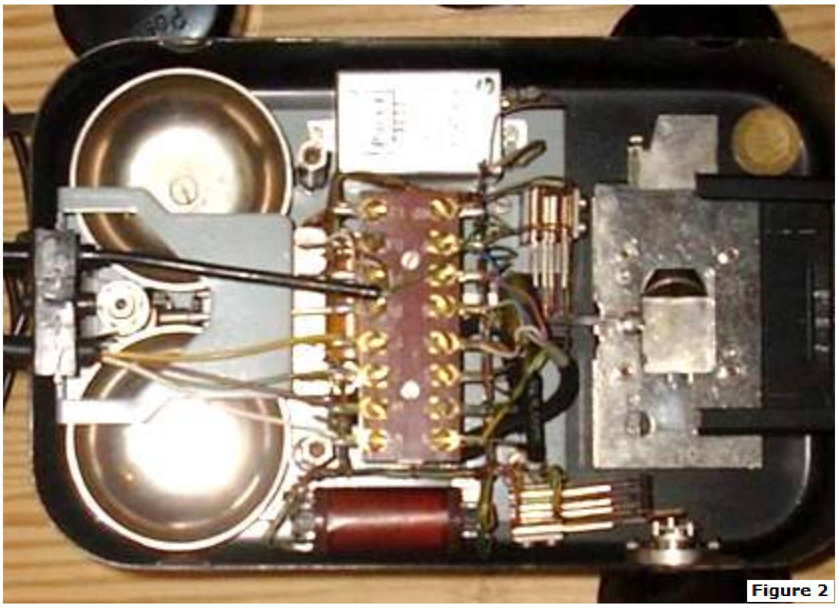

Figure 2

These wiper arms are individually moved according to the first three digits dialed and come to rest on the contacts representing the respective digits. Thus, they set up a conductive path between the solid "a" contact arc and the individual "c" contacts within the respective contact banks. Full segment arcs "a" of both blocking banks are electrically connected in series and represent the input. The contact arc "b" of all three levels of the *first* blocking bank are wired together and are used as the output.

If there is a conductive path between input and output in any one of the blocking banks, the impulse contact of the dial is shorted, thus preventing the call from being completed. Such a conductive blocking path is set up whenever the tongue of a "c" arc contact is soldered to the relevant "b" arc and the wiper comes to rest on the segment in question.

A circuit is prepared whenever a "c" contact of one arc is soldered to the full "a" contact arc of the successive decade, which will become active if the wiper in the *successive* decade is moved to the proper position via the digit dialed.

For instance: say that the digits 113 are dialed. The wiper arm of blocking arc 1 comes to rest on contact 1. The "c" contact is soldered to the solid "a" contact arc in the next (second) decade. The wiper arm of decade 2 is also positioned at contact 1, and the "c" contact is soldered to the solid "a" contact arc in the next (third) decade. The wiper of decade 3 rests on contact 3 where the "c" contact is soldered to the "b" contact arc. Thus, there is a conductive path between input and output, shorting the dial pulse contact out.

Any number of "c" contacts within one and the same blocking bank may be soldered to the "b" segment of the same bank, but only one "c" contact may be soldered to the solid "a" contact arc of the *next* decade in order to prevent unintentional blocking of number groups.

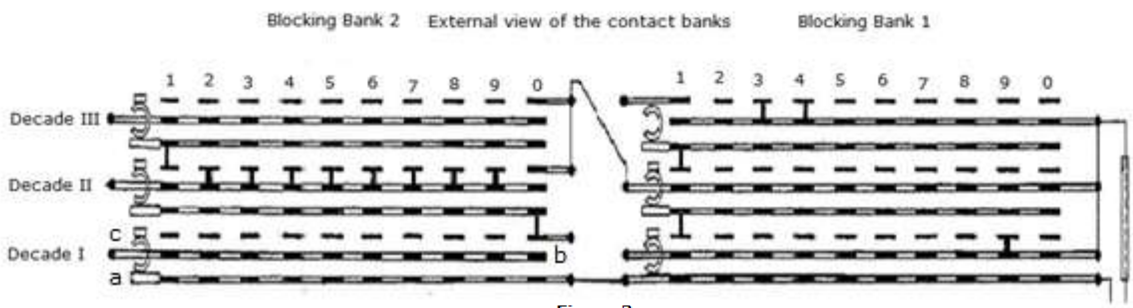

Figure 3

Blocking bank 1 is programmed to block 9, 113 & 114

Blocking bank 2 is programmed to block 00 and 010

This dial also has a slew of additional contacts not found on other dials, such as two S.P.D.T. contacts, which can be hardware programmed to individually switch over upon the first, second, third or fourth pull of the dial (irrespective of the digit dialed).

The illustrated photographs on the next four pages give readers a general overview of the mechanical complexity of this sort of dial.

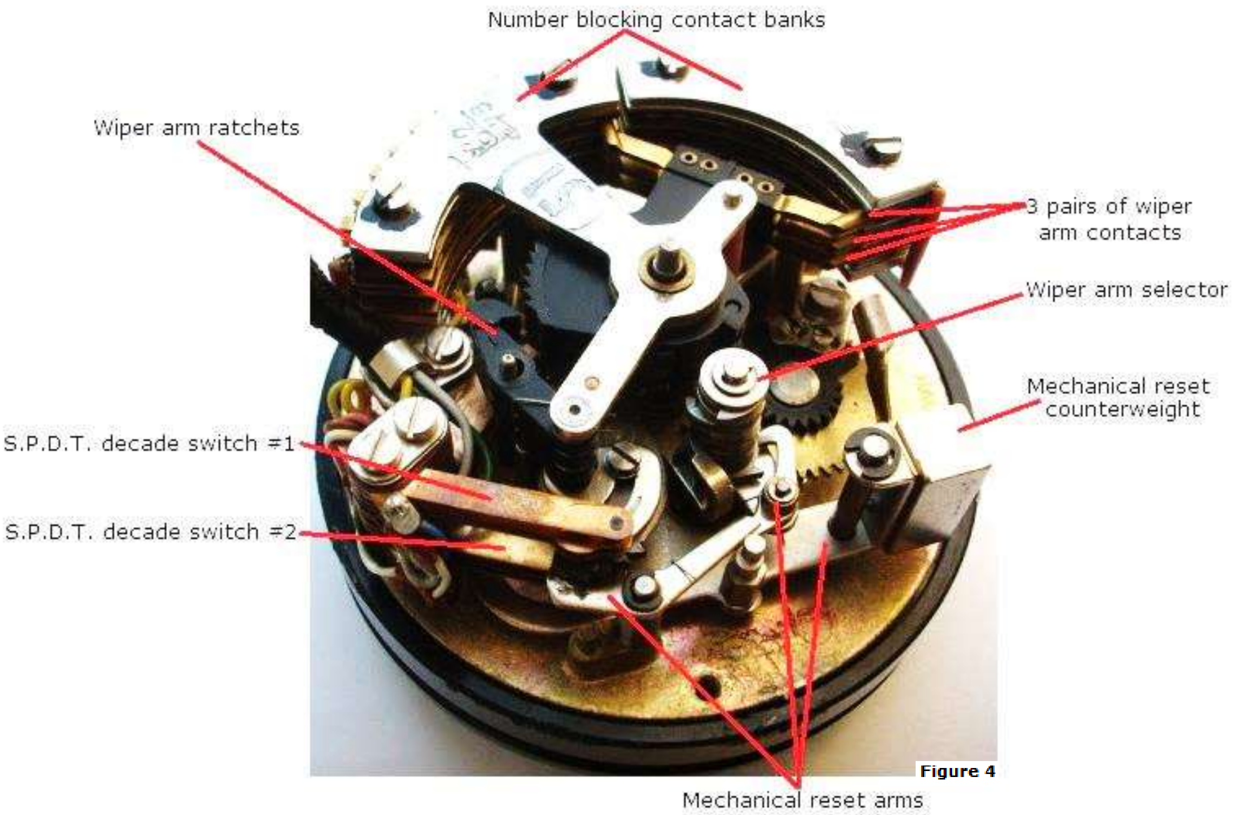

Figure 4

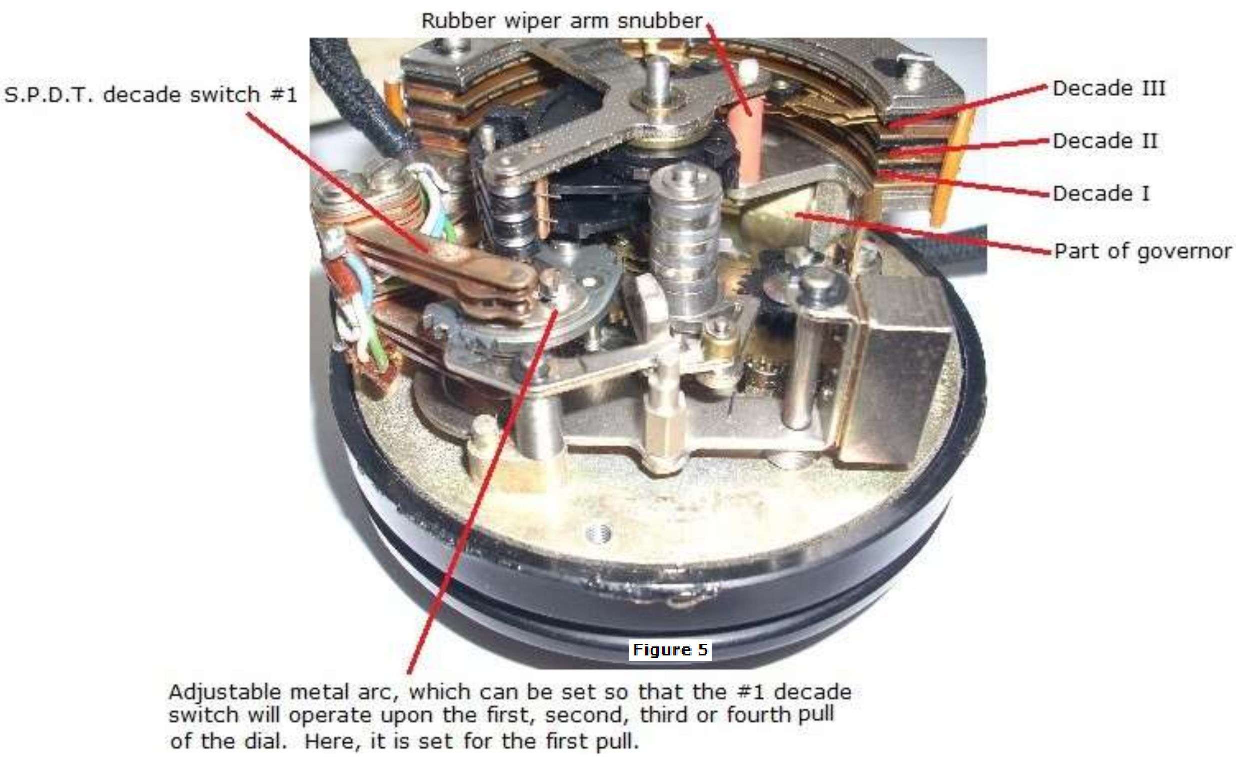

Figure 5

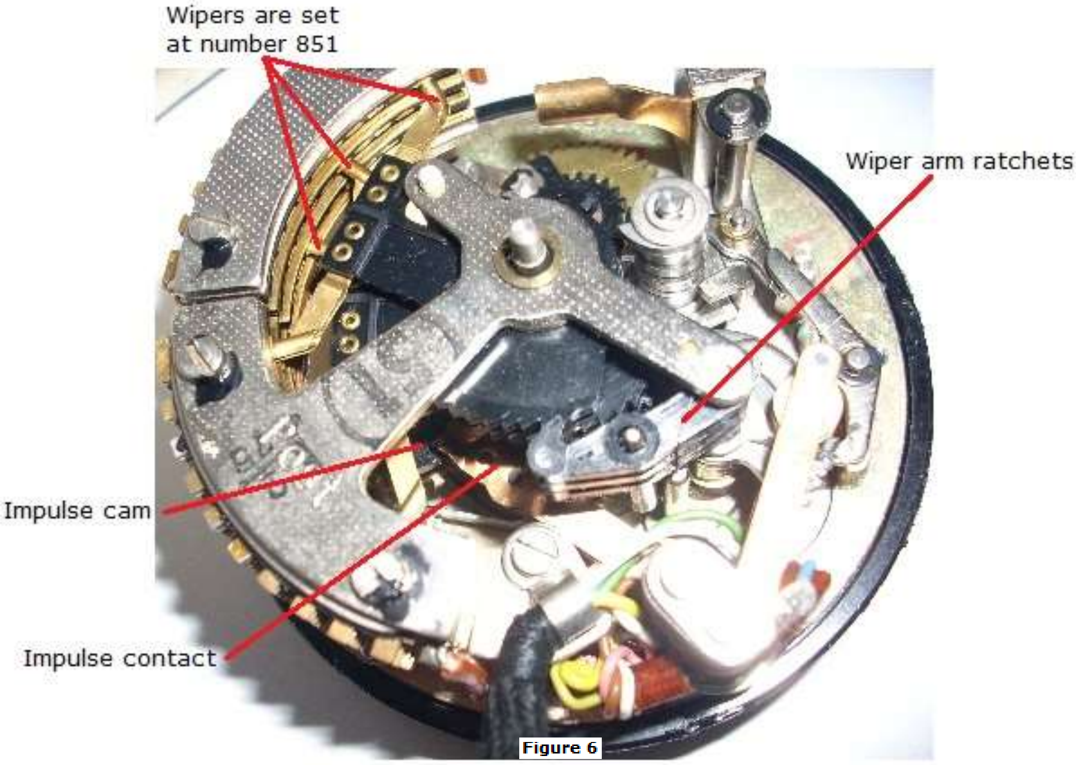

Figure 6

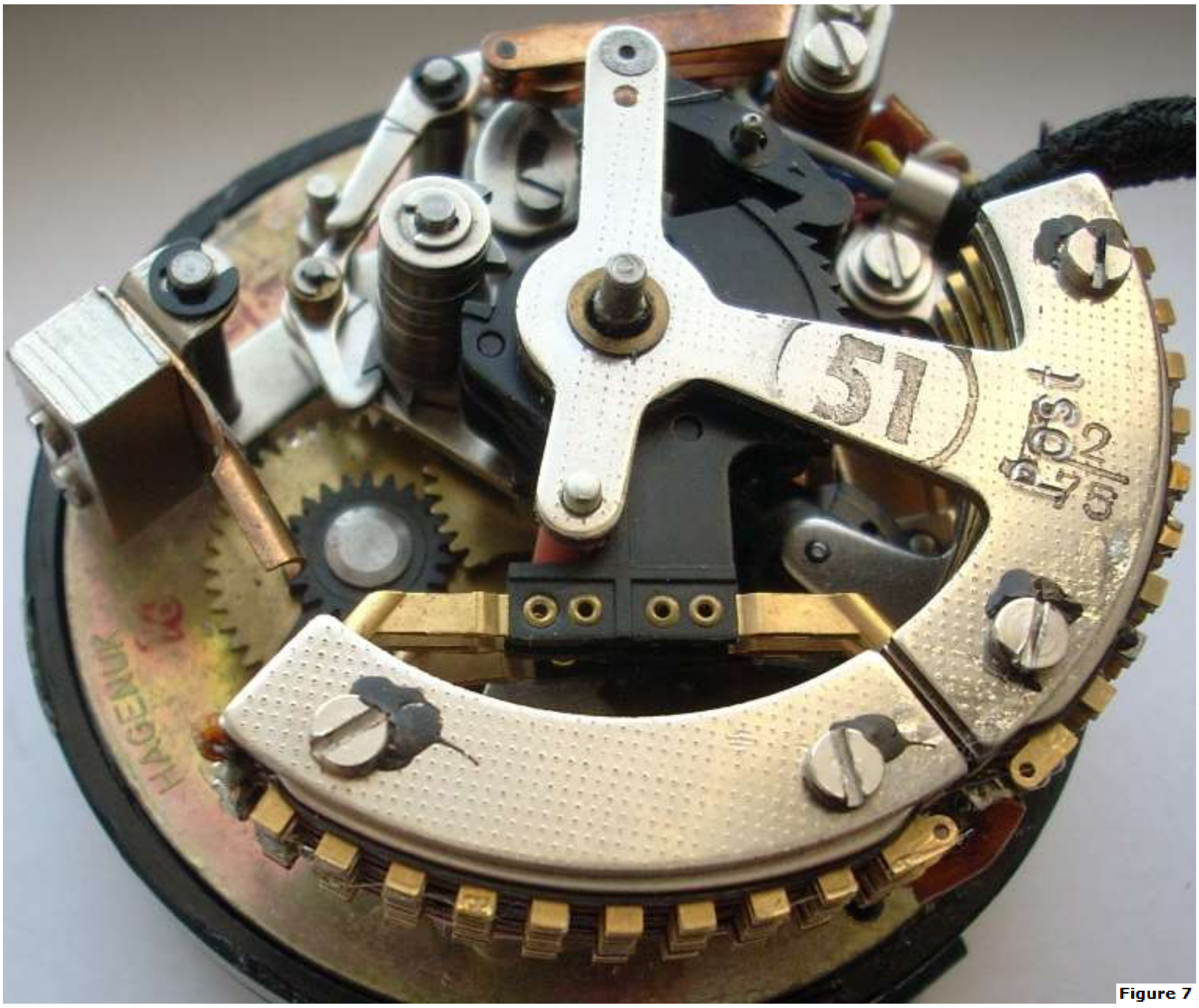
Figure 7

The wipers and the contacts in the two banks are gold-plated in order to prevent corrosion, which could cause the number blocking scheme to malfunction (the longer I look at the underside of the dial, the more I find that it has much more in common with a complicated, mechanical watch than it has with a telephone dial).

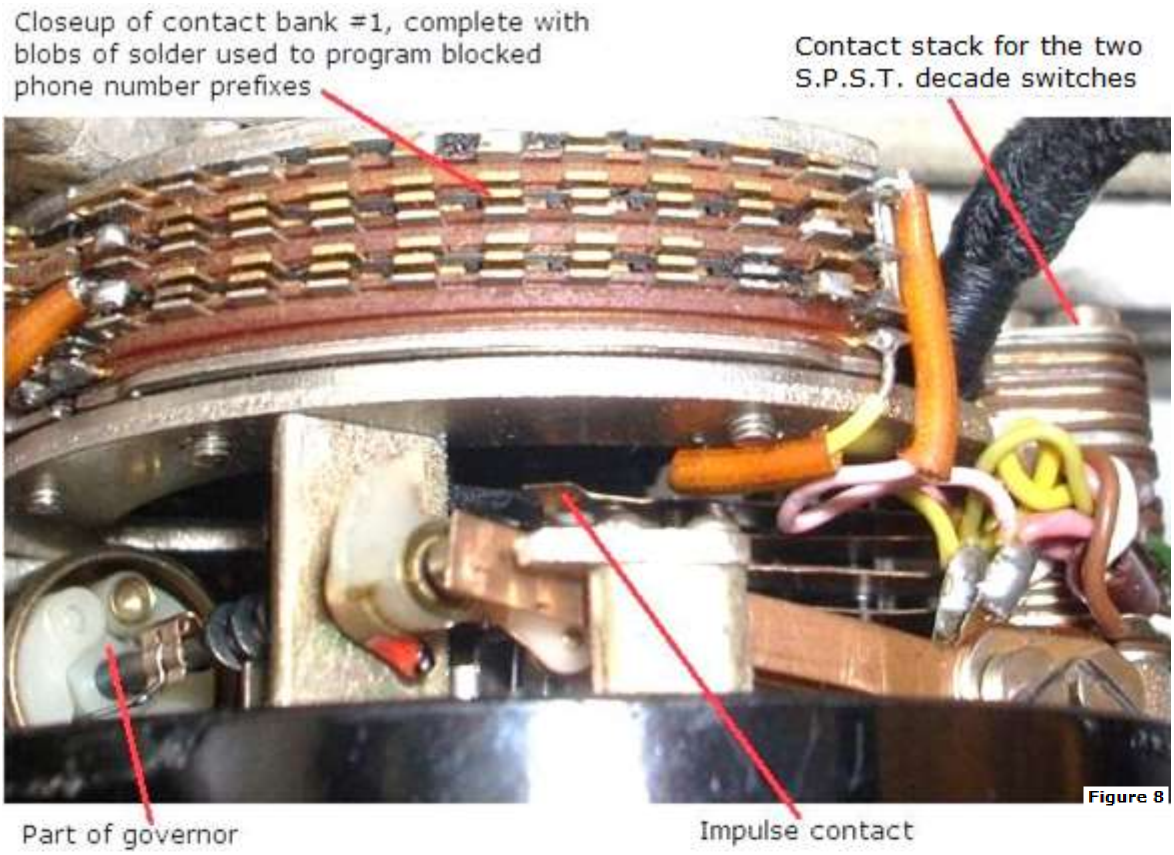

Figure 8

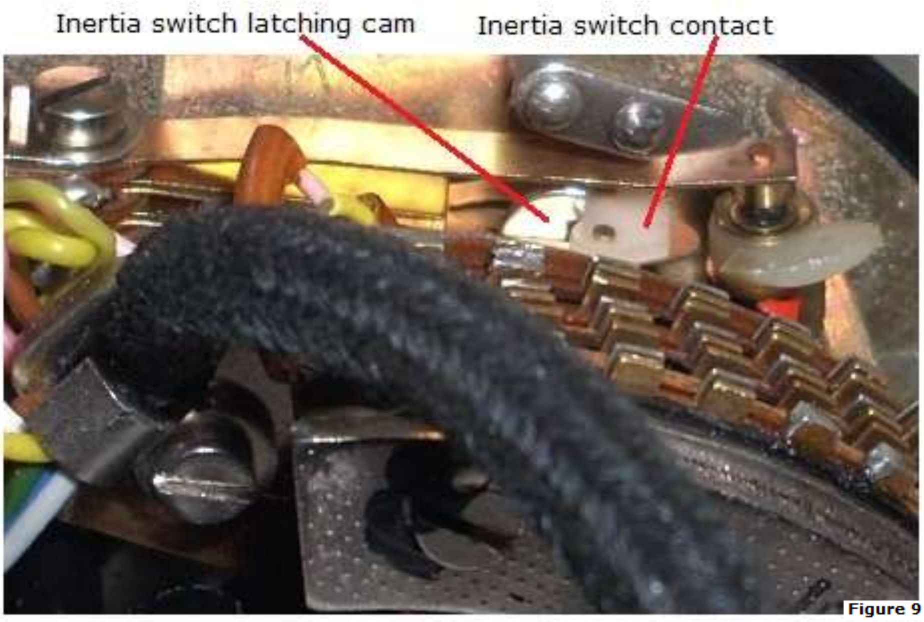

Figure 9

The two bifurcated contacts of the inertia switch have a gap of roughly 40 mils when open; the upper contact has a small bit of white plastic attached to it, so that the latching cam won't cause a short circuit to ground when activated.

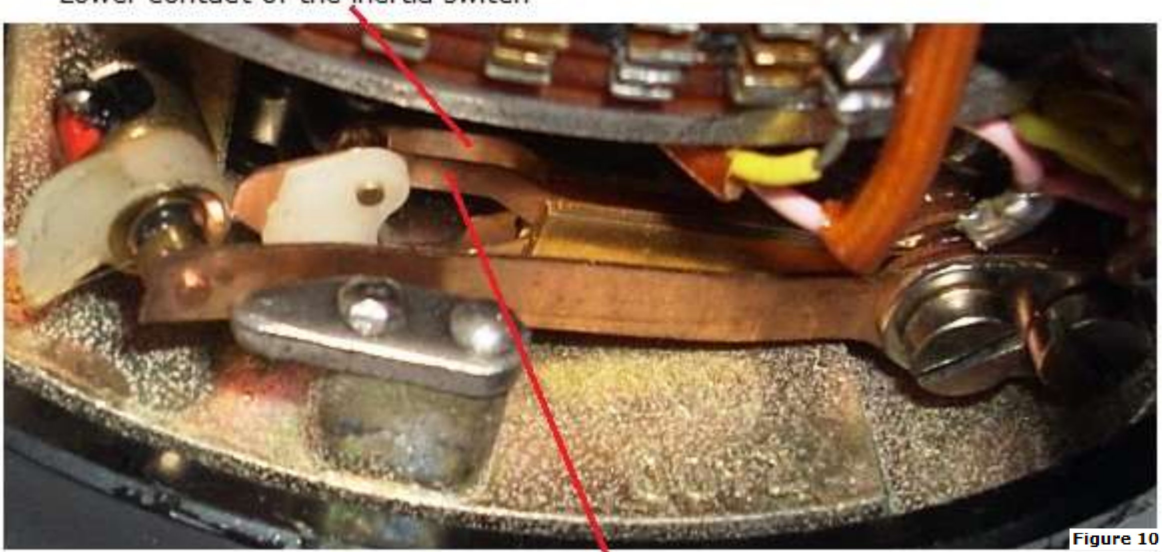

Figure 10

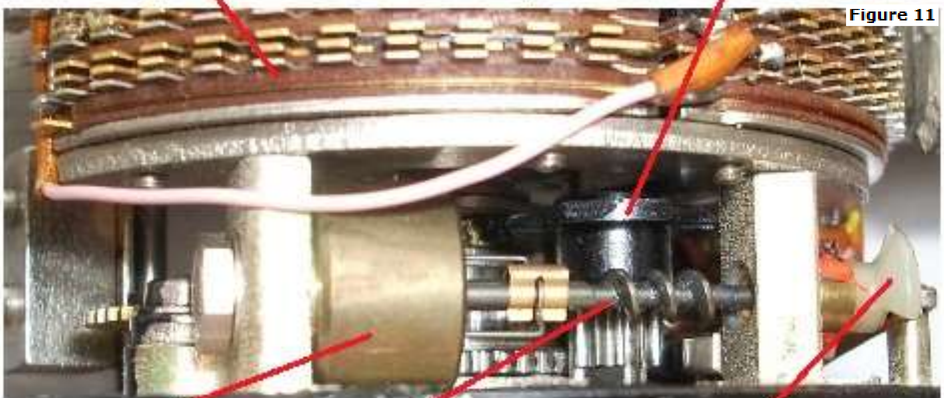

Figure 11

Anyway, now for a bit more information on the subscriber pay phone model 1955b itself. Since this type of pay phone was used at indoor locations to which there was no 24/7 access, proprietors were forbidden from hanging any form of sign in a window, on a door or anywhere outdoors, which claimed that there was a *public* pay phone inside. The coin box of your garden variety pay phone, such as ones in phone booths, &c., was regularly exchanged for an empty one by Telco employees; with the subscriber pay phone it was the proprietor who emptied the small coin drawer and paid his phone bill just like everyone else.

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The coin collecting mechanism is very simple; the coins are only checked for their diameter and thickness – no fancy stuff, like weighing the coins or checking their conductivity. One could just as well insert two washers of the proper diameter and thickness ….

Figure 12

The operating instructions translate as: "Insert 2 coins of 10 Pfennig, remove handset and dial. When the call is answered, push the left knob all the way to the right and then release it."

These instructions hint at the fact that the only thing the coin collector/acceptor did was to close the circuit for the transmitter when the coins activated a switch inside the phone, prior to falling into the coin drawer.

BTW – despite all the fancy precautions realized in the design of the pay phone dial, which were intended to prevent the placement of toll calls, there *was* one method by which a user *could* place a fraudulent toll call (without requiring the bypass key switch) – but this was only possible with very good luck.

If one were able to covertly access the wall terminal (shown to the right) and remove one of the pluggable straps, dialing the first three digits of a local number would defeat the selective lockout function of the three pairs of wipers *without* sending any pulses to the CO … after that, one would only have to replace the strap, close up the terminal box and dial a "zero" to place a toll call.

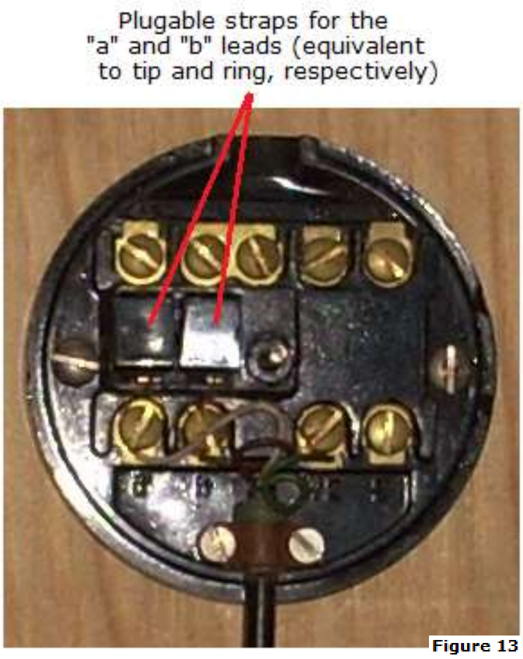

Figure 13

Opening and closing the cover on such wall terminals was very easy, since the German Bundespost required that wall terminals could be opened without the aid of a screwdriver … the cover was held in place with the aid of a knurled knob.

Readers may also wish to refer to Mr. Gary Goff's excellent "Phone of the Month" article (concerning this specific type of pay phone) in the September 2011 issue of "Singing Wires."

A Brief Description of Subscriber Station Wiring in Austria

Back in the teens of the last century, the Imperial-Royal Administration of Posts and Telegraphs took great pains when it came to the neatness of their station wiring and had twisted pairs and triplets of 1 millimeter thick copper wires, which were protected by a layer of vulcanized rubber, over which there was a braid, on stock. These twisted pairs and triplets were available in the following braid colors: white, dove gray, dark gray, olive green, brown and dark red, in order to match the room décor as well as possible. One of the wires of the twisted pairs had a black tracer woven in, while two of the three wires of triplets had either a black or an orange-yellow tracer.

These twisted pairs and triplets were usually "buttoned" onto very small porcelain knobs of similar colors as the wires themselves, and were run as nearly horizontal and vertical as possible, high up on the walls and out of harm's way. If the phone was a desk set, there were different options available for mounting the wall terminal. If the desk (or other object, such as a small table) was very near or against a wall, then the terminal was mounted on the wall at a convenient height above the floor, so as to be out of the way during cleaning. If the desk or table was near a window, then the terminal was often mounted on the underside of the same. If the desk or table (or whatever) was somewhat removed from the wall, then it was common to run the wires inside wooden, over-floor duct and to mount the terminal on the underside of the table or desk itself.

Protection of the indoor station wiring was accomplished by one of four possible methods: no protection at all, fuses and heat coils, fuses and carbon block lightning arrestors or fuses, carbon block lightning arrestors and heat coils.

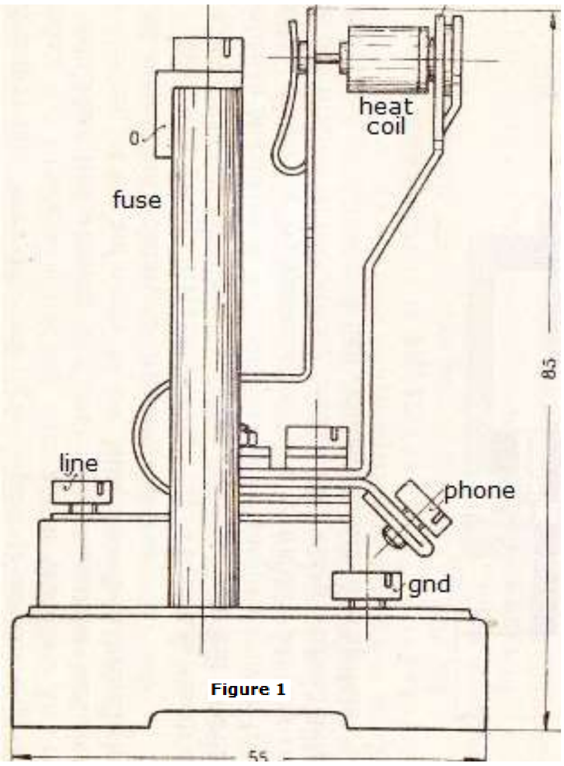

Figure 1

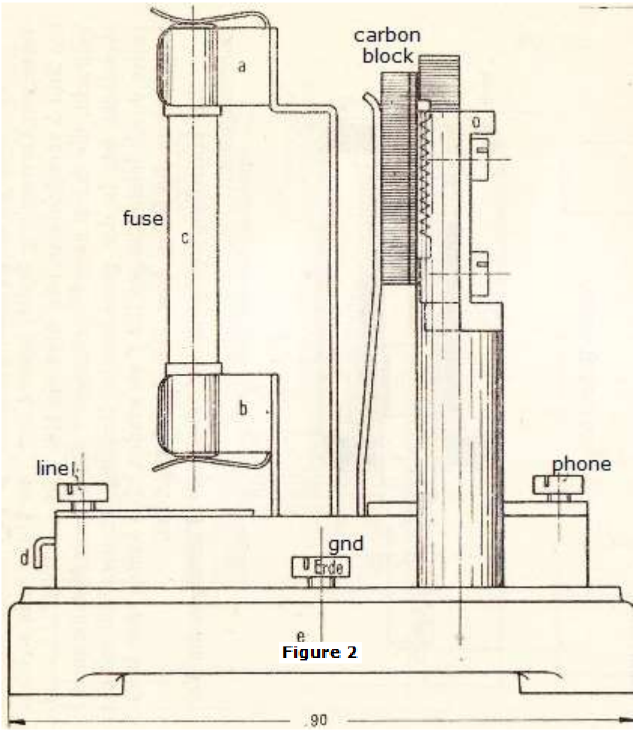

Figure 2

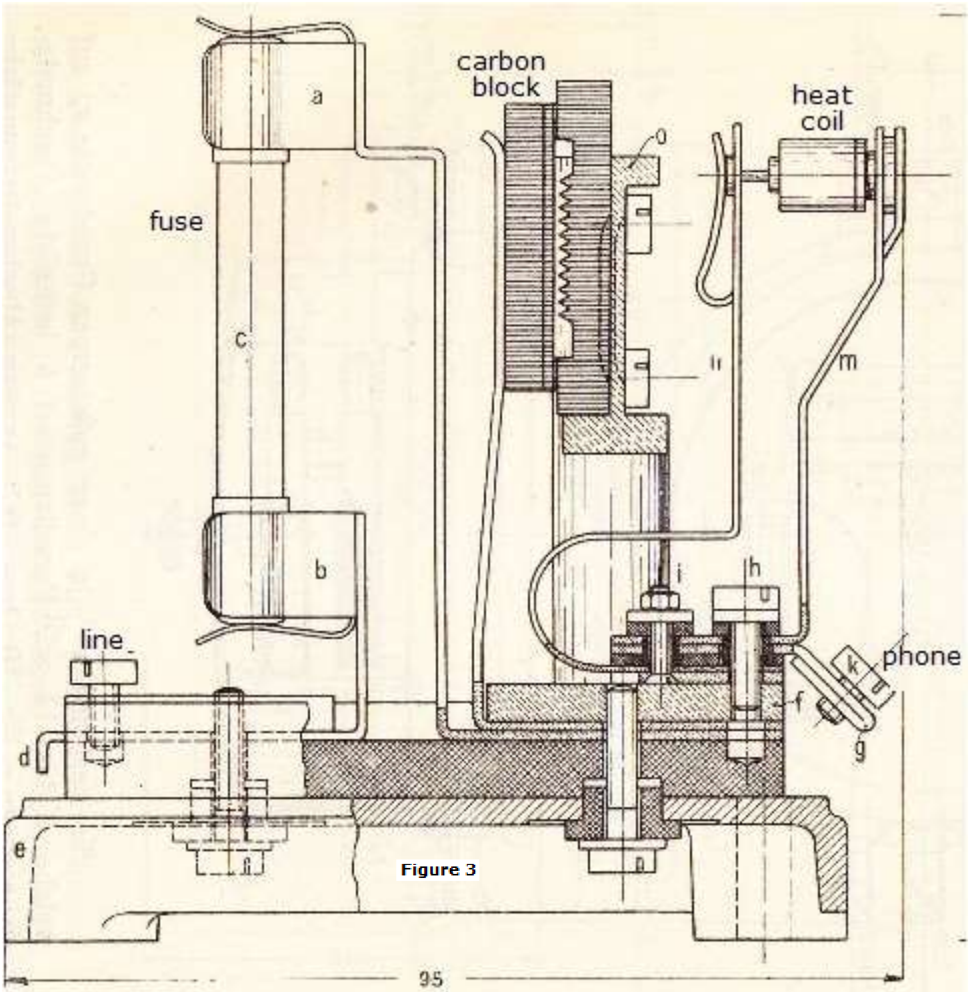

Figure 3

This drawing shows the combined fuse, carbon block lightning arrestor and heat coil protector; for some reason the original illustrator from 1912 somehow forgot to include the ground screw ….

Since the advent of the Ö10 magneto desk set as of circa 1906, the Imperial-Royal Administration of Posts and Telegraphs offered wall jacks and plugs, so that the phone could be moved from room to room[1]. The wall jack was a 6 conductor affair with a hard-rubber case, mounted in a hollow wooden block. The line cord was terminated on a matching 6 conductor plug made of hard rubber, with strips of brass as contacts. The plug barrel was originally made of nickel-plated brass, which was changed to aluminum at some later point in time.

[1] The Imperial-Royal Administration of Posts and Telegraphs only leased one phone to the subscriber, and it was next to impossible to buy a second phone from any of the OEMs, so that the problem of keeping telephone conversations within a residence secret didn't really exist at the time.

Figure 4

Figure 5

All 6 conductors of the plug and socket were used: 2 for the line wires, two for the battery leads, one for an auxiliary ringer and one ground wire (as required).

This type of plug and jack, as shown above, had one serious drawback – the plug sat very loosely in its jack because there was no latching mechanism to hold it in position. With the advent of semi-automatic telephone service circa 1913, it became necessary to design a jack and plug system for the 3-wire line cords used with semi-automatic telephones; the same basic design was then also used for the 5-wire line cords of desk magneto phones. The photographs below show the jacks used.

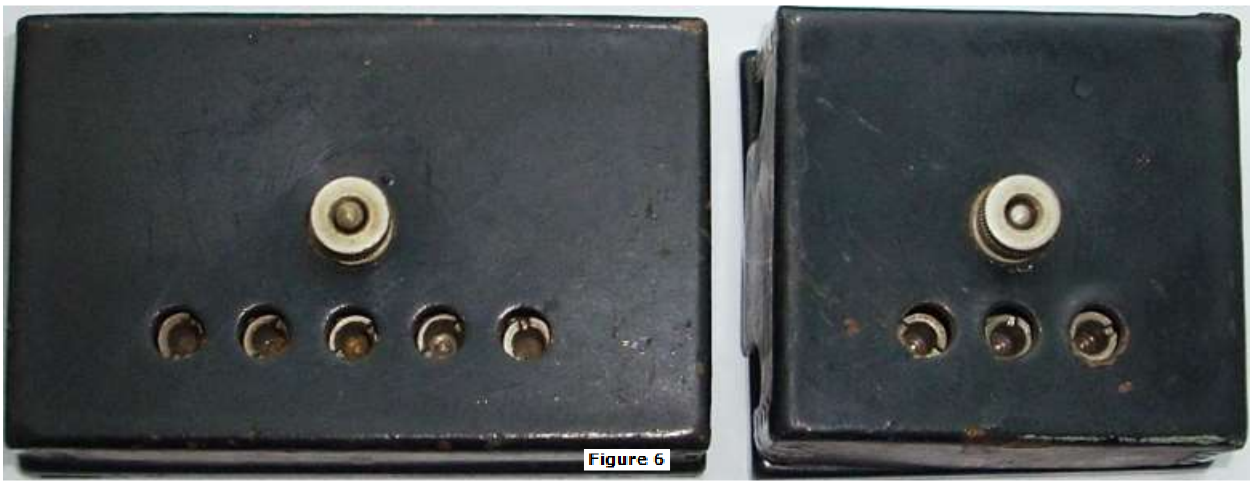

Figure 6

The covers of these wall jacks were made of stiff cardboard, which gained additional stiffness from the thick layer of black paint used and by the use of metallic stiffeners on the corners. An interesting feature of these jacks is that they could also be used as regular, screw-type terminal blocks by loosening or unscrewing the individual jack posts and either wrapping the bare ends of the line cord wires around the screw portion of the jack posts or by pushing the line cord terminal loops over the threaded portion of the jack posts and retightening the posts.

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Figure 7

Although difficult to read, the five jack posts had the following lettering *below* them: R, W, GR, Sch and G. These were the abbreviations for the line cord wire colors red, white, green, black and slate. As a matter of fact, this wall terminal had a cut off line cord, whose terminal loops were screwed down underneath the jack posts … alas, I removed this bit of line cord before taking the photographs.

This type of wall jack was used for 2 different kinds of installations, which can be told apart by the lettering *above* the five screws on the top end: A(L1), B(L2) with the letter "Z" between them, then E(G) and a(B), b(B) with the letter "N" between them. The first type of installation was that for a magneto desk set – the wires were hooked up as follows: the outside line to L1 and L2, an external ringer (or jumper) between "G" and B(L2), and the local battery to the two terminals marked "B."

The second type of installation was for semi-automatic telephone lines: the wires from the CO were connected to the terminals "A" and "B," a local ground to terminal "E" and the wires for an extension phone connected to the terminals "a" and "b"… taking the phone which was connected to this jack off-hook automatically disconnected the extension phone. The letters "Z" and "N" are abbreviations for the German words "**Z**entrale" (central office or exchange) and "**N**ebenstelle" (extension).

The reason for labeling the first three screw terminals as A(L1), B(L2) and E(G) was because of the different nomenclature used with magneto and semi-automatic service. Magneto phone lines had their pairs designated as L1 and L2 (tip and ring), while semi-automatic (and full-automatic later on) phone lines had their pairs designated as "A" and "B" (again tip and ring, respectively), while the early semi-automatic extension phones had their tip and ring letters written in lower case. Semi-automatic ground was designated as "E" (German = **E**rde).

The same 3 and 5 socket wall jacks were also produced in Bakelite (as of circa 1949) for the Austrian model W48 series of dial telephones. Since the W48 telephones were available in black, ivory, burgundy red and two shades of green, the new terminals were also available in these colors.

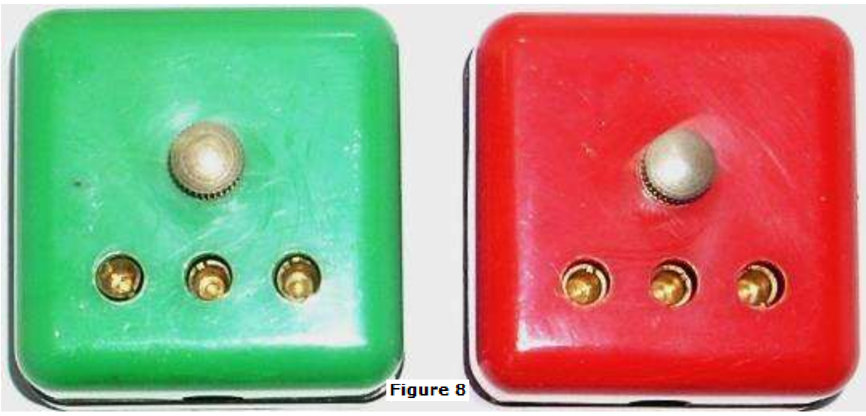

Figure 8

While the bases of the red and green wall jacks were made of Bakelite, the caps were made of a cheap thermoplastic, and since these caps are rather thin they're very fragile …. Conversely, the caps for the black and ivory wall jacks were made of Bakelite, the same as their bases.

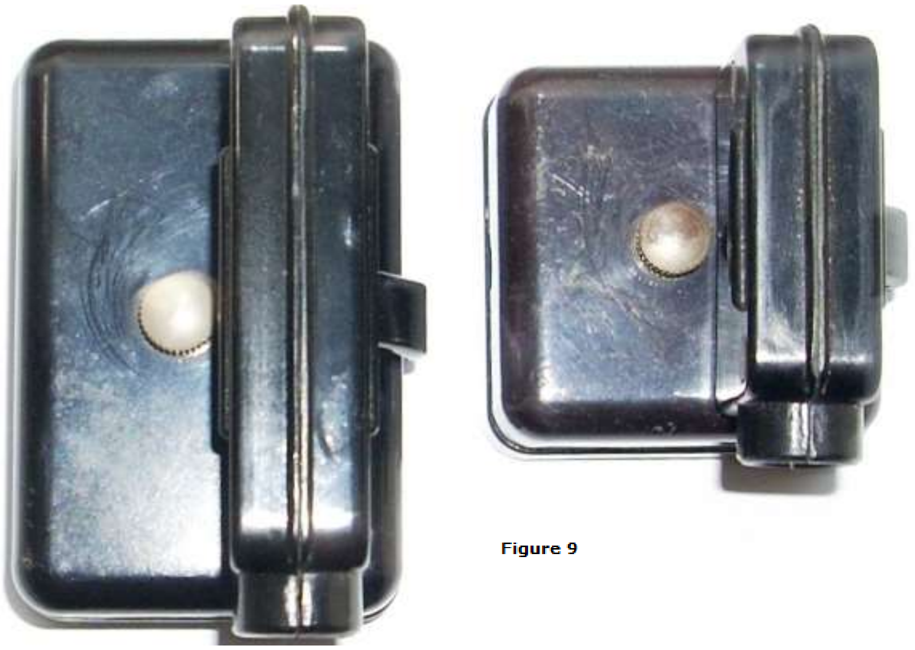

Figure 9

Figure 10

As can be seen on the black wall jacks shown above, the matching plugs have a nose on one side, to prevent them from being inserted upside down. The somewhat dirty ivory-colored cover on the right only has provisions for the holes for the three jack posts and was often used when a wall *terminal* was needed.

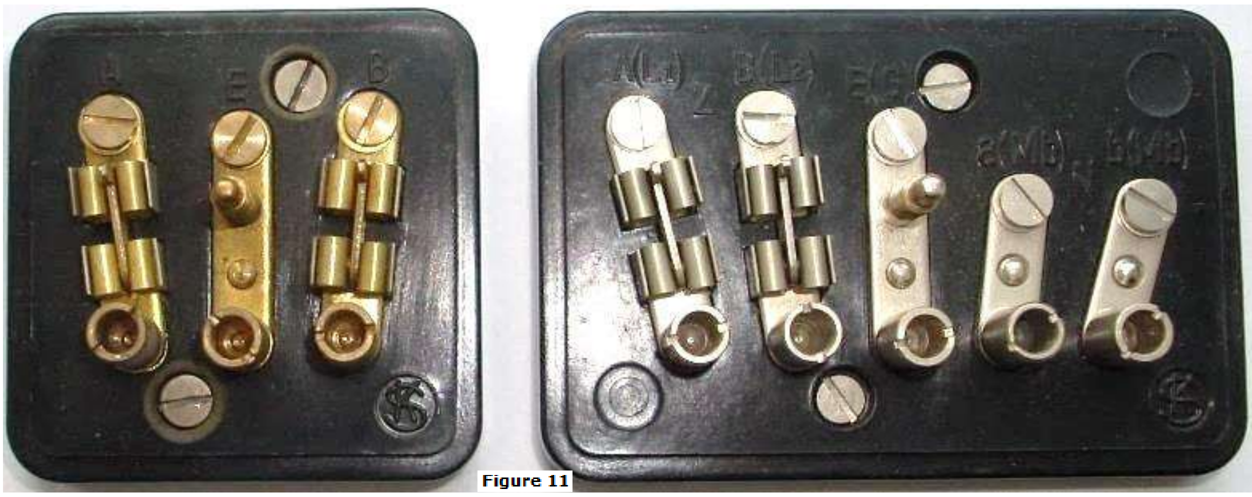

Figure 11

The lettering above the screw terminals on the left-hand wall jack read as "A," "E" and "B" respectively, while the lettering on the right-hand wall jack is practically unchanged from the early version – the only real difference is that the battery terminal designation having changed from "B" to "Mb" ("**M**ikrofon**b**atterie" = microphone battery).

Oddly enough, the more modern version of the wall jacks had movable links to open up the tip and ring jacks without having to remove the telephone line cord wires (or to unplug the phone) if line current measurements were necessary. This simple method for opening tip and ring was first put into use in Germany in the 1930s.

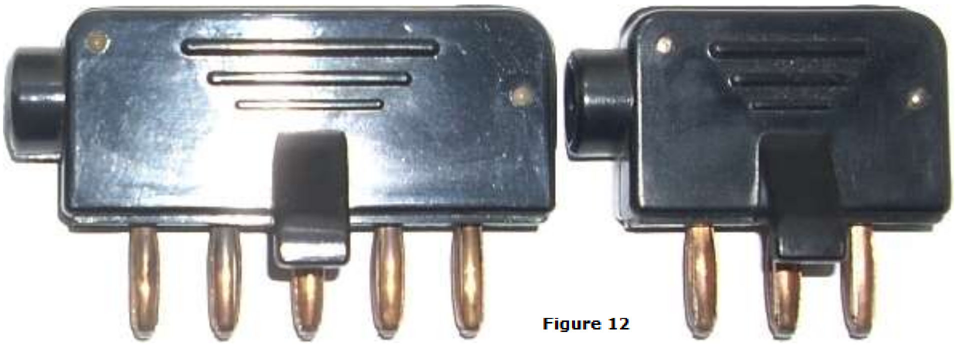

Figure 12

The snapshot above gives a better view of the nose on the Bakelite plugs; the ones used with the older type of wall jacks had a metal housing, which naturally also had a nose to prevent polarity reversals. The pins on these plugs not only resemble banana plugs, they're about the same length and diameter.

It's unusual that Austria went its own way, as far as these wall jacks/terminals and the corresponding plugs were concerned, because the German Reichspost had been using a quite different (and more robust) plug/jack combination since circa 1927, which became a defacto standard in Austria around 1955 (and which was used up to the late 1970s, early 1980s). The two photographs below show the older version of this German plug/jack combination as used in Austria.

Figure 13

The surface-mounted wall jack shown to the left is of white material, while the housing of the plug is more of an ivory color. "Pure" white was a special color only offered by phone manufacturers in conjunction with privately owned PBXs circa 1950 – it wasn't a color which the Austrian PTT offered its subscribers.

This picture shows the above parts without their housings. The wall jack and plug offer a few new features not found with the older ones.

In addition to the regular "a" and "b" terminals for the line wires there is also a "c" contact, which was used to supply a ground on the jacks, and an "a1" contact which was connected to the "a" terminal as long as there was no plug inserted into the jack.

Figure 14

The "W2" terminal was used with an external ringer, which was switched off from within the telephone (in which case the telephone line cord had four conductors – white, brown, green and yellow – instead of the normal three conductors of white, brown and green).

The plugs were commonly referred to as a "Walzenstecker"[2] in German (cylindrical plug), and, naturally, the jacks were known as "Walzensteckdosen" (cylindrical jacks). The jacks were not only offered as a type which was attached to a wall, but also as a type which was mounted inside a wall box, so that only a round wall plate was visible. The Austrian PTT offered this type to subscribers, but it was more commonly found used in privately-owned PBXs.


Figure 15

The guts of this type of jack were basically the same as those of the wall-mounted type. The only difference was that the type intended for mounting in a wall box had two small standoffs with separate screws which, when tightened, spread two little "claws" out which held the innards snugly inside the wall box. This type of fastening is still in use for mounting electric switches and sockets inside wall boxes today.

The newest style of wall-mounted jack was of the type shown on the right. The guts are still the same as before, but the housing has been streamlined a bit in order to look modern. The Austrian PTT also had a streamlined plug to match the jack … I *know* I have at least 30 of the plugs somewhere, but I can't find even one of them at the moment.

This was the most common jack in the late 1960s thru the early 1980s, when a radically different type of wall-mounted jack was placed into service. This new type offered some features intended for use with the new digital exchanges which were just coming into service circa 1983.


Figure 16

[2] The plug was officially known as the "Stoepsel 27" (plug 27) in Germany.

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I must digress for a moment – I got *so* carried away with writing about all the various jacks and plugs used throughout the ages that I completely forgot to mention the types of station protection which were in common use in the 1950s and 60s ….


Figure 17

The station protector shown to the left was a late model of what was officially known as the "S-K-Hp" type.

This station protector offers everything: the line wire terminals in the lower left-hand corner are equipped with spark gap lightning arrestors; after these come two four ampere fuses; these are followed by vacuum spark gaps (the early versions had carbon block arrestors), and last but not least we have two heat coils in the lower, right-hand corner. The terminals for the station wiring are hidden beneath the heat coils.

The heat coils are rated at a nominal current of 0.8 amps and will open at 1.5 amps. When one of the heat coils operates, the respective spring terminal snaps upwards and comes to rest on one of the arms of a "T"-shaped grounding strip. The heat coils used with this unit are of the most modern type which was used with electromechanical exchanges; the heat coil unit inside the housing could be removed after it had cooled down and be reinserted upside down, and thus be fully functional again without any need for special tools or equipment.

The station protector to the right only offers protection in the form of two ten amp fuses.

Such high amperage fuses were commonly used to protect the very smallest type of "PBX" offered by the Austrian PTT in the early 1950s: one "main" station and a single extension. The main station was supplied with -60 V.D.C. via the tip lead (against a local ground), while the extension was supplied with -60 V.D.C. via the ring lead.


Figure 18

The method by which two or more of the cylindrical jacks were wired together was very primitive when compared with the wiring of the newer jacks. The drawing below is an example with four of these old jacks…

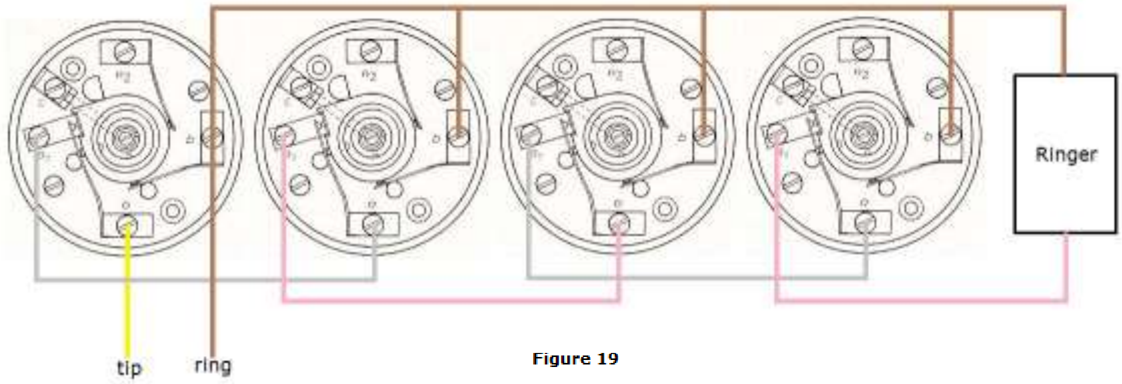

Figure 19

This type of wiring was commonly referred to as the "circuit in a1" ("Schaltung in a1" in German). It automatically cut off any "illegal" second or third phone plugged in, since inserting a plug into any one of the jacks opens the switch contact between terminals "a" and "a1." As can be seen, there was a mandatory auxiliary ringer connected between the terminals "a1" and "b" of the *last* jack – so that the line would be properly terminated even if there was no phone plugged in.

It was standard that no more than four jacks belonging to one and the same phone line were allowed within any residence or on one and the same parcel of land with several buildings.

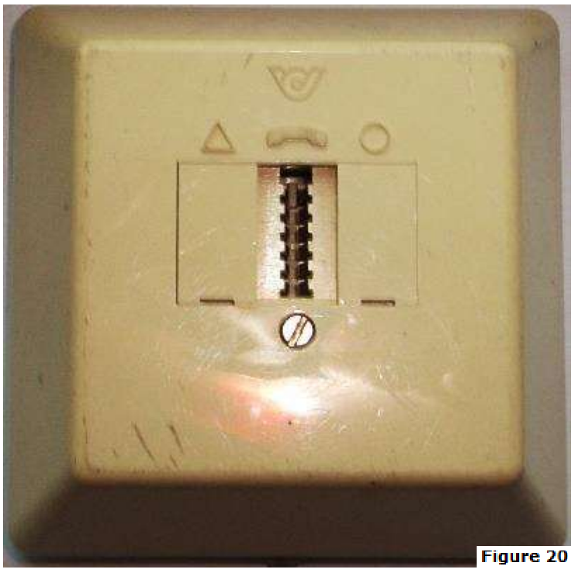

Figure 20

The wall-mounted telephone jack shown on the left is of the type which was commonly installed from the early 1980s onwards.

Only one open jack can be seen, but there are two more, hidden behind the protective caps in the left and right positions. Although the physical dimensions of all three of the jacks are the same, they were used to connect different pieces of telephone equipment.

The jack on the left (identified by a triangle) was commonly used to connect an answering machine, while the jack on the right (identified by a circle) was commonly used to connect a cordless phone to the line. The jack in the middle (identified by a handset) was used to connect a standard desk telephone rented from Telecom Austria … nowadays, one has to go and buy a phone to plug in, because Telecom Austria has given up renting or leasing phones to subscribers (the last type which Telecom Austria leased to subscribers was their model 1998).

This particular type of telephone jack caused subscribers much grief the moment they connected accessories, such as an answering machine or a cordless phone. The line cords often had fewer conductors than would've been necessary for proper operation – because the three jacks are connected in a certain sequence (left, right, center); the tip/ring contacts are looped through all three jacks, and these loops are interrupted the moment a plug is inserted into one of the jacks.

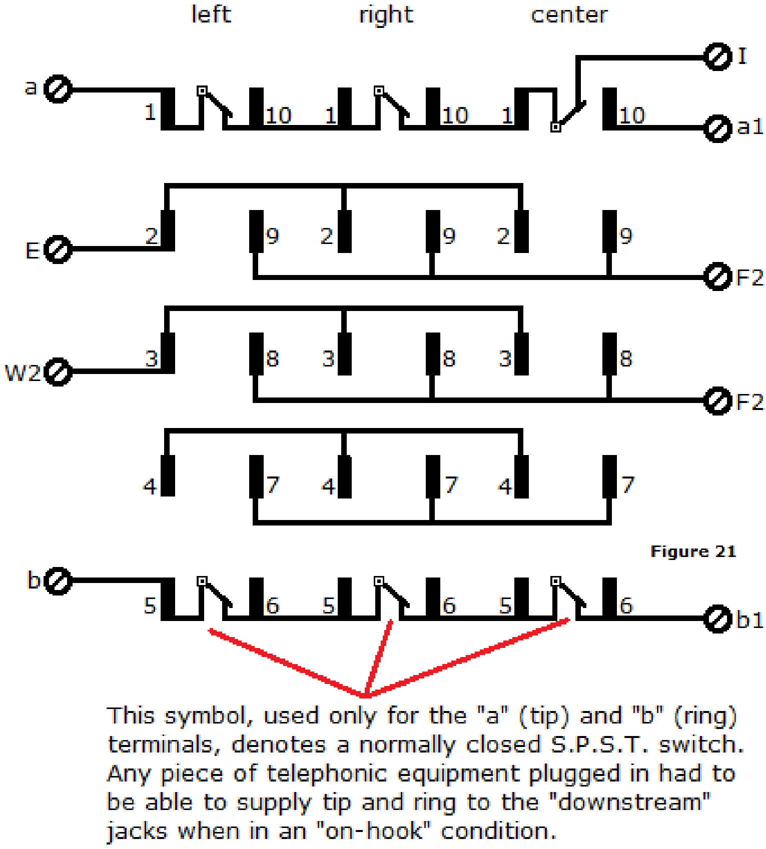

Figure 21

The drawing on the right shows this very unusual and complicated setup.

Any accessories plugged in required at least four terminals on the plug, namely those for the incoming tip and ring wires and those for passing tip and ring on to the next jack in sequence.

Any equipment not capable of passing tip and ring on would kill the jacks "downstream" and make them unusable.

If one looks closely at the switches/links for the "a" and "b" leads, it's obvious that "b" and "b1" are straight thru, while the "a" lead doesn't end up exiting the wall jack at "a1," but rather at "I" instead. Two contacts of the jacks (positions four & seven) are only wired up internally; there are also two external terminals both marked "F2."

The "F2" terminals were originally used to identify the terminals to which a second receiver ("2. Fernhörer" in German) could be connected to the phone. In this case, though, the "F2" terminals were used differently … namely to connect an approved tape recorder to the phone.

The internal "loop" connection on contacts four & seven were used in conjunction with older modems and a special telephone having what was dubbed a "data pushbutton." Older modems in Austria were connected to computers via an RS232 serial data link, and the modems were not capable of automatically dialing the remote computer over a phone line. The modem looped tip and ring through to the telephone. The phone was used to dial into the remote computer – when the remote modem began to send a carrier signal, the person calling would depress the data pushbutton on the phone; this sent a signal to the modem to disconnect the phone and to enter into negotiations with the remote unit. The data pushbutton was connected to the modem via contacts four & seven.

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"W2" still refers to a separate, external ringer – but there is an Austrian "Catch-22" to this, because if one only had a single one of these wall jacks installed, it had an *internal*, electronic ringer. This ringer is disconnected from the line when any one of the three jacks has a plug inserted; it serves the purpose of making the subscriber aware of incoming calls if there was nothing plugged into any one of the three jacks. This electronic ringer serves another purpose when the phone line belongs to one of the new digital COs: these exchanges periodically test every subscriber line in the link list for continuity by sending out a few volts A.C. – too low a voltage to cause a ringer to tap, but high enough to allow a few milliamps of current to flow through the line. However, being the night owl that I am, I have noticed that the standard A.C. ringer in my ancient TAP80K desk phone will occasionally start to gently tap somewhere between 1 and 2 in the morning ….

There was an additional twist to things: the ringer inside the telephone and the one connected to the "W2" terminal and the "b" terminal had to be of the same type – both either electromechanical or both electronic, because the back EMF from an electromechanical ringer was high enough to kill an electronic ringer sooner or later.

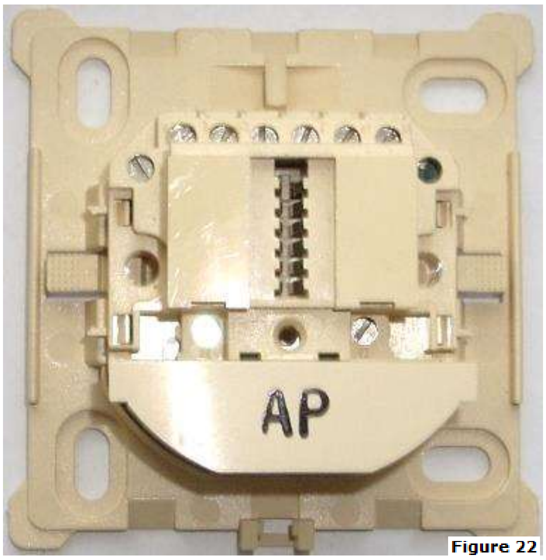

Figure 22

The screws have the following designations from left to right at the top: I, a, b, W2, E, a1 and b1. The odd-shaped unit marked "AP" is the electronic ringer; there are two more screws immediately above the ringer – these are the F2 terminals.

This type of wall jack was the first type that "officially" allowed more than one phone to be connected to the same line within one and the same premise, but this, too, had a yet another Austrian twist – telephone conversations are always private, so there must be a way of disconnecting any phones downstream from the one in use.

Connecting several of these wall-mounted jacks together is a very complicated business if the setup is to work as advertised. Such a series of jacks is shown in the illustration below.

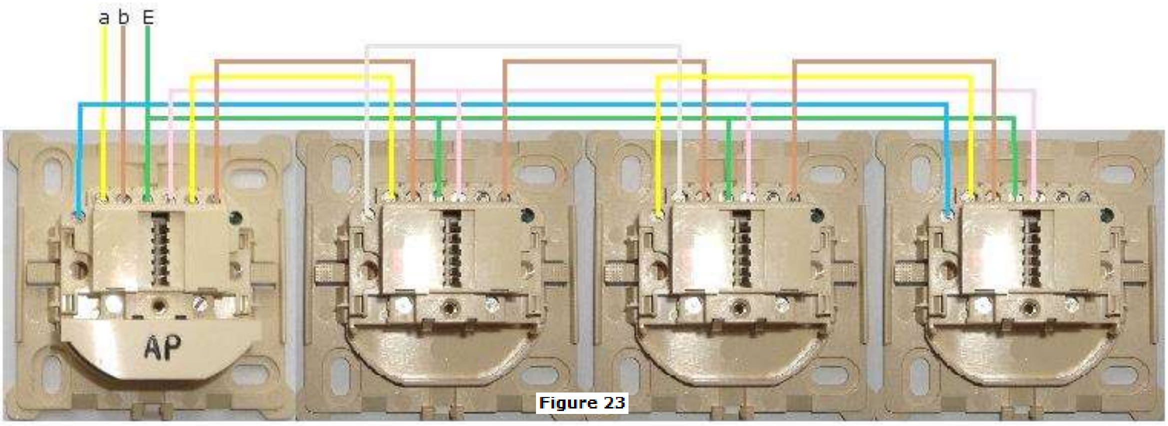

Figure 23

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The very latest type of wall jack used by Telecom Austria is a stripped down version of the previous one.

Figure 24

This new type has the cover attached with a small, plastic snap instead of a screw and the wires are no longer attached to the terminals with screws, but are punch-down terminals instead.

This new type doesn't contain a ringer – it has a passive test termination, which consists of a 470 Kilo-ohm resistor and a 1N4148 type diode; this serves the same purpose concerning the nightly line test as the electronic ringer in the previous version.

The IDC terminals are arranged in the following sequence: a1, b1, a, a, b, b, W2 and W2; this *isn't* a typo, since terminals a, b and W2 are present two times. Terminals with the same designation are connected to each other.

If one takes a close look at the three sockets, it's just barely possible to see that the contacts at the top and bottom of the jacks are also switches – the same as in the first of this type of jack array.

The horizontal plastic barrier between the IDC terminals and the sockets prevents the little bits of wire which are cut off at the bottom of the terminals from falling into the sockets and getting trapped there, possibly causing malfunctions.

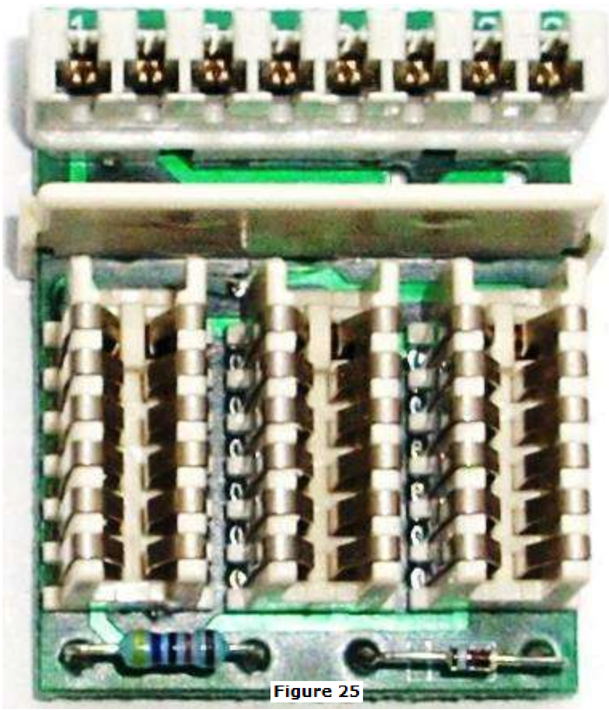

Figure 25

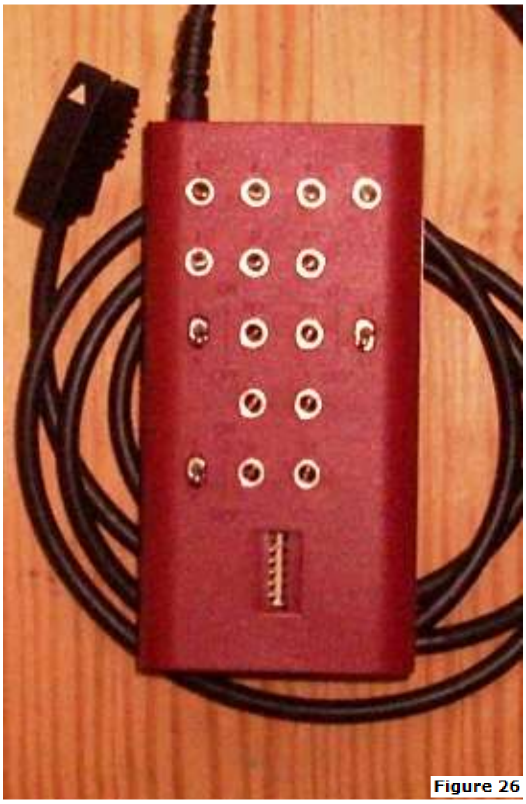
Figure 26

Telecom Austria used a special type of breakout box for testing both of these modern wall jack types.

This breakout box was inserted between the telephone equipment and the wall jack; it allows access to all ten contacts with standard banana plugs, as well as the possibility to open up the a, a1 and b lines within the box itself.

Oh, yes – before I forget to mention it: to this day, it's illegal to add to, or modify, station wiring which was installed by Telecom Austria. There used to be a company which offered a DIY telephone wiring kit, which allowed the conversion of a single wall jack into a full-blown jack system; this was then connected to the "official" Telecom Austria wall jack with a plug … thus, one could get away with expanding the station wiring without touching anything belonging to Telecom Austria. However, if I recall correctly, Telecom Austria went to court over this DIY kit – and apparently won, since I haven't seen such stuff being offered anywhere for a good number of years now.

The last two types of plug/jack combinations bear an uncanny resemblance to the modern plug/jack equipment used by the Deutsche Telekom – excepting that their stuff has fewer contacts and has keying to prevent the subscriber from plugging a telephone or answering machine into the wrong jack. The reason why the newest German and Austrian jacks and plugs have a family resemblance is because both are patented designs proprietary to the German firm "Quante," which has belonged to the 3M® concern since the year 2000.

Austrian Telephone Tickets & Bills 1929 thru 1962

As should be clear by now, I have a penchant for writing about subjects no one else would bother with – it's the same with this tale. Are there really any folks out there who collect paper ephemera connected with telephony? There is certainly at least one collector, although this is another one of those collections which began in a haphazard and accidental manner, rather than on purpose. Oh, well, be that as it may, telephone bills belong to the everyday items which, in the usual course of things, find their way into the wastepaper basket pretty quickly and are then lost forever.

This specific collection began quite a number of years ago, when one of my friends gave me a small packet of telephone bill envelopes (from the era of the German Reichspost in Austria, i.e. 1938 thru 1945), complete with tickets inside, as a birthday present.

At first, I wasn't all that happy with what appeared to be useless paper, but I was forced to revise my opinion when I started looking at the various tickets *inside* the envelopes … this stuff belonged to a subscriber living in the city of Klosterneuburg, which was part of what was known as "Greater Vienna" during the years of Nazi occupation, but which belonged to the province of Lower Austria before 1938 and again at some time after the demise of the Third Reich in 1945.


Verm.-Stelle
Rufnummer Klosterneuburg 2190
Lastzettel über besondere Kosten

	RM	Rpf
1. Herstellung, Verlegung, Umwandlung, Austausch		
E A a) Bauzug 9.8		
b) Arbeiten		
Baukostenbeitrag	108	–
c) Kostenzuschuß		
d) Vorranggebühr		
2. Andere Arbeiten		
3. Umschreibgebühr bei Übertragungen		
4. Gebpfl. Auskunft		
5. Gesprächsgebühr für a) Erinnerung		
b) Sperrankündigung		
6. Sperre		
7. Stundung		
8. Zinsen		
9. Mahn- u. Vollstreckungsgebühren 4203		
Summe	108	–

Ausgefertigt   Geprüft

(5. 36)

△ Figure 1

What made this paperwork especially interesting was the fact that the city of Klosterneuburg and environs were one of the small islands of subscriber dial service in a sea of manual service. What was really unusual, though, was the fact that subscribers in Klosterneuburg had metered service, so they could dial their own calls into Vienna, but Klosterneuburg and environs were only reachable from Vienna via the toll exchange – although Vienna was mostly dial by 1938, there was no provision for automatically metering originating toll calls.

There was one phone ticket which helped to exactly date when the subscriber began using telephone service, because there was a bill for 108 Reichsmarks (this was equal to U.S. $ 615.00 in 2010) for line construction work.

But this ticket has even more to tell, because there are the handwritten letters "EA," which was the German abbreviation for a single-party (private) telephone line (**E**inzel**a**nschluss) with the phone number 2190.

The envelope for this particular bill survived, so it's possible to say on which day of which month of the year the bill was paid: the 18th of July in 1939, barely 1½ months before the Germans attacked Poland on September 1st.

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Figure 2

If one looks closely, it’s possible to see the marks on the envelope where the ticket was stapled to it; the ticket itself still has the staple in the upper left-hand corner. This lot of phone bills is spread out over the years 1939 thru 1944, without any year being complete.

Figure 3

Before we get into these old phone bills & tickets much deeper I should explain that the total amount due was written on the front of the envelope; the day and month the bill was sent and the date by which the bill was to be paid were rubber-stamped on the envelope. The post office stamp shows the date and location where the bill was paid. In the case of the lower envelope on the previous page, the amount was 17 Reichsmarks and 20 Reichspfennig, paid on December 8th, 1939.

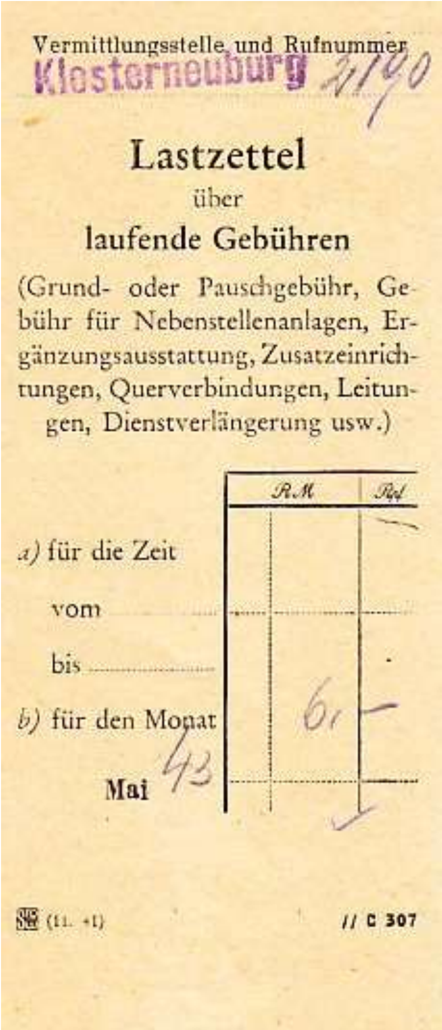
Figure 4

Figure 5

The left-hand ticket is for 9.33 Reichsmarks (RM; U.S. $ 53.00 in 2010) rental fee for the telephone, the line and the subscriber's circuit in the exchange, while the right-hand ticket is for 4.9 hours of subscriber-initiated telephone calls (so-called "active" calls are outgoing; "passive" calls are incoming), which amounted to RM 7.84 (U.S. $ 44.63 in 2010).

I wonder if any readers have bothered to add RM 9.33 and RM 7.84 together – the sum is namely RM 17.17 and *not* RM 17.20 as is shown on the lower envelope on the previous page. However, RM 17.20 **is** correct, because there are credits amounting to RM 125.81 and the sum owed amounts to RM 143.01 (143.01 – 125.81 = RM 17.20). I won't bother to continue to give the dollar amounts; if anyone *really* wants to know, multiply the RM amounts with 5.69 to obtain dollar values for the year 2010.

The next phone bill for the same subscriber is from May 20th, 1943 ….


Vermittlungsstelle und Rufnummer
Klosterneuburg 2190

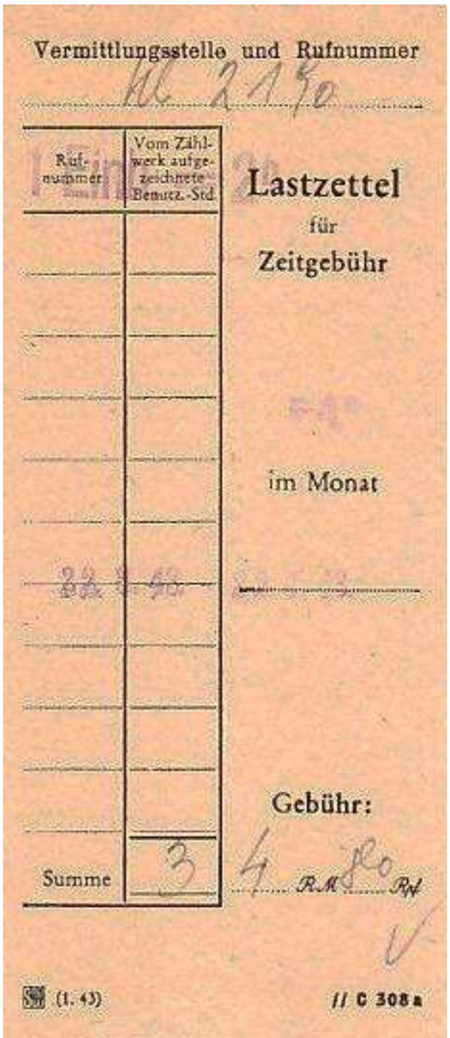
Lastzettel
über
laufende Gebühren

(Grund- oder Pauschgebühr, Gebühr für Nebenstellenanlagen, Ergänzungsausstattung, Zusatzeinrichtungen, Querverbindungen, Leitungen, Dienstverlängerung usw.)

	RM	Rpf
a) für die Zeit		
vom		
bis		
b) für den Monat Mai 43	6	–

(11. 41) // C 307

Figure 6


Vermittlungsstelle und Rufnummer
Kl 2190

Rufnummer	Vom Zählwerk aufgezeichnete Benutz.-Std
Summe	3

Lastzettel
für
Zeitgebühr

im Monat

Gebühr: 4 RM 80 Rpf

(1. 43) // C 308 a

Figure 7


Gespräch von Wien 2190

am

nach

Ruf-Nr. B 33367

Gattung	V	XP	R
	G	N	
	Str	nach	
	Z	v.	bis
	U	v.	bis

angem. um 10 11 bei 928

weitergem. um in Ltg durch

Leitweg Zone

ausgef. um 10 18 in Ltg 4 durch 928

Gespr.-Dauer Minuten 8

71

Gebühr RM – Rpf 80

geprüft:

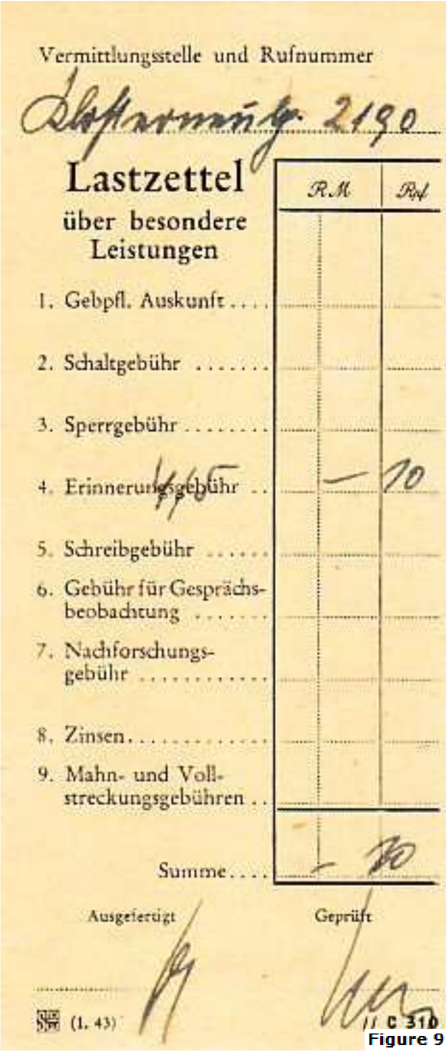
(3. 35) // C 321

Figure 8

It's very interesting to note that the rental fee dropped between 1939 and 1943; in December, 1939, the rental fee was RM 9.33 and in May, 1943, RM 6.00. The price for an hour of active phone calls has remained the same, namely RM 1.60. The middle ticket is also interesting in that it's rubber-stamped with the information that 1 unit was equal to 2 hours of active phone calls (this stamp is barely legible in the scan).

The third ticket shown above is a toll ticket for a call to the Viennese phone number B3-33-67 … hmm, how very odd. Every period book I've ever read claimed that subscribers in Klosterneuburg and environs *could dial their own calls into Vienna* … the answer may be found in the 1943 telephone directory for the province of Lower Austria. The text may be understood as follows: those who wished to be able to reach subscribers in Vienna without the aid of an operator had to contract for this special service; they dialed "99" (as the area code for Vienna) plus the full number of the subscriber in Vienna.

Note: since Vienna had its offset-order dials at the time in question, while the dials in Klosterneuburg had the standard 1-0 numbering, the pulse-trains were converted to match the numbering in Vienna … and subscribers in Klosterneuburg also needed to be able to covert the letters on the Viennese dials to their proper digits – not really customer-friendly in any sense of the word.



Vermittlungsstelle und Rufnummer

Klosterneuburg 2190

Lastzettel
über besondere Leistungen

	RM	Rpf
1. Gebpfl. Auskunft		
2. Schaltgebühr		
3. Sperrgebühr		
4. Erinnerungsgebühr	—	10
5. Schreibgebühr		
6. Gebühr für Gesprächsbeobachtung		
7. Nachforschungsgebühr		
8. Zinsen		
9. Mahn- und Vollstreckungsgebühren		
Summe	—	10

Ausgefertigt Geprüft

(1. 43) II C 31b

Figure 9

This ticket from May, 1943, is for a reminder fee in the amount of RM 0.10; the ticket itself is multipurpose, having been used to bill any special services, such as: billable information services, switching service (what is meant is installing the jumper wires on the MDF, reconnecting the line after a disconnect due to non-payment of fees, &c.), fees for service observation, interest on fees, &c.

One thing may be said about the subscriber – she was a quick payer. The bill was sent out on May 20th, and she paid in full on the 22nd of May, even though there was a one week grace period within which the bill was to be paid.

Zur gefälligen Beachtung

Fernsprechrechnung

Wien-Klosterneuburg 2190
Völker Therese
W.-Weidling, Hauptstr.124

Postfach

Fernsprechamt Wien
Postscheckkonto 1.012

Figure 10

The last phone bill for Mrs. Therese Völker which I wish to show readers is from December 19th, 1944 … this bill is very interesting, because the envelope contains 7 tickets and a handwritten note from the billing department of the dial exchange in Klosterneuburg.

Vermittlungsstelle und Rufnummer
Klosterneuburg 2190

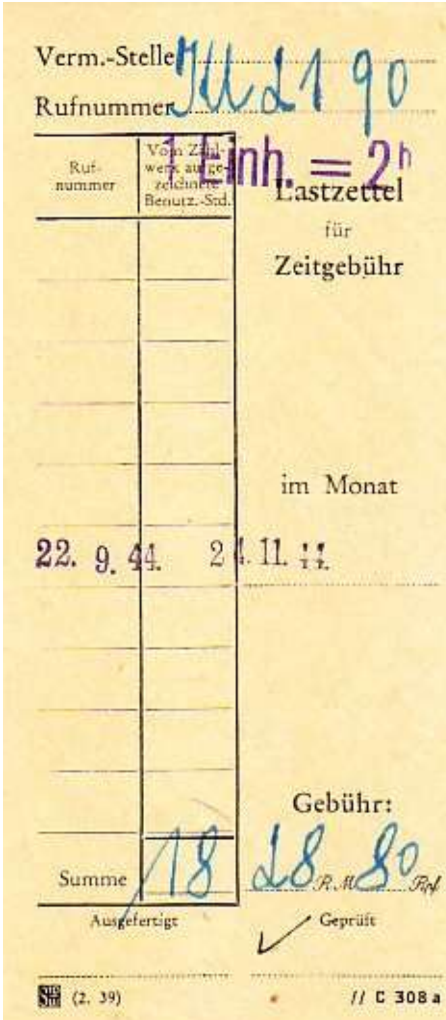
Lastzettel
über
laufende Gebühren
(Grund- oder Pauschgebühr, Gebühr für Nebenstellenanlagen, Ergänzungsausstattung, Zusatzeinrichtungen, Querverbindungen, Leitungen, Dienstverlängerung usw.)

	RM	Rpf
a) für die Zeit		
vom		
bis		
b) für den Monat		
Dezember 44	12.	–
Jan. 1945		

(11. 41) // C 307

Figure 11

In 1943, she was paying RM 6.00 rental fee on a monthly basis, while the relevant ticket from December, 1944 covers the rental fee for two months instead of just for one ….



Verm.-Stelle Kl
Rufnummer 2190

1 Einh. = 2h

Lastzettel
für
Zeitgebühr
im Monat

Rufnummer	Vom Zählwerk aufgezeichnete Benutz.-Std.
22. 9. 44.	24. 11. 44.
Summe	18

Gebühr: 28.80 RM Rpf

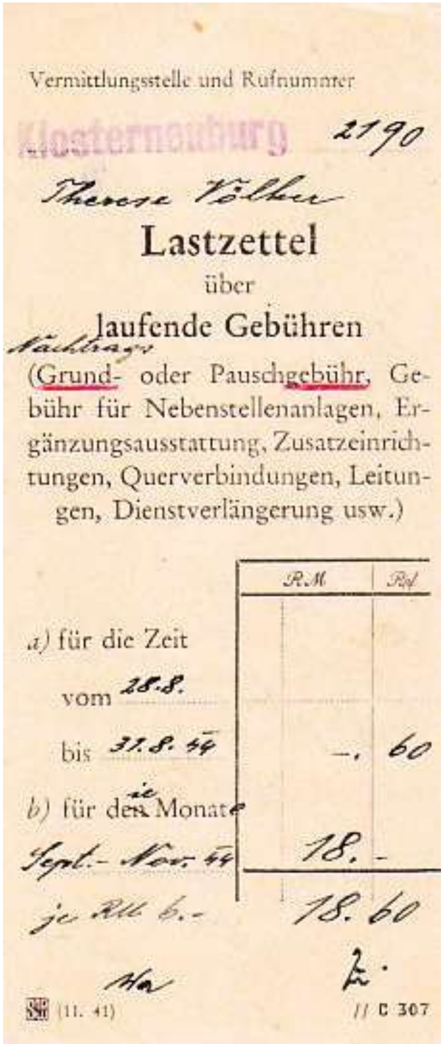
Ausgefertigt Geprüft

(2. 39) // C 308 a

Figure 12

She also did a *lot* of talking between September 22nd and November 24th.

The price for 2 hours of active phone calls was still RM 1.60 in late 1944, and she wound up paying RM 28.80 for a total of 36 hours of talking (she must *really* have had "the gift of gab").


Vermittlungsstelle und Rufnummer
Klosterneuburg 2190
Therese Völker
Lastzettel
über
laufende Gebühren
Nachtrags
(Grund- oder Pauschgebühr, Gebühr für Nebenstellenanlagen, Ergänzungsausstattung, Zusatzeinrichtungen, Querverbindungen, Leitungen, Dienstverlängerung usw.)

	RM	Rpf
a) für die Zeit vom 28.8. bis 31.8.44	–.	60
b) für die Monate Sept.– Nov. 44	18.	–
je RM 6.–	18.	60

(11. 41) // C 307

Figure 13

This is a very interesting ticket for rental fees, since it covers the time period August 28th thru the 31st, as well as for the following *three* months (rental fee tickets were normally issued on a monthly basis).

The billing department was actually kind to Mrs. Völker, because the standard fee was RM 6.00 per month; if one divides the 31 days of the month of August by RM 6.00, the rental fee per day works out to be RM 0.194. If one multiplies this with four, it works out to be RM 0.77, but she was only charged RM 0.60 for those 4 days.


Gespräch von
Klosterneuburg 2190
am
nach Graz
Rufnr. 0686
Gattung D
V XP R
N
Str nach
Z v. bis
U v. bis
angem. um
bei
weitergem. um
in Ltg
durch
Leitweg
Zone
ausgef. um 2039
in Ltg 8654
durch
Gespr-Dauer Minuten 6
95
Gebühr RM 6 Rpf
geprüft:
(12. 42)
Δ C 321

Figure 14

Here we have a toll ticket for a call of 6 minutes duration, where number 0686 in the city of Graz, in the province of Styria, was called.

The capital letter "D" written in blue pencil identifies the call as an urgent one (**D**ringend in German).

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Distributed by Telephone Collector's International
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Gespräch von
Klosterneuburg
2190
am
nach
Rufnr.
1684
Gattung
V XP R
G N
Str nach
Z v. bis
U v. bis
angem. um
bei
weitergem. um
in Ltg
durch
Leitweg
Zone
ausgef.
um
in Ltg
durch
Gespr-Dauer Minuten
3
54
Gebühr RM Rpf
3 60
geprüft:
(12 42)
C 321

Figure 15

Another toll ticket from the same billing period, this one for a call to phone number 1684, in the city of Salzburg. Once again, the call was urgent, and in this case the rate was RM 1.20 per minute.


Gutzettel
(Bitte deutlich mit Tinte schreiben)
V. -Stelle Klosterneuburg
Rufnummer 2190
Name
Wohnung
hat 7 RM 40 Rpf
wörtlich sieben
RM Rpf wie oben
Fernsprechgebühren eingezahlt.
Annahmeliste f. Fernsprechgebühren
Lfde. Nr. 739
Tagesstempel
Postannahme
Für dienstliche Vermerke
Gefälligst vom Einzahler auszufüllen
Erstattung
(zurückvergüteter Betrag)
(S. 39)
C 2211

Figure 16

Mrs. Völker received credit to the amount of RM 7.40 for the rental fee from February 24th to August 28th in 1944. Her phone number was used by the German Luftwaffe during that time period.

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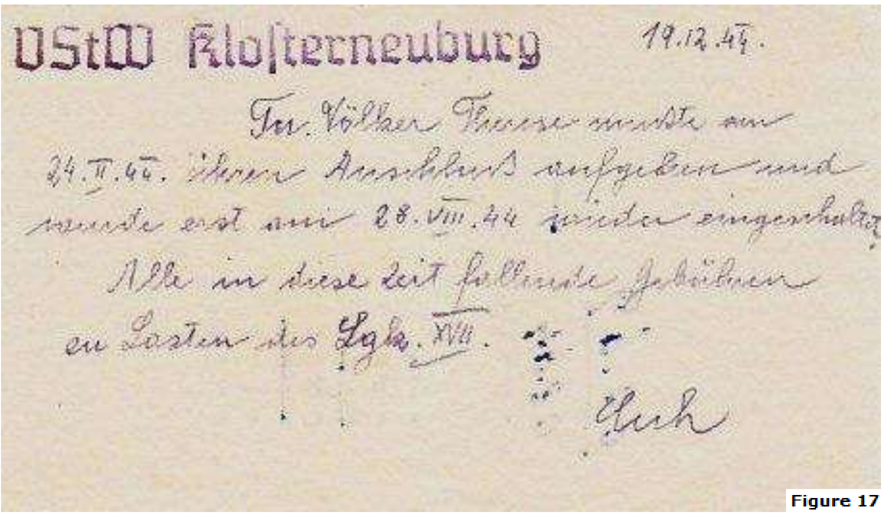
Distributed by Telephone Collector's International
--- NOT FOR SALE OR COMMERCIAL DISTRIBUTION ---


UStW Klosterneuburg 19.12.44.

Fr. Völker Therese mußte am 24.II.44. ihren Anschluß aufgeben und wurde erst am 28.VIII.44 wieder eingeschaltet. Alle in diese Zeit fallende Gebühren zu Lasten des Lgk. XVII.

Figure 17

The handwritten note shown above is most interesting, because it says that Mrs. Völker had to give up her telephone line on February 24th, 1944, and was reconnected on August 28th. Any fees within that time period were to be billed to the German Air Force district command XVII (she was obviously forced to surrender her phone line to the German war effort).

Now we come to a few phone bills and tickets belonging to a subscriber at Vienna. The first bill shown is dated January 30th, 1942; the subscriber was a Mrs. Marie Drechsler, and she had a party-line phone – A2-23-27-Z. Her monthly rental fee was lower than that of the previous subscriber, because she only paid RM 5.33 per month (party-lines were slightly cheaper because of the inconvenience that the line was fully blocked whenever any one of the other three subscribers was using the phone).


Verm.-Stelle

Rufnummer A2 23 27 Z

Lastzettel

über

laufende Gebühren

(Grundgebühr für den Hauptanschluß, Gebühr für Nebenanschlüsse, Querverbindungen, Anschlußdosen, Zusatzeinrichtungen, zuschlagpflichtige Leitungslängen, Dienstverlängerung usw.)

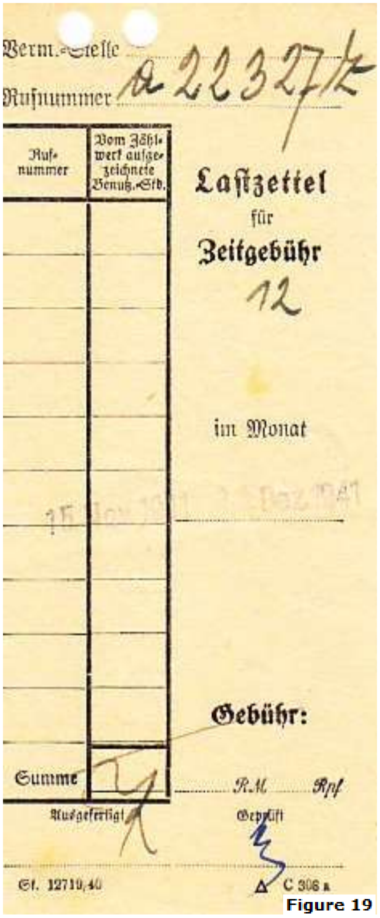
	RM	Rpf
a) für die Zeit vom ... bis ...		
b) für den Monat Januar 42	5	33

Ausgefertigt Geprüft

✱ 6572 40 △ C 307

Figure 18

As can be seen on the right, Mrs. Drechsler didn't use her phone at all between November 15th and December 24th because the "sum" (Summe) box is empty.


Verm.-Stelle

Rufnummer A 22327 Z

Rufnummer	Vom Zählwerk aufgezeichnete Benutz.-Std.
Summe	

Lastzettel für Zeitgebühr 12 im Monat

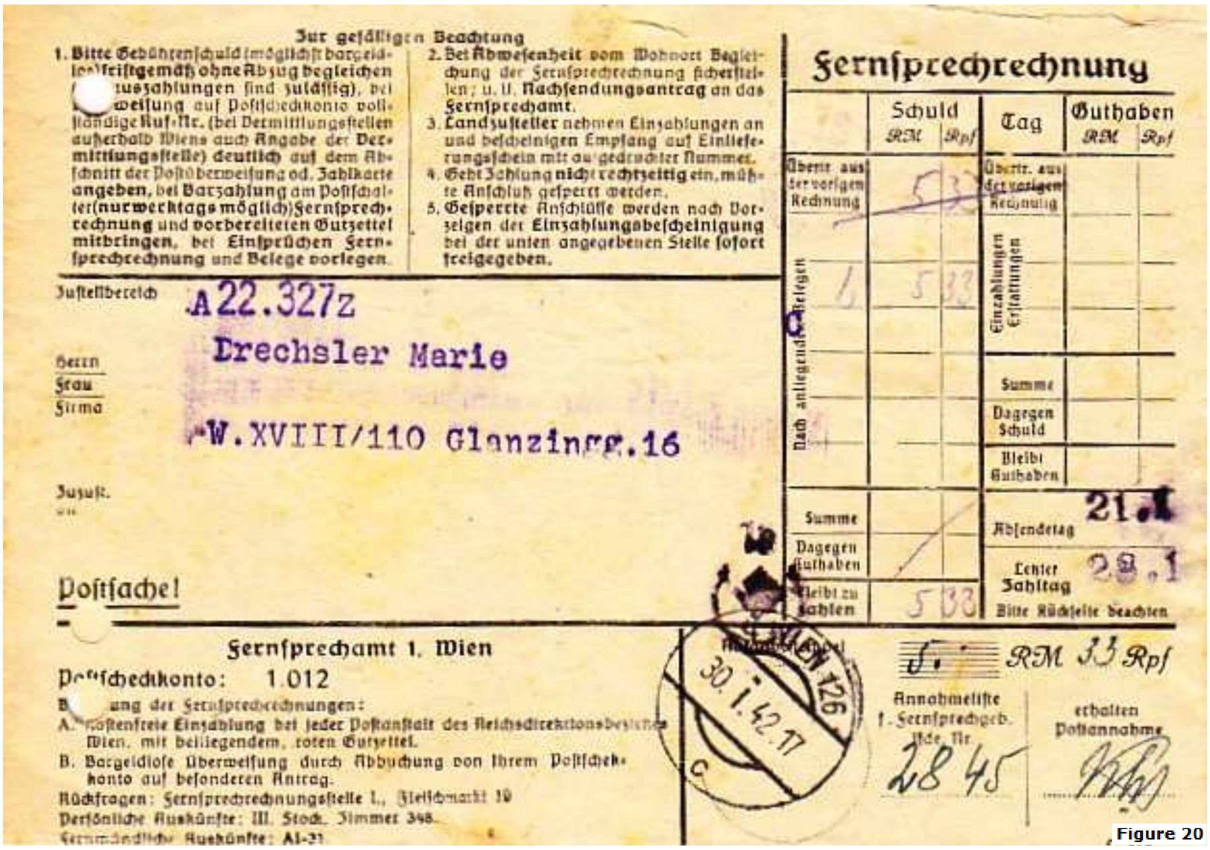
15. Nov. 1941 – 24. Dez. 1941

Gebühr: RM Rpf

Ausgefertigt Geprüft

St. 12719/40 △ C 308a

Figure 19



Zur gefälligen Beachtung

1. Bitte Gebührenschuld (möglichst bargeldlos) fristgemäß ohne Abzug begleichen (Teilzahlungen sind zulässig), bei Überweisung auf Postscheckkonto vollständige Ruf-Nr. (bei Vermittlungsstellen außerhalb Wiens auch Angabe der Vermittlungsstelle) deutlich auf dem Abschnitt der Postüberweisung od. Zahlkarte angeben, bei Barzahlung am Postschalter (nur werktags möglich) Fernsprechrechnung und vorbereiteten Gutzettel mitbringen, bei Einsprüchen Fernsprechrechnung und Belege vorlegen.
2. Bei Abwesenheit vom Wohnort Begleichung der Fernsprechrechnung sicherstellen; u. U. Nachsendungsantrag an das Fernsprechamt.
3. Landzusteller nehmen Einzahlungen an und bescheinigen Empfang auf Einlieferungsschein mit aufgedruckter Nummer.
4. Geht Zahlung nicht rechtzeitig ein, muß te Anschluß gesperrt werden.
5. Gesperrte Anschlüsse werden nach Vorzeigen der Einzahlungsbescheinigung bei der unten angegebenen Stelle sofort freigegeben.

Zustellbereich A 22.327 z

Herrn / Frau / Firma Drechsler Marie

W.XVIII/110 Glanzingg.16

Zusatz

Postsache!

Fernsprechamt 1. Wien

Postscheckkonto: 1.012

Begleichung der Fernsprechrechnungen:
A. Kostenfreie Einzahlung bei jeder Postanstalt des Reichsdirektionsbezirks Wien, mit beiliegendem, roten Gutzettel.
B. Bargeldlose Überweisung durch Abbuchung von Ihrem Postscheckkonto auf besonderen Antrag.
Rückfragen: Fernsprechrechnungsstelle I., Fleischmarkt 19
Persönliche Auskünfte: III. Stock, Zimmer 348
Fernmündliche Auskünfte: A1-21

Fernsprechrechnung

	Schuld RM	Schuld Rpf	Tag	Guthaben RM	Guthaben Rpf
Übertr. aus der vorigen Rechnung	5	33	Übertr. aus der vorigen Rechnung		
Nach anliegenden Belegen	5	33	Einzahlungen Erstattungen		
			Summe		
			Dagegen Schuld		
			Bleibt Guthaben		
Summe			Absendetag	21.1	
Dagegen Guthaben			Letzter Zahltag	29.1	
Bleibt zu zahlen	5	33	Bitte Rückseite beachten		

5.- RM 33 Rpf

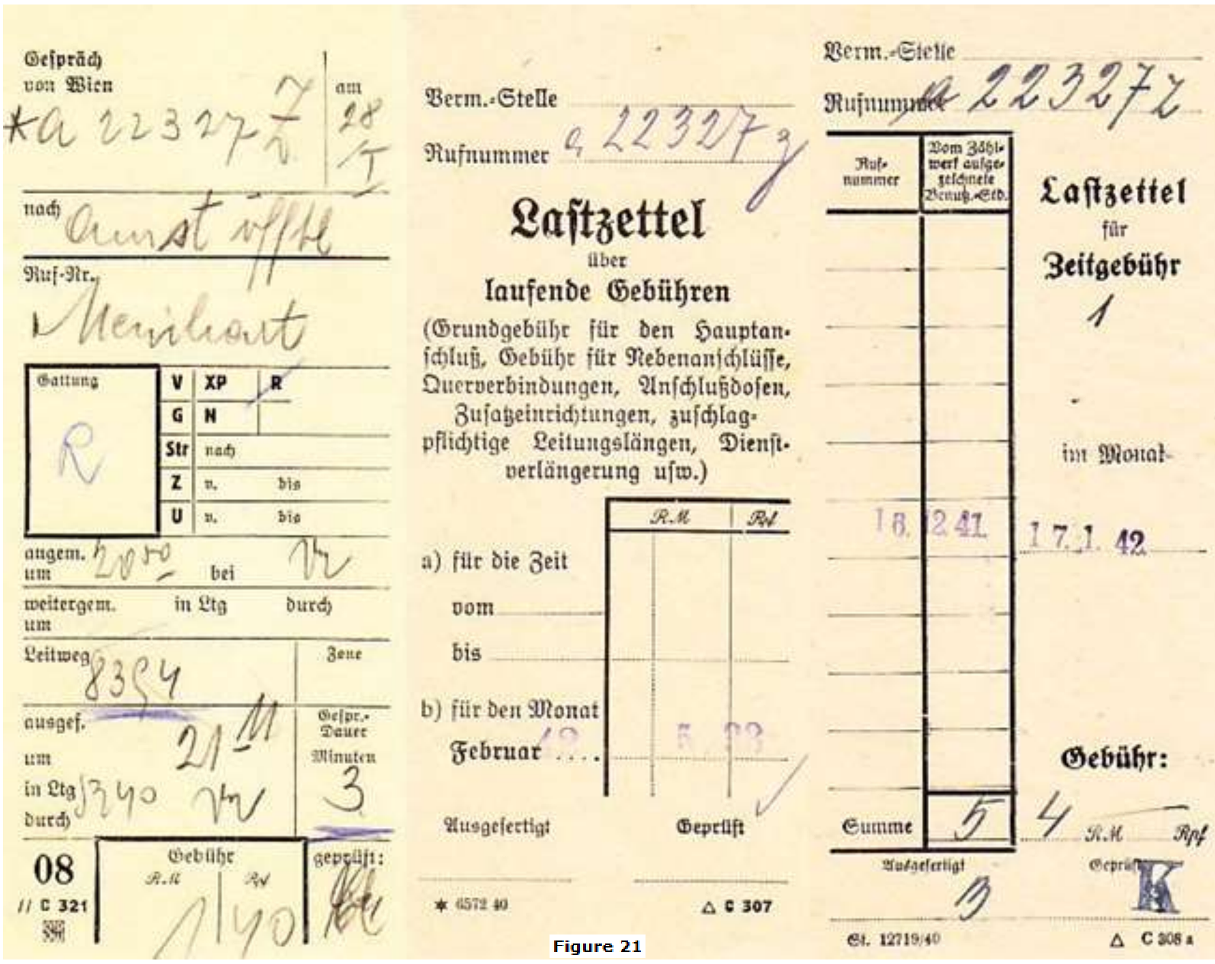
Annahmeliste f. Fernsprechgeb. Nr. 2845

erhalten Postannahme

Wien 126 30.1.42.17

Figure 20

Mrs. D. was a bit tardy in paying her phone bill; it was sent out in the mail on January 21st and was overdue on the 29th – she didn't pay until the 30th of the month ….



Gespräch von Wien A 22327 z am 28/I

nach Amstetten

Ruf-Nr. Meinhart

Gattung	V	XP	R
R	G	N	
	Str	nach	
	Z	v.	bis
	U	v.	bis

angem. um 20 50 bei

weitergem. um in Ltg durch

Leitweg 8354 Zone

ausgef. um 21 55 Gespr.-Dauer Minuten 3

in Ltg 1340 durch

08 Gebühr RM 1 Rpf 40 geprüft:

// C 321

Verm.-Stelle

Rufnummer A 22327 z

Laftzettel über laufende Gebühren

(Grundgebühr für den Hauptanschluß, Gebühr für Nebenanschlüsse, Querverbindungen, Anschlußdosen, Zusatzeinrichtungen, zuschlagpflichtige Leitungslängen, Dienstverlängerung usw.)

	RM	Rpf
a) für die Zeit vom bis		
b) für den Monat Februar 42	5	33

Ausgefertigt Geprüft

✱ 6572 40 △ C 307

Verm.-Stelle

Rufnummer A 22327 z

Ruf-nummer	Vom Zählwerk aufgezeichnete Benutz.-Gsp.
18	2 41
Summe	5

Laftzettel für Zeitgebühr 1

im Monat 17.1.42

Gebühr: 4 RM Rpf

Ausgefertigt Geprüft K

St. 12719/40 △ C 308 a

Figure 21

The toll ticket shown on the bottom left of the previous page has reversed charges. This ticket is unusual because there is no phone number listed as being called … the call *destination* is given as "Amst öfftl" which refers to any one of the public pay phones in the central post office at the city of Amstetten in the province of Lower Austria; the name of the called party (Meinhart) is also listed. A messenger had to be sent from the post office to notify the person wanted that there was a call waiting … very unwieldy and time consuming.

The other two tickets at the bottom of the previous page show that party-line subscribers in Vienna paid less for their calls – 5 units for only RM 4.00 (instead of RM 8.00) and also paid less in monthly rental fees: RM 5.33 instead of RM 12.00.

The subscriber's husband owned and operated a café in Vienna's 6th district, not all too far from the city center. The following paper ephemera are even rarer than the phone bills and tickets shown up to now, because they have to do with the pay phone installed in the café.

Pay phones in Vienna were an entirely *private* enterprise between August, 1903, when the first phone booth was installed in a public place, and the end of February 1941, when the contract between the pay phone operating company and the Reichspost (as successor to the Austrian PTT) expired and wasn't renewed.

According to the contract between the "Telephon-Automaten-Gesellschaft" (TAG; Telephone Automat[1] Company) and the café, restaurant, bar, &c. owners guaranteed the TAG a certain minimum income per year; if this minimum wasn't met, the operator of the pay phone had to pay the difference out of his or her own pocket.

[1] For the longest time, pay phones in Austria and Germany were called "automats" because they automatically collected the fee in the form of coins or tokens.


P. T. Wir teilen Ihnen untenstehend die Einnahmen mit, welche im I. Quartal 1931 bei dem bei Ihnen befindlichen Telephon-Apparat mit Geldeinwurf erzielt wurden. Die Zahl links oberhalb der Adresse bedeutet die Sprechstellen-Nummer.

Hochachtungsvoll
Telephon-Automaten-Gesellschaft
m. b. H.

Wien, am 15. April 1931

1311
Titl.
Cafe Drechsler
Wien VI.,
Linke Wienzeile 22

Einnahme im I. Quartal 1931
S 134.70

Figure 22

The notification shown on the previous page informed Mr. Drechsler that the pay phone in his café had collected ATS 134.70 (U.S. $ 19.11) in the first quarter of 1931

I. Quartal 1934.

Einnahmen:	Staatl. Tel.-Geb.
S 150.50	50 40 44 40 44 40 13 44 152 64*

1311
Titl.
B 20379
Cafe Drechsler
Wien VI.,
Linke Wienzeile 22

Wien, am
5. April 1934

P. T. Wir beehren uns, Ihnen obenstehend nähere Angaben über die Einnahmen bei Ihrer Telephonstation, sowie über die staatlichen Teilnehmergebühren zu machen. Die Zahl links von der Adresse bedeutet die Sprechstellennummer, die Zahl rechts von der Adresse die Telephonnummer.

Bitte wenden!

Figure 23

The notification from the 1st quarter of 1934 indicates that the pay phone collected ATS 150.50 and that the operating costs (paid to the Austrian PTT) amounted to ATS 152.64 – at that time both the pay phone and the café owner were losing money.

Telephon-Automaten-Gesellschaft
m. b. H.
Wien, XII. Schönbrunner ... Seumegasse 10

№ 503

Wien, am 7. 12. 1936

Titl.

An Cafe Drechsler

in VI. L. Wienzeile 22

Wir teilen höflichst mit, daß wir von Ihnen

am 7. 12. 36.

S – 5 – g

Schilling fünf

in Empfang genommen und Ihrem werten Konto bei uns gutgeschrieben haben.

Hochachtungsvoll

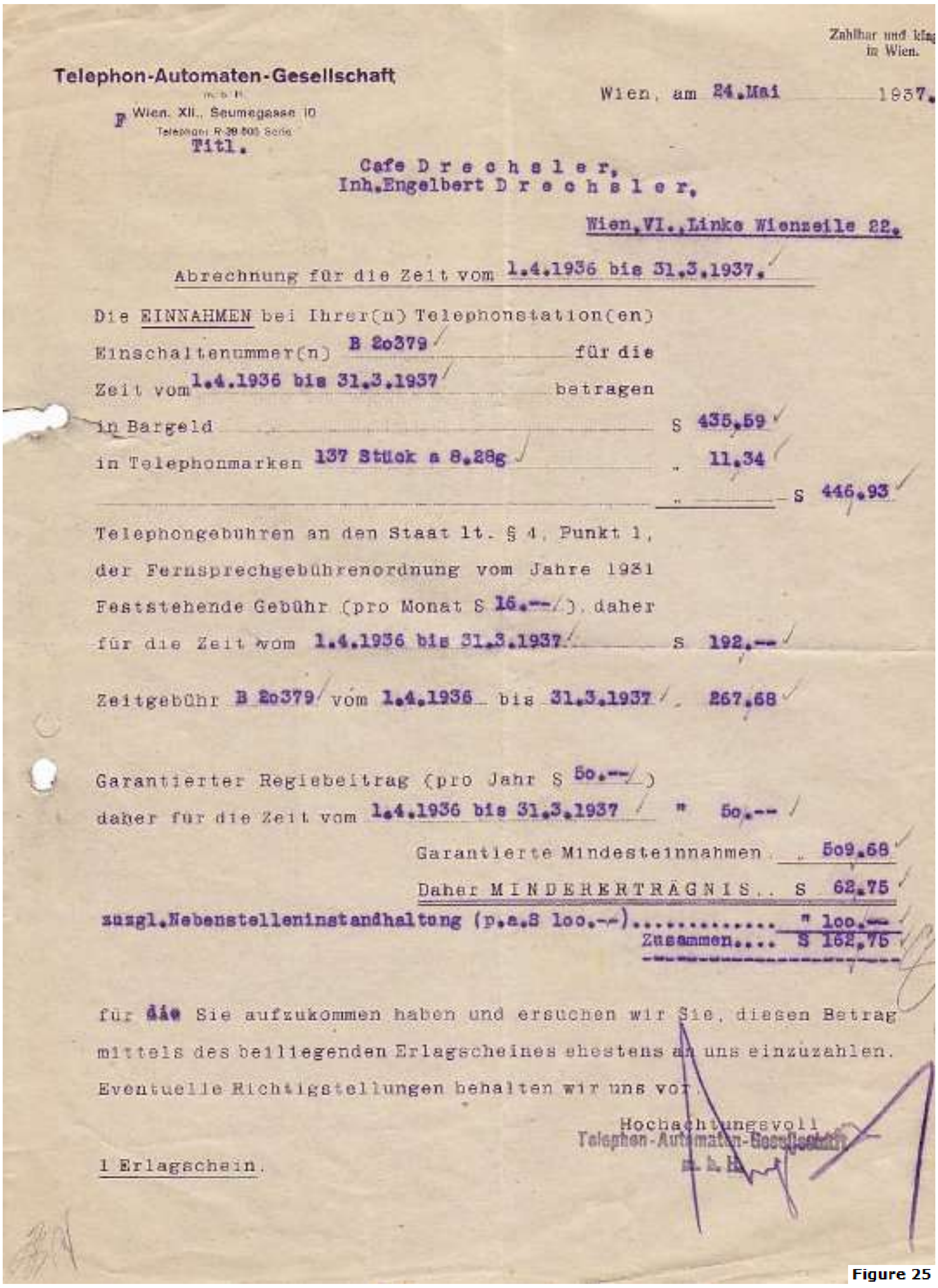
Telephon-Automaten-Gesellschaft

NB. Andere Ausfertigungen über Geldempfangnahme haben keine Giltigkeit.
D. O.

Figure 24

The piece of paper to the left is nothing more than a receipt for the amount of ATS 5.00 having been paid to the TAG on December 7th, 1936. Making a pay phone pay off was hard, piecemeal work at best.

What I personally like about this receipt is that two employees of the TAG signed it – was one of them there to keep the other one honest?



Zahlbar und klagbar in Wien.

Telephon-Automaten-Gesellschaft
m. b. H.
Wien, XII., Seumegasse 10
Telephon: R-39 505 Serie

F Titl.

Wien, am 24.Mai 1937.

Cafe D r e c h s l e r,
Inh.Engelbert D r e c h s l e r,

Wien,VI.,Linke Wienzeile 22.

Abrechnung für die Zeit vom 1.4.1936 bis 31.3.1937.

Die EINNAHMEN bei Ihrer(n) Telephonstation(en)
Einschaltenummer(n) B 2o379 für die
Zeit vom 1.4.1936 bis 31.3.1937 betragen

in Bargeld	S 435,59	
in Telephonmarken 137 Stück a 8,28g	" 11,34	
	"	S 446,93

Telephongebühren an den Staat lt. § 4, Punkt 1,
der Fernsprechgebührenordnung vom Jahre 1931
Feststehende Gebühr (pro Monat S 16.--), daher
für die Zeit vom 1.4.1936 bis 31.3.1937 S 192.--

Zeitgebühr B 2o379 vom 1.4.1936 bis 31.3.1937 " 267,68

Garantierter Regiebeitrag (pro Jahr S 5o.--)
daher für die Zeit vom 1.4.1936 bis 31.3.1937 " 5o.--

Garantierte Mindesteinnahmen " 509,68

Daher M I N D E R E R T R Ä G N I S S 62,75

zuzgl.Nebenstelleninstandhaltung (p.a.S 1oo.--)............. " 1oo.--

Zusammen.... S 162,75

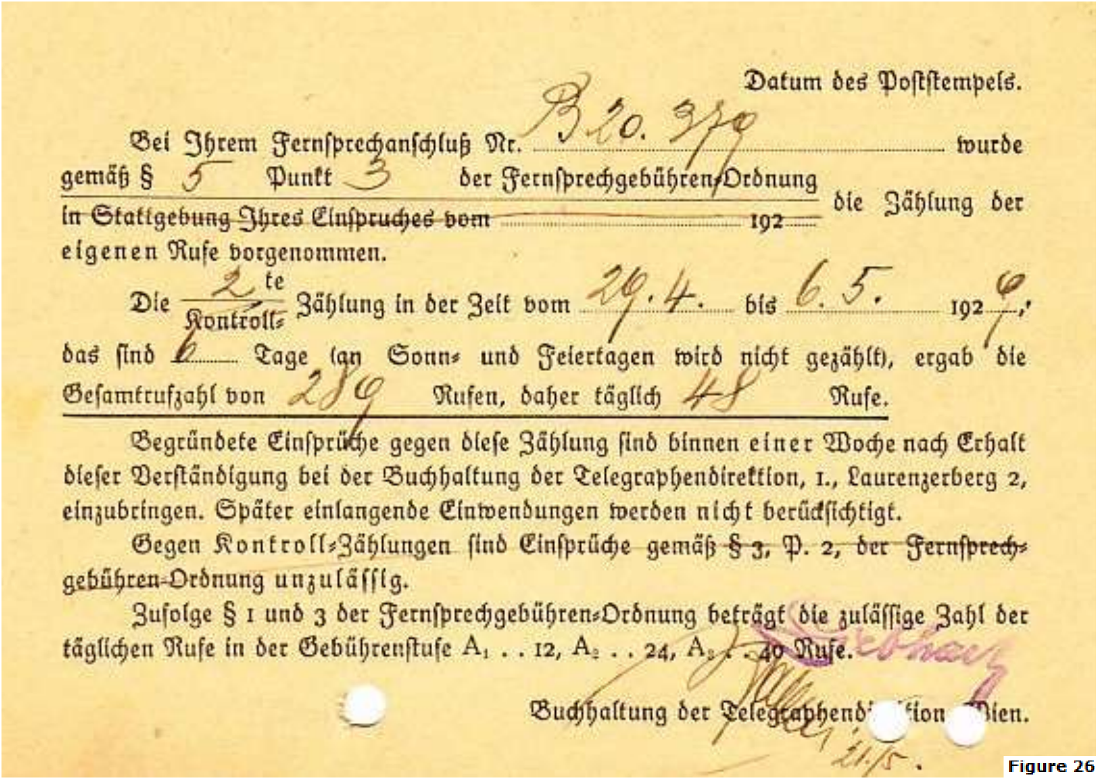
für die Sie aufzukommen haben und ersuchen wir Sie, diesen Betrag mittels des beiliegenden Erlagscheines ehestens an uns einzuzahlen.
Eventuelle Richtigstellungen behalten wir uns vor.

Hochachtungsvoll
Telephon-Automaten-Gesellschaft
m. b. H.

1 Erlagschein.

Figure 25

This is one of the yearly bills that the café owner received from the TAG (this one is for the period April 1st, 1936 to March 31st, 1937.) Among other things, this bill reveals that the guaranteed yearly earnings for TAG on the pay phone were ATS 509.69 (U.S. $ 72.30) per year, and that this goal wasn't reached. The café owner had to pay the TAG ATS 62.75 out of his own pocket. But that wasn't all – he also had to pay ATS 100.00 for the upkeep of the extension phone he had on the pay phone line ….



Datum des Poststempels.

Bei Ihrem Fernsprechanschluß Nr. B 20.379 wurde gemäß § 5 Punkt 3 der Fernsprechgebühren-Ordnung ~~in Stattgebung Ihres Einspruches vom ... 192..~~ die Zählung der eigenen Rufe vorgenommen.

Die 2te Kontroll- Zählung in der Zeit vom 29.4. bis 6.5. 1929, das sind 6 Tage (an Sonn- und Feiertagen wird nicht gezählt), ergab die Gesamtrufzahl von 289 Rufen, daher täglich 48 Rufe.

Begründete Einsprüche gegen diese Zählung sind binnen einer Woche nach Erhalt dieser Verständigung bei der Buchhaltung der Telegraphendirektion, I., Laurenzerberg 2, einzubringen. Später einlangende Einwendungen werden nicht berücksichtigt.

Gegen Kontroll-Zählungen sind Einsprüche gemäß ~~§ 3, P. 2, der Fernsprechgebühren-Ordnung~~ unzulässig.

Zufolge § 1 und 3 der Fernsprechgebühren-Ordnung beträgt die zulässige Zahl der täglichen Rufe in der Gebührenstufe A_1 . . 12, A_2 . . 24, A_3 . . 40 Rufe.

Buchhaltung der Telegraphendirektion Wien.

21/5.

Figure 26

According to the postcard shown above, there was already trouble in River City back in 1929 … at that time, one paid a specific flat rate for telephone service, based upon the number of outgoing calls per day. The rate categories were A_1 (with a maximum of 12 outgoing calls/day), A_2 (24 outgoing calls/day) and A_3 (40 outgoing calls/day).

Service observation between April 29th and May 5th showed that there were too many outgoing calls – namely an average of 48 per day. The problem was a financial one, because if one exceeded the limit in any of the lower categories, then one was moved up a notch, into the next higher category; if one exceeded the limit of category A_3, it was mandatory to do one of two things – either give up the phone entirely, or else have a second phone installed so that the individual outgoing call rates would fall below 40. Alas, I don't have any records which would show what the café owner opted for.

However, the subject is open to intelligent speculation. The directory number listed on the postcard is B 20-379; this is the same phone number listed as being the pay phone number in 1937, and this number was also the pay phone number in 1934. I also found the café listed under the directory number B-20-3-79 in the Viennese telephone directory of May, 1938, so one can guess that a second phone was installed (or else the outgoing call category limits were raised at some unknown time).

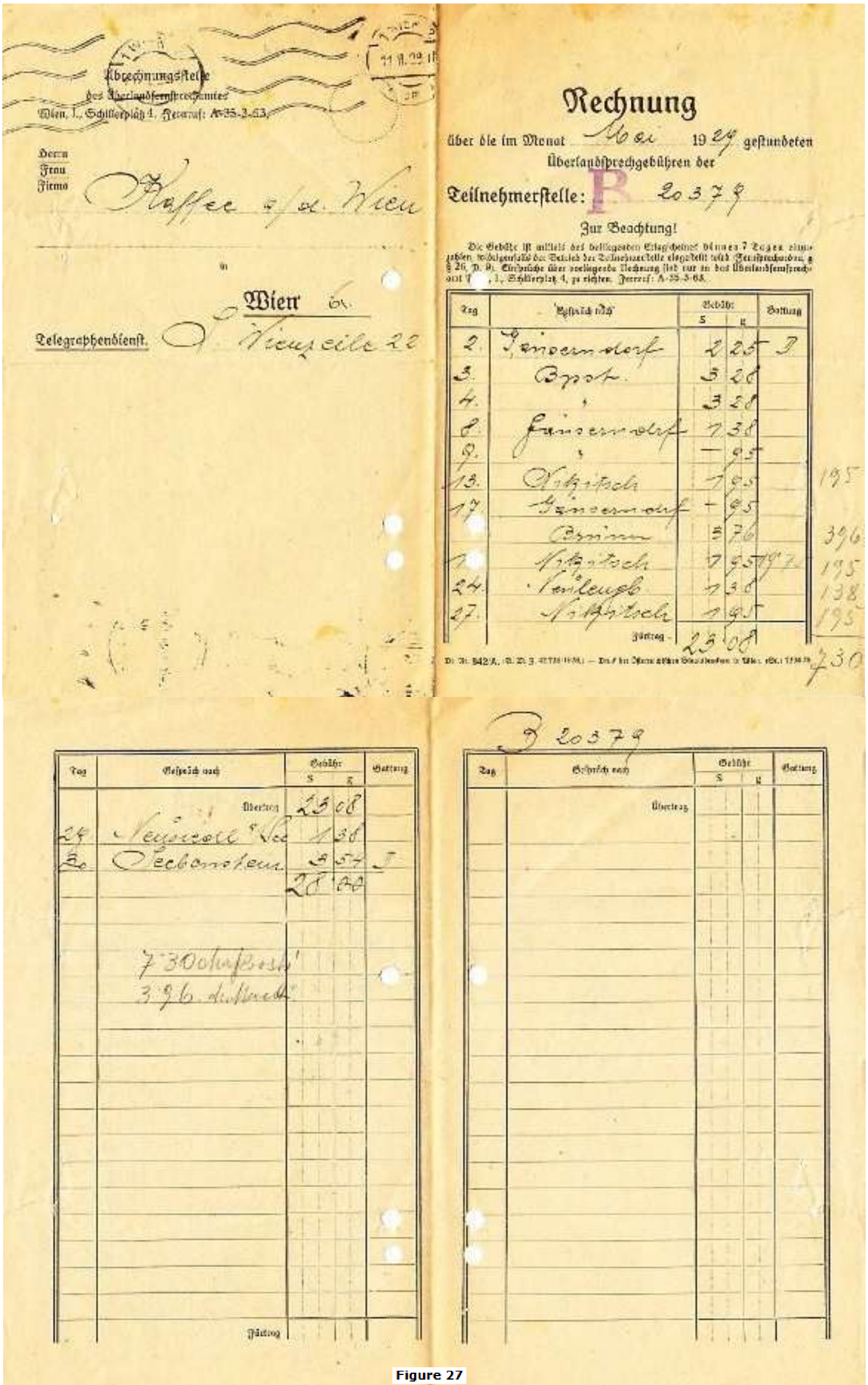
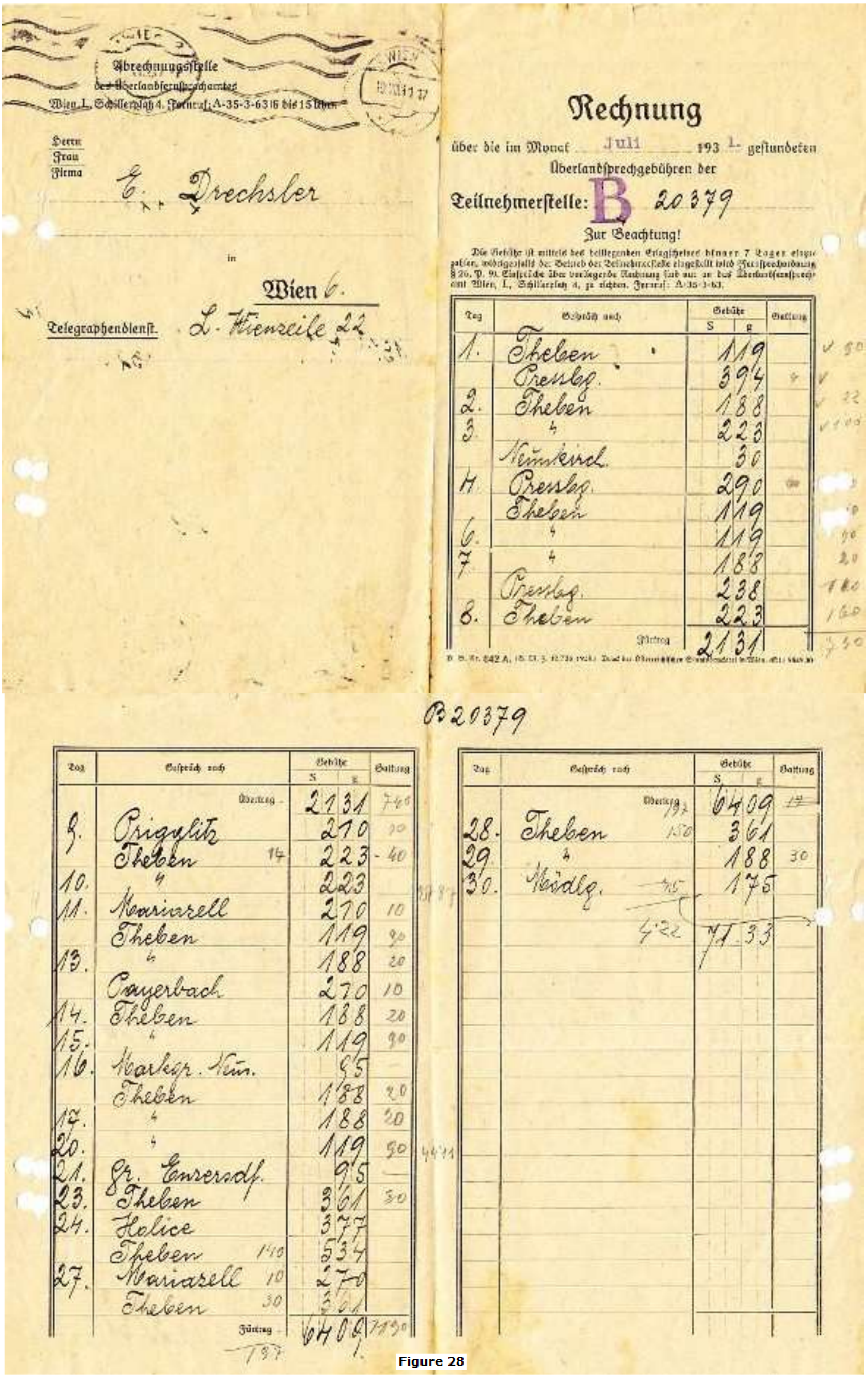

Abrechnungsstelle
Herrn
Frau
Firma
Wien
Telegraphendienst.
Rechnung
über die im Monat
gestundeten
Überlandsprechgebühren der
Teilnehmerstelle:
Zur Beachtung!
Tag
Gespräch nach
Gebühr
Gattung
Übertrag
Fürtrag

Figure 27



Abrechnungsstelle des Überlandfernsprechamtes
Wien I, Schillerplatz 4, Fernruf: A-35-3-63 16 bis 15 Uhr

Herrn / Frau / Firma E. Drechsler

in Wien 6.

Telegraphendienst. 6. Wienzeile 22

Rechnung

über die im Monat Juli 193 1. gestundeten Überlandsprechgebühren der

Teilnehmerstelle: B 20379

Zur Beachtung!

Die Gebühr ist mittels des beiliegenden Erlagscheines binnen 7 Tagen einzuzahlen, widrigenfalls der Betrieb der Teilnehmerstelle eingestellt wird (Fernsprechordnung § 26, P. 9). Einsprüche über vorliegende Rechnung sind nur an das Überlandfernsprechamt Wien, I., Schillerplatz 4, zu richten. Fernruf: A-35-3-63.

Tag	Gespräch nach	Gebühr S	g	Gattung
1.	Theben	1	19	
	Preslbg.	3	94	
2.	Theben	1	88	
3.	〃	2	23	
	Neunkirch.		30	
4.	Preslbg.	2	90	
	Theben	1	19	
6.	〃	1	19	
7.	〃	1	88	
	Preslbg.	2	38	
8.	Theben	2	23	
	Vortrag	21	31	

B 20379

Tag	Gespräch nach	Gebühr S	g	Gattung
	Übertrag	21	31	
9.	Prigglitz	2	10	
	Theben	2	23	
10.	〃	2	23	
11.	Mariazell	2	70	
	Theben	1	19	
13.	〃	1	88	
	Payerbach	2	70	
14.	Theben	1	88	
15.	〃	1	19	
16.	Marktgr. Neus.		95	
	Theben	1	88	
17.	〃	1	88	
20.	〃	1	19	
21.	Gr. Enzersdf.		95	
23.	Theben	3	61	
24.	Halice	3	77	
	Theben	5	34	
27.	Mariazell	2	70	
	Theben	3	01	
	Vortrag	64	09	

Tag	Gespräch nach	Gebühr S	g	Gattung
	Übertrag	64	09	
28.	Theben	3	61	
29.	〃	1	88	
30.	Mödlg.	1	75	
		71	33	

Figure 28

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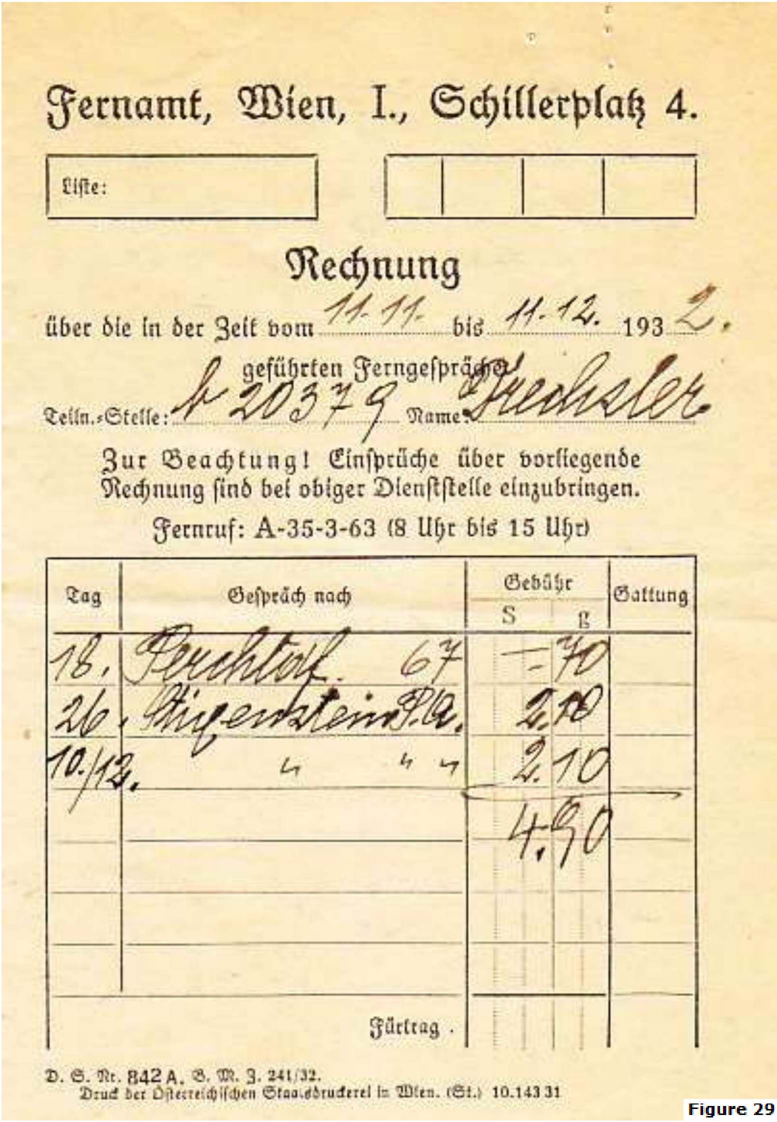


Fernamt, Wien, I., Schillerplatz 4.

Liste:

Rechnung

über die in der Zeit vom 11.11. bis 11.12. 1932.

geführten Ferngespräche

Teiln.-Stelle: A 20379 Name: Drechsler

Zur Beachtung! Einsprüche über vorliegende Rechnung sind bei obiger Dienststelle einzubringen.

Fernruf: A-35-3-63 (8 Uhr bis 15 Uhr)

Tag	Gespräch nach	Gebühr S	Gebühr g	Gattung
18.	Perchtdf. 67	–	70	
26.	[illegible] N.Ö.	2	10	
10./12.	" " "	2	10	
		4	90	
	Fürtrag			

D. S. Nr. 842 A. B. M. Z. 241/32.
Druck der Österreichischen Staatsdruckerei in Wien. (St.) 10.143 31

Figure 29

What I really found unusual were several calls to a place listed as “Theben” (Thebes) in the toll call bill shown on the previous page. Up until recently, the only place named Thebes that I knew about was located near the city of Luxor in Egypt. Apparently, though, there was (at one time) a small place of the same name in Austria, because I found an engraving of Thebes next the Danube River on the internet.

By comparing the cost of a toll call from Vienna to Thebes with the cost of a toll call to the town of Mariazell (located in the region of Upper Styria in the province of Styria), one can see that the former toll call was less expensive than the latter, so it’s only logical to assume that there must have been a place called Thebes in Austria.

The last batch of phone bills presented are from 1961-62, when the Austrian PTT was using an unwieldy IBM® computer for billing purposes.


Fernmeldegebühren-Rechnung
Empfangsbestätigung
[redacted]
549669
21.02.62
BAR
15 | 18000 | 8450
26450
Zählerstand-Unterschied | Zeitgebühr | Festst. Gebühr | Ferngespr.- u. Telegr.-Geb. | Fernschreib-Gebühren | Fallw. Geb. u. Beilage | Gebühren-Summe | Letzter Zählerstand
FERNSPRECHGEBÜHRENAMT WIEN I, LAURENZERBERG Nr. 2
FERNSPRECHGEBÜHRENAMT WIEN
15 MRZ 1962

Figure 30

The telephone bill with attached receipt shown above is dated March 15th, 1962. The subscriber placed 15 units worth of active phone calls during February 1962, amounting to ATS 180.00 (1 unit of time was equal to ATS 12.00), while the rental fee was ATS 84.50 for the same month. The total phone bill amounted to ATS 264.50 (circa U.S. $ 12.00 at the time).

This particular phone bill reveals a very interesting fact, namely that directory numbers for Vienna's 12th district began with the CO identifier "54" in 1962, which was changed to "83" at a later date.

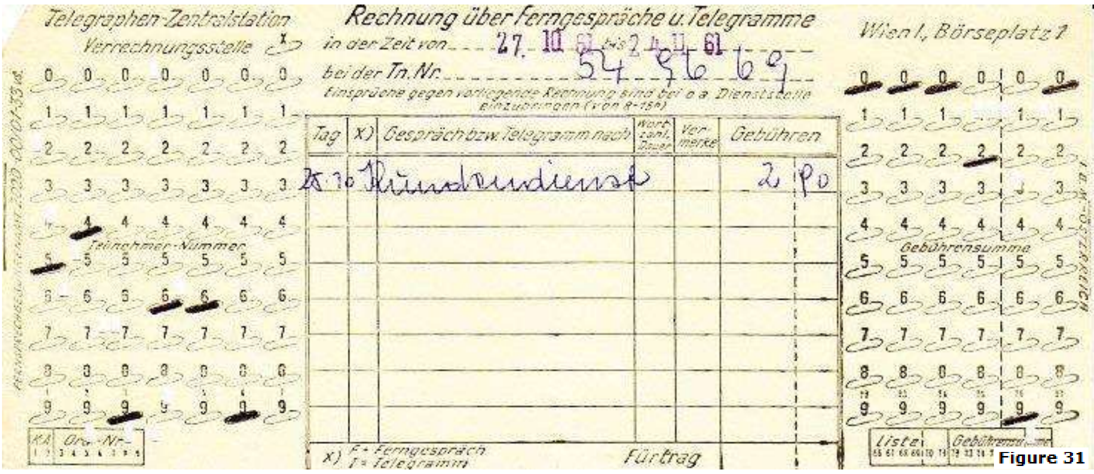

Telegraphen-Zentralstation
Verrechnungsstelle
Rechnung über Ferngespräche u. Telegramme
in der Zeit von 27. 10. 61 bis 2. 11. 61
bei der Tn. Nr. 54 96 69
Wien I, Börseplatz 1
Teilnehmer-Nummer
Tag | x) | Gespräch bzw. Telegramm nach | Wort-zahl, Dauer | Vermerke | Gebühren
25.10. | | Kundendienst | | | 2 90
Gebührensumme
x) F = Ferngespräch, T = Telegramm
Fürtrag

Figure 31

The punched card shown above was used for billing operator-assisted toll calls and telegrams, as well as for billing special services – in the case above, the subscriber placed a call to customer services on October 25th, 1961. This call cost ATS 2.90.

The 7 data columns on the left of the card are for entering the directory number to be billed, while the 6 data columns on the right are for entering the total costs to be added to the regular phone bill. The card also has several regular punches which define the card type.

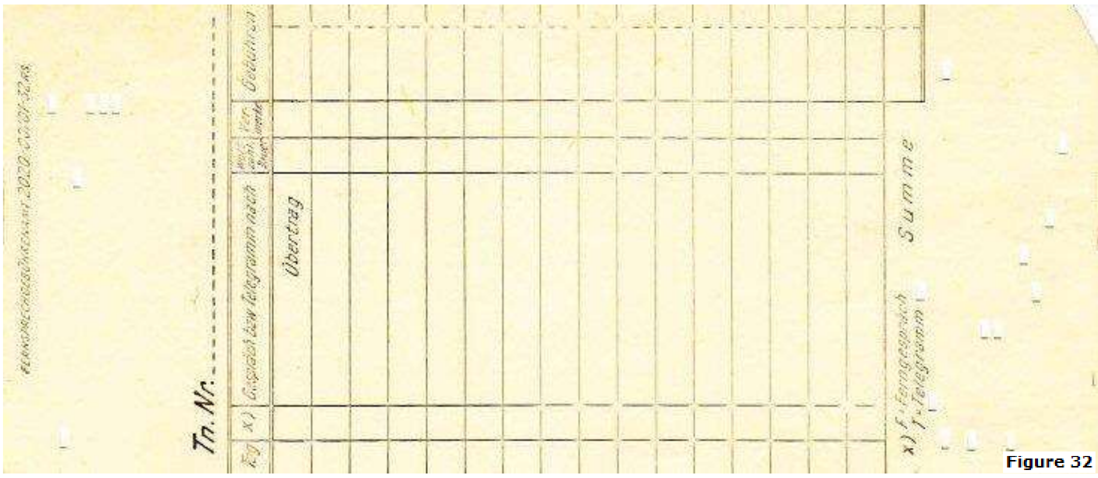

Tn. Nr.
Tag | x) | Gespräch bzw. Telegramm nach | Wort-zahl, Dauer | Vermerke | Gebühren
Übertrag
Summe
x) F = Ferngespräch, T = Telegramm

Figure 32

The lower scan on the previous page shows the reverse side of the same card. One can see the punch marks on the card as a faint series of slate-colored "dashes." The table on the reverse side of the card is intended for entering additional billing information, in case the table on the front of the card was full.

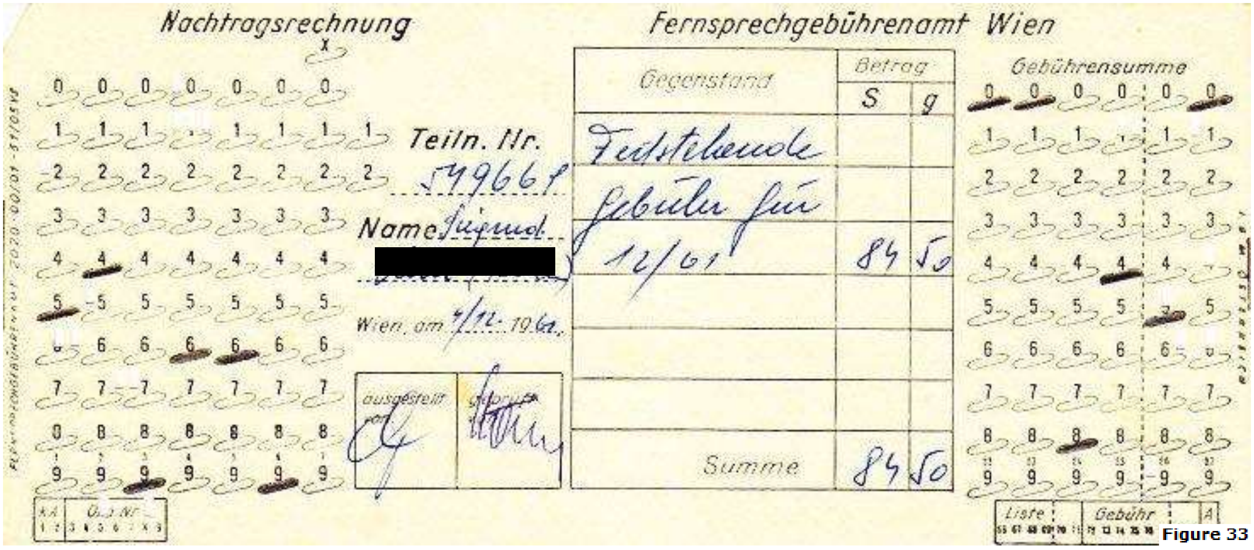


Figure 33

The punched card shown above was for additional billings not covered by the punched card type shown on the previous page. In this case, it was the first bill for the rental fee. Once again, the 7 data columns on the left of the card are for entering the directory number to be billed, while the 6 data columns on the right are for entering the total costs to be added to the regular phone bill.

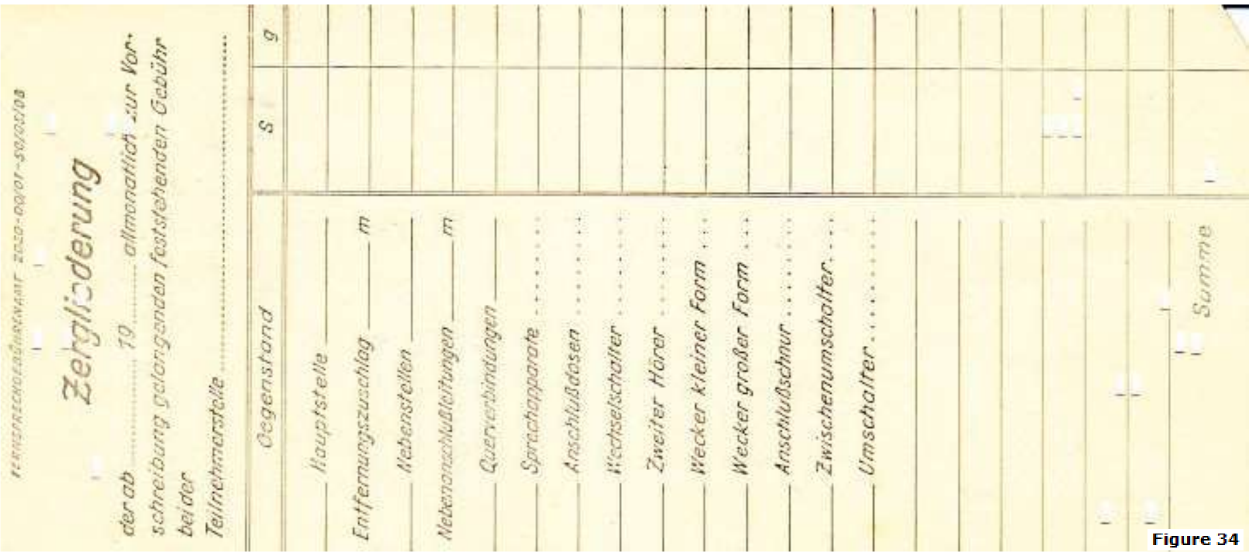


Figure 34

The reverse side of this type of punched card has a table with a list of auxiliary telephone equipment which subscribers could rent from the Austrian PTT and for which there was a monthly fee. Such auxiliary equipment could, among other things, be cylindrical plugs and jacks, a second handset, a large or small auxiliary ringer, an over-length line cord, &c.

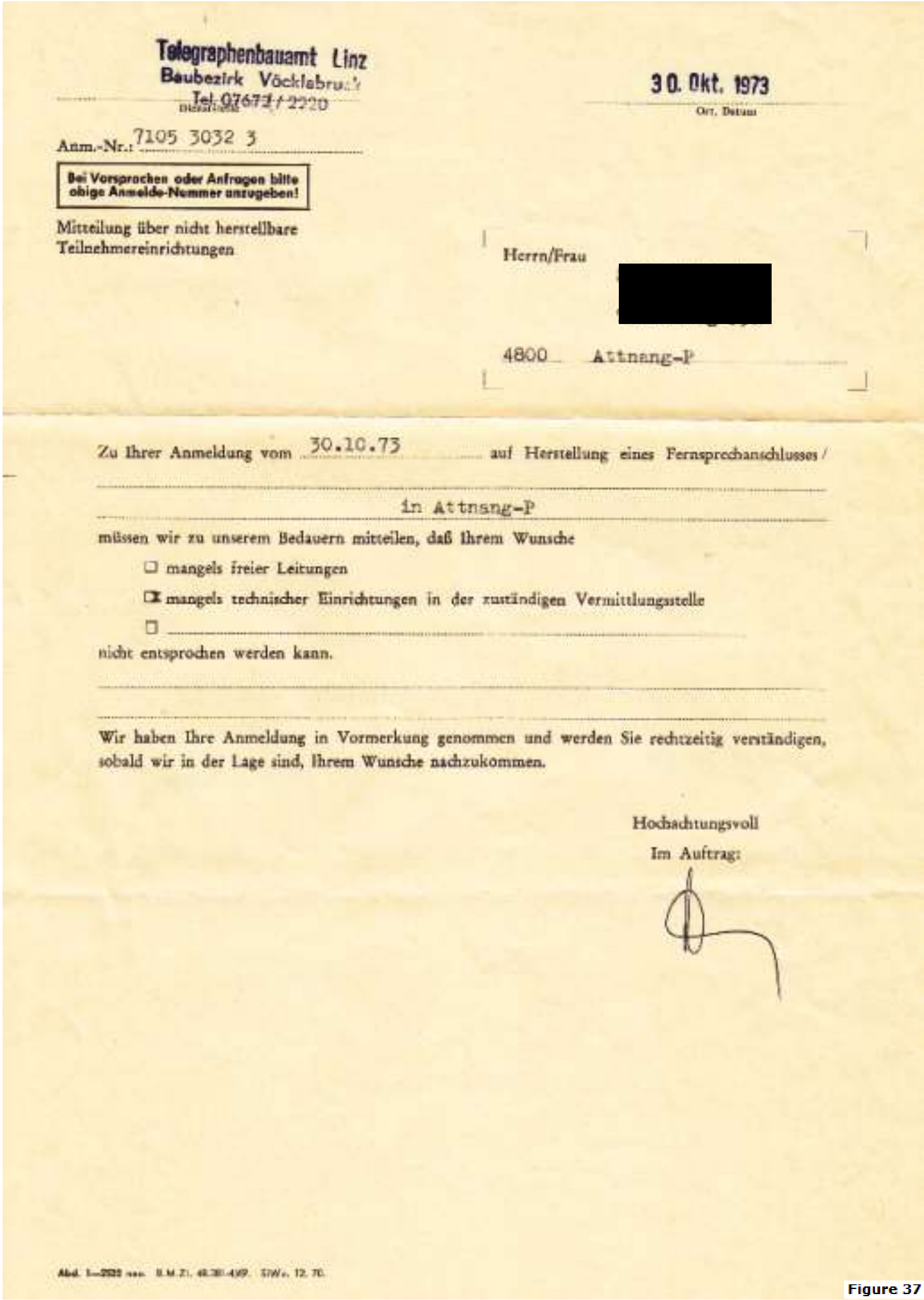
Figure 35

This punched card is of the same type as the one shown on the previous page, but in this case the billing was for the transfer of the phone and directory number to a new subscriber. The data columns serve the same purpose as on the previous card and the reverse side of this card is exactly the same as on the previous card as well.

Figure 36

The punched card shown above was for billing a subscriber for the disconnection of his or her telephone due to non-payment of telephone bills. In this case, the subscriber was in arrears to the amount of ATS 469.00 on March 13th, 1962; the cost for disconnecting the line was ATS 16.50.

It’s curious that the 6 data columns on the right were not used to enter the costs of disconnection which were to be added to the regular phone bill. Possibly the holes punched into this card signify that the bill amounts to ATS 16.50, since billing disconnections was the only thing this type of card was used for.



Telegraphenbauamt Linz
Baubezirk Vöcklabruck
Tel. 07672/2220

30. Okt. 1973
Ort, Datum

Anm.-Nr.: 7105 3032 3

Bei Vorsprachen oder Anfragen bitte obige Anmelde-Nummer anzugeben!

Mitteilung über nicht herstellbare Teilnehmereinrichtungen

Herrn/Frau
[redacted]

4800 Attnang-P

Zu Ihrer Anmeldung vom 30.10.73 auf Herstellung eines Fernsprechanschlusses /

in Attnang-P

müssen wir zu unserem Bedauern mitteilen, daß Ihrem Wunsche

☐ mangels freier Leitungen

☒ mangels technischer Einrichtungen in der zuständigen Vermittlungsstelle

☐

nicht entsprochen werden kann.

Wir haben Ihre Anmeldung in Vormerkung genommen und werden Sie rechtzeitig verständigen, sobald wir in der Lage sind, Ihrem Wunsche nachzukommen.

Hochachtungsvoll
Im Auftrag:

Figure 37

Nope, the above isn't a telephone bill, but it's still very interesting all the same, and shows the Austrian PTT from a less pleasant side. This document was used to inform a potential subscriber that his or her order for telephone service could not be filled, either due to a lack of a free pair of wires or due to a lack of exchange equipment … in this case, it was due to the latter cause. Note the date on the document: 30 October *1973*.

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Telegraphenbauamt Linz
Baubezirk Vöcklabruck
Tel. 07672/2220
Dienststelle

Vöcklabruck 80 03 05
Ort, Datum

Anm.-Nr.: 710530323

Bei Vorsprachen oder Anfragen bitte obige Anmelde-Nummer anzugeben!

Einverständniserklärung

Herrn/Frau
[redacted]
4800 Attnang

Zu Ihrer Anmeldung vom 30.10.73 erklärt sich die Post- und Telegraphenverwaltung mit der gewünschten

☒ Herstellung ☐ Umwandlung

des / der

☒ Fernsprechanschlusses ☐ Amtsleitung für Nebenstellenanlagen

auf folgender Adresse (Standort): w.o.
Straße Haus-Nr. Stiege Stock Tür Postleitzahl

einverstanden. Die Gebühr für die bezeichnete Arbeit beträgt S 750.-

Dieser Betrag sowie die Gebühr für allfällige sonstige Arbeiten (wie Herstellung von Zusatzeinrichtungen), wird Ihnen **nach Durchführung der Arbeiten mit der Fernmeldegebühren-Rechnung** zur Zahlung vorgeschrieben werden.

Der genaue Zeitpunkt der Durchführung wird Ihnen vom zuständigen Bautrupp noch bekanntgegeben werden.

Für den Anschluß ist — vorbehaltlich etwaiger Änderungen aus technischen Gründen — die Fernsprechnummer [redacted] in Aussicht genommen.

Sollten Sie bedingt durch die gegenständliche Herstellung an einer anderen Adresse Ihre Fernsprecheinrichtungen nicht mehr benötigen, müßten Sie diese kündigen. Die Kündigung wird zum Ende eines Kalendermonates wirksam, wenn sie spätestens am dritten Werktag dieses Monats der zuständigen Dienststelle zugeht. Eine an einem späteren Tag dieses Monats einlangende Kündigung wird erst zum Ende des folgenden Monats wirksam.

Hochachtungsvoll
Im Auftrag:

43 829 Auflage 1978 (Abc. I—2325 5 ecu.) 5M21. 2735-41/78.

Figure 38

In March of 1980, after waiting a *mere* 6 years and 5 months (!), the Austrian PTT informed the prospective subscriber that service could finally be provided. The subscriber was (among other things) informed that the service charge for connecting his phone to the exchange would be ATS 750.00 (roughly 65 dollars at the time).

An Early Postwar Austrian Desk Telephone

Figure 1

I purchased this phone a good number of years ago – I had only wanted it because it has the old style Viennese dial; I needed the finger wheel and the number ring to repair a more "deserving" phone.

This phone was *very* dusty and dirty, and to top things off, the dial was stuck as well … but that didn't matter at first.

It was only when I removed the handset caps and saw what was inside that I began to think that it would be worthwhile to clean the phone up and get the dial running again.

Shown to the right is the transmitter I found in the handset. It's of much smaller size than is normal, and it was held in place inside the handset with the aid of some phenolic paper rings which are riveted together. This type of microphone was used by the German Wehrmacht in a special headset circa 1942.

Figure 2

Figure 3

What was hidden under the receiver cap is shown to the left – basically, it's a headphone unit from a pilot's headdress used by the German Luftwaffe (also circa 1942).

The resistance of the two coils inside this headphone unit is 200 Ohms in sum; this is much higher than the 54 Ohms a normal telephone receiver has.

Now I really began to wonder what sort of unusual telephone I had bought ….

It turned out that this type of telephone was the best the Austrian industry could do in the very early years after WW II. The construction was as simple as possible, the housing and baseplate were punched out of sheet iron and then pressed into shape. The handset handle was from Siemens & Halske, while the unusual innards are unmarked as to manufacturer; however, I know that the small carbon microphone was manufactured by Siemens as well.

Figure 4

As to the manufacturer of the phone itself, the decal with the logo was originally hidden beneath a thick layer of grime. After I had wiped the logo clean, I saw how well preserved the decal was and decided that it was time to polish this phone up nicely and get it back into working order.

I first removed the dial from the housing and then washed the housing using lukewarm water, pH neutral soap and nothing more than my hands. I polished it up by hand after first carefully drying it, using some clean rags and a special polish which was guaranteed to restore luster to dull car body paint. The black paint turned out to be in very good overall condition.

Ah, yes, I *do* recall what I previously wrote about restoring woodwork and/or paint, namely that "I'd like to point out that I consider every nick, scrape and scratch to be part of the unique history of any telephonic item I have collected. I never disguise or repair such damage, but if anything can, for instance, be polished up without repainting, then I will do so." – That is precisely what I did in this case.

Figure 5

The handset cradle of this particular phone was cast out of aluminum, and apparently only given a rough going-over with a coarse file … one can still see the scratches left by the file.

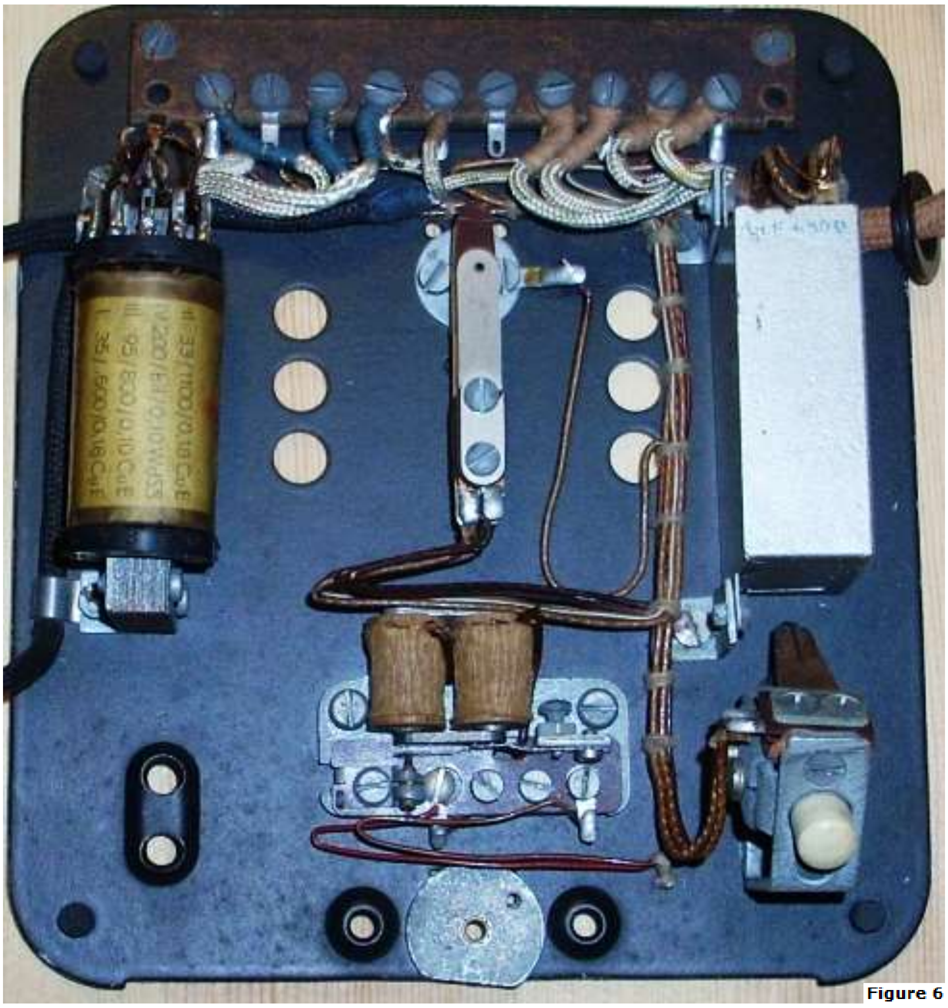

Figure 6

This is the baseplate belonging to the phone. As can be seen, the factory installed a D.C. buzzer instead of an A.C. ringer – this was simply due to a lack of parts in 1946, when this phone was built.

Although it sounds very strange to use a D.C. buzzer or ringer in a "normal" desk telephone, instead of an A.C. buzzer or ringer, it *does* work. Not too well, perhaps, but as an expedient, where the only alternative is nothing at all, it's quite satisfactory.

The pushbutton in the lower right-hand corner of the baseplate indicates that this particular phone was intended for use with an exchange which was wired for "ground start," where the subscriber line had to be briefly grounded in order to receive dial tone, as opposed to "loop start" exchanges, where dial tone was immediately available after lifting the handset.

Even such paltry items as screws were in short supply in 1946; the baseplate is held in the housing by two punched tangs along the rear edge, while there is a small, simple slit on the front of the housing, into which the rotating "latch" (between the two punched screw holes in front on the baseplate) was turned.

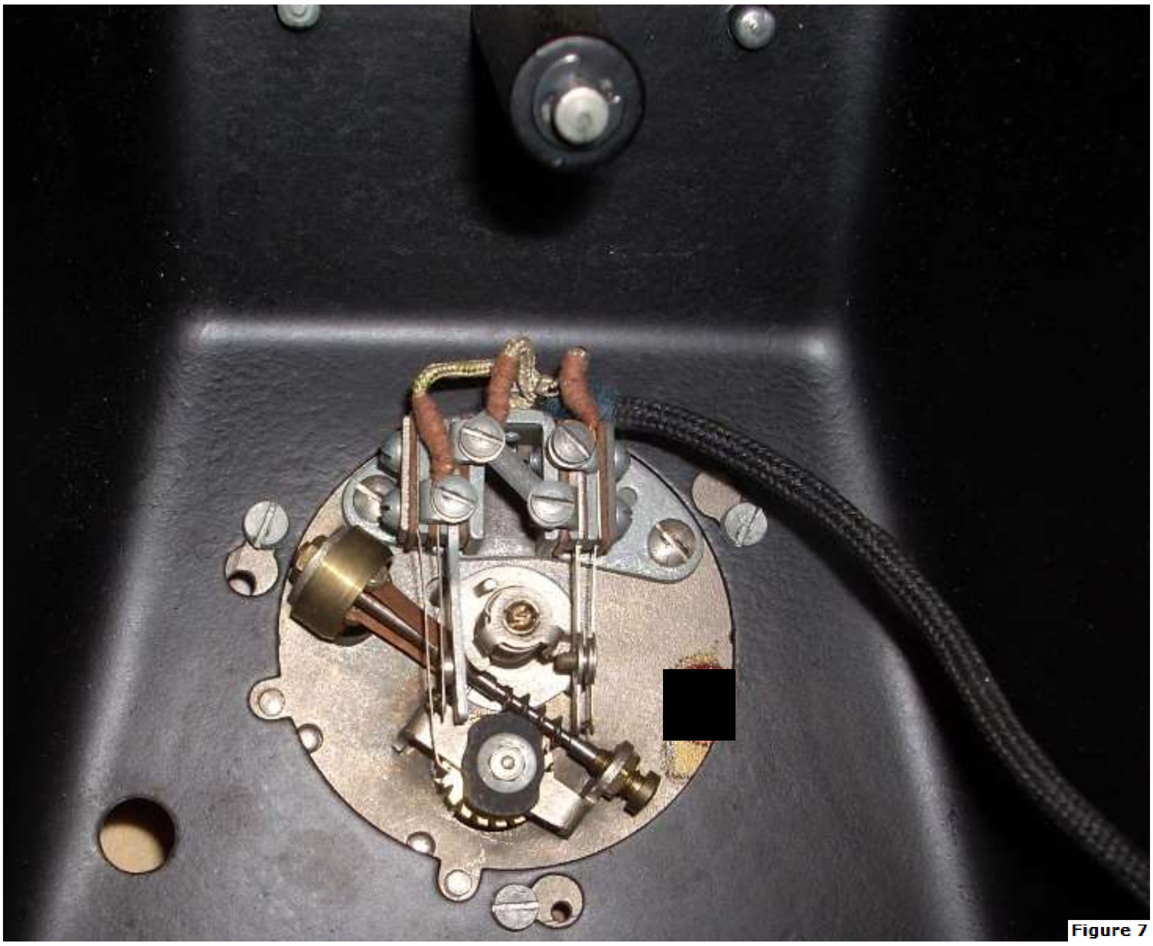

Figure 7

This close-up of the interior of the housing reveals a few interesting facts: the dial was refurbished before being put back into service, the handset cradle has two guide pins to prevent it from rotating, as well as a spring-loaded, center plunger which operates the cradle switch.

Figure 8

Although the phone to the left doesn’t have any identifying marks as to the manufacturer, it bears such a strong resemblance to the previous phone that I am willing to bet that it was built by the same company.

The most obvious difference to the preceding telephone is the handset cradle – a two piece affair with two separate plungers (not exactly located where the holes for the two guiding pins are on the other phone); the housing could, however, also be used with a cradle of the same type as on the other phone. Here, the hole for the plunger is plugged.

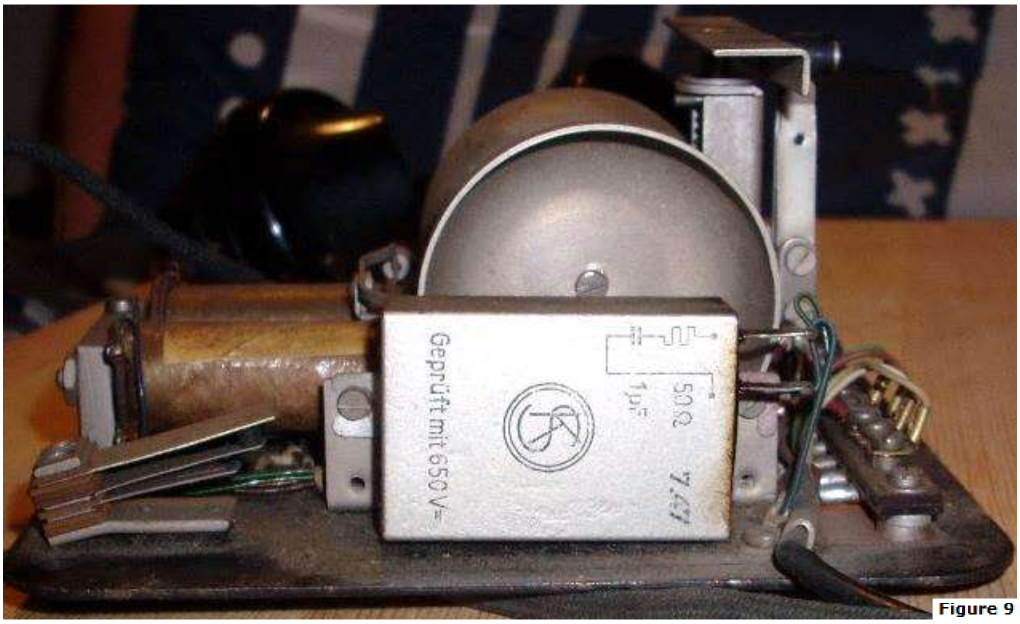

Figure 9

As can be seen in the photograph above, the date code on the condenser is July, 1947, which means that this particular phone was built at some time during the second half of that year. This particular phone has an A.C. ringer instead of a buzzer, and the grounding pushbutton is of a different design, as is also the cradle switch.

Figure 10

The most interesting information to be gained from this snapshot is that the A.C. ringer and the two gongs are of the exact same type as were used in the German field phone 33.

It's a little-known fact that the Viennese firm of Schrack built field phones for the Wehrmacht during the years of occupation, so they may well have had some stock left over from then, or else they bought the ringers and gongs from Czeija, Nissl & Co. or Kapsch and Sons (who also built FF-33 field phones during WWII).

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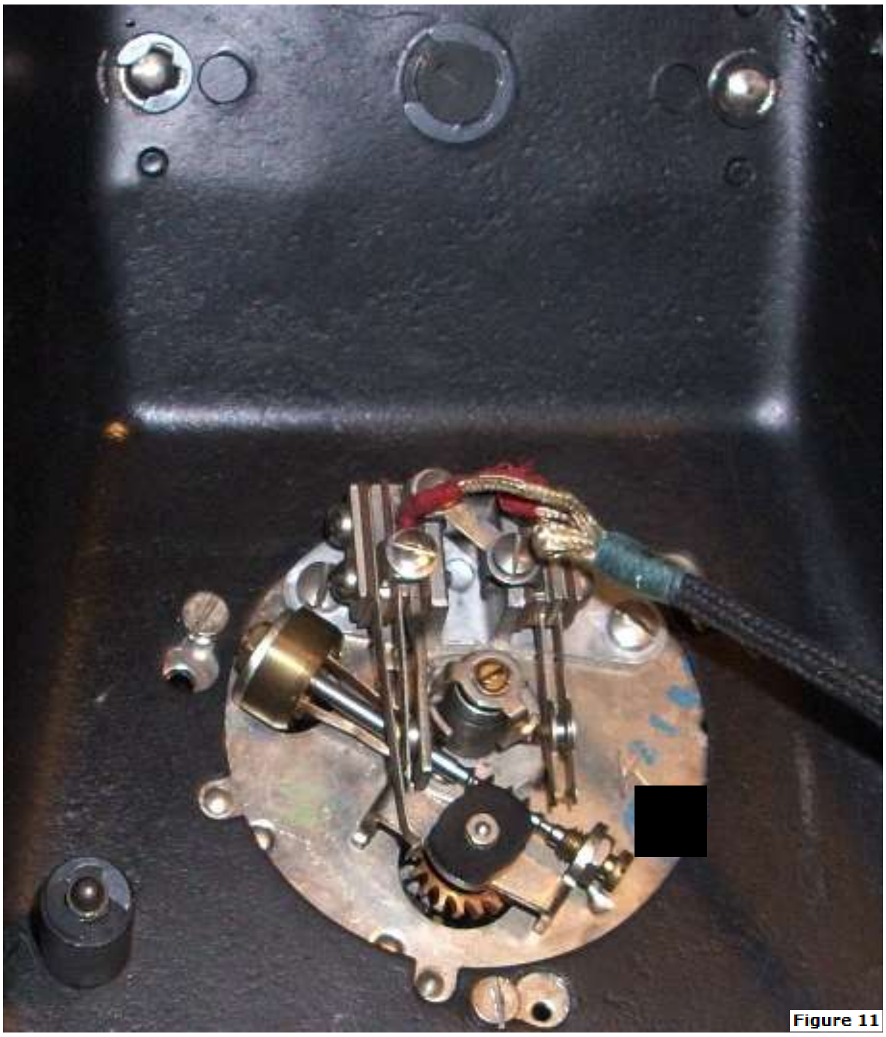

Figure 11

As can be seen, the hole for the handset cradle plunger is plugged on this housing and that, apparently due to poor planning, the position of the holes for the two cradle plungers don’t coincide with the holes for the two guide pins of the one-part handset cradle of the other phone shown here.

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Errata on Vienna & Austria in the Book "Telephone Dials & Pushbuttons"

(*As well as some other obvious errors*)

The following pages are not intended to discredit Mr. Swihart's work in any manner, but should rather be viewed as a means to increase the factual value of the book to future readers by identifying some of the more or less serious errors which crept into the work. Since Mr. Swihart is, sadly, no longer with us, and while the publisher is apparently pretty well fed-up with matters concerning the book and openly states that even the most-needed changes are *too time-consuming and costly to make* (when compared with the possible income generated by the book), the author has decided to write up and publish the following corrections independently.

The author wishes to make it perfectly clear that he held Mr. Swihart in high esteem for his exceptionally deep and widespread knowledge of telephony, as well as of telephone history in general, and anyone who followed Mr. Swihart's trials and tribulations knows just how difficult it was for him to finally get his book into print (if correctly remembered, version 1.00 was a mere 78 pages long). It's more than just a shame that Mr. Swihart's highly specialized library was disposed of in the manner in which this took place (in part, literally, packed off to the recycling center or just plain thrown away), because this makes it impossible to recheck information where this appears to be necessary … the portion of Tacitus which Mr. Swihart quotes on page 3 of his book sums things up nicely – both as to his own fate and that of his book. Refer to Mr. Swihart's post scriptum for more on this – was prophecy at work here?

The author feels that it would be very desirable if others would, for the sake of propagating verified & correct information, undertake writing supplements and/or corrections in their areas of expertise, similar to those presented here.

Having written what was to be written on this matter for the moment, onwards …

Volume I

Page 3-64, "Offset-order dials, continued" – reference to Vienna in the right-hand column

In chapter 3.6.3., it's written that offset-order dials invariably caused problems when long distance calls were dialed from a country with an offset-order dial to any country not utilizing the same dial layout – purportedly, the same sort of problem was encountered when dialing from Vienna to anywhere else ("Vienna also had offset-order dials. There too a similar problem arose. Chapter 5.5.6 discusses the problems with this layout in Vienna").

Throughout the years, and as the book evolved, the book's editor had one pet misconception: that it was possible to dial *out* of Vienna (or *into* Vienna, for that matter) prior to the dial conversion of 1957 – this simply *wasn't* possible, except to and from a very limited number of locations situated near Vienna, and by unconventional ways and means. The reference on page 3-64 is misleading and should therefore be deleted for the sake of accuracy.

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Page 3-97, Exhibit 3-9H, “Dial with 12 holes”

Exhibit 3-9H — This dial with twelve holes was ~~used only in service handsets of Bundespost technicians, never in customer apparatus~~ the last one used on outward toll positions in Vienna, Austria.

Figure 1

The dial shown in the exhibit is attributed to the German Bundespost; in reality, this dial was used (until circa 1998) on outward toll positions by the *Austrian* PTT, for operator-assisted calls to Eastern Europe (from Vienna), in situations in which ‘code 11’ and ‘code 12’ dialing was required[1] in order to reach an English-speaking inward operator in a foreign country. This error was reported to the book’s editor, but it was obviously never rectified. The scan to the right is from a draft version dated October 5, 2006, and shows the author’s handwritten correction as submitted to the editor.

[1] Such as between Vienna and Belgrade, Yugoslavia, which was placed into operation in September, 1966; this toll line terminated in the toll tandem exchange in Vienna.

Page 3-98, Excursus 3-9M, “Dial with two holes and one pushbutton”

As published in the book, several paragraphs of text were inadvertently printed out of sequence, and one small photograph was omitted, so that the excursus doesn’t *really* make much sense and can, therefore, be deleted as well.

Page 3-114, Exhibit 3-11-2D, “Model W64 Austrian PTT telephone”

While being correctly identified as belonging to the W64 generation, the telephone shown *isn’t* a PBX telephone, as is stated in the exhibit. The phone shown was used for party-line service, in connection with a small subset, which isn’t shown. Party-line service in Austria was, with few exceptions in rural areas, strictly “secret service” from 1905 onward, and the subscriber had to push the “ground” pushbutton on this telephone to seize the party-line (if the same wasn’t already busy). Also, while it is correct that the pushbutton was also available in the color black, white was commonly used; the color wasn’t a customer-orderable option anyway.

The electromagnetic indicator in the lower left-hand corner of the phone gave a visual indication of whether the party-line was busy or not while the pushbutton was being depressed with the handset off-hook; such indicators are commonly known as “star” indicators in German-language Telco parlance.

Page 3-119, Exhibit 3-11-4A, German Reichsbahn area code directory, August, 1939.

The last sentence of the second paragraph of text in the exhibit reads: “In this extract from late 1939, the Morse code was used only in four cities, all in Austria.” This isn’t quite true; *one* of the four cities using a Morse code city identifier was <u>Oppeln</u> – the historical capital city of the district of Upper Silesia, which belonged to Prussia between 1742 and 1945 & which fell to Poland after WWII.

Page 3-124, Chapter 3.11, “Call progress tones, continued”

In the first full paragraph of text in the left-hand column, the first line of text reads: “In parts of Europe, this extra immediate ring may have had to do with PBXs.” It isn’t the case that the “…extra immediate ring ‘may’ have had to do with PBXs…” – it *did* and *still has* to do with PBXs, for the reason stated in the text.

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Page 3-128, Exhibit 3-15C, "Abbreviated dialing equipment"

The abbreviated dialing equipment shown in the exhibit is correctly identified as a "Telerapid" dialer, manufactured by the German firm of the same name. However, something got mixed up, because the author never stated that "An American telephone collector also has such a phone," but rather pointed out to the book's editor that "Telerapid" dialing equipment was also used by the Bell System in the USA, which is proved by the existence of an appropriate BSP (Section C34.112). The author happens to own a NOS Telerapid type 125 dialer from the late 1940s (but it isn't connected to any phone at all).

Readers may also wish to refer to the lead article in the January 2011 issue of "Singing Wires," which makes mention of the Telerapid type 125 & 350 electromechanical automatic dialers (further information may also be found in Part 2 of the same issue).

Page 3-131, Chapter 3.16, "Dialing long-distance, continued" – Subscriber dialing in Europe

In the right-hand column of text, near the bottom of the page, it is stated that "Several other countries had made limited installations before the war – Italy from 1928, Austria, France and Belgium in the 1930s …."

Austria was virtually a sea of manual service at the time written of, with a few small, isolated islands of local dial service – it simply *wasn't* possible for people at Vienna to dial their own long-distance calls to other cities in Austria (let alone to anywhere *else* on the planet), and folks in other cities in Austria couldn't dial calls to each other, or to Vienna (or elsewhere), either.

It wasn't until the dial exchange network group in the town of Klosterneuburg and environs[2] (near Vienna) was installed and placed into service circa 1929 that *any* form of subscriber-dialed long-distance service was available – but even then, subscribers could only dial from Klosterneuburg *into* Vienna, but not the other way around[3].

This situation changed somewhat during the years of WWII – toll calls to and from nearby towns which were of importance to the war effort (various factories had been located predominantly to the east and south of Vienna in order to protect them from possible Allied bombing raids) were placed by the subscriber in Vienna dialing directly to an inward operator's position[4] in the town concerned – the inward operator then completed the call manually. Some of these operators could also dial directly into the Vienna telephone network (the less fortunate ones only had C.B. lines running to the Vienna toll exchange), but neither mode of operation could even remotely be considered to be direct distance dialing in the traditional sense.

[2] More information on the Klosterneuburg network group (and later additions) may be found in "A *Closer* Look at Telephone Levers, Dials and Pushbuttons at Vienna," which is planned to be published separately and at some later date.

[3] Subscribers connected to the Klosterneuburg dial network group had to separately contract and pay for service which allowed direct distance dialing into the PSTN in Vienna; those who didn't enter into such a contract had to make do with traditional, operator-assisted connections to reach subscribers there.

[4] The dial telephone lines were hosted on various exchanges *within* Vienna in all cases and since Viennese local exchanges were not equipped to meter or handle toll calls at the time, the inward operator at the distant end of the line took care of toll ticketing.

Page 4-9, Chapter 4.5, "Austria, 1909-1930"

Although the author's name is listed under the heading "acknowledgements," he never saw so much as a draft of this chapter, and was thus unaware of the more or less serious errors which found their way into the text ….

There is erroneous information, possibly arising from a misinterpretation of German-language text, concerning the lever telephone system installed at the city of Graz in the province of Styria. The book states that, "initially this system apparently had about 2,000 residence lines and 1,200 business lines." The original German-language source writes of "… eine vollautomatische Zentrale für 2000 Einzel- und 1200 Gesellschaftsanschlüsse …." The German word "Gesellschaftsanschluss" *could* be construed as meaning "business line," since one of the common translations of the root word "Gesellschaft" is "business," but it also, *very literally*, translates to "party" in the sense of a group of people. "Gesellschaftsanschluss" refers to a *party-line* within the context of the original German-language source; hence the system at Graz was initially installed with 2,000 single-party (private) lines and 1,200 lines, each hosting a maximum of either two or four parties. Thus, the 3,200 lines the exchange was equipped with could support a maximum of 6,800 subscribers (under the condition that all party-lines had four parties connected).

It may also be of interest to note the fact that, since the subscriber's telephones were originally of the lever type (with 4 digit phone numbers), the numeral ring on the dials used later on were numbered 0-9 (the same as at Vienna, but sans letters).

Exhibit 4-5A on the same page contains some factual errors; there never was a specific "table model version" of the lever-type telephone, and it wasn't intended to offer this type of telephone in a wall-mounted version. While it may, or may not, be true that Dietl, et al, developed the lever-type desk *telephone* (at the very least, blueprint number 10979 from the Imperial-Royal Administration of Posts and Telegraphs, dated April 1910, bears his signature), it *wasn't* Dietl who invented the Austrian version of the lever-type dialing mechanism.

The Austrian lever 'dialing' mechanism was designed and patented by Johann (Hans) Föderl (not "Förderl" – the author missed this, because he, like most other folks, constantly misspelled the name); the patent (number 77678) was granted on November 15th, 1919. Föderl was a contemporary of Gottlieb H. Dietl and was, as Dietl, a telephone engineer under State employment, although he wasn't directly supervised by the Chief Technical Department of the Imperial-Royal Administration of Posts and Telegraphs, of which Dietl was a high-ranking employee.

BTW – there is conflicting information throughout the German-language literature as to Dietl's first and middle names; some sources list him as Hubert Gottlieb Dietl, while others list him as Gottlieb Hubert Dietl. Among the latter sources are official almanacs of the Imperial-Royal Administration of Posts and Telegraphs, so Gottlieb H. Dietl is deemed to be correct.

Page 5-57ff., Chapter 5.5.6., – Vienna

For unknown reasons, an unrevised, ancient version of chapter 5.5.6. (from the year 2007) was published – the book's editor said it was the publisher's fault and vice versa, but who knows? The author hereby *disassociates* himself from the version published in Mr. Swihart's book – due to the *very* many factual errors and shortcomings it has.

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Page 6-19, Exhibit 6-3-5C, "Semi-automatic systems in Europe"

In the first line of data in the table belonging to the exhibit, the equipment *manufacturer* is listed as being "Dietl." G. H. Dietl *wasn't* a manufacturer of switching equipment as used for the semi-automatic system in Vienna. In reality, a consortium of the firms of Siemens & Halske (Vienna branch), Czeija, Nissl & Co and the Österreichische Telefon-Fabrik A.G., vormals J. Berliner (aka "ÖTAG"; Austrian Telephone Factory, Joint Stock Company, formerly J. Berliner) was responsible for manufacturing all of the equipment, including the telephones, with each firm being awarded exactly 1/3 of the contracts involved. However, the Viennese semi-automatic switching system (and its later transition to subscriber dial service) was commonly known as "System Dietl" in Austria; this designation may have been misinterpreted.

Gottlieb H. Dietl, and others within the Imperial-Royal Administration of Posts and Telegraphs, developed the switching equipment, modifying the original Strowger system to meet specific and uniquely Austrian design criteria in the process. As an interesting side note: practically no "off the shelf" telephone switching equipment was ever used in Vienna or Austria (the most notable exception being the 1905 trial Strowger exchange) – nearly every little bit and piece was modified to meet local design criteria; even the Nortel DMS and Siemens (Germany) EWSD digital switches in use today "required" modifications before being placed into service.

Volume II

Page 9-24, Excursus 9-4-4-A, "Flexible pushbutton pads"

The exhibit shown to the right was found in a draft version of chapter 9, concerning itself with modern pushbutton pads, which the author received on December 30th, 2005. As may be seen, the keypad was *erroneously* attributed as being of *Australian* origin ….

Since the author recognized the keypad as being of *Austrian* origin, he wrote a long note to the book's editor, explaining the function of the pushbuttons R, K, M and W. The information in the note was purely off the top of the author's head and *wasn't* intended for publication. Therefore, the author disassociates himself from excursus 9-4-4-A because the information is jumbled up and makes little sense the way it's presented.

BTW – *there are* no *kangaroos in Austria* – it is, rather, the 1,000+ year old country of Mozart and the Alps.

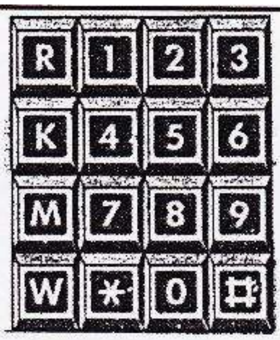

Exhibit 9-4-5-A—Pushbutton pad used in ~~Australia~~ Fill in details.##, giving date, etc.
The letters in the left vertical column, are used:
R—redial
K—##
M—##
W—####

Figure 2

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Page 9-27, Exhibit 9-6-1B, "Pay phone in Austria"

The photograph of the pay phone in the exhibit is cropped so that only a portion of the right-hand side (which is important in conjunction with the operating instructions) is shown, while the lower edge of the instrument (which is important in order to understand its unusual mode of operation) is completely cut off.

Although the pay phone shown to the left below is slightly younger than the one in the book (the one shown here accepted a single Austrian coin of 1 Schilling for operation instead of two ten Groschen coins [= 0.20 Schilling]), the basic mode of operation and the text of the operating instructions are the same. The translated operating instructions read as:

Figure 3

1) Insert coin
2) Lift handset from hook
3) Depress pushbutton
4) Dial & then speak

<u>Calling</u> <u>time</u> <u>extension</u>: When calling time expires, depress the lever [on the right side of the instrument] completely [downward] and then let go; afterwards, insert new coin. Do ***not*** hang up the handset, [because] otherwise the connection will be lost and the call must [then] be repeated.

If busy tone is heard, or the call isn't answered, *remain standing in the booth* and try calling again.

After every call, and upon hearing busy tone, hang the handset up.

The pay phone depicted in the exhibit (as well as the one shown here) doesn't have a coin return chute … the reason is because pay phones in Austria were operated as an *entirely private enterprise* between 1903 and 1941, and the operating company was apparently of the opinion that pay phones were costly to operate & maintain and that, therefore, *any* use was reason enough to require payment – even if the call attempt was unsuccessful.

The operating instructions for the pay phone state that the subscriber was to remain standing in the booth upon receiving busy tone, or if the call wasn't answered, and to repeat the call; the following instruction, namely to *hang up* the handset upon hearing busy tone, is quite misleading. Why? Because these old pay phones operated upon a rather unusual principle, intended to prevent what the operating company considered to be fraudulent use.

If the caller finished the conversation before the allotted time (5 minutes) expired, depressing the pushbutton per 3) of the operating instructions would bring back dial tone (a fact that isn't mentioned in the operating instructions) and a second call could be placed. It was possible to talk until the timer expired *without* having to deposit a new coin for this second call … it was quite imaginable that this (free) second call might be placed by a different person.

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Naturally, this *wasn't* what the operating company wanted, so the phone booth floor was mounted on two sturdy, flat springs so as to float with respect to the rest of the structure, and was mechanically linked to the pay phone. Leaving the phone booth with the handset off-hook (in order to allow someone else to enter and use up the remaining speaking time, or in order to allow a second person to share the call) would cause the pay phone to reset, just as if the caller had hung up the handset. The handset cord was short enough to prevent anyone standing inside the booth from handing the handset to anyone standing outside.

Figure 4

The phone booth was also pretty narrow, so as to prevent, as far as possible, two people from standing inside at the same time, which would circumvent the function of the anti-fraud floor; from what the author can recall, it took roughly 80 lbs. of pressure on the floor of the booth to allow the pay phone to operate correctly – practically anyone tall enough to operate the pay phone was also heavy enough for the floor to function properly. Two slim teenagers might fit into the booth at the same time, but two adults of even normal stature wouldn't. The technique of linking the booth floor with the pay phone was self-defeating, though, because the floor oftentimes jammed (especially in the winter months), leaving the pay phone inoperative.

Page 9-28, Exhibit 9-6-1C, "Instrument in Austria, for local calls only"

The first portion of the text belonging to the exhibit reads "Instrument in Austria equipped for local dialing only. Early versions of the phone had a sticker saying (in German) 'For local calls only.' The first payphone for international calls went into service in 1972."

The pay phone shown in the exhibit is the 1952 model, which is electrically and mechanically more or less equivalent to the model 1958 pay phone shown at the bottom of the next page. The major differences were that the 1958 model was physically hardened somewhat, making it more difficult to steal the coin box & that the coin return chute was replaced with an "anti-stuffing" type. A rather minor change was moving from black, crinkle paint to gray "hammer-tone" paint (the dry, painted surface looks as if it has been repeatedly struck with the ball end of a ball peen hammer). The new paint was easier to clean because it gave a smooth surface.

Writing that the pay phone referred to was "equipped for local dialing only" is misleading in the sense that, up until 1962, *all* pay phones in Austria (with the exception of phones located within a post or telegraph office[5]) were physically designed to accept one or two low denomination coins as payment, and call duration was timed within the pay phone itself; there was *no* technical method available in Austria for keeping track of payment for toll calls placed from pay phones until the early 1960s.

Figure 5

[5] Interestingly enough, using a phone within a post or telegraph office in the Austro-Hungarian Empire usually involved buying a pre-paid voucher for the call.

The fee of 1 Austrian Guilder (the Guilder was in use between 1857 & 1892 and equated to roughly US$ 8.55 purchasing power in 1992) was sufficient for a 5 minute long toll call between Vienna and Prague circa 1889. Such vouchers were in use until December 31st, 1916, after which the calling fee was paid in cash.

The text in the left-hand portion of the voucher literally translates to: "Imperial-Royal Administration of Posts and Telegraphs; card for telephonic speaking in interurban traffic," while the text in the right-hand portion reads: "Used on 5/3 (5th of March at) 7 O'clock, 13 Minutes a.m. at the Imperial-Royal telephone location Vienna 1 (1st District, i.e. inner Vienna) Telegraph Building. Number 1673 (the number was used for accounting purposes).

Until the advent of subscriber-dialed toll calls within portions of Austria (from pay phones circa 1962), there was no need for a caller to know whether or not toll calls could be placed from a pay phone. Hence, it's erroneous to write that "early" versions of this pay phone had the sticker stating "For local calls only" – this sticker was only added *after* pay phones suitable for toll calls were placed into service. The author had *mistakenly* informed the book's editor that no pay phone suitable for toll dialing was available until 1972 because he was under the impression that the model 1961/62 pay phone he had once seen in Vienna's Technical Museum was a prototype which never entered into public service (mea culpa).

The 1952/58 model pay phones did away with the mechanical phone booth floor linkage which some previous pay phones had, and the operating instructions specifically told the user that a subsequent call was possible if there was still time left on the clock.

Older pay phones, such as the one depicted in exhibit 9-6-1B, always collected the coin(s) inserted, whether the call went through or not, while the 1952/58 models only collected the coin when the caller depressed the payment button ("Zahlknopf" in German). Since it was necessary for the caller to hear whether or not someone answered, these models of pay phone always had the receiver portion of the speech circuit in operation, but short-circuited the microphone until the payment button was depressed.

Figure 6

This mode of operation *could* have led to a new form of telephone fraud because, at the time, there were many 4-digit customer service phone numbers (in the 15xx range) in Vienna, which, among other things, allowed callers to listen to a "Song of the Day," obtain the latest lottery results, the "Recipe of the Week," whatever [6] – in their heyday, there were almost 90 such services available. How so, fraud? Well, listening to a song for five minutes free of charge (until the clock in the pay phone timed out) certainly wasn't what the Austrian PTT had in mind when thinking about customer service … so the electromechanical clock in the pay phone was redesigned.

[6] These 15xx phone numbers operated as endless tape recording loops, some shorter, some longer. Some, such as skiing condition reports during the winter months, were *very* long indeed.

In older pay phones with similar clocks, speaking time was simply limited to five minutes and the complete speech circuit (listening *and* talking) was always active, while the clock in the 1952/58 pay phones automatically disconnected the line if the payment button wasn't depressed within 30 seconds after removing the handset from its hook … the reasoning being that, if the called party didn't answer by the sixth ring, then there was probably no one at home anyway.

Despite the efforts to make stealing the coin box more difficult, redesigning the clock mechanism in order to prevent fraud and replacing the coin return chute with an "anti-stuffing" type, the model 1958 pay phone was *highly* prone to another form of fraud, namely placing local calls of practically *unlimited* duration for the cost of a single, 5 minute call. The method was simple, highly effective and anyone with two hands was capable of doing it … one simply tore a 1" wide by 5" long strip off of the stiff paper cover of the phone book in the booth, folded the top 1½" over to form a flap, smoothed the crease of the flap with a coin and slipped the strip, creased end up and short end below, between the glass plate covering the clock face and the housing, until the flap sprang open.

One then gently pulled the strip back until the crease was resting on the top edge of the glass plate, and pushed the strip over until it was wedged into the right-hand corner. When the clock pointer hit the flap, it jammed and the clock didn't time out; this left the connection intact for as long as one pleased. It was naturally also possible to place several consecutive local calls, simply by depressing the payment button and dialing a new number.

Figure 7

Figure 8

Why was something like this possible? Well, the glass plate which covers the clock face was designed to be movable. The upper half was clear glass, while the lower half was painted white, with the German-language text "GESTÖRT" (literally: "disturbed", out of order) printed in black, in an arc to match the curvature of the window on the housing. If the pay phone was out of order and not immediately repairable, the repairman unlatched a spring on the slide which held the glass plate in place and pushed the glass up – there was no need for a separate "out of order" sign (which some wag might steal).

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This was one *very* expensive lesson for the Austrian PTT, because the next pay phone type to be placed in service, the 1961/62 toll-capable pay phone, was far too complex (and much too expensive) to be used as a replacement for the 1,000s of model 1952/58 pay phones in service at the time. The major phase-out of the 1952/58 pay phones didn't happen until the advent of the *next* generation of toll-capable pay phones around 1971/72 … the author recalls at least one model 1958 pay phone which was still in daily use at Vienna circa 1984; it was located in the hallway of the au pair dormitory at the U.S. Embassy personnel compound at Vienna, where a former girlfriend of his lived for a time.


Figure 9

Page 9-28, Exhibit 9-6-1D, "Trial Pay Phone"

The version of the smart card pay phone shown in the exhibit is, indeed, the field trial version installed at Vienna (and other select places in Austria) around 1979 (*not* 1981, which was the year in which the Austrian PTT decided to accept this type of pay phone for general public service). The version shown to the left is the one which was common throughout Austria as of circa 1983. This type was designed and manufactured by a division of the Swiss firm of Landis & Gyr and is supported by the Kapsch Group of Austria.

Landis & Gyr dubbed this pay phone the "PHONOCARD®;" the prepaid card used with this type of pay phone is neither of the chip, nor of the magnetic strip type … the country code, the number of calling units available and the unit denomination are optically encoded as a series of holograms on a metalized strip hidden beneath a layer of white ink. A heated die defaces one unit at a time during the call; the heat of the die is sufficient to deform the holograms. The cards are prone to damage if left in a hot place, such as in a car on a hot summer's day. The cards are also susceptible to damage from scratches … so they were physically modified over time. Two major differences are protective ridges above and below the holographic reading zone, to help prevent scratches in that area and the addition of a roller-pin detent to hold the card in the proper position during read/write operations.

The Austrian PTT originally offered a rebate to users of these pay phones – one only paid for 48 units of speaking time when buying a 50-unit card, and for 95 units when buying a 100-unit card. This was an attempt to migrate pay phone users from costly coin-operated pay phones to the "less expensive" prepaid card pay phones, but it turned out that the infrared card reader inside the pay phone was anything *but* easily and cheaply maintainable. The PHONOCARD® pay phone wasn't placed into as widespread service as originally planned, and it never replaced coin-operated pay phones in the manner in which the Austrian PTT had intended.

Page 9-36, Exhibit 9-7-2C, "An Austrian standard telephone for dial PBX use."

Figure 10

The first line of text, as quoted above, is inaccurate. The phone depicted in the exhibit is simply one of three basic models of the W80 generation telephones which were placed in service from around 1981 onward; the phone in question could equally well have been used as a single (private) line telephone, a party-line telephone *or* as a PBX telephone, because the W80 phones were designed to be very flexible. This flexibility allowed the PTT to carry less phone types in stock without sacrificing options required to fulfill a specific role.

The last two lines of text in the exhibit state that "The pound (#) button is square, not with four crossed lines" – sorry, it just isn't so. The keypad shown to the left is of the exact same type as that on the phone shown in the exhibit.

The author was unaware of the existence of this exhibit until he had received (and read thru) the book; he wasn't the source of the photo used in the exhibit. The author was very surprised that he wasn't asked anything about the phone or its keypad – from the foreshortened view in the original photograph it was apparently *assumed* that the "pound" sign was a square ….

Errata not directly relating to Vienna or Austria

Volume I

Page 3-43, Exhibit 3-6-1-T, "Dual purpose Reihenanlage"

The English-language translation of the German-language telephony term "Reihenanlage" is given as "row key type," which is a non-sequitur. Although the German root word "Reihe" is most commonly translated as "row," the word "Reihenanlage" simply has *nothing* to do with the pushbuttons (or keys) being arranged in a horizontal or vertical row on the telephone.

The "Reihenanlage" and the "Parallelanlage" were among the smallest types of private branch exchanges used in Germany and Austria. The Reihenanlage was named so because the CO line(s) were looped through all telephone in *series*, while the Parallelanlage was named for the fact that the phones were all wired in parallel with the exchange line(s). The distinction between parallel and series types was more common in Austria than in Germany.

Both types supported intercom functions between phones and connection to 1 (or more) exchange lines – the most common types in Austria either had 1 outside line and intercom between a maximum of 6 phones or 2 outside lines and intercom between a maximum of 11 phones (both required a separate subset to supply local talking battery, intercom buzzer power and to support optional functions).

The English-language translation of the German telephony term "Sternschauzeichen" is simply given as "visual display" in the exhibit. The term is better translated as "star indicator."

Such electromagnetic star indicators were commonly used to show whether the exchange line the indicator was assigned to was in use or not (black = not in use, white = in use). In Austria, such indicators were also used on some party-line telephones to indicate whether or not the party-line was busy. These indicators were low-current devices, operating on 6 to 10 milliamps at 3 volts D.C.


Figure 11

Page 3-63, Chapter 3.6.3, "Offset-order dials"

In the first five paragraphs of chapter 3.6.3., it is *inferred* that using offset-order dials offered certain benefits in conjunction with dialing the head numbers of large PABXs, which oftentimes ended in zeros. While this may, or may not, have held true for Norway and Sweden (*if* these countries truly and strictly adhered to the Bell System practice of ending PABX numbers in zeros), this *wasn't* the case at Vienna, Austria, because the Viennese switching system didn't support direct inward dialing to PBX extensions during the semi-automatic phase (because only 5, later 6, digit numbers could be entered on the operator's keypad). Because of this it was *wholly* immaterial where the numeral zero was located on the dial (or on the levers).

The lever-type telephones in general and the 1928-1957 Viennese dial wound up having an offset configuration because of an unusual definition in the original Viennese switching system specifications, and *not* because it made direct inward dialing to PBXs any easier, nor for any other reason. This offset dial configuration was also used with dial phones at Graz (in the province of Styria), but sans the Viennese lettering. The dials at Graz were changed to the international 1-0 numbering scheme in 1949, 8 years before Vienna.

Page 3-127, Excursus 3-14B, "Telephony moving backward in time."

Paragraphs 4 & 5 of the text in the left-hand column of the excursus read as: "To fill this gap, in the absence of working equipment, several district exchanges in Cologne were partially or totally equipped for some years with no-longer needed former Army field switchboards, type Fk16, somewhat modified for use in civilian city telephone service, until replacement dial equipment could be manufactured and installed.

It was impossible to obtain a picture of these field switchboards for this book. The picture [in the book] is a different type of interim switchboard, developed quickly and roughly so some kind of basic telephone service could be restored as rapidly as possible."


Figure 12

While it may be correct that a photograph of a *modified* German WWII magneto field switchboard was 'impossible to be obtained' for inclusion in the book, it would've been nice if the book's editor had at least included a photograph of an *unmodified* switchboard. The author once owned enough such equipment to handle 400+ magneto lines, and if asked (or if he had at least known that anything was going to be written concerning these switchboards) he would've been more than happy to supply a photograph, such as the one shown on the left (which shows part of a German field switchboard setup the author had standing around in his kitchen – of all places.)

To designate a German WWII magneto field switchboard as being an "Army" switchboard is misleading, since *all* branches of the German Wehrmacht (Army, Navy and Air Force) used the same equipment.

Writing that this type of field switchboard is "type Fk 16" isn't quite proper, since the original FK16 switchboard was designed and placed into military service by the Germans in 1916. The switchboards used by the German Wehrmacht prior to and during WW II were an *updated* version which included several new components not found in the original design. The proper German-language designation for the WW II field switchboard shown above is "großer Feldklappenschrank" – large magneto field switchboard, as opposed to the small field switchboards, which handled a maximum of ten or 20 magneto lines[7], which were not modular or expandable. Many European collectors of German field telephone equipment are in the bad habit of using the term "FK16" to designate both the WW I and WW II versions of these large field switchboards.

[7] Information concerning these switchboards can be found in the tale "The Smaller WWII German Field Switchboards" in this collection.

Pages 6-17 & 6-18, Exhibits 6-3-5A and 6-3-5B

The lower, semi-automatic console in Exhibit 6-3-5A is erroneously listed as being located in Germany; in actuality, it was in use in the Netherlands. It's the same console shown in exhibit 6-3-5B, but with operators seated in front of it. A portion of the text belonging to the latter exhibit states: "There is some conflict in identification of this console. One description with this picture in one collection indicates that this console was in service in 1911. If that date is correct, the console would be in Amsterdam, in the Netherlands. Another description has the console at Dresden, Germany, from January 1912."

Although the author wasn't the person who supplied the scans referred to, he was able to verify the true, original source in September 2010. The photo of the lower semi-automatic console in exhibit 6-3-5A and the photo in exhibit 6-3-5B were published by Siemens & Halske, in conjunction with a lecture entitled "On Automatic Telephony," held on November 26th 1910 before the German Society of Electrotechnicians (in German).

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The photographs appeared as figures 26 and 27 in the Siemens & Halske reprint of this lecture. The relevant portions of the lecture specifically state that this console was intended for installation at Amsterdam. The conflicting information possibly arose because Siemens & Halske may have reused the two photographs in a later publication, and that this semi-automatic console was then incorrectly identified as being installed at Dresden, Germany.

Volume II

Page 7-64, Excursus 7-3-4AG, "Getting dials to big-city panel suburbs"

In the second full paragraph of text in the right-hand column, reference is made to "The ZZZ call-metering methodology introduced in Germany by Siemens in 1923 …" Some readers may be wondering what text or other information it was intended to replace the supposed placeholder "ZZZ" with, but there really *was* such a thing as the "ZZZ call-metering" scheme. The "ZZZ" is the German-language abbreviation for "**Z**eit-**Z**onen-**Z**ählung," which roughly translates to metering (or counting; "**Z**ählung" in German) calls by duration (**Z**eit = time) and distance (the German word "**Z**one" has the same meaning as the English word, although it's pronounced differently) at the same time. In theory, the ZZZ system allowed for a vast number of toll zones, each of which could be metered at a different rate, but actual day to day use was limited to a certain number of zones and timing rates. If the author recalls correctly, it *is* eventually explained what "ZZZ" refers to, but only *much* further on in the book.

A similar system was in use in Austria when subscriber toll dialing finally became a reality, and was implemented in the so-called zoning registers ("Registerverzoner" in German); there were four toll tariff zones for subscriber-dialed long distance calls to points outside of Austria in 1989. The fourth zone set the subscriber back 28 Austrian Schillings – roughly US$ 2.55 at the time – per minute.

Page 7-142, Chapter 7.3.9., "Dialing Q and Z, continued" – "The Letter Z in Vienna"

The book states that "This subject is discussed in the chapter on Vienna, 5.5.6."

Well, yes and no – but more *no* than yes, actually, because the letter Z on the 1928-57 Viennese dial face led a rather dull and boring life. It was never used as a letter prefix to subscriber phone numbers, and only came into its own when it began to be used as a party-line *suffix* letter between 1934 and 1957, and it is only in this capacity that the dial letter Z is mentioned at all.

A while before the author was requested to co-author chapter 5.5.6. circa 2005, the book's editor had begun work on an analysis of the evolution of subscriber telephone numbers in Vienna (it was intended to publish this in a future issue of Telecom History, but this never came about). The task of compiling and analyzing the numbers was passed on to the author, and the final version surpassed 100 pages in length – even in this lengthy analysis, only the following facts came to light: circa 1946, the phone number Z-0-11 was used to call the fire department, Z-0-22 to call the police & Z-0-44 to call an ambulance; Z-0-7 was dialed by subscribers who wished to set up a conference call. Dialing Z all alone was akin to dialing zero to reach a telephone operator in the U.S.A., but in Vienna one was connected to an outward operator in the *toll* exchange instead of to a *local* operator; Z-0-5 was dialed in order to reach an information operator.

Page 7-200, Exhibit 7-5B, "Dialing international calls"

If the CCITT country code for Germany is given as 0049, **and** the country code for Switzerland is given as 0041 in the exhibit, **then** the CCITT country code for Luxembourg is 00352, and not simply 352.

Page 9-4, Exhibit 9-2E, "Two early Ericsson pushbutton pads"

The lower of the two "pushbutton pads" shown in the exhibit *isn't* a pushbutton pad. In the exhibit, the mode of operation is described as: "The subscriber set up the number to be 'dialed' by pressing the buttons at the top, the correct number of times for each digit. The digits were transmitted when the subscriber 'released' the call by turning the knob just below the indicators on the right."

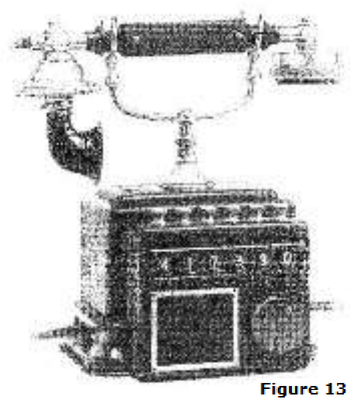

Figure 13

As may be see in the scan on the left, the dialing mechanism doesn't have any buttons to depress on top; it has knobs instead, which are to be rotated until the appropriate digits are shown behind the display windows (at least, that is what LME says). When the entire number has been "dialed" by the subscriber, he was to lift the handset, listen for dial tone and then give the knob in the lower right-hand corner of the phone one full turn – to wind up and release the dialing mechanism.

The last paragraph in the exhibit states that, "… at the time of the invention, Stockholm didn't yet have any dial telephones (until 1924) nor any 6-digit numbers, but Stockholm changed to 6-digit numbers in 1928. No other Ericsson customer, with dial systems, had 6-digit numbers at the time."

The phone shown above was produced by LME in – guess when? – 1924. It's a rather obvious fact in manufacturing that one can't design a new telephone (or an oddball dialing mechanism) in the wink of an eye, so at least having a prototype by 1924 is just enough lead time to get all the kinks out of the mechanism before going and trying to sell it to anyone – the phone *could* have been perfect for Stockholm in 1928, but by then a more or less standard type rotary dial was available, which was much simpler to operate and which had fewer moving parts. Just what the doctor ordered to prevent maintenance headaches ….

The photo to the right shows part of another telephone prototype from 1924 – this phone has six rotary knobs as well (the knob to wind up and release the dialing mechanism can just be seen in the lower right-hand corner of the photo). This phone was considered for use at Vienna, Austria, and was thought to be more ergonomic than the lever telephone … in the end, though, a "plain Jane" dial mechanism won the day.

Figure 14

Exhibit 9-3G on page 9-10 and exhibit 9-3Z on page 9-15 convey the same information – the book's editor repeatedly stated that everything had been proof-read more than once before going into print; how duplicate exhibits managed to get overlooked is a bit of a mystery – or, if they *were* noticed, why weren't such duplications rectified? The author pointed out the one mentioned here back in 2006 … and was very surprised to find it still alive and kicking in the finished product.

Page 9-34, Exhibit 9-7-2A, "Autovon Telephones"

There is a serious error in the designation of the keys "P", "I", "F" and "FO" on the AUTOVON keypads shown; "I" doesn't stand for "interrupt," but rather for "immediate," as any collector of AUTOVON telephones knows.

The same error crops up in the text on page 9-35, in the middle column, where it is written that "The precedence levels, in ascending order of priority are Routine (which every telephone in the system has and for which there is no special priority button), Priority, Interrupt, Flash, and the highest level, Flash Override." This is another error which the author pointed out in 2006, and which still persisted.

Page A-12, "Appendix C", "Early automatic telephone systems, continued"

The data under the heading "Europe, Austria-Hungary, Vienna" in the left-hand column of text is incorrect insofar as here, once again, G. H. Dietl is incorrectly listed as being the *manufacturer* of the semi-automatic equipment used.

Page A-15, "Appendix D"

It appears that the biography the author had originally furnished to the book's editor was misplaced and cobbled together from information which the book's editor *believed* to be correct instead. The author wrote an updated & correct version, which is presented at the end of this collection.

Yes, the author **is** well aware that there are *quite* a number of other errors, fluffs, typos, etc. contained in the two volumes of "Telephone Dials & Pushbuttons" – a really bad one is that the book's editor equates the Danish monetary unit "Crown" with U.S. dollars *throughout* both volumes, despite the fact that the two currencies were *never* at parity. Personally, though, he finds exhibit 7-3-1-1C on page 7-35 in volume 2 to be one of the *quite* serious errors the book contains; one that *really* hurts.

The text begins "The first full alphabet dial, used in the first telephone system to dial the first letters of the exchange name. This was at Minneapolis and St. Paul, Minnesota, beginning in June 1920." The author would've liked to see the dial face referred to very much, and it's an awful shame that the picture in the exhibit is a scan of an AT&T advertisement; it appears that the *dial* referred to is "lost in space" forever … this specific error is so painful because the relevant subchapter, *complete with the AT&T ad*, had been previously published in the July, 2008, bonus section of Singing Wires – nearly two years before the book was finally printed and published.

P.S. Lest there be any misunderstandings concerning copyright(s), intellectual property and the current (and future) fate of the book "Telephone Dials and Pushbuttons:"

In an email dated March 27, 2011, Mr. Steve Swihart wrote the author the following: "Stan did send myself and my sisters a letter about a year ago stating many things, among which was that he gave the intellectual property, physical property, etc., to Lyle for everything related to telephone history[8]."

[8] The author personally regards it as a colossal error for the book's father and editor to have left everything related to telephony and telephone history in the hands of the *one* man who hasn't the *slightest* idea of the historical value of those goods and properties, or of the ins and outs of telephony in general. Truly: "…*can more easily be* ***crushed,*** *than brought to life again*."

In an email dated February 22, 2011, the publisher wrote the author: "You mentioned taking things up with Stan's son as well. For the record, the family has no interest in the book and Stan made me the heir to "all things telephone-related;" the publisher further wrote that, "With regard to your own book or publishing, feel free to do whatever you want and use whatever you want … the target market for these highly specialized materials is so small that it is really a non-issue anyway …."

Concerning the current & future fate of the book, the author once more quotes from the publisher's email: "I am like you in that I don't want a knowingly erroneous product to be out there, but you have to understand that this has not been a money-making venture at all since sales haven't even covered production costs, let alone any of my time …." The publisher isn't willing to make any changes to the book, no matter how important they may be for the sake of accuracy.

P.P.S. Yes, the author *is* well aware of the all-encompassing disclaimer in the book, but he feels that the disclaimer can't be viewed as giving license to *knowingly* publish erroneous information and for not having errors, which were pointed out in due time, corrected.

Addendum

This collection has been "in the works" on and off for a number of years, and as time went on, I found that I could take better photos of two of the dials shown in the book, so I decided to add them here.

I am also going to give an overview of telephone dials and pushbuttons of a country that no longer exists, namely Eastern Germany (aka the German Democratic Republic, GDR), since the book doesn't cover this subject at all ….

Volume I

Page 3-65, Exhibits 3-6-4A & 3-6-4B

The above exhibits show one version of the Siemens "pull-down dial," with the digits printed on the non-movable portion of the drum, with the Berlin lettering on the finger-hole arc of the drum.

At some later date, Siemens redesigned this dial type, so that the digits (and eventual letters) were all on the finger-hole arc. The following photographs show such a revised "pull-down dial," manufactured by Siemens at Vienna, Austria, during April of the year 1943.

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Figure 1

As can be seen, the non-movable portion of the drum no longer carries the digits, which are now on strips of electrically oxidized aluminum, riveted along the outside edges of the finger-hole arc.

This had the advantage that the digits were no longer subject to the everyday wear & tear of dial use, and thus could not be scratched off over time.

If it were necessary to add lettering to this style of dial, then the *middle* strip of blackened aluminum would have been replaced with one bearing the requisite letters.

As I previously wrote, this particular dial was manufactured at Vienna, Austria, but it was certainly used somewhere else, because (back then) Viennese dials began with the digit zero and the numbers 0-9 were associated with the letters "iFABRUMLYZ."


Figure 2 Figure 3

Part of the text belonging to exhibit 3-6-4B states that "… the insides [are] partially uncovered, so as to reveal some of the operating mechanism inside." This is incorrect, in that, since these dials were installed on switchboards, only the portion up to, and including, the finger stop, was visible. The rest of the dial was below the surface of the switchboard keyshelf, and required no further (dust) protection other than a round, aluminum case for the dial mechanism itself.

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Page 5-56, Exhibit 5-5-5A

The exhibit referred to above shows two different versions of the style of dial used at Prague (the former capitol of Czechoslovakia, now the capitol of the Czech Republic). The dial shown below belongs to a PBX telephone, manufactured by Standard Electric (ITT) Prague circa September, 1946. The enameled ring with the letters and numerals is interesting, in that it was hand-painted (I have intentionally left the photograph so large, so that it is easier to see the ring).

Figure 4

One may easily see the ends of the strokes in the red enamel paint, since these are darker than the rest – proof positive that the letters and numerals were **not** printed.

Page 5-80, Exhibits 5-8-A, 5-8-1B thru 1D

All of the above exhibits are of poor quality, especially exhibit 5-8-1C (very poorly cropped, if not to say chopped-up). I happen to own a NOS Soviet telephone, manufactured by the company "VEF," at Riga, Latvia, dated 1953, and the large photograph below shows the dial clearly.

Figure 5

The most unusual thing about the telephone with the above dial is that it incorporates design features from several different phones from different eras. The body is a two-part design like the German W 28 (lower portion of stamped metal, the upper portion formed of Bakelite), the handset cradle has the classic "wings" of Ericsson PBX telephones from the 1930s, and the finger-wheel of the dial (including the screw which holds the central aluminum disk) are wholly interchangeable with those of the Siemens W 48 telephone.

Chapter 5.5.3.1 – The German Democratic Republic

Early dial (desk) telephones of the German Democratic Republic (GDR) were made of Bakelite and had dial bodies and finger-wheels of the same material. In appearance, these early desk phones can easily be confused with the West German W48 desk set … even their Model 38.

Yes, I am well aware that the digits refer to the year the phone was designed or first went into service, and that the GDR didn't exist in 1938 – but, the GDR W38 telephone *was* actually manufactured in the 1950s!

Figure 1

This dial is from a GDR W38 desk set from 1952; physically, it is a carbon copy of the standard German Reichspost style "N30" dial, which was in use as of circa 1930.

The inner disk shows the emergency numbers ("Notrufe") for the fire department ("Feuer", 112), the police ("Polizei", 110) and the Red Cross of the GDR ("DRK" – Deutsches Rotes Kreuz, 115; ambulance service).

The finger-wheel is made of Bakelite, while the inner disk is of electrically oxidized aluminum. The numeral ring is enameled iron.

Figure 2

This dial belongs to the GDR Bakelite desk set model W63a.

The finger-wheel is made of a transparent plastic, while the numeral ring and the central disk are made of electrically oxidized aluminum.

The lettering "RFT" refers to the GDR umbrella corporation which manufactured and sold all manner of telecommunications equipment, such as telephones, teletypes, personal computers, commercial and other types of radio transmitters & receivers, as well as electrical and electronic components.

RFT stands for the German expression "Rundfunk- und Fernmeldetechnik," which literally translates to "broadcast and telecommunications technology." The RFT itself was called a "Volkseigener Betrieb" (publically owned company) – this being the German communist designation for all factories (large and small), according to the tenant that the means of production must be placed in the hands of the people, so that only such products are manufactured as are planned by the number of units to be sold, and their usefulness to the society at large.

Figure 3

This was the GDRs first attempt at a telephone keypad (from the early 1980s), based on a 40 pin soviet microcontroller … it is believed that this keypad was only produced in small numbers and was intended to be the prototype for following keypads.

For all its complicated circuitry, this keypad could do no more than out-pulse keyed-in phone numbers. The "star" key inserted a pause in between dialed digits, while the "pound" key redialed the last phone number entered.

The "pause" key was necessary when a number was redialed from the keypad memory, in cases where the phone was a PBX extension and a one (or more) digit access code was required to access an outside line … in normally dialing from an extension, one would first enter the access code, press the "star" key and then enter the number of the subscriber called. To wit: since the GDR only had analog PBXs, it could take a second or two until an outside line was accessed.

In redialing the number, the keypad would dial the access code and then pause until the subscriber pressed the "star" key, upon which it would out-pulse the rest of the number. The keypad was only capable of storing a single phone number, namely the one last dialed.

This keypad had five wires to connect it to the rest of the phone; two were directly connected to tip and ring of the line, while the three others were a combination of the dial pulse and "off-normal" contacts. Since the keypad was permanently connected across tip and ring, this style of keypad would retain the last number dialed for as long as the line was powered.

This style of keypad had three columns of four pushbuttons each, and they were true pushbuttons – which caused mechanical trouble in the form of stuck keycaps, as can be seen in the photograph shown below.

Figure 4

Figure 5

This is the final version of the GDR dial-pulse keypad; the one shown here is a drop-in replacement for rotary dials.

The “features” of the “star” and “pound” keys remained the same, with the exception that the last number redial only worked for circa half an hour after hanging up – after that, the number was simply lost.

This keypad no longer uses mechanical pushbuttons and keycaps, but rather employs an elastomer-based pad with short-travel keys. The photograph below shows a side view of this keypad; one can see that it is much thinner than the prototype was.

Figure 6

Figure 7

This is the mechanical dial of a GDR desk set (model “Alpha Ferro”) from the mid-1980s, approximately the same time the drop-in keypad was placed into service.

The phone numbers on the central disk are the same as on the dial from the GDR W38 telephone, but the exact designations have changed … “Polizei” became “Volkspolizei” (people’s police), “Feuer” became “Feuerwehr” (fire brigade) and “Deutsches Rotes Kreuz” simply became “Rotes Kreuz” (Red Cross).

Note the modern “RFT” logo in the middle of the central disk.

Figure 8

This integral keypad design was used on the GDR "Alpha" series of desk phones, namely on the "Alpha Ferro Quick" and the "Alpha Tast."

The former of the two "Alpha" phones was one with a dial-pulse keypad – which makes one wonder why they named it "quick," since one could key in the number as fast as one chose, but then had to wait forever for the keypad to finish out-pulsing the number.

There was no real operational advantage for subscribers using dial-pulse keypads. In the dial-pulse version, the "star" and "pound" keys had the same functions as the drop-in keypad. The "Ferro" portion of the name stems from the fact that the 2-4 wire hybrid used an induction coil, instead of a discrete, electronic hybrid.

An operational advantage was first achieved in the late 1980s, when DTMF keypads became available in the GDR … however, most of these DTMF phones were intended for export, since the phone exchanges in the GDR were mostly of the Strowger type, model 1922.

The DTMF version keypad had one *serious* drawback: although not sensitive to line polarity, it was *very* sensitive as to the off-hook line *voltage*. If it dropped even slightly below 12 VDC, the frequencies began to "wander," resulting in wrong connections or even no connection at all. The author wonders why the GDR technicians, who designed the DTMF keypad, didn't opt for a lower operating voltage and a voltage regulator to keep the frequencies stable.

On the DTMF keypad, the "star" and "pound" keys generated the standard frequency pairs assigned to them; the "extra" key in the lower right-hand corner is an "earth" or "ground" key, required if the phone were a PBX extension.

The East Germans even produced a telephone with a concept similar to that of the U.S. "Trimline®" – it had an electronic 2-4 wire hybrid (and a hearing amplifier) integrated into the handset, while the keypad and the electronic ringer were mounted in the base of the telephone. This desk set was called the "Apart 2001" (my German-English dictionary defines the German word "apart" as: uncommon, singular, odd, remarkable or cute.) This type of phone stops working if the line voltage drops below 8 VDC.

Figure 9

This is the keypad of the "Apart 2001;" it is of the GDR standard dial-pulse type, but its operation is slightly different: the "star" key is dead (there is no redial function), and the "E" key is an "earth" or "ground" key.

The author hasn't connected one of these to his local PSTN yet (only to a power supply), so he can't really tell what the yellow light-emitting diode (LED) is for … one thing known is that it doesn't flicker when a number is being out-pulsed – which would have been handy, since the handset is completely dead during dialing (*absolutely* no sidetone and no dialing clicks.)

A *Brief* Explanation of Secret Party-Line Service in Austria

Telecom Austria, and its predecessors, the Imperial-Royal Administration of Posts and Telegraphs (1887 to 1918 – as related to telephones) and the Austrian Administration of Posts and Telegraphs (1919 to 1938 & 1945 to 1998) were always touchy about telephone conversations not being kept secret, even within one's own house or apartment – to date, it is wholly illegal to simply connect telephones in parallel in the same manner as is common in the U.S.A. and elsewhere. The only exception was the "Landanschluss" (literally: rural connection), which was the equivalent of the "farmer's line" in the USA – subscribers had to sign away their right to secret telephone conversations when contracting for this service.

Figure 1

This tale will mostly be about the *very* basics of four-party, secret party-line service as implemented as of circa 1950, and which was in operation until the demise of party-lines (and of electromechanical telephone switches as well) circa 1999.

The idea of four-party, secret service party-lines in Imperial Austria dates back to 1905, when Mr. Gottlieb H. Dietl and telephone mechanic's apprentice Friedrich G. Koch developed such a system for magneto telephones; this was placed in widespread service circa 1908. The same basic principle was later adapted to C.B. and dial service.

There is a mechanical clock installed inside the upper housing of the magneto phone to the left. This clock was used to keep track of the *total* time the telephone was in use – irrespective of whether the subscriber initiated a call or received one. The clock also terminated the call after six minutes; this portion of the clock was reset every time the handset was placed back on-hook.

Below the clock there is a small, round glass window which appears to be black. It's black at the moment and remains so until the handset is taken off the hook. If the party-line is already in use, then the window will remain black; if the party-line is free, then the window will show a white flag.

The party-line phone shown to the right was intended for use on a C.B. line (as opposed to a dial service line; a distinction more common in Austria than elsewhere in the world).

The clock has been simplified & only has two pointers; as of now, it cut off any conversation running over 10 minutes and was reset whenever the handset was placed back on-hook.

Another feature remained, namely the white flag which indicated a free party-line, while if the window above the clock remained black the line was already in use.

When it became time to convert these party-line phones to dial service, the original backboards were modified and reused …

Figure 2

Figure 3

The dial was mounted in the space which previously held the D.C. ringer, while the upper curve of the original backboard was reworked and a round piece of wood was added for the bell.

The other major difference was that the clock was changed from a (difficult to interpret) two pointer affair to one with rolling digits – the first three digits in black, for the 100s, 10s and 1s of hours, while the last two digits were in red (these were for the tenths and hundredths of an hour).

The black/white mechanical flag still works the same as before ….

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The two styles of party-line phone shown on the previous page were very common in the teens and twenties of the last century, while the one shown here was a neater and more compact version which came into widespread use as of the thirties of the last century.

The clock is the rolling digit type as used with the dial version shown on the previous page, and the principle of indicating the status of the party-line by using a black/white mechanical flag has remained unchanged.

BTW: the "black" flag was an integral part of the white flag, and not a separate unit. Movement of both the switch-hook and the flag were dampened by a dashpot.

Figure 4

Figure 5

The housing of the party-line phone shown immediately above was recycled for use with party-line phones belonging to the model 1948 generation of telephones.

Seizing the party-line was no longer automatic, as it was with earlier versions; one now had to depress the white pushbutton on the front of the phone – if the star indicator remained black, then the party-line was already in use.

Since the generation W48 party-line telephones no longer had an internal clock, there was no time limit imposed on line usage by the individual subscribers. If one party were to constantly use the line (hogging), the Austrian PTT reserved the right to force the party hogging the line to switch to a single-party (private) line.

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Anyway, having gotten the older versions of the Austrian party-line telephones out of the way, I will only describe the *basics* insofar as a single subscriber is selected from a group of four on an incoming call, because the selection in the case of an outgoing call was somewhat more complicated. I will also only be describing things "off the top of my head;" our Austrian colleague, Mr. Fuchs, shouldn't get bent out of shape if I happen to omit anything important. An in-depth explanation of the intricacies of this system would take up two or three complete issues of SQ and be as interesting as watching a glacier race by.

Each party-line had an electromechanical sender associated with it in the CO, as shown on the right.

At the top we see some of the electromagnetic counters, one for each single subscriber to a party-line.

The individual sender units within the frame support two four-party-lines, with the exception of the unit at the top, which only supports one four-party-line; it also carries a set of special relays which were used to intercept calls to individual parties and redirect them to pre-recorded messages, such as "no such number" or "the number has changed," &c.

The blocks to the left of the uniselectors are used to program the individual party-line service options, such as blocking outgoing calls, completely dis-connecting subscribers from service, blocking outgoing toll calls, &c. The various option plugs are color-coded so that the option(s) selected are immediately obvious.

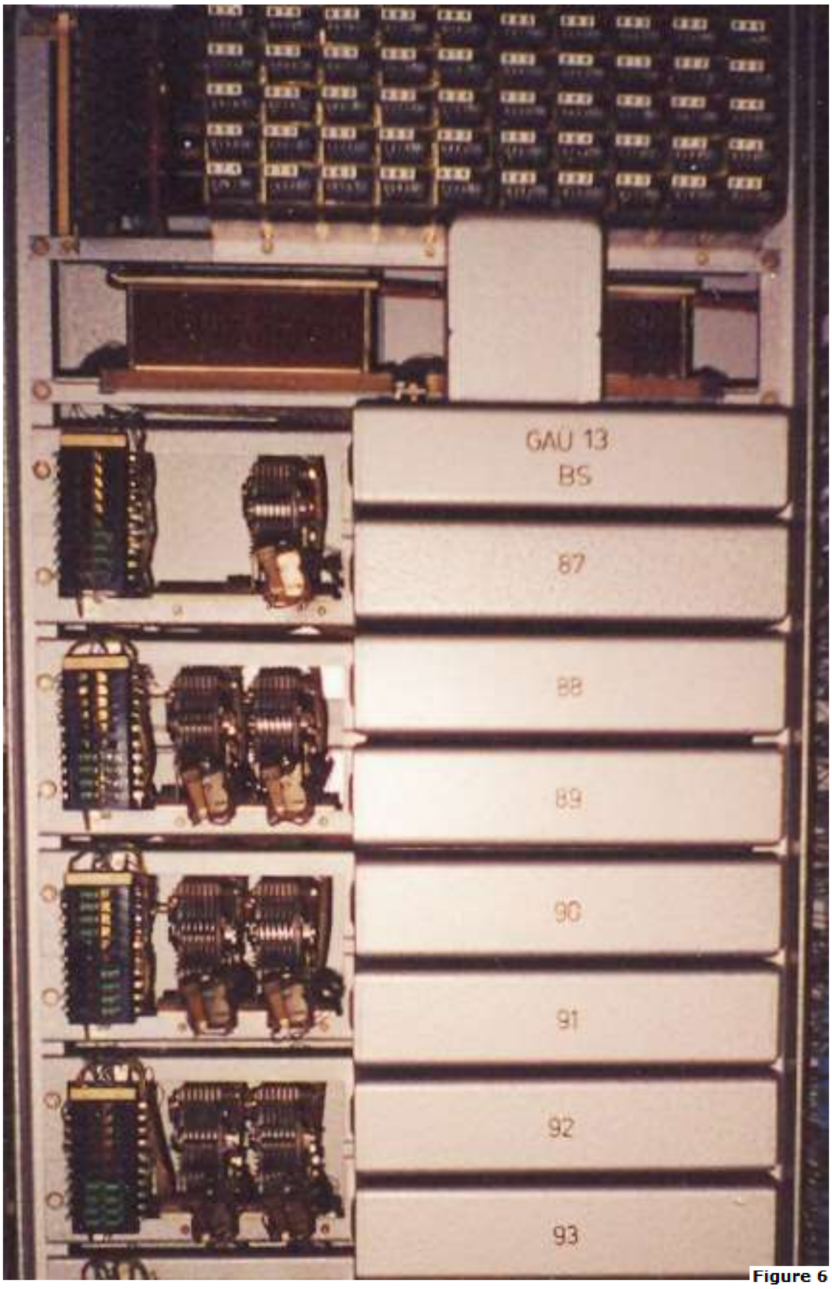

Figure 6

Figure 7

Figure 8

These two photographs show a total of three different programming plugs[1] … as can be seen, they have side contacts in varying combinations. I only recall that the one coded green/brown was most commonly used, since it programs the individual subscriber for full party-line service, including outgoing toll calls.

[1] The one in clear plastic has a yellow stripe and is electrically equivalent to the yellow one.

Figure 9

The version of the party-line telephone shown in the lower photograph on two pages back was commonly used in bars and pubs since it was less subject to tampering as were the subsets used in private residences … each party-line subscriber had a wall or desk phone with a smallish subset, which contained a "bridging" and a "selective" relay, as well as a number of diodes, resistors, capacitors and interconnecting straps (the latter were used to program the subset to only respond to the selective proper code).

The phones and subsets were sealed, originally with a lead seal (as may be seen to the right), later on with a self-adhesive paper seal; the latter existed in two versions – the earlier version may be seen on the left in the photograph below. These paper seals were nicked radially a few millimeters every 90°, so that they'd tear if one tried to peel them off. However, the early version seals were relatively easy to obtain at the flea market at Vienna or from any phone installer one might happen to know (the going price was a big glass of beer).

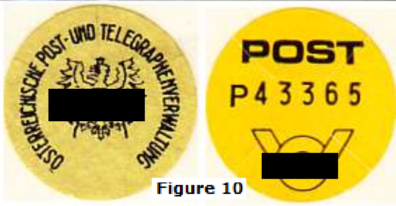

Figure 10

The second version of the paper seal had an orange background color, a stylized postal horn and had unique serial numbers – and the installer noted the serial number of the seal on his service order. Thus, there was no sense in getting hold of a new seal to replace a damaged one since the serial numbers wouldn't match up.

Towards the end of party-line service even the paper seals were no longer available, so that the newer subsets and phones weren't sealed at all, while the fat style subsets were "sealed" with a bit of thin, bare copper wire without a piece of lead ….

At Vienna, single-party (private) directory numbers used to have six digits, while party-line directory numbers had seven digits (caveat: this applies to W48 generation switching gear only); the first two digits identified the exchange, the next four the line number and, in the case of party-lines, the seventh digit (which was either two, three, four or five) identified the party. The reason for using the oddball two thru five sequence (instead of the more logical one thru four sequence) had its roots in the idea that the party-line equipment might need a few milliseconds before being ready to accept the final (party-line) digit. A single digit pulse (i.e. a "one") might be a few milliseconds short for proper operation of the party-line equipment.

The end digit two, three, four or five moved a uniselector with five contact arcs to the position of the selected subscriber, and then a series of relays in the sender transmitted the proper selective pulses: the first impulse on a party-line pair was always 120 V.D.C.; this impulse operated the slow-release "bridging" relay in all of the subsets on the line called. When the "bridging" relay operated, its contacts connected the "selective" relay in all of the subsets on the line called between either tip or ring of the line and a local ground (lead cable sheath – in essence a third wire between the CO and the party-line subscribers).

The selective relays (by being strapped via various diodes and condensers, as well as to either tip or ring and ground) were polarity sensitive and only reacted to A.C. or D.C. current flowing from either tip or ring to ground; the selective pulses were: +60 V.D.C. on tip to ground, 60 V.A.C. on tip to ground, +60 V.D.C. on ring to ground or 60 V.A.C. on ring to ground. These selective pulses were superimposed on the regular 60 V.D.C. between tip and ring, with *tip* carrying -60 V.D.C. with ring at ground potential in the CO.

When the proper selective relay pulled in, it bridged itself across tip and ring with its low-resistance coil and closed a loop to the sender; this caused the sender to hold the loop to the line selector. At this point, the slow-release "bridging" relay returned to its normal position in all four subsets.

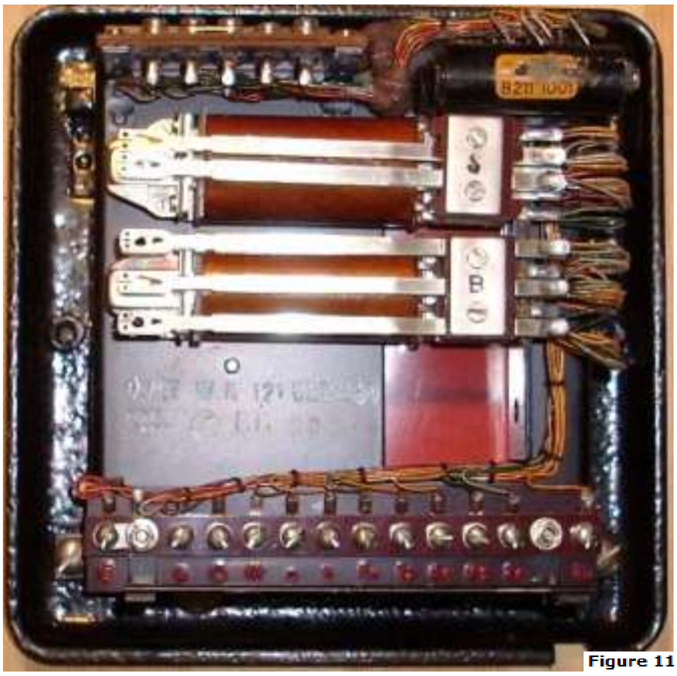

Figure 11

The photograph to the left shows the innards of an early model W48 party-line subset. The bridging and selective relays are visible and, fancy that, they carry the first letter of the words "bridging" and "selective" – the German equivalent words for these relays is "**B**rückenrelais" and "**S**elektivrelais."

The terminal strip at the bottom of the case was used to connect the party-line (a, b and ground) as well as nine wires between the case and the phone … a short piece of five-pair cable in the case of a wall phone, or a ten-conductor line cord in the case of a desk set.

Since the loop between line selector and sender is intact, the line selector will begin sending ringing current to the selected telephone. When the handset of the phone is removed from its cradle, normal loop current will flow between the line selector and the called parties' phone. The loop current flows through a low resistance coil of the selective relay to keep the loop intact; this coil is bridged with a 2uF capacitor to allow speech current to bypass it (the relay coil acts as a choke and blocks speech currents).

The selective relay in the subset drops off when the subscriber hangs up after conversation, the loop to the sender is terminated and the line selector train, as well as the sender, restore to their normal positions.

The picture to the right is a top view of the subset shown on the previous page. The terminal strip on the left in the photo was used to program the selective portion of the equipment to react to the proper sequence of pulses from the CO.

Figure 12

The scan below the picture shows the strapping options for the four possible subscribers: subscriber 1 = end digit 2, 2 = end digit 3, 3 = end digit 4 and 4 = end digit 5 of the phone number; the German word "subscriber" is "Teilnehmer" (literally someone who partakes) abbreviated in German as "Teiln."

Figure 13

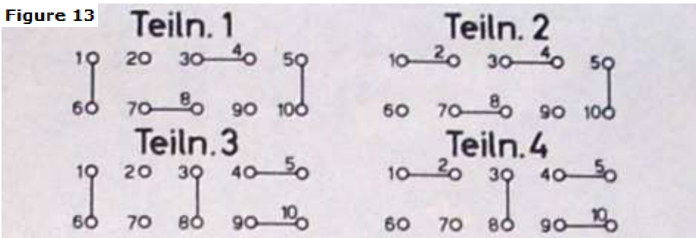

Figure 14

The picture to the left is included so that readers can gain an idea of how thick the subset originally was: four inches deep and six and a half inches square.

Whoever dismantled this particular subset (and the desk phone connected to it) just pried the subset from the wall, without opening it up – which is why it still has an intact lead seal. This is the only subset I have which is still sealed.

These really thick subsets were the earliest ones manufactured for the GA48 party-line telephones, and the Austrian PTT eventually ran out of them (they had underestimated just how many folks would find party-line service attractive), and so a new subset was developed and placed in service.

Figure 15

The footprint of the newer GA48 subset was the same as before, but the height was drastically reduced from four inches to two inches.

As can be seen, the capacitors, resistors and diodes were mounted on a printed circuit board, instead of relying on point-to-point wiring as in the earlier type subset.

Both types of GA48 subset emitted a few hefty clicks and clunks when there was a call to one of the four subscribers, and party-line subscribers often developed the knack of being able to hear the difference between the click of the bridging relay and that of the selective relay, so that they'd know whether their own, or someone else's, phone was about to ring – I had a party-line phone for several years and was in the habit of answering before it even rang (which some callers found disconcerting, because they hadn't heard any ringing tone).

The GA48 system had some serious drawbacks: the frames in the CO were big and heavy; by necessity, they had to be mounted adjacent to the final selectors in order to keep the interconnect wiring as short as possible. One frame of party-line senders could support 30 four-party party-lines (the eighth and sixteenth units only supported a single four-party party-line and the intercept relays) so equipping a CO with a goodly proportion of party-line equipment ate up floor space real fast (one frame = 120 individual party-line subscribers max).

Although the backlog of people awaiting the day they'd finally receive party-line service kept growing bigger and bigger, there was simply no more floor space for GA48 frames. The solution was to design a *new* subset and *new* sender equipment for the CO; each card cage of this new party-line equipment could handle 96 individual party-line parties, and the best thing was that this new equipment (designed in 1978 and thus known as GA78 equipment) no longer required a local ground connection in order to operate, since it relied on tone-selective circuitry.

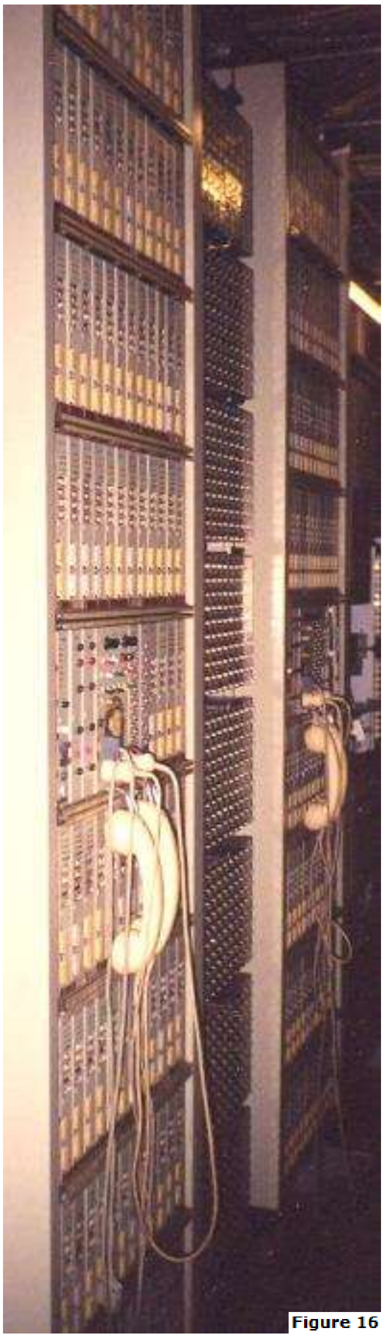

Figure 16

The photograph to the left shows two frames of GA78 equipment in an exchange on the outskirts of Vienna. The frames each have eight card cages, seven of which are equipped with twelve cards for two four-party party-lines each – hence one card cage serves a maximum of 96 individual subscribers, and a single frame of GA78 senders can support up to 672 individual subscribers.

These two frames of GA78 equipment are capable of supporting a maximum of 1,344 subscribers; there is a frame with eight fields of 100 message registers each (one for every individual subscriber) located between the two frames of GA78 equipment; the rest of the message registers are located elsewhere in the switch room.

The fifth card cage from the top is dedicated to the tone generation equipment (consisting of one printed circuit card in active mode and one in backup on each frame), as well as carrying test equipment and PCBs with call intercept relays.

The printed circuit board shown below is that of the GA78 subset as installed on the subscriber's premises. If one looks closely, it's possible to see two screw-down terminals in the lower, left-hand corner of the PCB. These terminals are labeled "A" and "B" – there is no third terminal labeled "E" for a ground wire. There were, however, several screw-down terminals which were intended for hard wiring an answering machine to the subset, as well as terminals which allowed the connection of an external ringer.

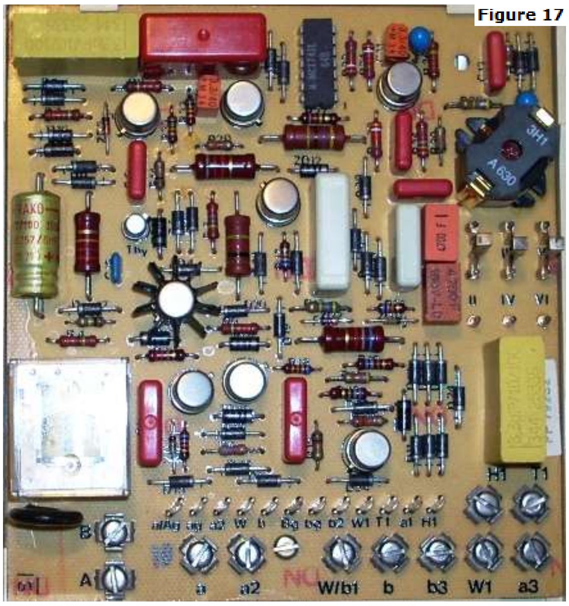

Figure 17

Figure 18

The ivory-colored Bakelite desk telephone shown above was used with the GA48 subsets, and this one is still attached to its subset. Unfortunately, the phone itself isn't sealed, but it at least carries the small reminder card with the subscriber's phone number written on it … 92-79-462. Back when this phone was in use, the office prefix "92" belonged to an exchange in the 15th district of Vienna.

Since the phone lines to all of the subscribers on any party-line were in parallel to one another (and thus carried the speech currents when a conversation is in progress), the subset and the phones were sealed. The early type paper seal was used by every installer, and it was relatively easy for non-Telco folks to lay hands on such seals and have some illegal "fun" with their phone – either to eavesdrop on conversations or, more nefariously, reprogram their subset to a different end digit (thus changing the subscriber billed) and place some long-distance calls late at night. One could also have bought a subset and phone at a flea market, programmed the subset for any party other than one's own and simply connect the equipment in parallel. The fraudulent user just had to be careful of exactly which of the phones he answered (the smart ones disconnected the ringer in their second – illegal – phone).

The latter type of fraud was *very* easy to detect, even if the extra phone had its ringer disconnected: the Telco simply measured the current the bridging relays were pulling and compared it with the current which so and so many subsets would normally draw (i.e.: if the current measurement showed that there were three subsets connected to the line, but the records showed that only two subscribers should be connected, well ….) In order to prevent eavesdropping and the former type of fraud, the Telco implemented new self-adhesive paper seals, as already described (but, of course, the Telco didn't go and replace tens of thousands of older-type paper seals with the new ones).

The thick, old style subsets had space for a *third* relay (below the bridging relay) – this relay was only installed in subsets which were used for *eight-party* party-lines (these were only implemented at Graz, in the province of Styria, if I remember correctly).

The GA48 and GA78 party-line subsets offered a unique and undocumented (and, from a Telco point of view, undesirable) feature: if someone (accidentally) left the handset off-hook the party-line wouldn't be blocked, but if the phone left off-hook were to be called, it (obviously) wouldn't ring. However, everything happening near the phone could be clearly heard over the line. People often used their party-line phone as a remote babysitter – leaving the phone, off-hook, near their baby's crib while visiting with their neighbors, etc. They only had to phone home (like good old "E.T.") and listen in whether or not the baby was crying ….

Another undocumented feature was that if the ground pushbutton was pressed while the handset was on-hook, nothing untoward happened – the party-line remained unblocked. If the pushbutton was pressed during conversation, after having answered or initiated a call, nothing happened. The pushbutton was only functional when the handset was off-hook and it was pressed to initiate a call … so, some folks held the pushbutton permanently in the depressed state with the aid of some adhesive tape, so that time was saved when placing a call.

One question remains: if this system was so complex, how did installers manage to test out party-lines without having to lug a complete party-line phone and subset with them? The butt sets had two separate test cords: one which ended in two alligator test clips, and one which ended in a small spike. A brief ground on tip (to activate the party-line equipment in the CO) was required when testing a party-line and the spike was used to supply this ground. An installer would simply attach the alligator clips to the line, wedge the spike under a convenient local ground, switch the butt-set to "talk," dial the digit "one," wait for dial tone and then simply call the test desk, MDF, whatever … the only difference to a regular, subscriber-initiated call was that only local calls could be made when using a butt set in this manner; that is, if a "one" was dialed.

However, if someone just happened to own such a butt set and had access to a party-line, then it was just as easy to dial any one of the digits two thru five, in which case the butt set would mimic a subscriber and, hey, presto!, toll calls were possible as well. The only problem with this was that the respective subset would be selected by the CO equipment and the defrauded subscriber could listen in on the call ….

The party-line equipment was designed in a manner which *didn't* allow parties who shared the same final *hundreds* group to call each other … but this was no big hardship, since the Austrian PTT usually assigned party-lines such that the subscribers connected to one and the same line lived in the same building (or, at the worst, in adjacent ones).

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The Smaller WWII German Field Switchboards

Having already written a longish tale concerning the restoration of a large German WW II switchboard, I felt that the smaller-sized German field switchboards deserve to be described as well.

Personally, I find the two smallest types to be of special interest, because they demonstrate that the Germans always aimed at having a viable alternate for any type of small switchboard as well as for the FF-33 SB-33 accessory (the exchange interface set 33, which will be covered in the next tale).

Figure 1

The smallest switchboard consisted of nothing more than two FF-33s and a patch cord; this type was already covered in the tale concerning the FF-33. The first of the smaller switchboards was a fully modular system using a single cord and jack per circuit (similar to the U.S. Army Signal Corps BD-71 type). The modules were usually used to assemble switchboards ranging from 3 to 9 lines ….

The individual modules, such as the one shown on the left, were held together by straps on the front and back; these straps were also used to connect an FF-33 to the switchboard as an operator's set. There are two binding posts for the incoming line (La and Lb/E), as well as a two-contact socket (into which a special type of drop was plugged) on the top of the module.

The Kellogg switch on the front is pure overkill, as far as the design was concerned, because it is like the ones on the large German field switchboard – spring-loaded for the ringing position and latching for answering an incoming call. The reason that the switch is overkill is because the individual contacts belonging to both positions were wired in parallel – it was possible to ring a line with the switch in the "answer" position and vice versa. A waste of time, materials and money as far as manufacturing went … the WW I version of this module had a latching *rotary* switch with two positions: normal (allows the module to signal an incoming call) and a single, combined "ring/answer" position.

Although not visible in the photograph, the plug was inserted into a *stowage* jack when not in use … the plug of the module shown here is plugged into the *connecting* jack (labeled "VK" = "**V**ermittlungs**k**linke" in German).

There is a small frame above the Kellogg switch; this held a small, plastic card which was white on the one side and red on the other. White indicated that the line was a loop circuit, red that the line had a ground return. If the modules weren't all connected to the same type of line, then a ring-through, talk-through induction coil (as described at the end of the tale concerning the German WW II FF-33 field phone) was used.

The three modules shown on the right are strapped together, front and back, ready for use.

The three cord plugs are plugged into the stowage jacks (labeled "RK") since there is no call in progress. The black rectangles on top of the modules are the drops – when a call came in, a yellow flag dropped into view, and the drop gave off a buzzing sound every time ringing current was present.

The drops were reset by depressing the pushbutton on the top of the housings.

These small modular switchboards even allowed for ringing a night alarm bell whenever one of the drops fell – there is a small terminal in the lower, right-hand corner on the front of the drops … this was one side of the night alarm contact, while the second contact exited the housing in a similar manner on the rear of the drops. The front and rear terminals were individually connected in parallel, one of the wires then went to a small, special D.C. ringer while the other one went to one terminal of a battery made out of two to three used field elements; a further wire connected the other terminal of the D.C. ringer to the second terminal on the battery.

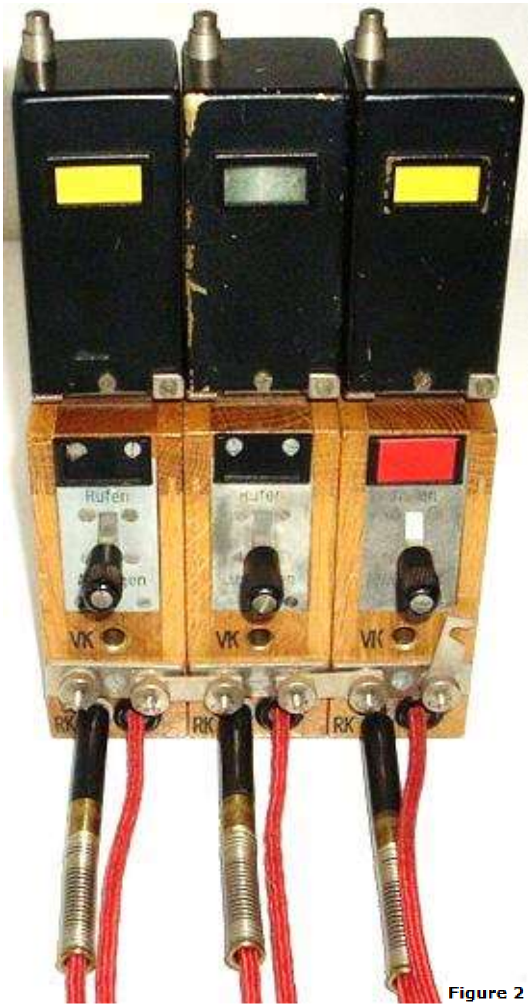

Figure 2

Figure 3

This is the rear view of the same switchboard. It's possible to see the small tab of the second terminal of the night alarm circuit in the lower, right-hand corner on the rear of the drops.

The straps which link the modules together mechanically and electrically are easy to see (the front strap array is "tip," the rear one "ring"), as well as the module schematic, which was printed on a zinc tab on each unit.

No one has been able to tell me what the odd-shaped hooks on the top back of the modules were good for; I have heard that they were supposedly used to hang such small switchboards on a wall, but I believe that this isn't true. The modules would be in danger of getting knocked of the wall, which could destroy such a puny switchboard.

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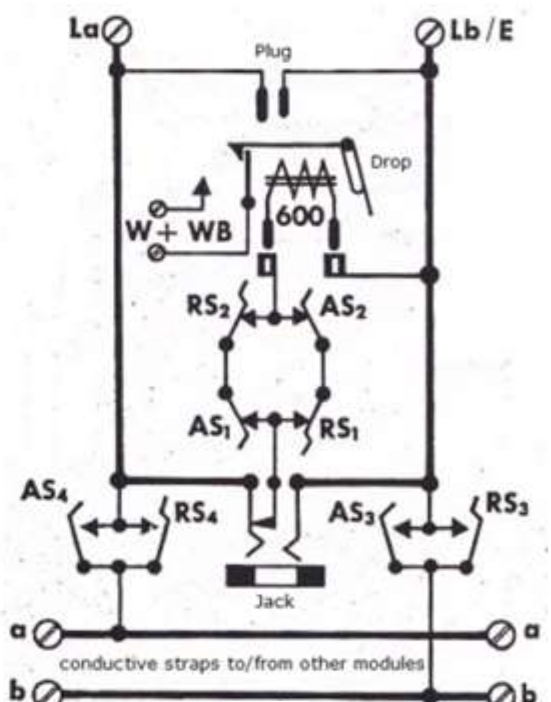

Figure 4

As previously mentioned, and as may be seen here, the Kellogg switch is overkill because the appropriate contacts from the "momentary" side are wired in parallel with those of the "latching" side.

Contacts AS_1 thru AS_4 (answer) are used when the Kellogg switch is set to the latching position, while contacts RS_1 thru RS_4 (ring) are used when the switch is set to the momentary position.

AS/RS one and two are normally closed contacts, while AS/RS three and four are normally open contacts.

Terminals "La" and "a" equate to "tip," while terminals "LB" and "b" are equal to "ring."

Although the unit shown to the right looks very similar to the modules used by the Germans during WW I, complete with its rotary switch, this one is from Switzerland and was built circa 1930.

The drop is smaller in size on the Swiss unit, and the pushbutton to reset the drop is on the right, while the terminal for the night alarm bell is in the lower left-hand corner of the drop when compared with the German one.

The schematic for both the Swiss and the German modules (those equipped with a rotary switch) is shown below.

Figure 5

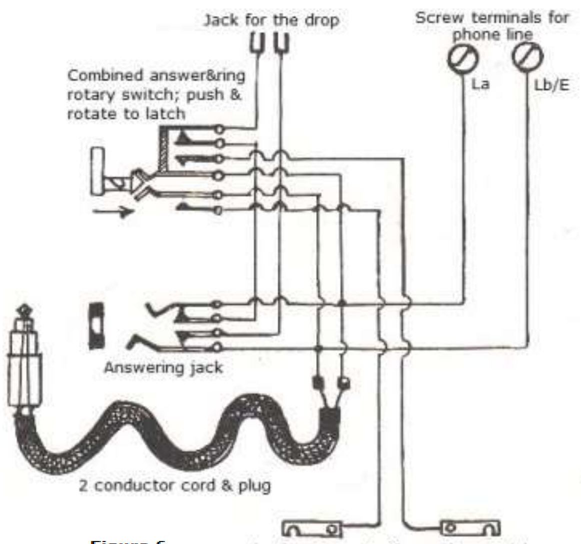

Figure 6

Rotating the knob forced the switch shaft to move inwards. The end of the shaft has an insulated tip which opens the normally closed contact (shown at the top of the contact stack to the left), while at the same time closing the two normally open contacts. This disconnected the drop and connected the operator's phone to the line.

Figure 7

The two photographs on this page show the Swiss switchboard module with an unusual type of call indicator. This consisted of a small, enclosed receiver capsule which was mounted with its membrane in a horizontal position; resting on top of the membrane there were two or three small, lightweight plastic balls which were enclosed in a transparent half-dome of plastic.

This type of indicator wasn't intended for use with magneto field phones, but rather for use with the type of field phone much favored during WW I, which used an entirely different method for signaling.

Those field phones used what was known as a "differential buzzer" … when the "buzzer" pushbutton on the handset belonging to such a field phone was depressed, the buzzer did its thing – and the alternating magnetic flux which the primary winding of the induction coil and the differential coil induced in the buzzer's iron core resulted in a strong alternating current in the induction coil's secondary winding, which was connected to the line.

Figure 8

This alternating current was too weak to operate even the most sensitively adjusted drop, but it was more than enough to cause the membrane of the receiver of a distant field phone (or the one in an indicator as shown here) to vibrate and emit a loud buzzing sound. A buzzing indicator was easy to hear, and the plastic balls dancing on top of the membrane gave a visual indication of which line was calling.


Figure 9


Figure 10


Figure 11

The three photographs above show a NOS WW II German switchboard night alarm D.C. ringer; the pictures are about two-thirds of the natural size … this D.C. ringer was used in conjunction with all German field switchboards, except for the one designed for 20 lines – which had an internal D.C. ringer.

The modules shown previously were used to tailor a small switchboard to the exact number of lines served. When the number of lines reached ten, it was much more practical to use the small field switchboard for ten lines, instead of having to cobble a ten-line board together. Such a switchboard is shown below.

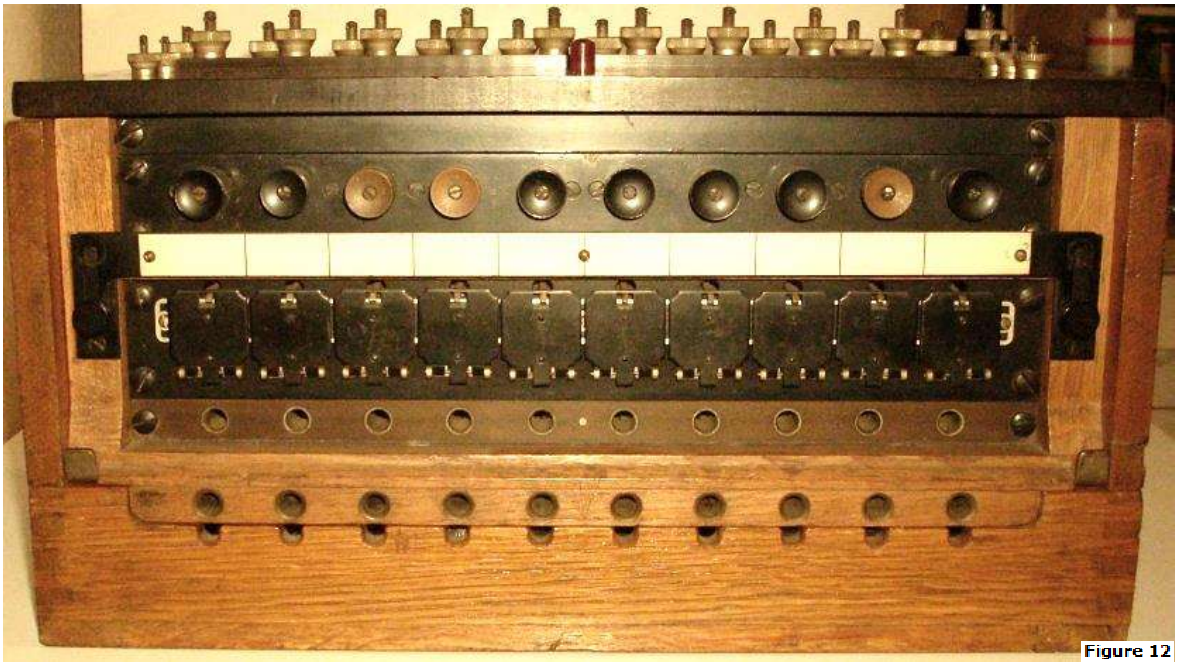
Figure 12

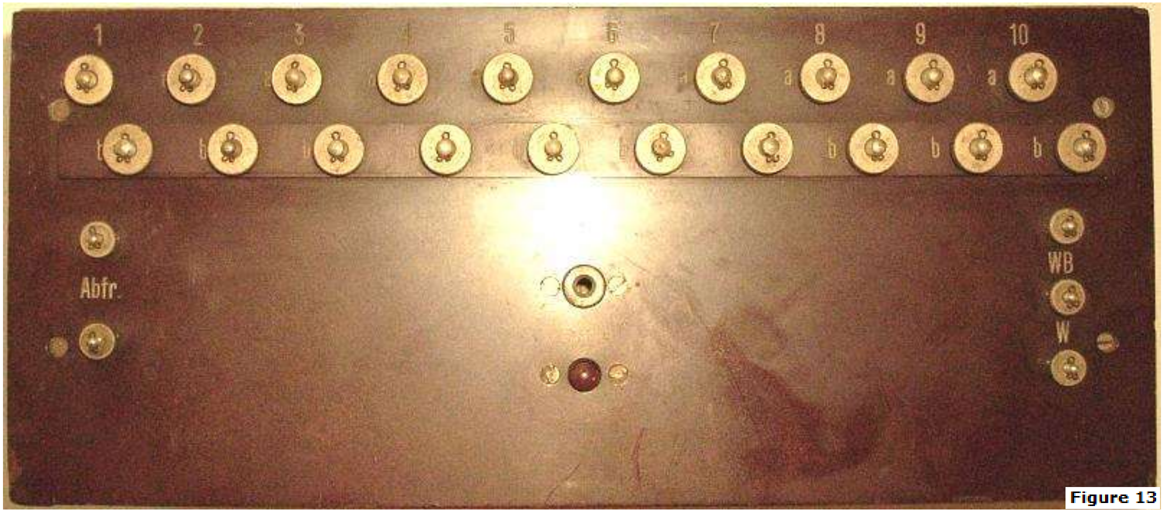

Figure 13

This photograph shows the various binding posts on the top of the ten-line switchboard. From left to right there are: two small binding posts marked "Abfr." ("Abfrage" = German for "answering"); an FF-33 was connected to these terminals, which was used as the operator's telephone. Then there are ten pairs of larger binding posts, numbered from one to ten and marked with "a" and "b", for a maximum of ten field phone lines. On the right-hand side, there are three small binding posts; the top and bottom ones are wired up to the night alarm contacts of the drops, just the same as in the large field switchboard. The middle one isn't connected to anything inside the board, but is used as a tie point to which the battery and the ringer were connected together.

The binding posts for the "b" wire (ring) of all ten lines have an extra strip of insulating material underneath. This was done because there was an accessory which allowed all ten lines to be run to a ten meter (circa 33 foot) long connecting cable, and this accessory had twenty staggered, spade-style lugs (mounted on a wooden board) for attachment to the switchboard.

There is a threaded insert on the top of the switchboard; a protective cover was attached here whenever the switchboard was transported. There is a red pushbutton below the insert, which is used to release any of the self-latching "answer/ring" pushbuttons (mounted above the drops) which were depressed in order to answer a call or to ring a line.

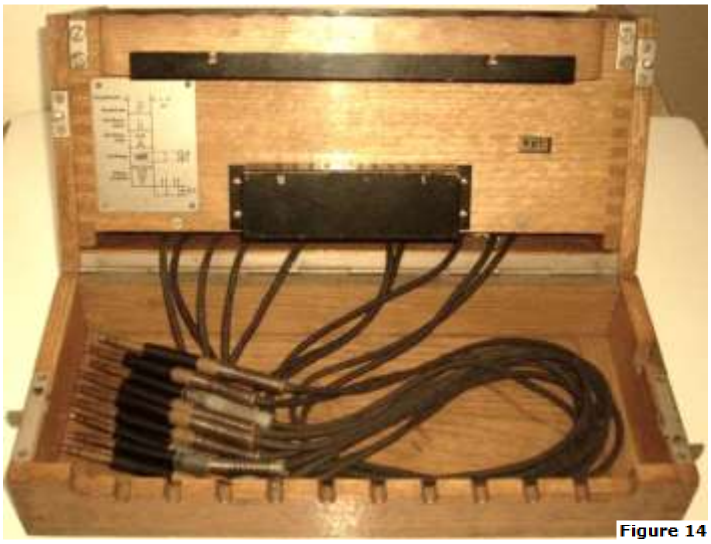

Figure 14

When one opens the latches on the sides of the switchboard, the top of the board may be swung back to allow access to the stowed cords and plugs.

The black, rectangular unit on the top portion of the board is a 30-contact jack, which was used in conjunction with another style of connecting cord … which will be covered a bit later on.

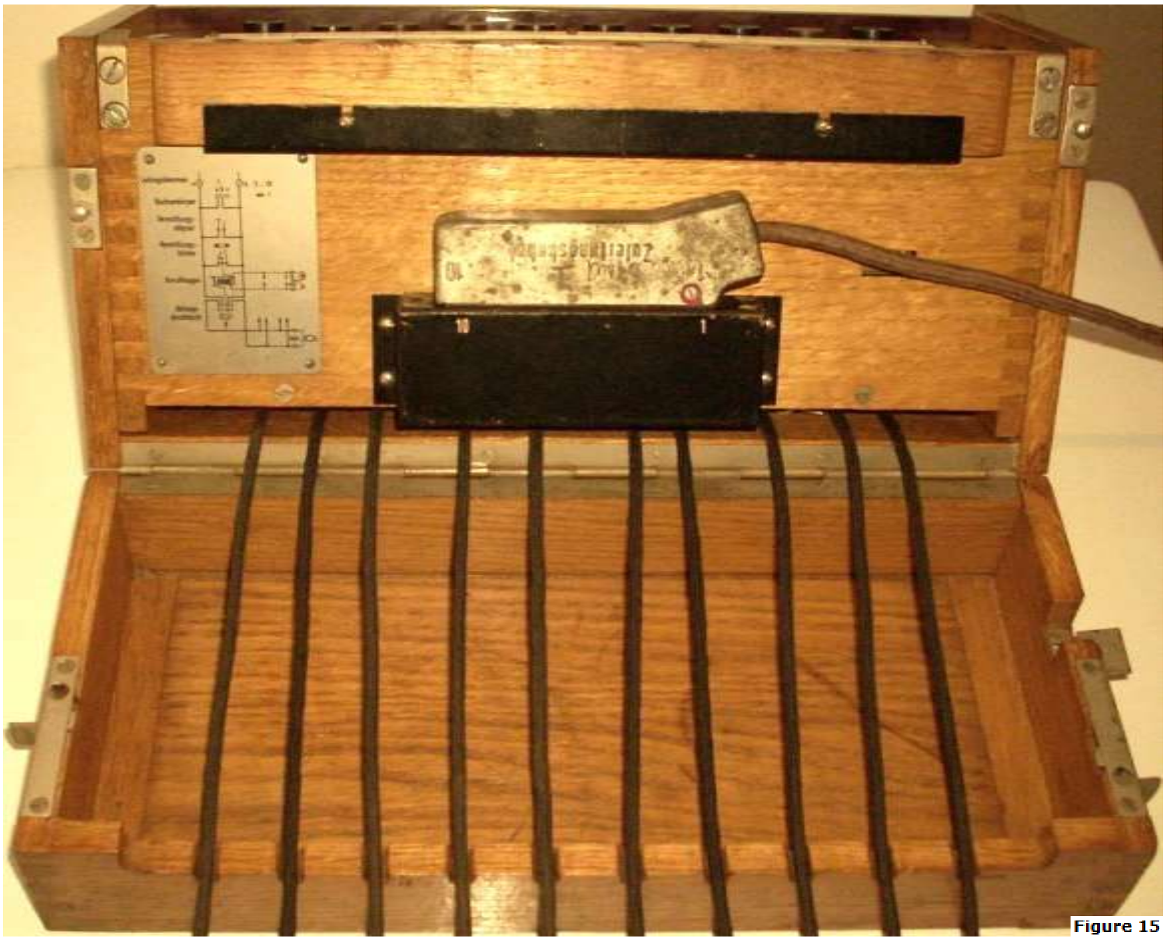

Figure 15

Here, the cords have been unstowed and lain into the proper slots so that the board can be closed without pinching the cords. A connecting cable is plugged into the 30-contact jack; it exits through a special cutout on the right-hand side of the case. Electrically, this small field switchboard is nothing more than ten switchboard modules wired together.

The schematic for one of the switching units is printed on the aluminum tag to the left of the 30-contact jack (refer to the last page of this tale for a scan of the schematic).

Figure 16

The lower photograph on the previous page shows the small field switchboard with all ten plugs in their stowage jacks … early switchboards of this type didn't have these stowage jacks, and the ten cords were simply allowed to dangle down as they may. The problem with that was that crosstalk could occur if the plugs touched moist or wet ground. All ten of the drops were placed into their actuated position to show that there is a line numbering strip behind the drops. The white plastic strip above the drops is attached to a flat metal bar which may be raised or lowered – when lowered, the drops were locked (this was done when the board was being readied for transport).

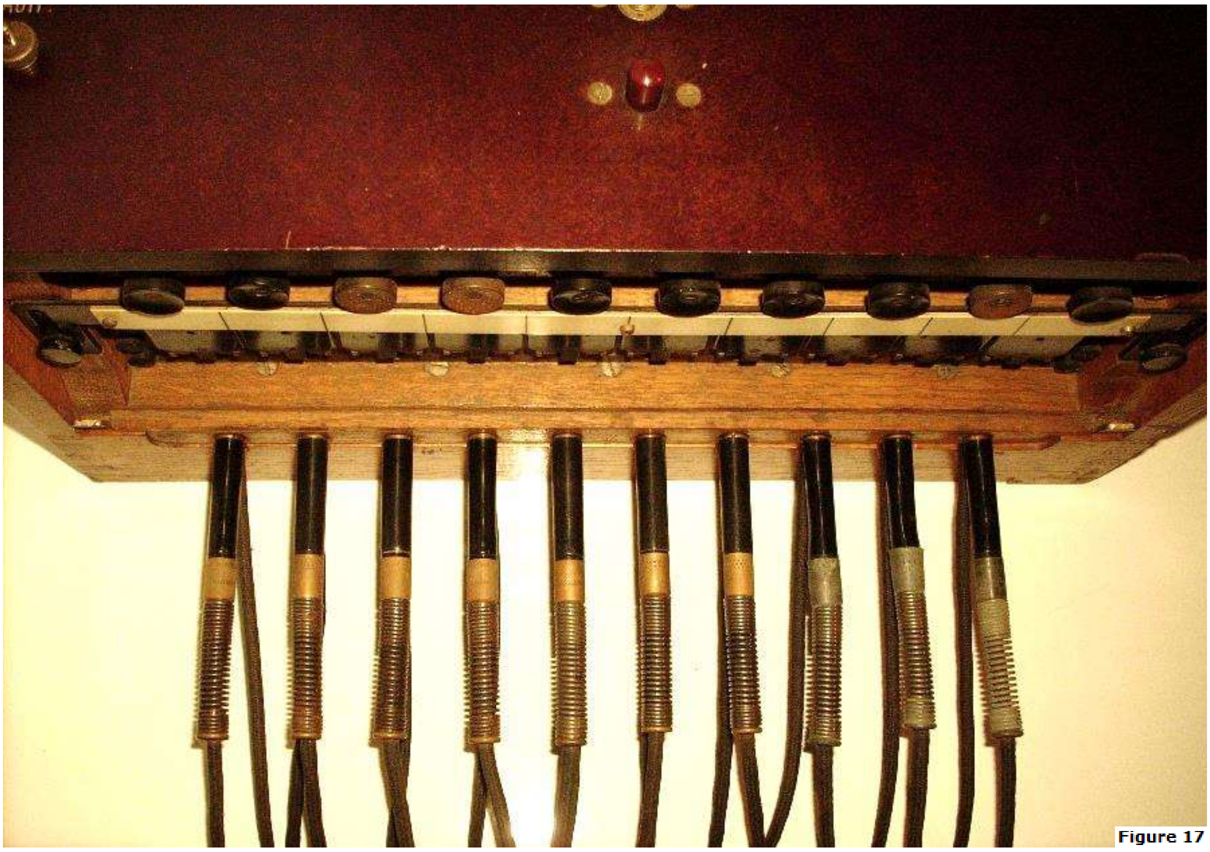

Figure 17

As can be seen, the first seven of the plugs have brass collars, while the last three have collars made of a zinc alloy – this was one of the German's moves to get war-critical metals out of equipment which didn't require them. The problem with the zinc alloy only surfaced after decades, but surface it did: the zinc collars cracked and got loose, while those made of brass are all still as good as new. It isn't all too noticeable, but even the sleeves of the plugs are different … those of the first seven plugs are made out of sturdy Bakelite, while the last three sleeves were made out of a cheap, black thermoplastic.

BTW – re-enactors simply *love* using original equipment, even when they don't *quite* understand the proper mode of operation. Case in mind: the 30-contact jack mentioned on the previous page; someone going by the name of "Karl-Heinz K." of a re-enactor's group calling themselves the "2nd battalion of the chasseur regiment" (FJR/2) wrote a "technical reference" concerning this small field switchboard. He believes that the 30-contact jack is used "… to plug an *extension* switchboard unit in" – which is *pure* ah, well, you know … (the stuff that drops off from the rear end of bulls, to put it politely).

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Figure 18

As can be seen, the sleeves made out of thermoplastic are deformed after 70 years and the zinc collars cracked and loose.

What I just noticed now, as I write, is that even the small collet on the end of the cord protection spring was also changed from brass to a zinc alloy. Even the springs are the "cheap" version, which were not tempered until they showed the typical dark blue luster.

Before I forget all about it, here is the cable I had plugged into the 30-contact jack on the switch-board.

This particular cord has its own little tale … what I saw at the flea market was what appeared to be a very long piece of brown cable, wrapped around the terminal board, with a plug at the other end of the cable.

It wasn't so, which was a good reason to refuse to pay what the seller was originally asking. What I namely held in my hands was a roughly 10 meter long piece of cable, cut off at one end and with a plug at the other end, with a second circa 10 meter long piece of cable with the terminal board, but without a plug. I reconstructed this cable from the bits I had bought.

Figure 19

Naturally, the small field switchboard had its own special adapter with which it could be connected to a dial or C.B. exchange line.

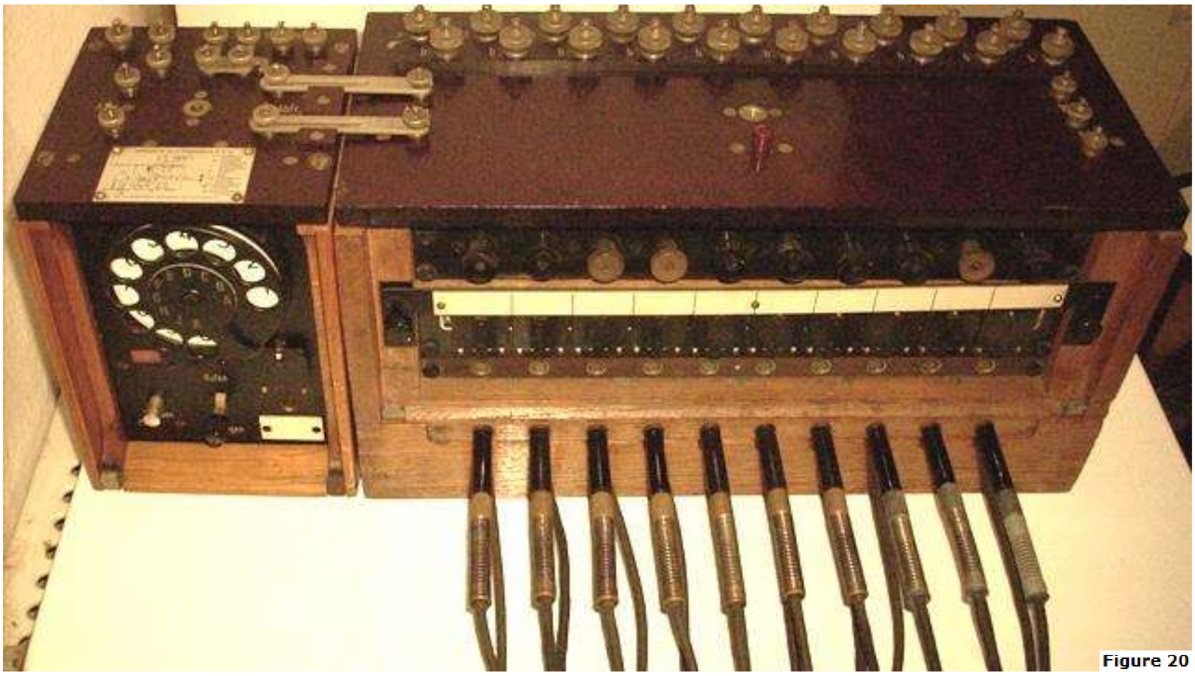

Figure 20

A standard German telephone dial of the type "N30," a single drop with a line jack beneath it and Kellogg switch (spring-loaded for the ringing position and latching for answering an incoming call) are on the front panel of the adapter. The last item is a round, nickel-plated pushbutton with a small red flag above it.

The FF-33 used as the operator's set is connected to the adapter by means of the two binding posts on the left side on top of the adapter, while the adapter itself is linked to the switchboard by means of the two sliding bars seen in the photograph. The C.B./dial phone line is connected to the two binding posts in the top, left-hand corner of the adapter terminal plate, while the night-alarm battery/bell are connected to the three terminals in the top, right-hand, corner of the terminal plate.

The pushbutton is normally depressed (and the flag black) when the adapter is "on-hook;" when an incoming call actuates the drop, the handle of the Kellogg switch is moved to the "answer" position (this unlatches the pushbutton and the flag changes to red) and the switchboard operator answers. After hearing which line was wanted, the operator takes the cord of the line and inserts the plug into the line jack on the adapter, moves the handle of the Kellogg switch to the "ring" position and rings the line with the magneto of the FF-33. The operator then moves the handle of the Kellogg switch back to the latching "answer" position and waits for conversation to begin; when conversation has begun, the handle of the Kellogg switch is restored to the off position.

When the call is completed, the magneto line rings off as normal, after which the plug is removed from the jack on the adapter and is placed back in its stowage sleeve. The pushbutton on the adapter is pressed in (where it latches), the flag changes from red (which indicates that the CO line is off-hook) to black (which signifies that the CO line is on-hook). Calling from the field phone network into the PSTN is almost as easy ….

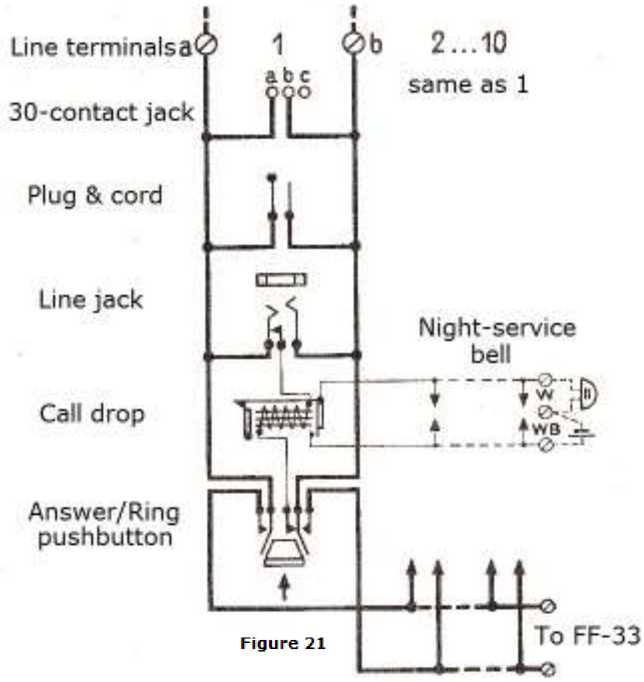

Figure 21

The schematic is so simple and straightforward that I don't think it's necessary to explain it.

That the incoming "a" lead (tip) is connected to the tip of the connecting plug and the short spring of the break jack (where the drop is disconnected when a plug is inserted) is obvious.

It's also obvious that depressing the self-latching "answer/ring" pushbutton will connect the operator's FF-33 to the line while, at the same time, disconnecting one side of the coil from the drop.

What to do if there are more than ten magneto lines? Simple: use a field switchboard equipped to handle twenty lines. If there isn't one available, then one can use two of the ten line field switchboards by placing them next to each other at an angle, so that the left-hand outermost plug on the left board can just reach the right-hand outermost jack on the right board … there is also another trick one can use.

… One simply builds a small, rickety wooden frame into which two or three of the small field switchboards are inserted from the rear. *Stacking* the boards in such a manner actually makes for easier and swifter operation than having two boards sitting at an angle.

The German WWII Exchange Interface Set 1933

As already written, the German Wehrmacht was always interested in having an alternative piece of equipment on hand to replace things not available.

In the case of the SB-33 (described on pages 296-297) the exchange interface set, model 1933, could be used as an alternative, although this would've been overkill too, because the exchange interface is a complete dial telephone which uses the field handset 33. Since it's a complete phone, it could be used to connect a FF-33 field phone line to a C.B. or automatic dial exchange; in a pinch, it was also useable as a standard desk telephone.

Figure 1

An interesting design feature of this telephone is that, when the handset is disconnected and removed, the basic unit doesn't have any protrusions, so that it's very easy to pack away (the phone and the handset had their own leather storage cases, which are next to impossible to come by).

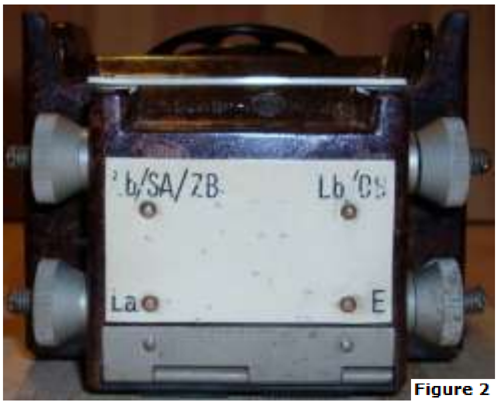

Figure 2

The picture to the left shows the binding posts on the rear of the phone. Tip (La) is only present once, while the binding post for the ring lead (Lb) is present twice – one for connecting the phone to a C.B. or dial exchange, and an electrically independent Lb terminal for connecting the phone to an magneto exchange, where it fulfills the role of a SB-33 accessory for the FF-33 field phone. The terminal marked "E" is for a ground connection, for use with dial exchanges which worked using grounded dial pulses on tip and ring.

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When used in the role of a "plain Jane" Wehrmacht desk telephone, the exchange interface was connected to the phone line via a special line cord, as shown below.


Figure 3

This particular type of line cord and terminal block are pretty rare, especially when in NOS condition.

Yes, I know that the cover of the terminal is scratched and is missing some paint, but the cord is still wrapped up the way it was when delivered to the Wehrmacht; the oversized spade lugs were designed to fit the binding posts on the phone.

The terminal block has removable links for the tip and ring leads; this is another instance where the basic design of a piece of equipment didn't change over a timespan of a few decades (compare with the terminal block shown on page 397).

Figure 4


Figure 5

This terminal block even has a Wa.A. hallmark, proving that it's a piece of military equipment, just the same as any rifle, machine gun or field cannon.

The exchange interface 1933 has two jacks which allow connection of a FF-33 field phone – both of which are placed so that incorrect connections and handling are prevented. The jacks are labeled "Vermittlungsklinke" (German for "exchange jack") and "Induktorklinke" (German for "magneto jack") – the former was used to connect a FF-33 field phone line to a C.B. or dial exchange, the latter when the interface was used as an alternative to the SB-33 accessory.

Figure 6

The exchange jack is located between the cradle plungers, so that it's impossible to hang the handset of the exchange interface up while there is a conversation in progress. The question arises as to how the soldier who connected the interface to the FF-33 would know when the conversation had ended … simple: the distant end of the field phone line (another FF-33 or a switchboard) simply rang off as normal (listening in on the conversation was strictly "verboten").

Figure 7

To use the exchange adapter as an ersatz SB-33, the FF-33 was connected to the interface via the magneto jack – which is only accessible when the handset is unplugged from the unit.

When not in use, the handset of the FF-33 rested on the cradle, just as it would on the genuine SB-33, with the incoming line connected to the terminals La and Lb/OB.

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Figure 8

Figure 9

The photographs above show the exchange interface and the field handset(s) in the two possible configurations as explained on the previous page. For those who'd like to try and decipher European telephone schematics, I've included the schematic for the exchange interface below ….

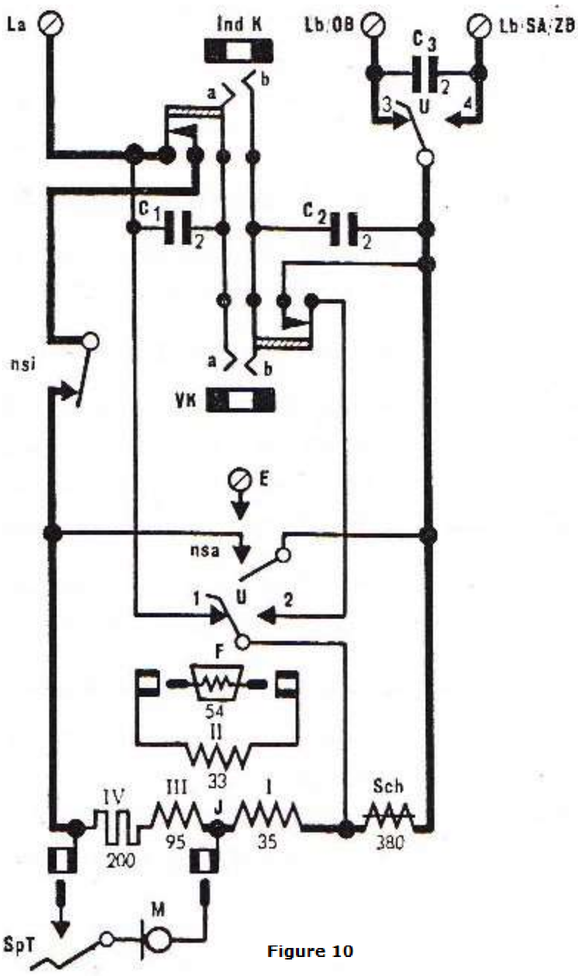

Figure 10

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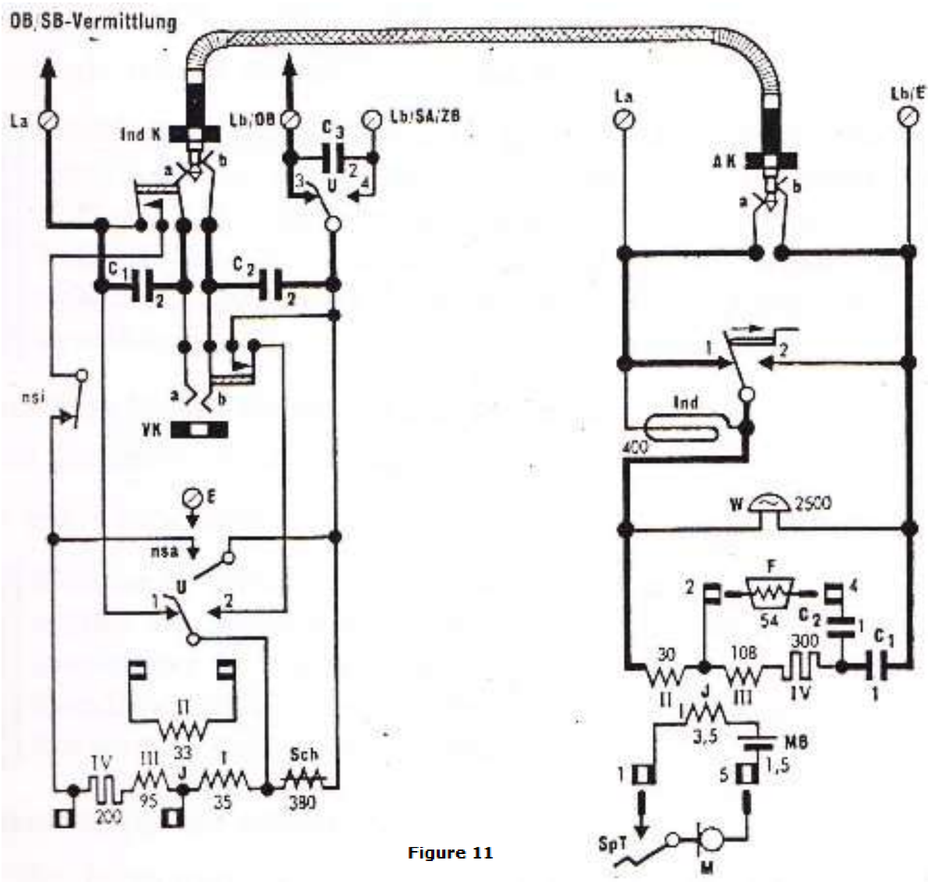

Figure 11

The funny thing about the schematics shown above is that the left-hand schematic is supposed to show the exchange adapter in its role as a replacement for the SB-33 field phone accessory, while the right-hand schematic shows an FF-33. Now, what was the role of the SB-33? Right – to *close* a D.C. loop to the switchboard when the handset was in an on-hook condition … if one takes a good look at the left-hand schematic, it's easy to see that something is wrong, because the condensers C_1 and C_2 are always in series with the magneto jack and the line; there'd never be a D.C. loop between the terminals La and LB/OB. Or would there?

The drawing, as shown above, was scanned from a manuscript which described various accessories for field telephone or field switchboard use. This was official training material of the "Luftnachrichtenschule" (Air Force Telecommunications School) in Halle an der Saale in Germany, and was printed in May, 1942.

Under normal conditions, one would expect a training manual to be proof-read a few times before going into print, and that people well-versed in the subject would be responsible for drafting and verifying the correctness of schematics and circuit diagrams. In this case, however, someone made a serious blunder ….

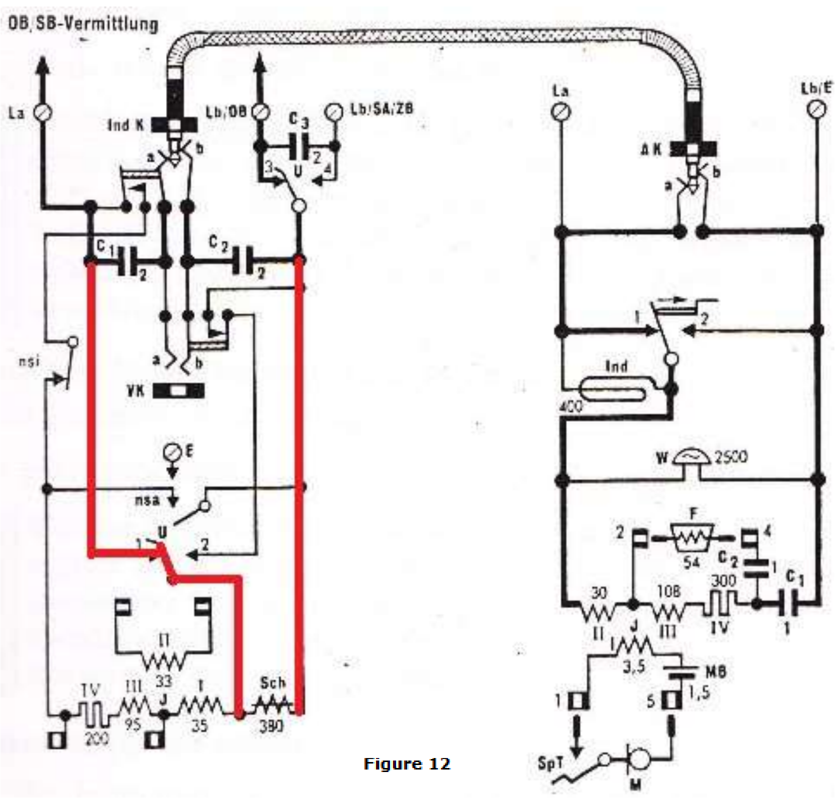

Figure 12

Ah, now that's much more like it. There **is** a D.C. loop to the switchboard, after all, when the handset from the FF-33 is on the cradle of the exchange interface … the hook-switch "U" with contacts 1 and 2 (near the middle bottom of the left-hand schematic) and the hook-switch "U" with contacts 3 and 4 (in the upper right-hand corner of the left-hand schematic) are shown in the *on-hook* position. The item labeled "Sch," which has a D.C. resistance of 380 Ohms, is an A.C. buzzer which takes the place of a ringer inside the unit and which behaves much in the same manner as the 400 Ohm choke in the SB-33 accessory. As I wrote before: whoever was responsible for the original schematic made a serious drafting error.

If readers refer back to the lower photo on the first page of this tale, they will see that the upper left-hand screw terminal of the phone is labeled "Lb/SA/ZB" – this labeling reveals a little-known fact, namely that dial exchanges were referred to as "**S**elbst**a**nschluss-Ämter" in Germany until circa 1933. A telephone intended for dial exchange operation was commonly referred to as a "SA" telephone, &c. The Nazis had the German Reichspost change the terminology from "SA" to "W" (German = **W**ähl = dial [operations]) in order to prevent confusing the Nazi Storm Troops (German = **S**turm**a**bteilung, abbreviated "S.A.") with dial telephones. Yes, I know it *sounds* rather ridiculous, but it's a historical fact all the same. However, there is one instance in which the term "Selbstanschluss" still exists to date: the railway-internal phone network is still commonly referred to as the "BASA" network in Germany and Austria (BASA = **Ba**hn-**S**elbst**a**nschluss).

The abbreviation "SA" for a dial telephone or exchange can be cause for confusion, *even today* … case in mind: someone in Germany wrote a very interesting book on civil defense air raid shelters in Germany during the Nazi era. At the beginning of a paragraph, the author explains that a specific bunker was intended to also house a dial exchange on two floors, while at the end of the same paragraph he goes on to write that an "office of the S.A." (i.e.: an office of the Nazi Storm Troops) was "installed" in the bunker. Nope – it was a dial phone exchange, which was placed in the bunker to protect it from Allied bombing raids, after all ….

A Telephone, a Friendship & a Community

One can find almost any telephone ones heart may desire at one or the other of the eBay® web sites nowadays, but this wasn't always so … back around 1996, the pickings at the Vienna flea market near the city center were *much* better than any other flea market to be found at or near Vienna, and also much better than the pickings in the early years of eBay®.

Figure 1

It was also in the year 1996 that I discovered a very unusual "subscriber set" which, according to the metal tag attached to the wooden case, was manufactured in the USA and which sported a black painted, metal handset. The wording on the tag specifically stated that this phone was a *subscriber set* with the model number 521-A.

I saw this particular phone at the stall of one of the dealers at the flea market (which is split 50:50 between commercial dealers and private persons) – but only because he had it sitting up front on his table.

After giving the phone a good looking over I asked him how much he wanted … he replied that he was looking for 600 Austrian Schillings (~ 50 dollars at the time) for one set, or 1,000 for *both*. Both? Where was the other one? Hidden in a big cardboard box behind the table ….

It had just begun to rain, so I only gave the second phone a quick looking over, paid what was due and ran off to seek shelter in the nearest subway station. I got on the subway and took my booty home.

I examined both phones in detail after I got home, and was very surprised to discover that the battery holder was designed to accept two 4.5 volt batteries of a shape I only knew from Europe[1] – which led me to believe that these sets had been modified for use in hereabouts (I later heard that the specific size and shape of battery was also available in the USA).

[1] Because of this, I *originally* thought that these two phones had found their way to Vienna via the firm of Czeija, Nissl & Co., which had a long-standing contract with the International Western Electric Company (which also covered the rights of both companies to mutually share and use patented inventions).

One of the handsets (commonly known as the "type 1001"; in this specific case type 1001-M) carries a patent date of August 18, 1903 embossed on the transmitter housing. Although I didn't know it at the time, this handset turned out to be very interesting, because both the transmitter and receiver units had Western Electric "design" numbers ("D" numbers were used as a prefix for design models, experimental sets and field trial sets). The transmitter is marked as "D44302", while the receiver carries the number "D44303 70."

I did a search of the web for the fourth or fifth time in as many years and, this last time, actually managed to find a site which has various documents related to the WE 521-A subscriber set[2], but these are from the 1930s, so it's difficult for me to date this set. After all, the microphone on one of the handsets carries a patent date from 1903 while the flat "B" type relay used in the set carries patent dates from 1914/15.

[2] The documents are from a division of Western Electric known as "Electrical Research Products, Inc." (ERPI), which was responsible for sound and public address systems.

Although not clearly readable, the cover on the one handset bears the two lines of text: "PAT IN USA – AUG 8 1909."

One of the ERPI documents is an equipment bulletin dated July 15, 1932, and refers to the handset used with the 521-A. As may be seen in the scan on the next page, the handset consisted of a handset handle, transmitter, receiver and cord with plug.

I gave my second 1001 handset (which no longer carries any design numbers, but rather standard WE part numbers), a good look while conceiving this tale and happened to notice that the part numbers of the handset handle, transmitter and receiver exactly match those in the scan referred to above … which means that Western Electric's very first commercial style of handset was available and in use up to the early 1930's.


Figure 2


Figure 3

Another interesting bit of information is to be found in the ERPI document: the handset handle, sans transmitter & receiver, officially carried the Western Electric type designation "1E" (and one of the handsets belonging to my 521-A's actually carries this number).

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1. Description

1.1 This set is a black finished hand set used in Sound or Public Address Systems, in connection with 521-A Subscriber Set for communication between the booth and an observer or monitor.

1.2 It consists of: One - #1-E Hand Set Handle
One - #285 Transmitter
One - #131 Receiver
One - #786 Cord (6 Ft.) with #110 Plug,

interconnected as shown below:

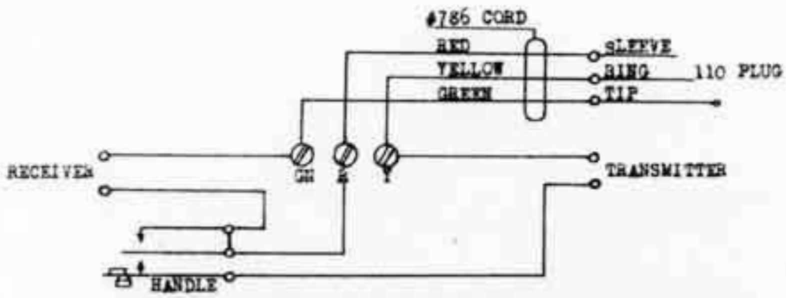

DIAGRAM OF CONNECTIONS

2. Merchandising

2.1 The 1001-M Hand Set is available in the Stores Division. Order as "One 1001-M Hand Set".

2.2 The component parts listed in 1.2 above are separately replaceable. Order them as listed on a full price basis only. The replaced parts should be junked locally in the field.

Issued by
Operating Dept.- Equipment Div.
Printed in U.S.A.

Issue #1
July 15, 1932

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According to another ERPI document, dated October 27, 1934, the handset and the 521-A subscriber set were no longer carried in stock ….

RESTRICTED DISTRIBUTION
ERPI PERSONNEL ONLY

WIDE RANGE Western Electric SOUND SYSTEM

4.17

EQUIPMENT BULLETIN

Figure 5

HAND SET, 1001-M

0. REASON FOR REISSUE

0.1 To change Merchandising as shown (Section 2).

1. DESCRIPTION

1.1 This set is a black finished hand set formerly supplied as part of Sound or Public Address Systems, in connection with 521-A Subscriber Set for communication between the booth and an observer or monitor.

1.2 It consists of:- One - #1-E Hand Set Handle
One - #285 Transmitter
One - #131 Receiver
One - #786 Cord (6 Ft.) with #110 Plug,

interconnected as shown below:-

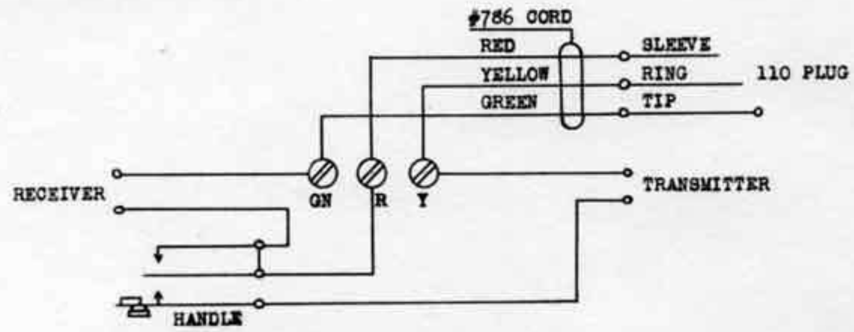


DIAGRAM OF CONNECTIONS

2. MERCHANDISING

2.1 1001-M Hand Sets and the 521-A Subscriber Set are no longer supplied with systems. Neither the Hand Set nor its component parts are any longer carried in stock, and orders for them will be handled on an "As Ordered" basis.

1 Page - Page 1

Electrical Research Products Inc.
Operating Engineering Dept. - Equipment Div.
Printed in U.S.A.

Issue #2
October 27, 1934

The following facts concerning the 521-A sets bothered me no end:

1) the phones both had a push-pull switch to turn the instrument on or off – which I couldn't reconcile with the fact that these phones were dubbed "subscriber sets;"

2) a signaling arrangement which consisted of a D.C. buzzer and a pushbutton switch instead of a magneto and A.C. ringer and,

3) the handset cords were very thick and were terminated with 3-conductor switchboard plugs, with mating jacks on the units themselves.

So, what, exactly, had I gotten hold of here? The term "subscriber set" is commonly reserved for telephones connected to an exchange – but I had never heard of Western Electric manufacturing exchanges which accepted D.C. signaling with buzzers instead of drops or lamps before.

Figure 6

I already owned several bound volumes of the International Western Electric/Standard Electric Company publication "Electrical Communication" and I was certain that I had seen a picture with very similar sets in one of those volumes. It took me a while to dig the relevant article out (Electrical Communication, Volume 5, Number 2, October 1926 – "The Public Address System in Liverpool Cathedral"), but I found it in the end. The text of the article mentioned the fact that the phones (near the middle of the picture) were used as an intercom … ah, well now, that'd make much more sense than any exchange type connection (although some special field switchboards of German and Swiss origin used buzzer signaling during WW I).

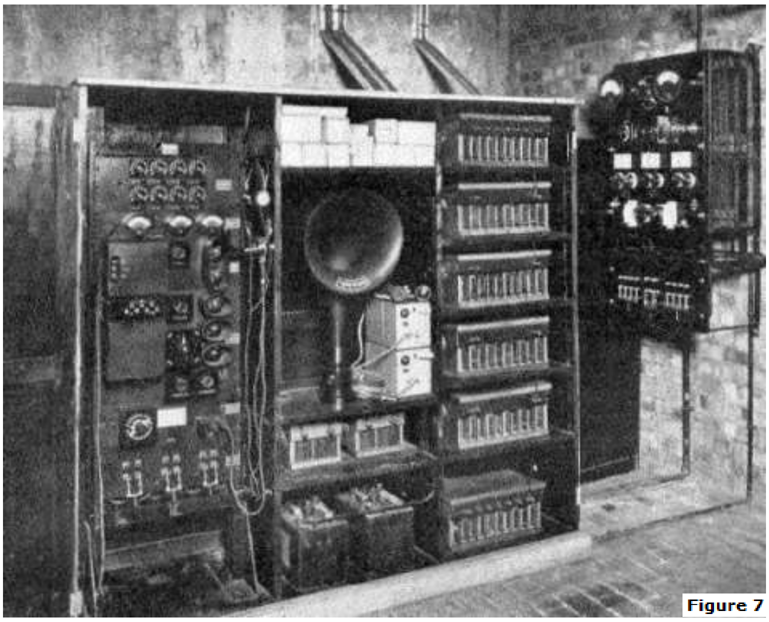


Figure 7

Another unusual fact concerning my 521-A phones was that, contrary to Western Electric standards, there was no schematic glued to the wood somewhere inside. Since I am especially curious about any phones without a schematic, I took the time to ring out the wiring and components. The first version of my schematic was lost in a software crash a few years later (yes, I do know that one should do backups regularly …), but I decided to take the time and ring everything out and to draw another one, since I was certain that I'd be writing this tale.

As it turned out, I could have saved myself the time and effort if I had searched the internet one more time before I rang one of the units out, because one of the ERPI documents I came across (dated February 16, 1931) was a wiring diagram for the late model 521-A unit.

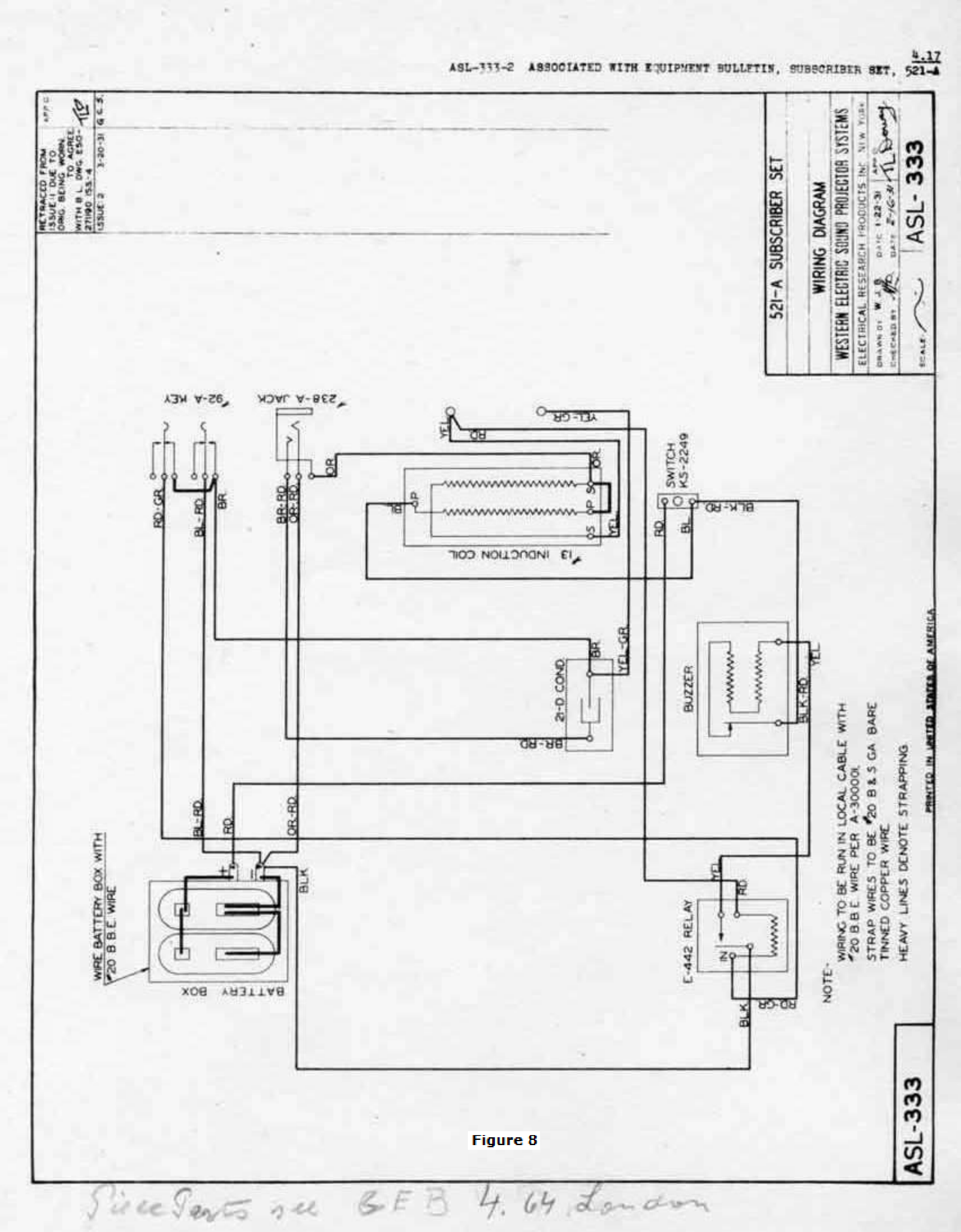
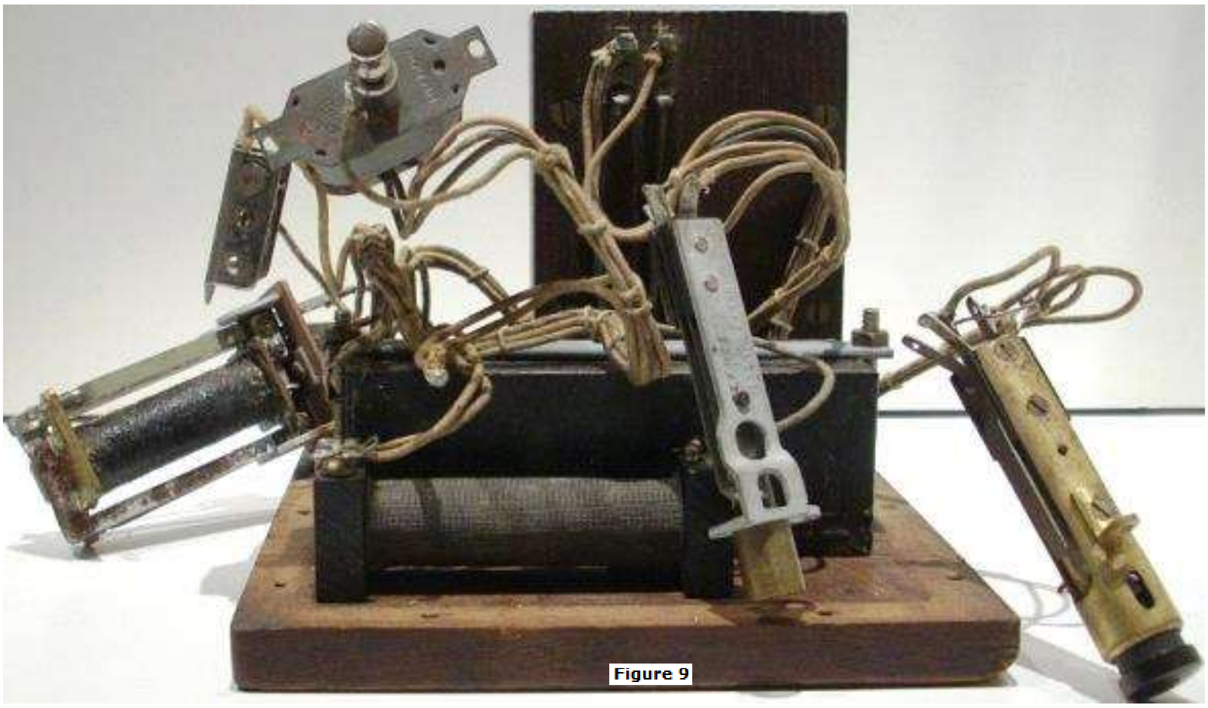


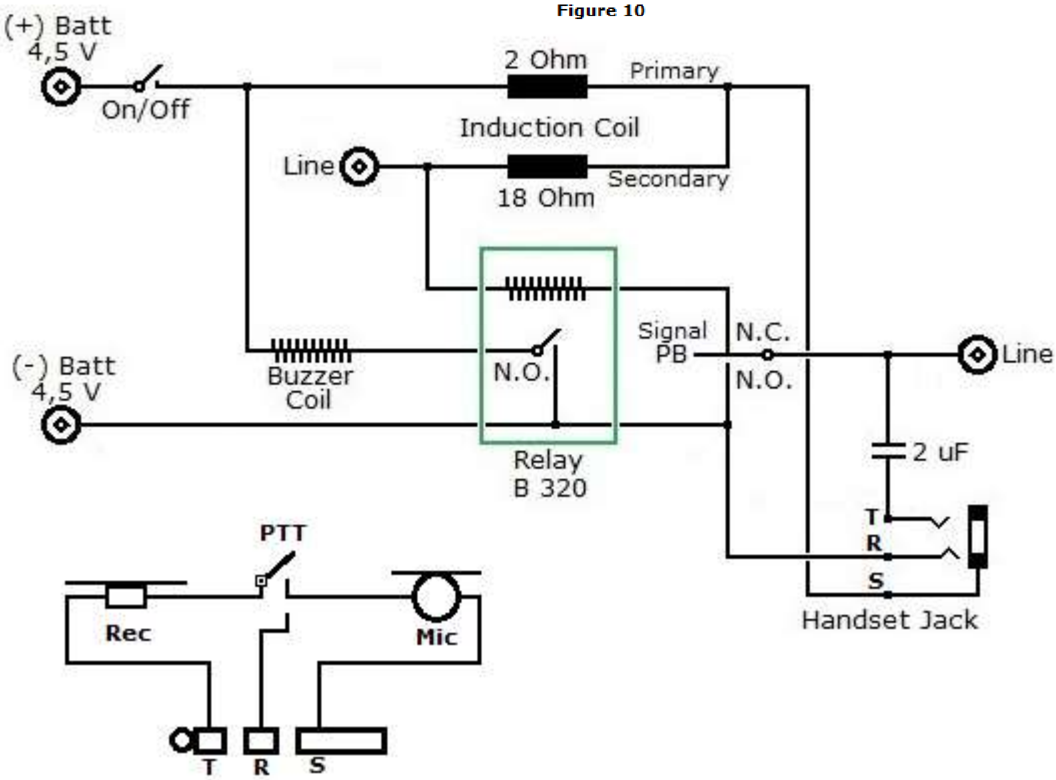
Figure 8

This is what my 521-A subscriber set looked like after I took it apart to ring the wiring out:



And this is the schematic as rung out:

Figure 10



It was around the year 1998 that I saw such a phone up for auction at eBay® in the U.S.A. Back then, www.ebay.com was the *only* address for this site, and the rules were much laxer than today – among other things, members could leave feedback for each other *without* having entered into a transaction, or communicate with others via eBay® without all of the rigmarole of having to log in, etc., that is with us today.

Anyway: someone had bid on the phone and had won the auction. I thought that he or she might be able to supply me with some more information about it. No such luck at the time, but this was how I happened to meet Mr. Paul D. Wills; he was the one who introduced me to Telephone Collector's International.

I am deeply indebted to him for introducing me to a world full of people who share my love for old telephones and switching equipment.

Reading European Telephone Schematics

The following drafting symbols once were, or are commonly used throughout western and eastern Europe when drawing schematics for telephones and other telecommunications equipment.

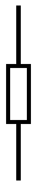


Figure 1

Everybody recognizes a resistor, or do they? The resistance is noted differently than in the States – in the USA the resistance is usually either given in full, i.e. 1,200 Ohms or as 1.2 Kilo Ohms or simply as 1.2K. In Europe, 1,200 Ohms is listed as 1k2. "Kilo" (k) means 1,000; "Mega" (M) means 1,000,000 and "Giga" means 1,000,000,000. Resistors are usually given the letter "W" (**W**iderstand in German) and are sequentially numbered.

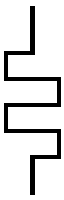


Figure 2

So, what in the world is this? Believe it or not, this happens to be a resistor, too. More precisely, it a special type of wire-wound resistor, where insulated resistance wire is wound on a bobbin made of cardboard or plastic in such a manner as to be as nearly non-inductive as possible ("bifilar" coil). Such resistors were commonly included in European telephone induction coils as part of the so-called sidetone balancing network.

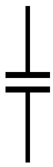


Figure 3

This is a non-polarized condenser, such as an old aluminum foil (or a more modern plastic foil) type of low capacity; a polarized capacitor will have its positive terminal identified by a "+". In the States, a capacitor of 0.000,001,2 Farad capacity is listed as 1.2 mfd or 1.2 mF or 1.2 µF; in Europe, the designation is 1µ2. 1 Farad = 1,000,000 µF, 1 µF = 1,000 Nanofarad (nF) 1 nF = 1,000 Picofarad (pF). Capacitors block direct current and allow alternating current to flow. Capacitors are usually given the letter "C" (but **K**ondensator in German) Sounds illogical, but that's the way it is.

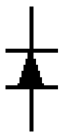


Figure 4

A single diode, usually made out of a semiconductor called silicon, more rarely made of germanium. Diodes allow D.C. currents to flow in one direction only: from anode to cathode; A.C. currents are rectified, so that only the positive portion(s) pass. The anode is the end at the base of the triangle. Diodes are usually given the letters "Gl" (**Gl**eichrichter in German) and are sequentially numbered.

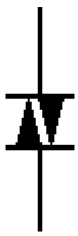


Figure 5

A varistor ("variable resistor"). Varistors alter their resistance according to the voltage applied and are commonly used to regulate an A.C. or D.C. voltage to a certain limit. In telephony, varistors were commonly used to limit the line voltage presented to a common battery (C.B.) or dial telephone in an off-hook condition, and to limit the volume in receivers, so as to protect the users hearing. In German-speaking Europe they're often labeled as "GGs" or "Ggl" (**G**ehörschutz**gl**eichrichter in German = hearing protection rectifier).

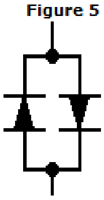
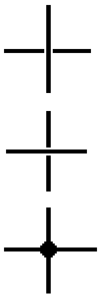


Figure 6

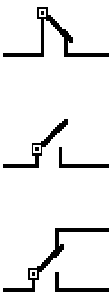
This is the old-fashioned way in which varistors were once drafted in Europe.



These two symbols identify drafting lines (representing wires or circuit paths) which *cross* each other with *no* electrical connection between them; I draw them with a small gap where the lines cross, but normally the lines are simply drawn as crossing each other at right angles.

This symbol represents a point at which wires or circuit paths are electrically connected to one another.

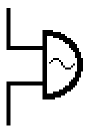
Figure 7



The first symbol represents a single-pole, single throw (aka "S.P.S.T.") switch or contact, such as a contact in a hook-switch or dial. In this case, the switch or contact is *closed* in the "normal" position (called a "normally closed" – N.C. – contact). The second symbol also represents an S.P.S.T. switch; however, in this instance the contact is *open* in the "normal" position (called a "normally open" – N.O. – contact). The last symbol represents a single-pole, double throw (aka "S.P.D.T.") switch or contact, shown in its "normal" position. An S.P.D.T. switch has one N.O. and one N.C. contact. Contacts or switches used in telephone schematics are commonly shown in their *non-operated* condition, e.g. when the handset is resting on its cradle and the dial is at rest.

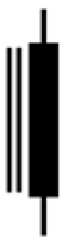
Figure 8

In German, hook-switch contacts are identified as "GU^{I}, GU^{II}" &c., whereby "GU" is the abbreviation for the German word "**G**abel**u**mschalter;" dial contacts are identified as "nsi," "nsa" and "nsr" respectively. "Nsi" is the dial N.C. contact which delivers the dial pulses, "nsa" is the N.O. contact which shorts out the telephone speech circuit whenever a digit is pulled on the dial ("off-normal" contact). Not every dial has an "nsr" contact; if a dial is mechanically designed to deliver 11 or 12 impulses whenever the digit 0 is dialed (or 3 impulses when a 1 is dialed, &c.) the "nsr" contact shorts out the extra impulses. The abbreviation "ns" stands for the German word "**N**ummern**s**chalter" (literally = "numbers switch" or simply "dial").



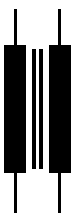
In general, this symbol identifies any form of A.C. ringer – irrespective of whether or not the ringer has one or two coils and/or one or two gongs. The D.C. resistance of the coil (or coils connected in series) is usually given next to the symbol and is commonly within the range of 1,200 to 6,000 Ohms.

Figure 9



This symbol represents a single inductor. An inductor consists of a winding of insulated wire, wound on a bobbin made of cardboard or plastic. A laminated core of specially treated iron is inserted to create a closed *magnetic* circuit. Such coils are called "chokes," possibly due to their characteristic of allowing direct current to flow, while choking off alternating currents. The inductance of a choke is measured in Henrys; chokes used in telecommunications equipment usually have values in the mH (10^{-3} Henry) range. The value of a choke is usually only defined to the nearest mH.

Figure 10



This symbol is generally used to identify a transformer, consisting of a single primary and a single secondary coil or winding of insulated wire, wound and mounted as above. Such a setup is usually used to step the alternating current on the primary side up or down to that found on the secondary winding. When such transformers are used in telephony, they're referred to as induction coils.

Figure 11

Transformers and induction coils may have auxiliary windings (such as for sidetone balancing) and may be drafted as being 2 or more chokes … the nature of the circuit in which such separate chokes are used to identify an induction coil will tell whether the physical circuit uses electrically and magnetically independent chokes or not. The D.C. resistance of the individual coils is usually listed, and commonly ranges from circa 5 to 600 Ohms.

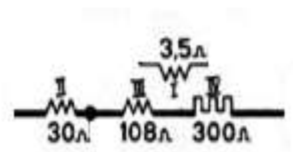


Figure 12

This is a really old way of drafting a telephone induction coil, with an integrated, non-inductive resistance ("bifilar" coil) of 300 Ohms which is used for sidetone balancing. In this case, the induction coil is for a magneto telephone, with a 3.5 Ohm primary and two secondary coils of 30 and 108 Ohms. The roman numerals identify the order in which the coils are wound on the bobbin.

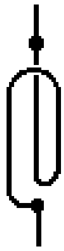


Figure 13

This symbol was commonly used to identify a magneto, and only depicts the magneto coil – sans magnet, gears and crank. The waveform of the alternating current generated is only a very rough approximation of a sine wave and is therefore termed as being sinusoidal in nature. Depending upon how the magneto is geared and the speed with which the magneto crank is turned, the voltage generated will usually range between 30 and 90 V.A.C. at a frequency usually somewhere between 15 and 25 Herz. Common armature D.C. resistances run between 400 and 600 Ohms.

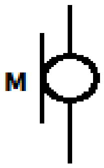


Figure 14

This symbol was generally used to identify a carbon microphone, both for magneto and C.B./dial telephones in older telephone schematics. It's said that this symbol is a stylized representation of a membrane pressing against a carbon ball which, at an early date in the history of telephony, was actually in use (Blake microphone). The most common type of microphone was the carbon granule type. In newer telephone schematics this symbol is used to identify an electronic type microphone.

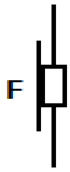


Figure 15

This was the symbol used to identify an electromagnetic receiver, irrespective of the physical type used. It's said that this symbol is a stylized representation of a soft iron membrane or diaphragm in front of an electromagnet.

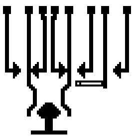


Figure 16

This symbol depicts a pushbutton-type switch; in this case with two S.P.D.T. contacts and one N.O. S.P.S.T. contact. The form of the pushbutton plunger and the springs which the plunger actuates tell whether the pushbutton is of the push-pull or the spring-return type; this one is "spring-return."

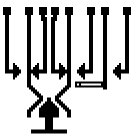


Figure 17

Conversely, this pushbutton switch is of the push-pull type. In the previous figure (and here) the right-hand spring (actuated by the plunger) moves an electrically insulated link which, in turn, closes the N.O. contact at the far right of the switch.

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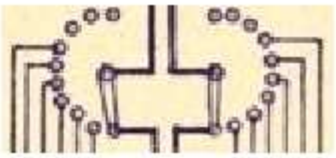


Figure 18

Here we have an old-style rotary switch with two contact banks and two wiper-type contact arms. Although it isn't shown in this symbol, the two contact arms are physically linked together so that they move at the same time – but they're electrically separate. In this specific case the rotary switch is of the lever type, as opposed to the more common type with a rotary shaft.

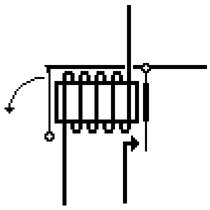


Figure 19

This symbol depicts an electromagnetically operated annunciator which was commonly called a magneto drop. The coil is shown wound around an iron core; the "flap" of the drop is on the left in this case. The arm which holds or releases the flap is furnished with a normally open contact which closes the circuit for a local D.C. bell & battery as a night alarm whenever the electromagnet is energized.

Figure 20

This symbol was the stylized representation of an electromagnetic "star" type indicator. The most common type of star indicator was that with a black face into which 4 more or less rectangular holes were punched. When the coils were energized, a vane with four arms (painted white) rotated so that the arms came to rest behind the punched holes. They were called star indicators because, when visible, the four white arms formed four rays emanating from a central point.

Figure 21

This is a 2 spring telephone/switchboard jack, with a 2 conductor plug and cord inserted. In this instance, the two springs are labeled with the letters "a" and "b," which are equivalent to the terms "tip" and "ring." This jack has an insulated N.C. switch which is opened whenever a plug is properly inserted. The switch is opened by the movement of the "a" spring; the rectangle between the "a" spring and the left-hand switch contact represents a mechanical (but electrically insulated) link.

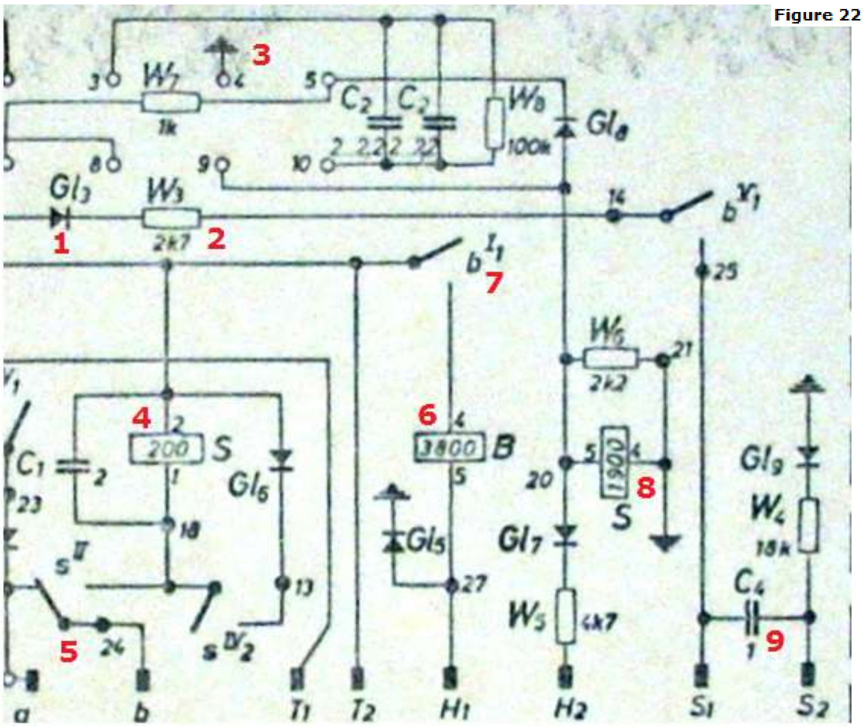


Figure 22

The scan at the bottom of the previous page is an excerpt of the schematic for an old GA48 type party-line subset. I have included it in order to show examples of how some of the components previously explained are drafted. There are also a few new symbols, which I was too lazy to redraw.

#1 is a diode, with its cathode on the right-hand side. In this case, the diode is #3 in the schematic (Gl 3).

#2 is a resistor with a value of 2,700 Ohms which is listed as 2k7. Standard resistors can handle 1/4 watt of power. If a specific resistor can handle more power, the power rating will be given as "2 W," "5 W," "10 W" &c.

#3 is one of the new symbols; it identifies an electronic ground. Grounds are commonly drafted as individual points on schematics – it's understood that they're connected together electrically.

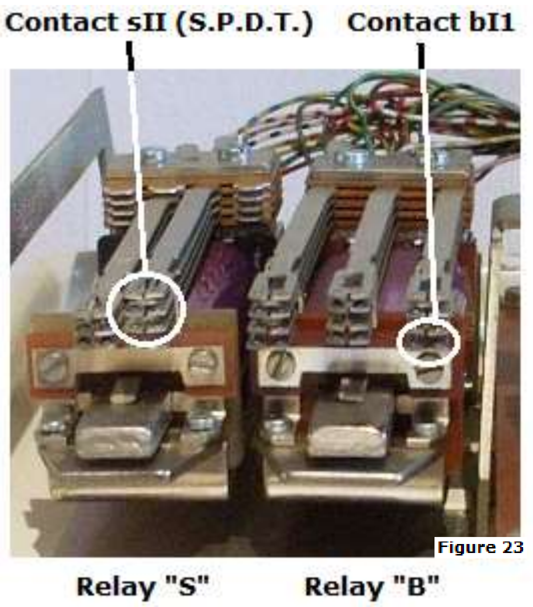
#4, #6 and #8 are also a new symbol, which identifies a coil belonging to a relay. The digits 1 and 2 (resp. 4 and 5) above and below the coils identify the pins of the relay which are connected to the relevant coil. Relays often have a capital letter, such as "B" or "S" in this schematic, next to them. The letter often hints at the function of the relay.

#5 is an S.P.D.T. contact which is actuated by relay "S." The contact itself is identified as "S^{II}" (relay contact identification will be covered a bit later).

#7 is a normally open S.P.S.T. contact which is actuated by relay "B." This contact is designated as "B^{IV}1."

#9 is a condenser with a capacity of 1 microfarad; a numeral by itself always identifies a capacitor in the microfarad range. If the digit(s) are accompanied by the letter "n" or "p" (e.g. 4n7 for a capacitor of 4.7 Nanofarad) then the capacity is in the nano- resp. picofarad range.

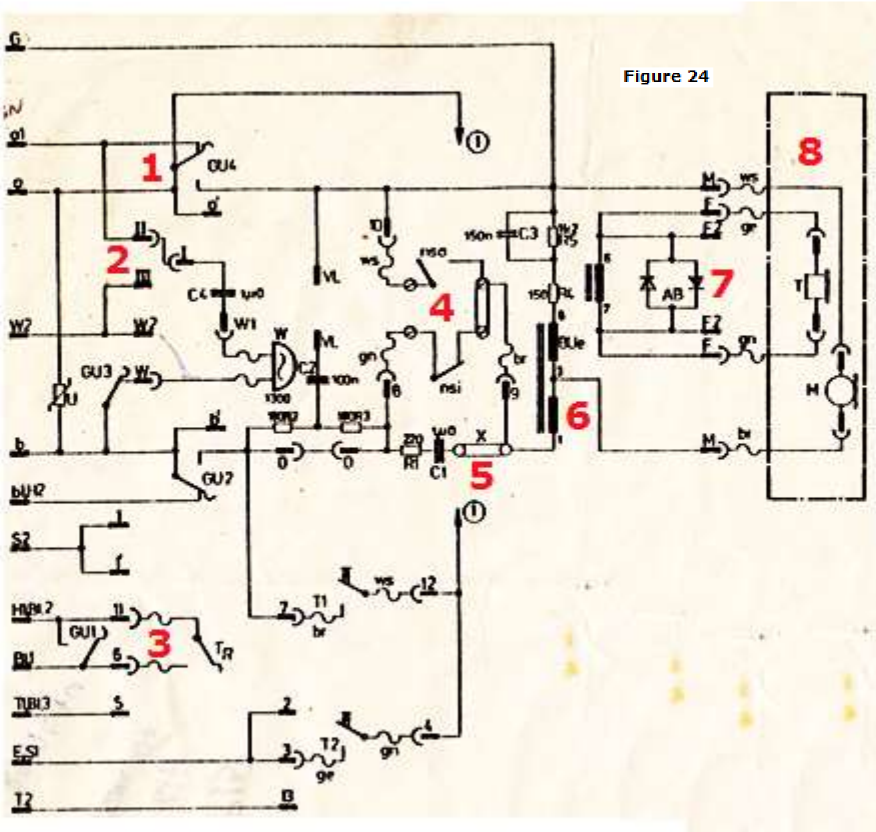
Now we come to the definition of relay contacts, in which I will use the relay contacts as shown under the numbers 6 and 7 above.



"Flat" style relays such as these are known as "Flachrelais 27" (flat relay model 1927.)

Such relays can have between 1 & 3 contact stacks, which are designated by roman numerals (as viewed from the rear side of the relay.) Relay "B" has contact stacks on positions I, III and V while relay "S" has them on positions II and IV. A single contact stack would be centered above the armature and have the designation III. These relays rarely have 4 contact stacks, which would be identified as I, II, IV and V.

The contact letter defines which relay the contact belongs to, the Roman numeral the contact stack the contact(s) belong to, and the Arabic numeral the position within the stack (from bottom to top.)



Here we have another schematic with some new drafting symbols, this time on the schematic of an Austria model 1980 dial desk telephone.

#1 is an S.P.D.T. handset cradle switch designated "GU4" – the fourth switch in the cradle switch unit. The switch is shown in its normal position = handset resting on its cradle.

#2 is a strapping option, where I, II and III are individual pins; a pluggable strap or link between pins I and II is shown in this case.

#3 is an S.P.S.T. momentary pushbutton switch with flexible wire leads. The switch is shown in its normal position = pushbutton not depressed.

#4 is a dial with its S.P.S.T. N.C. pulse contact "nsi" and its S.P.S.T. N.O. shorting contact "nsa." There is a strap between one of the terminals of both contacts.

#5 is a wire link which may be cut through with a pair of diagonal wire cutters. If this phone were equipped with a DTMF keypad, then this strap (which disconnects the R-C combination which quenches sparks on the "nsa" contact) would be cut open.

#6 is an induction coil with two primary coils wound in series and one secondary coil drawn above and to the right of the primary coils.

#7 is a hearing protection varistor, drafted the old way. It carries the *non-standard* designation "AB."

#8 is the handset, complete with its coiled cord.

Standard wire colors are "ws"=white, "br"=brown, "gn"=green, "ge"= yellow, "rs"=pink, "sw"=black, "vi"=violet, "bl"=blue, "gr"=slate, "rt"=red.

Schematic Symbols circa 1914

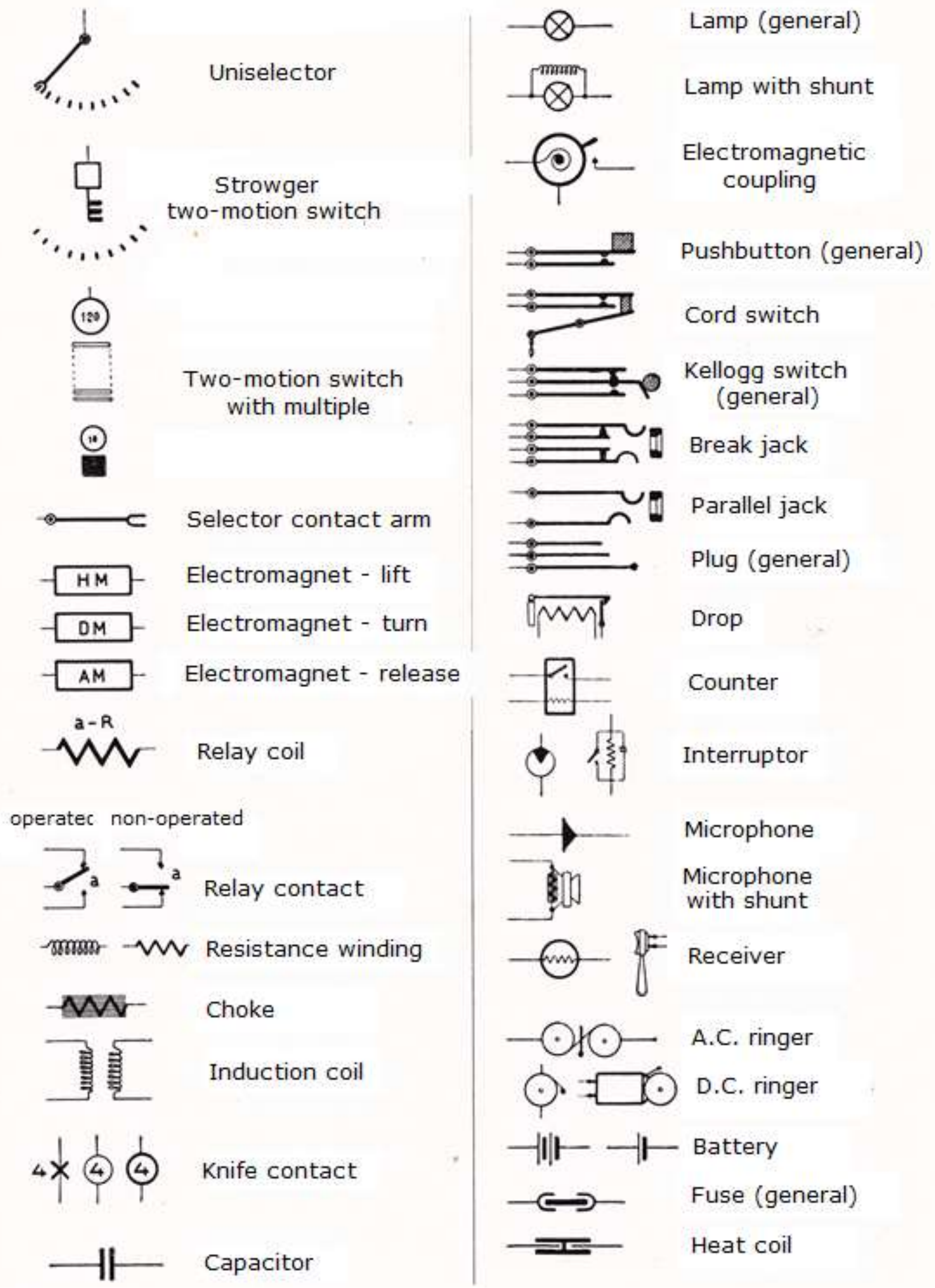


Figure 25

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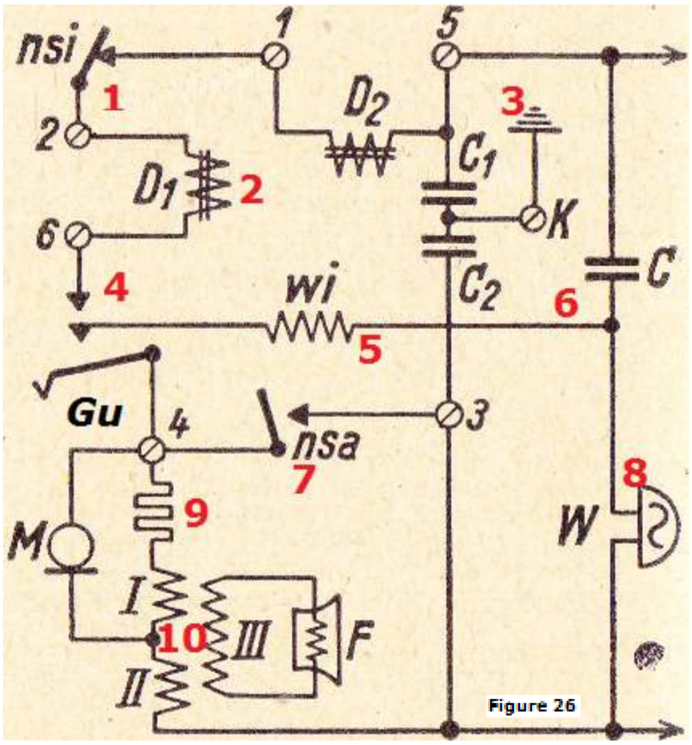

This is the schematic for a German dial telephone, circa 1935. I have included it because I found a few of the older symbols to be missing from this tale.

#1 is the normally closed (N.C.) dial impulse contact, designated nsi.

#2 is a choke, in this specific case with a laminated, soft-iron core.

#3 is the symbol for an earth (ground) connection.

#4 is the hook-switch; the "hook" portion is the "common" terminal, while the two "down" arrow symbol above the hook represent two normally open contacts (when the handset is on-hook). When the handset is off-hook, the contacts are closed and make a three-way connection.

#5 is a resistor. In older phones, such resistors were wire-wound types with a solid ceramic core; the value of the resistor is not listed in this case.

#6 is a capacitor without a specific value being listed. Since this specific capacitor passes A.C. to the ringer (#8), its nominal value would be circa 1 uF.

#7 is the normally open (N.O.) dial contact which shorts out the entire speech circuit whenever the dial is pulled. This contact is designated as the "off-normal" contact in the States. The designation "nsa" has nothing to do with the National Snooping Agency ….

#8 is the A.C. ringer, without any identification of the coil resistance.

#9 is a non-inductive sidetone balancing resistor ("bifilar" coil), which is wound onto the same bobbin as the electromagnetic windings of the induction coil (#10 below.)

#10 is the induction coil with its primary windings I and II, and secondary coil III.

"M" is the carbon granule microphone, "F" is the electromagnetic receiver.

A Bit about Me, Myself & I

My parents immigrated to the U.S. from Austria in 1953, when my father became a scientist under "Project Paperclip;" at the time, my parents were under the custody of the U.S. Army Signal Corps, and my father was a government employee at Fort Monmouth, N.J.; they were naturalized as U.S. citizens on May 5, 1961.

Around 1955, my father became Head of Solid State Electronics at Convair (a division of General Dynamics) in San Diego (where I was born in 1959), and was subsequently employed by the Lawrence Radiation Labs in Livermore, CA, specializing in space-borne nuclear power (LRL is usually now known as the Lawrence Livermore National Labs). My father passed away in 1968, when I was 9 years old.

Together with my mother, I moved to Vienna in 1976, where I completed my education at the American International School (aka A.I.S.). After having graduated from high school, I entered training at a vocational school in Vienna, from which I graduated with Honors in Electrical Telecoms and Electronics, later specializing in commercial airline electronics (aka avionics.)

My mother and I had not originally planned to live in Vienna indefinitely; my grandmother on my mothers' side of the family had passed away around Christmas in 1975, and we travelled to Vienna in order to settle her estate in March of 1976; I spent the second semester of my junior year in high school at A.I.S. (which, at the time, was the only international school in Vienna which was properly accredited in the States).

I liked the A.I.S. so much that I talked my mother into letting me finish high school there. After graduation, my mother raised the question of whether we'd move back to California or stay in Vienna. Well … give any 18 year old the choice between a town with a population of 48,000 and a city with 1.6 million residents and guess what he or she would choose … especially if he or she was fluent in both English and German.

Over the last 20 years, I have been an avionics engineer for Lauda-air, Austrian Airlines (after it absorbed Lauda-air) and my last employment was with the Austrian airline "Fly Niki." All three of these airlines have their home base at Vienna International Airport.

I currently hold 23 avionics endorsements on my license, for commercial jetliners ranging from the Canadair CL600-2B19 (a regional jetliner with 50 seats) up to the Boeing 767-300 ER with approximately 260 passenger seats and a crew of 14. My license is valid in all member states of the European Union.

I have long been interested in telephony and telephone history; I collect American and European telephones, switchboards, test equipment and other telephone materials, as well as literature related to telephony, also old telephone directories. I began my very first collection of telephones while still living in California, but each and every one of them magically disappeared while "good friends" were taking care of our home while we were in Vienna.

I am a member of Telephone Collector's International and have published articles on telephony and switchboards in the TCI journals. I also helped out on several chapters of Mr. Swihart's book on telephone dials and pushbuttons, and co-authored a few as well.

This was me back around July in 1999 – slightly more than 7 years after I started out with Lauda-air. Not much gray hair yet, but I already had eleven of the 23 avionic maintenance endorsements I hold today. The engine I'm resting against is a Pratt & Whitney 4060 belonging to one of Lauda-airs' Boeing 767's.

Here I am, around the end of September in 2006; the planes had obviously left their mark on me by then.

At this time in my life in commercial avionics, my task as an engineer in the troubleshooting group of maintenance support was to come up with stratagems for fault finding whenever standard troubleshooting practices didn't unearth the culprit.

However, that didn't prevent the base maintenance manager from calling on me when there was more work than you could shake a stick at – here, I'm adding some wires to an electronic equipment rack in the course of a service bulletin which took 6 days, during which we were busy 24 hours a day… not *quite* 24/7 ;} but almost.

Usually, you only see such stripped-out cockpits in planes standing around somewhere in Arizona … in this case, however, it's the cockpit of the same Boeing 767 that I was working on; and all this to add four measly wires from certain electronic units in the electrics/electronics bay (*and* a whopping two relays) and run the wires up to switches on both the pilot's and copilot's side panels.

Here's a brief tale about one of my niftiest bits of troubleshooting:

Back in the mid 1990's, Lauda-air had a small fleet of Canadair CRJ 200 airplanes (50-seat regional jets; more or less obsolete these days in favor of larger planes of the same series), which I had dubbed "flying Tamagotchi's" because they required constant love, care and attention … and one of these planes was throwing a tantrum.

A pilot wrote up that a *secondary* indication on one of the cathode ray tube (CRT) displays had gone missing after circa 20 minutes flying time; the fault disappeared within 5 minutes after landing (I personally saw it vanish). Within a day, other pilots wrote up similar complaints, concerning other faults – always cropping up within 15 to 25 minutes after takeoff and disappearing again before anyone could begin with troubleshooting after landing. Such problems are known as "cold soak" faults in the trade because they only occur when the airplane structure has "soaked up" the outside air temperature (somewhere around -55°C at 36,000 feet) and disappear when the structure warms up again after landing.

Since the fault reports were divergent, I decided to fly with the plane the entire second day (wedged into the small cockpit jump-seat) in order to determine which fault reports were fact. As it turned out, all the pilot reports were correct – but each pilot had only noted a single glitch (or two at best), although 4 or 5 secondary indications and/or instruments were simultaneously affected.

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Back in the office at the end of the day's flying, I went through the wiring diagrams belonging to the relevant systems and discovered that one of the data busses to the instruments shared a common terminal block, which was located in a junction box which was riveted to the interior (pressurized) side of the nose wheel well… *just* the right spot for a cold soak fault.

I had the night shift replace the terminal block and I flew with the plane again the next day in order to verify that the fault was gone for good. This was the only instance in which I was able to locate a fault solely by observation and logical thinking, without any tedious electrical measurements or having to use the (usually) useless "fault isolation manual" (aka "FIM".)

Lest any frequent-fliers out there get nervous reading about such "hands-off" troubleshooting: had the fault affected even so much as a single *primary* indication or instrument, then the plane would have been grounded (so-called "A.O.G." status – aircraft on ground) until the fault was tracked down and rectified.

It's only the first eight, and the last fifteen, minutes of any flight which are considered to be dangerous in the industry – the rest is usually clear flying.

Anyway: I've been unemployed since around the middle of 2010 and would love to get back into commercial aviation, albeit that I would need a 9-5 office job these days; the only job I'd like *more* would be curator of a public telephone museum here in Vienna, since the Technical Museum only covers telephones and telephony in a cursory manner these days… the big problem is finding a financially potent sponsor. Unfortunately, the telecom firms in Vienna aren't even really interested in their *own* histories, let alone in the history of Austrian telephony per se.

My favorite saying & long-standing personal motto is:

"Happiness is simply a lack of information."

Sources

Ordinarily, I wouldn't have bothered with anything as time-consuming as a complete list of sources for this collection; however, such a list became a necessary evil in order to be able to identify who, exactly, holds copyright to all the photos and drawings used. Wherever there are scans of material which is out of copyright I claim the copyright on the scans. "HS" is the abbreviation for: Herbert Schwarz, Vienna, Austria, European Union.

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Concerning Austrian Telephone Cables (pp. 45-65)

Figures 1-3, 7-10, 12 and 13 scans of illustrations (*refer to note # 2 on page 519*).

Figures 6, 15 and 16 scans of unnumbered blueprints taken from an informal, loose-leaf collection of toll cable specifications, possibly from the Austrian PTT, bought at a flea market at Vienna; no publisher or year of publication listed (some blueprints carry dates from the early 1940's, though). Scans © 2019 by HS.

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Hunting for Railway Open Wire Plant in Lower Austria (pp. 145-170)

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Figures 12, 17 and 36-38 scans of illustrations taken from the book "Vorschriften für die Herstellung von Telegraphen- und Telefonlinien" (*Regulations for the Construction of Telegraph and Telephone Lines*), written by a collective of authors and published by the Imperial-Royal Ministry of Trade in 1915. Original copyright expired; scans © 2019 by HS.

Figure 41 scan of an illustration from page 209, figure 42 scan of an illustration from page 207 and figure 48 scan of an illustration from page 204, all three taken from the book "Grundlagen der Fernmeldetechnik" (*Basics of Telecommunications*), © 1965 by the Federation of Austrian Unions (Österreichischer Gewerkschaftsbund). Author: Ing. Anton Capek, Office Director of the Administration of Posts & Telegraphs, Vienna, Austria. Reproduced with permission.

Figures 49 and 50 photographs © 2014 by Mr. Stephan F. Grothe, Germany, European Union. Reproduced with permission.

Telephone Plant at a Railway Museum in Schwechat, Lower Austria
(pp. 171-197)

Figures 1-36 © 2019 by HS.

The OB-33 Magneto Desk Telephone (pp. 198-205)

Figures 1 and 12 are scans of B&W photographs taken from my personal collection of original WW II photographs. One of the two photos has the year 1941 handwritten on the back; since both photographs show the same person at one and the same desk it's clear that the copyright on both photographs has expired. Scans © 2019 by HS.

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Restoration of a Bastardized German WWII Field Switchboard (pp. 206-242)

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Inside the WWII German FF-33 Field Telephone (pp. 243-299)

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Figures 17-19, 30-32, 34, 39-52, 54, 57-84, 89-93, 96-98, 107 and 112-121 © 2019 by HS.

Figure 33 scan of an information sheet, published by the Deutsche Reichspost circa 1930. Original copyright expired, scan © 2019 by HS.

Figure 95 scan of a table found in the guideline DIN VDE 0807/X.39. This guideline was published in October, 1939; original copyright expired. Scan © 2019 by HS (*refer to end note # 5 on page 519*).

All English text in red is my personal translation of text taken from the book "Nachrichtenverbindungsdienst," published in Nazi Germany in the year 1938 (date stamp found inside the front cover) by the publishing house "Offene Worte," Berlin W 35, Bendlerstraße 22. Primary author: Reg.-Baurat Dipl.-Ing. Schwant. English text © 2019 by HS.

Note: the German term "Nachrichtenverbindungsdienst" can loosely be translated as "telecommunications connection service," which doesn't really tell the tale; it is an informative work covering various methods of communication used by the German military during WW II (e.g. communications via carrier pigeon, dogs, signaling flags, telephony, field telegraphy, &c. – exclusive of communication and other radios).

Observations & Corrections Concerning Issues 1-4 of "Telecom History"
(pp. 300-307)

Figures 1-3 © 2019 by HS.

Figure 4 scan of Austrian PTT coat of arms circa 1916. What is commonly referred to as the "Austro-Hungarian Empire" actually consisted of three parts: imperial Austria, royal Hungary and royal Bohemia; the coat of arms shown is that of imperial Austria. Original copyright expired; scan © 2019 by HS.

Figure 5 scan of a magneto desk-set from an Ericsson catalog dated 1906. Original copyright expired; scan © 2019 by HS.

Figure 6 scan of telephone exchange list from the 1938 telephone directory for Vienna. Original copyright expired; scan © 2019 by HS.

Figure 7 scan of a portion of a page from a 1909 Viennese trade directory. Original copyright expired; scan © 2019 by HS.

A Most Unusual AUTOVON Telephone (pp. 308-317)

Figures 1-16 © 2019 by HS.

Two Austrian Village Switchboards (pp. 318-328)

Figures 1, 3-8, 10 and 12-14 © 2019 by HS.

Figures 2 and 11 scans of illustrations (*refer to note # 3 on page 519*).

Figure 9 scan of a blueprint (number 480/1) with the schematic for a 15 line cordless magneto switchboard, dated 1936. Original copyright expired; scan © 2019 by HS.

Miscellaneous Butt Sets (pp. 329-357)

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Figure 4 scan of an illustration from an Ericsson catalog dated 1902. Original copyright expired; scan © 2019 by HS.

Figure 37 scan of page "J 102 Sz", figure 38 scan of page "J 102 An", both taken from the handbook "Schaltbilder für Sprechstelleneinrichtungen der Deutschen Bundespost – Teil 2: Sprechstelleneinrichtungen beschafft nach 1945" (*Schematics for Subscriber Equipment of the German Federal Post Office – Part 2: Equipment Purchased after 1945*). © 1958 by Deutsche Telecom; reproduced with permission.

Figure 41 artwork © 2019 by HS.

Common Austrian Magneto Telephones Between 1910 & 1918 (pp. 358-377)

Figures 1 and 2 scans of illustrations taken from the book "Leitfaden für den Telegraphen- und Telefondienst" (*Guidelines for Telegraph and Telephone Service*), written by Hugo Leeb and Josef A. Mauer, fourth edition, privately published in 1908. Original copyright expired; scans © 2019 by HS.

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Figure 12, scan of an illustration (*refer to note # 3 on page 519*).

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Figure 22 scan of an illustration from an Ericsson catalog dated 1902. Original copyright expired; scan © 2019 by HS.

Figures 27 and 28 scans of subscriber listings taken from the 1942 telephone directory covering the region of Vienna which was called "Greater Vienna" (German = "Gross Wien") by the Nazis between 1938 and 1945. This region encompassed numerous towns and cities which had belonged to the province of Lower Austria before 1938. Original copyright expired; scans © 2019 by HS.

A Telephonic Time Capsule (pp. 378-383)

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From Russia – a True Lend-Lease Field Phone (pp. 384-389)

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Figures 9 and 10 scans of the wiring & schematic diagrams as found on my EE-108 field phone. Original copyright expired; scans © 2019 by HS.

The World's Most Complicated Dial? (pp. 390-397)

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A Brief Description of Subscriber Station Wiring in Austria (pp. 398-410)

Figures 1-3 scans of illustrations taken from the book "Vorschriften für die technische Einrichtung der Telegraphenämter, Telefonzentralen und Abonnentenstationen" (*Regulations Regarding the Technical Equipment for Telegraph Offices, Telephone Exchanges and Subscriber Stations)*, written by a collective of authors and published by the Imperial-Royal Ministry of Trade in 1912. Original copyright expired; scans © 2019 by HS.

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Austrian Telephone Tickets & Bills 1929 thru 1962 (pp. 411-432)

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An Early Postwar Austrian Desk Telephone (pp. 433-438)

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Figure 9 Logo © 1947 by the Kapsch Group of Austria, European Union. Reproduced with permission.

Errata on Vienna & Austria in the Book "Telephone Dials & Pushbuttons" (pp. 439-462)

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Addendum

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A *Brief* Explanation of Secret Party-Line Service in Austria (pp. 463-473)

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Figure 13 photograph of strapping options in subset case, © 1953 by the Kapsch Group of Austria, European Union. Reproduced with permission.

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The Smaller WWII German Field Switchboards (pp. 474-484)

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The German WWII Exchange Connector 1933 (pp. 485-490)

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A Telephone, a Friendship & a Community (pp. 491-498)

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Figure 7 scan of an illustration taken from "Electrical Communication", Volume 5, Number 2, October 1926 – "The Public Address System in Liverpool Cathedral." Original copyright expired; scan © 2019 by HS.

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Reading European Telephone Schematics (pp. 499-506)

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Figure 16 is an excerpt from the blueprint (figure 9) in the tale "Two Austrian Village Switchboards."

Figures 22 and 24 photograph and scan of schematics for a party-line subset and a W80 telephone. © 1953, 1984 by the Kapsch Group of Austria; reproduced with permission.

Figure 25 scan of a page from "Die automatischen Einrichtungen der K.K. Staatstelefon-Zentralen Wien, System G. H. Dietl" (*The Automatic Equipment of the I.R. State Telephone Centrals in Vienna, System G. H. Dietl)*, published 1914. Original copyright expired; scan © 2019 by HS.

Figure 26 scan of an illustration taken from "Taschenbuch für Fernmeldetechniker" (*Pocketbook for Telecommunication-Technicians*), published by R. Oldenbourg in 1940. Original copyright expired; scan © 2019 by HS.

A Bit about Me, Myself & I (pp. 507-510)

All photographs © 2019 by HS.

Note: the German-language abbreviation "AG" stands for "Aktiengesellschaft," which is equivalent to the term "joint stock company;" "GmbH" stands for "Gesellschaft mit beschränkter Haftung," which is equivalent to the term "limited liability company" (LLC).

NOTES

#1 The photographs were originally taken by employees of Telecom Austria, either on film or with a digital camera. I either received one or more rolls of exposed but undeveloped film or provided the digital memory medium to the photographer thru snail mail, and had it returned in the same manner.

I came into contact with these employees at one or the other of the yearly flea markets which used to be held for the benefit of the Saint Anna Children's Cancer Research Center here at Vienna, or at least got phone numbers of folks from Telecom Austria who might be willing to take some snapshots for me.

I met or called these employees between the years 1999 and 2003, and have long lost any contact I had with them. Since I paid for and thus own the relevant color negatives, as well as the original digital pictures as copied onto my computer, I am the copyright holder despite the fact that others took the photographs.

#2 Taken from the book "Fernmeldebau" (*Telecommunications Construction*), published by the Austrian Federal Ministry of Traffic and State-owned Industries, Directorate General for the Administration of Posts and Telegraphs in 1954; it was a learning aid for the telegraph service test II. Written by a collective of authors from the Central Office for Telecommunications. Exempt from copyright per § 7 of Austrian copyright law.

#3 Taken from the book "Fernmeldetechnik" (*Telecommunications Technology*), published by the Austrian Federal Ministry of Traffic and State-owned Industries, Directorate General for the Administration of Posts and Telegraphs in 1955; it was a learning aid for the telegraph service test II. Written by a collective of authors from the Central Office for Telecommunications. Exempt from copyright per § 7 of Austrian copyright law.

#4 I originally wrote this tale as a HTML back in the mid-1990s and had intended to publish it on my own web site, which never came to be. I once had emails in my possession which granted me the permission to reproduce numerous photographs; these were lost in a fatal computer crash circa 1998, and I therefore can't properly attribute copyright to the figures listed.

#5 DIN is the abbreviation for "Deutsche Industrie Norm" – German industrial standard; VDE was once the abbreviation for "Verband Deutscher Elektrotechniker" – Association of German Electrotechnicians; today the abbreviation stands for "Verband der Elektrotechnik, Elektronik und Informationstechnik e.V." – literally: Registered Association for Electrical Power, Electronics & Information Technology.

#6 I originally had emails in my possession which granted me the permission to reproduce these photographs. These were lost in a fatal computer crash circa 1998, and I can't properly attribute copyright to the figures listed.

Web Sites

The Kapsch Group of Austria: http://www.kapsch.net/

Mr. Martin Benson of Germany, E.U.: http://www.fernmeldeamt.de/ (in German)

Mr. John Conning of the USA: http://www.moviemice.com/

Mr. L. Robinson & the Rockwell-Collins Museum: http://rockwellcollinsmuseum.org/

Mr. Anton Gaemperle of Switzerland, Europe: http://www.armyphone.ch/ (in German)