LIST OF DRAWINGS

TESTING EQUIPMENT - CIRCUITS

LINE CIRCUITS

Bulletin No. 235

0.0 INTRODUCTION

A study made to effect savings and improvements in toll testboard equipment has resulted in the development of a new board known as toll testboard No. 5. On this board the line circuits are arranged in a jack panel and wired to terminal blocks. This assembly is an upper unit of the testboard. The testing equipment is arranged in a detachable unit which is referred to as a keyshelf or lower unit. These units consist of different groupings of circuits and include voltmeter testing equipment, Wheatstone bridge testing equipment, telegraph testing equipment and a blank unit not equipped with testing apparatus. These may be installed in any desired position or removed as required without affecting the line circuits.

The jacks are assembled on relay rack mounting as described in Bulletin No. 138 "Jack and Lamp Socket Mountings for Use on Relay Racks" and line circuits may be added in groups of 12 or more without affecting the testing equipment. The keyshelf units mount on the relay rack framework under the jacks.

The new design effects economy of space and equipment as compared with the No. 4 testboard and provides a greater flexibility of circuit layouts and growth. It is also well adapted for different sizes and types of installations, growth being possible in relatively small units so that the cost is more nearly in direct ratio to the number of circuits than would be possible where a greater portion of the total cost is in the framework and assembly.

1.0 GENERAL DESCRIPTION

1.1 Assembly of Equipment

The equipment of the toll testboard No. 5 is designed for mounting on a standard relay rack framework, thus making possible the use of the same assembly methods which are becoming more generally used throughout the toll terminal room. The testing equipment is assembled in keyshelf units which are, for the most part, self-contained and so designed that they can be mounted on the rack framework under the jacks. Drawing No. 213-B-13, page 113, shows a typical arrangement of a toll testboard No. 5 position equipped with a keyshelf unit. In this bulletin each bay of rack is referred to as constituting a "position" regardless of whether or not it is equipped with a keyshelf unit.

By the use of this assembly method, considerable advantage is gained in flexibility of initial arrangements and later extensions, since any desired grouping of line jacks may be associated with any desired testing equipment in the keyshelf units, whereas, in the section employed for the toll testboard No. 4, it was necessary to install sections equipped for each form of testing equipment desired. Since the testing equipment is provided in units separate from the jack equipment only a sufficient amount of testing equipment need be furnished to meet the requirements of the particular office in question. Furthermore, the new arrangement provides flexibility in regard to the ultimate amount of testboard equipment desired in any

office, being as well adapted to the small installations involving ultimately but a few circuits as to those requiring equipment for a large number of circuits.

1.12 Face Equipment

Punched frame singly mounted jacks are used in the No. 5 testboard. The jacks are mounted in No. 184 or No. 185 jack mountings which are adapted to mount on the framework by means of No. 25 jack fasteners as described in Bulletin No. 138, "Jack and Lamp Socket Mountings for Use on Relay Racks." These jack mountings together with such jack spaces, lamp socket mountings, designation strips, etc., as are required are assembled in units in the face of the board suitable to the various types of line circuits as described in Section 3.

Apparatus such as telegraph relays and sounders and other equipment not contained in the keyshelf unit is mounted on apparatus panels above the jacks. Where no testing equipment is provided or when it is not necessary to mount apparatus above the jacks, blank panels are available for use in place of the apparatus panels if desired. A 3-1/2-inch panel or "piling rail" is provided in every position directly under the jacks.

1.13 Keyshelf Equipment

Three types of keyshelf units have been provided one of which is adapted for voltmeter testing, one for Wheatstone bridge testing and one for testing telegraph circuits. A typical assembly of these keyshelf units is shown on Drawing No. 213-B-14, page 114. The keyshelf unit includes cords,

keys and other apparatus associated with the testing circuit except such equipment as must be mounted on the apparatus panel above the jacks or outside the position. A terminal strip is provided in the rear of each keyshelf unit for terminating the wiring external to the keyshelf unit such as battery leads, generator leads, etc.

For those cases where equipment will not ordinarily be required in each position, a blank unit or writing shelf as shown on Drawing No. 213-B-15, page 115, has been designed for use where additional writing space is desired. A commercial type card cabinet is furnished with the writing shelf as indicated on the drawing to provide space for card records, etc. No space is available for card record drawers in any of the other keyshelf units.

1.2 Classification of Positions

Toll testboard No. 5 positions are divided into several classes for terminating the various types of line circuits. The function of these various positions is given briefly below and the circuits and equipment are described in more detail in Section 3.

1.21 Primary Testboard Positions

Primary testboard positions are used in cable offices for terminating the cable pairs and to provide means for patching the cable pairs and line equipment. No phantom line jacks, telegraph line jacks or listening jacks are provided in the primary testboard positions. When jacks are provided

for terminating spare line equipment they are located in the primary testboard positions.

1.22 Secondary Testboard Positions

Secondary testboard positions are used in cable offices for terminating the two-wire and four-wire telephone circuits. Facilities are provided in the secondary testboard for monitoring on circuits as desired and for patching drop circuits. The jacks in the secondary testboard positions are on the drop side of the office equipment. In cable offices, "through" circuits do not ordinarily appear in the secondary testboard.

1.23 Open-Wire Testboard Positions

Positions for terminating open-wire lines differ from those used for cable circuits in that all jacks associated with a given line are located together in the same position instead of being divided between primary and secondary testboard positions. In open-wire positions jacks are provided for patching the superposed line equipment and for terminating and patching phantom circuits and grounded telegraph line circuits.

In this testboard sufficient flexibility is provided so that any jacks other than the regular line jacks may be included as required.

1.24 Telegraph Testing Positions

Telegraph subscribers' loops and telegraph repeaters are terminated in separate testing positions thus making it possible to test or patch this equipment without interfering

with the telephone circuits. The telegraph testing positions will accommodate grounded telegraph circuits, metallic telegraph circuits and voice-frequency or high-frequency carrier telegraph circuits.

1.25 Metallic Telegraph Line Positions

In large cable offices the jacks provided at the telegraph testing positions in connection with the metallic telegraph repeaters may not furnish the facilities required for patching metallic telegraph circuits. In such cases all the metallic telegraph lines may be grouped together in metallic telegraph line positions to facilitate patching.

1.3 Wiring and Cabling

All external wiring to the toll testboard is terminated on terminal strips at the top of the position. Connections between these terminal strips and the jacks and keyshelf units are made by means of a factory made form employing No. 22 BEDS and SCC wire. In the case of cable circuits the pairs are normally connected to the jacks in the order corresponding to the consecutive pair numbers in the cable. For open-wire lines the jacks are normally wired consecutively corresponding to the numbering on the distributing frame and may be assigned to circuits as desired consistent with the maintenance of proper quadding. However, where it is desired to have the relative location of the jacks indicate the pin positions on the open-wire pole nearest the office pairs 5-6, 15-16, etc., are shifted in the local cable form between the jacks and terminal strips

at the top of the testboard position to take care of the regular phantom grouping arrangement. In this case it will be advisable to carry the jacks corresponding with the fifth crossarm over to the next position, assigning the 41-48 jacks in the first position to other lines.

No. 19-gauge cable is used between the terminal strips at the top of the position and the I.D.F. Ordinarily one cable is provided between each vertical row of terminal strips in the position and the I.D.F. except in cases where it is necessary to provide two cables on account of their size or to provide the required separation between the different kinds of circuits in cable. In addition to these line cables, two separate No. 19-gauge miscellaneous cables are provided to certain positions equipped with voltmeter test circuits or telegraph test circuits. One of these cables is used for battery leads and other miscellaneous circuits; the second cable is used for tone and generator leads and any other miscellaneous circuits which it is desired to keep separate from the talking circuits to avoid trouble from noise.

In primary testboard positions, the line cables and local cable forms must be grouped as may be required to provide separate cables for (1) inputs of four wire repeaters (2) outputs of four-wire repeaters (3) No. 16-gauge H-44-25 two-wire circuits and (4) Nos. 16-gauge and 19-gauge H-174 two-wire circuits. The interposition trunks, which are provided between the testboard and repeater racks in cable offices, are separated into two groups to facilitate the patching of the various kinds

of cable circuits. Separate cables are used for these two groups of trunks.

Switchboard cables are used between the terminal strips at the top of the positions for carrying interposition trunks, talking trunks and other circuits which are multipled from bay to bay. Battery, tone or generator leads which are wired between bays are carried in a separate hand formed cable made up of No. 20 BBE wire.

The local factory made forms within the keyshelf units are made up of No. 20 BBE wire.

2. DESCRIPTION OF TESTING EQUIPMENT

As noted in Section 1, the testing equipment is contained in units separate from the jack equipment. The voltmeter testing and telegraph testing equipment is terminated in cords and plugs in the keyshelf. The Wheatstone bridge testing equipment is wired to the keys in the voltmeter testing circuits so that connection to the line is made through the voltmeter test cords when Wheatstone bridge measurements are to be made. The circuits are arranged so that one Wheatstone bridge may serve one or more voltmeter test positions as desired. Each position of No. 5 testboard is arranged so that any type of testing equipment may be provided or it may be omitted entirely, as desired.

2.1 Voltmeter Testing Equipment

The voltmeter testing equipment includes a testing circuit, a connecting cord circuit and an operator's telephone circuit, which are arranged as shown on Drawing No. 157-A-14, page 108. The apparatus is assembled in the keyshelf as shown on Drawing No. 213-B-16, page 116.

2.11 Voltmeter Test Circuit

The voltmeter test circuit is terminated in two test cords "A" and "B" with twin plugs and two single test cords. The shells of the twin plugs have the tip side knurled and the ring side plain to enable the testboard operator to distinguish readily between the tip and ring sides of the circuit. When inserted horizontally, the knurled edge is turned to the left

and when inserted vertically, the knurled edge is turned toward the top. The single plugs provided in connection with cord "B" facilitate tests for "crosses" and enable the testboard operator to test on split pairs when desired. The single cords have a much lower resistance than the ordinary tinsel cord and therefore can be used to advantage in Wheatstone bridge measurements. All the cords are of sufficient length to reach any of the jacks in either position adjacent to the one in which the testing equipment is located.

Keys are provided for making the usual voltmeter tests for continuity, crosses, grounds, etc. With all keys normal, the testing battery is disconnected and the telephone set is connected to the test cords for monitoring so that the operator may plug into the listening jacks to be sure that the line is not busy before applying the testing battery. The test cords are arranged so that they may be used independently of each other. The left cord may be used for talking or testing on a line while the right cord is being used for holding, or for Wheatstone bridge test, and conversely.

A key is provided in connection with each of the test cords which, when thrown back to the HOLD position, disconnects the associated cord from the other test cord and connects it to a repeating coil across the middle of which a 20-cycle ring-up relay is connected. The other winding of the repeating coil is connected to the interrupted low tone so that this tone may be sent out on the line by inserting the test plug in the line or

listening jacks. The cord may then be used as a holding cord for incoming calls from linemen, the tone serving to identify the circuit and the ring-up relay providing a ringdown signal. The telephone set may be connected to the holding cord as shown in Figures 1 and 2, Drawing No. 154-A-17, page 100, by operating the TEL. ON HOLD key. When a test cord key is thrown back, the sleeve circuit of the associated cord is opened so that the busy signals at the toll switchboard will not be operated.

When a test cord key is thrown forward to the BRIDGE position, the tip and ring terminals of the cord are disconnected from the voltmeter test circuit and connected to the tip and ring terminals of the Wheatstone bridge circuit. Since one Wheatstone bridge may be associated with several voltmeter testing circuits, lamp signals are provided in each voltmeter test position which are lighted whenever the Wheatstone bridge is in use at some other position.

The voltmeter used in the toll testboard No. 5 is a Weston square type meter similar to the Weston Model 502 meter. This voltmeter has a central zero scale with a full-scale reading of 150 volts in each direction from the zero point. It has a resistance of 100,000 ohms and is provided with a shunt coil which, when bridged across the instrument, reduces the resistance to 1,000 ohms and converts it to a milameter. When the shunt key is thrown, the scale reading in volts is equivalent to the current flowing in the circuit in milliamperes.

The 150-volt testing battery required in connection with the voltmeter test circuit is made up of eight 22-1/2-volt radio type batteries. The keyshelf unit is designed so that these batteries may be mounted inside the section.

2.12 Connecting Cord Circuit

One connecting cord circuit is provided at each voltmeter test position for the purpose of connecting toll lines together or to various desk telephones or other terminal sets in the toll office. It provides facilities for talking, monitoring, ringing and supplying talking battery and may be used as a secondary cord for handling incoming and outgoing calls. A dial associated with the right-hand cord to permit the testboard operator to dial machine switching subscribers directly is provided for use when required in machine switching areas. In this case a retardation coil is provided in the cord circuit for holding the machine switching connection and to trip ringing when answering calls incoming from the machine switching office.

2.13 Operator's Telephone Circuit

The telephone circuit is normally connected to the test cords. It may be disconnected from the test cords by operating the TEL. DISC key. The TEL. ON HOLD key is provided for connecting the telephone set to a test cord which is being used for holding. When the telephone set is connected to a holding cord by the operation of the TEL. ON HOLD key, it is disconnected from the other test cord, and when associated with

the connecting cord by the operation of the TEL. ON CORD key it is disconnected from both the test cord and the holding cord. Condensers are connected between the telephone set and the test circuit so that the telephone set may be bridged across the line without interfering with the test circuit. This enables the testboard operator to listen and test on a line at the same time.

The telephone circuit is designed to use a No. 528 receiver.

2.14 Monitoring

A 27-F repeating coil is provided in the operator's telephone circuit as shown on Drawing No. 157-A-14, page 108, to reduce the transmission loss when monitoring. This monitoring condition introduces a loss to the circuit being monitored of about 1/3 TU in offices having a 600 ohm impedance.

The impedance of the monitoring circuit using the 27-F repeating coil is too low to permit satisfactory monitoring on lines connected with cord circuit or through line repeaters. Where it is desirable to monitor on such lines, a vacuum tube amplifier, as shown on Drawing No. 213-B-17, page 117, may be provided in place of the 27-F repeating coil. This arrangement introduces a transmission loss of less than .1 TU and has a sufficiently high impedance so that the circuit may be bridged across a line adjacent to a 22-type telephone repeater without appreciable effect on the balance.

2.15 Telegraph Test Sets at Voltmeter Test Position

Telegraph test set No. 1, as shown on Drawing No. 213-B-18, page 118, is provided in the voltmeter test position. Telegraph test set No. 1 is terminated on cords, and is so arranged that it can be used in conjunction with miscellaneous battery and ground jacks for making continuity and other tests. Tests of this kind should be made in such a way that the line current will not exceed 100 milliamperes. The simplified diagram is shown in Figure 17, of Drawing No. 154-A-17, page 100.

Telegraph test set No. 3 is provided for use with the test wire circuit and is arranged as shown on Drawing No. 213-B-19, page 119. This circuit is wired to a telegraph subscriber's loop jack in a telegraph line terminal circuit for connection to the desired test wire. Spare test wires with series looping jacks are arranged as shown in Figure 4 of Drawing No. 213-B-20, page 120.

The telegraph relays in telegraph test sets Nos. 1 and 3 at the voltmeter test positions, together with the voltmeter shunt, vacuum tube monitoring equipment when required, and other miscellaneous apparatus, is located on an apparatus panel above the jacks as shown on Drawing No. 213-B-21, page 121.

2.16 Signal Receiving Circuits for Toll Switchboard No. 3

Where toll switchboard No. 3 is used, the toll line signal receiving circuits are located on the drop side of the testboard so that this equipment is cut off whenever a plug is inserted in the jacks at the testboard. Signal receiving

circuits, as shown on Drawings Nos. 213-B-22, page 122, and 213-B-23, page 123, which are adapted to receive 135-cycle and 1000-cycle signals respectively, are provided as required in connection with the voltmeter test circuit to permit the testboard operator to receive signals directly from the toll line. These will be required, of course, only where toll lines which employ 135-cycle or 1000-cycle signaling are wired through the testboard.

Apparatus in the signal receiving circuits, when required, is located outside the position along with the similar signal receiving circuits for toll switchboard No. 3.

2.2 Wheatstone Bridge Testing Equipment

2.21 Wheatstone Bridge

The Wheatstone bridge used in toll testboard No. 5 is an inverted dial-type bridge with an adjustable ratio and four sets of adjustable resistances in the rheostat arm. The general assembly arrangement of the bridge is shown on Drawing No. 219-B-65, page 164. The total resistance in the ratio arms is 1000 ohms and the ratio is controlled by a single dial, giving multipliers of $\frac{1000}{1}$, $\frac{100}{1}$, $\frac{10}{1}$, $\frac{1}{1}$, 1/4, 1/9. 1/10. 1/100, 1/1000 and M1000, the latter giving a Murray connection with 1000 ohms in the ratio arm. The rheostat arm is adjustable in units, tens, hundreds, and thousands and has a total resistance of 9999 ohms. The resistances in the rheostat arm are accurate to 1/10 per cent. and those in the ratio arm are accurate to 1/20 per cent.

In addition to the rheostat arm, 3 groups of resistances, adjustable in tens, hundreds and thousands, and having a total resistance of 9990 ohms, are provided in a separate rheostat referred to as the "condenser arm rheostat." This is used in making open-location tests as described in Section 4.26.

The maximum allowable power consumption in any resistance coil in the bridge is one watt and sufficient resistance should always be present in the battery supply to insure that this limit will not be exceeded. The bridge should never be used as an adjustable resistance for regulating current, etc.

A reflection type galvanometer employing a lamp and scale instead of a needle, is used in the bridge. The galvanometer and associated 2-F lamp are located inside the bridge and the scale on the top of the bridge as indicated on Drawing No. 219-B-65, page 164. The galvanometer is a dynamometer-type instrument, that is, it employes a separately excited field coil, which may be connected to the 24-volt central office battery, in place of permanent magnets. The electromagnetic field affords a stronger flux density than is usually secured with a permanent magnet and consequently the new galvanometer is inherently more sensitive than the permanent magnet needle type. The electromagnetic field also makes it possible to use the galvanometer for alternating-current as well as direct-current measurements, without requiring relays for reversing the galvanometer twice during each cycle.

No battery or galvanometer keys are provided in the bridge, it being intended that the battery key in the keyshelf be used for connecting the testing battery to or disconnecting it from the bridge circuit. Non-locking galvanometer shunt keys, giving shunt values of .001, .01, .1 and 1 are provided in the bridge which, when operated, also serve to close the galvanometer circuit. The internal wiring of the Wheatstone bridge is shown on Drawing No. 214-B-100, page 156.

A more complete description of the Wheatstone bridge is given in Bulletin No. 214, "Wheatstone Bridge per KS-3011".

2.22 Wheatstone Bridge Test Circuit

The Wheatstone bridge test circuit is show on Drawing No. 154-A-19, page 101. The Wheatstone bridge and associated keys are located in the keyshelf as shown on Drawing No. 213-B-24, page 124. Keys are provided in the testing circuit for reversing the line, for connecting the battery and for setting up the proper bridge connections when making Varley or Murray loop tests, open-location tests, or single-wire resistance measurements to ground. The operator's telephone circuit is permanently bridged across the line under test, except when making open-location tests.

A separate 150-volt testing battery which is made up of 22-1/2-volt radio type "B" battery units is required for each Wheatstone bridge circuit. The keyshelf unit is designed to accommodate the testing battery inside the section. A two-position battery key is provided which in one position connects

the full battery voltage to the bridge circuit and in the other position, reduces the voltage to approximately 6 volts through a potentiometer arrangement. The battery key is also used for connecting alternating current to the circuit when making open-location tests.

3.23 Alternating-Current Supply for Open-Location Tests

The location of "opens" on toll lines consists essentially of impedance measurements between the line in trouble and ground. The accuracy with which such locations can be made increases as the frequency is reduced. A motor-driven commutator is used for these tests, as shown on Drawing No. 214-B-37, page 154. This arrangement provides a 4-cycle alternating potential by reversing a separate test battery associated with the interrupter, as well as a 4-cycle alternating field potential by reversing 24-volt office battery and ground. The apparatus is located outside the position on the relay rack, as shown on Drawing No. 214-B-36, page 153.

Where a 4-cycle supply is not available, and where the length of circuits which it is desired to test does not exceed 20 miles in cable or 100 miles in open wire, 20-cycle ringing current if used for open-location measurements will give fairly satisfactory results. Drawing No. 214-B-39, page 155, shows the arrangement of the alternating-current supply to the Wheatstone bridge where 20 cycles is used.

3.3 Telegraph Testing Equipment

The testing apparatus provided in telegraph test positions consists of voltmeter testing equipment, telegraph

test sets Nos. 1 and 2 and an operator's telephone set, which are arranged as shown on Drawing No. 154-A-21, page 103, and telegraph test set No. 3, Drawing No. 213-B-19, page 119, which is intended for use with the test wire. This testing apparatus is located in the keyshelf as shown on Drawing No. 213-B-25, page 125, and the volt-milameter, the relay and sounder of telegraph test set No. 3, are located on the apparatus panel above the jacks with other miscellaneous equipment as shown on Drawing No. 213-B-26, page 126.

The voltmeter testing equipment and telegraph test sets Nos. 1 and 2 are each terminated in a looping test cord and two single cords. The milameter winding of the meter is normally connected to the looping test cord, but may be removed from the test cords and connected to telegraph sets No. 1 or No. 2 by means of a milameter key.

A key is provided in connection with the test cords which when thrown forward, connects the voltmeter winding of the volt-milameter to the test cords in place of the milameter winding so that the usual voltmeter tests may be made. The circuit is arranged to prevent interference between telegraph circuits when the test cords and telegraph test sets are being used simultaneously on different telegraph circuits.

When the test cord key is thrown back the operator's telephone set is connected to the test cords so that the looping test cord may be used for talking on local trunks, telegraph subscribers' telephone loops, etc. A ringing key and

a key for supplying talking battery are provided in connection with the operator's telephone circuit.

3.0 DESCRIPTION OF JACK CIRCUITS AND EQUIPMENT

The method of assembling the jacks in the toll testboard No. 5 effects economies in assembly, wiring, and installation and permits easy access to circuits for the purpose of testing, patching, and maintenance. The jack mountings are shop mounted on iron framework which is designed to mount directly on a relay rack framework employing standard drillings for 1-3/4-inch mounting plates. The jack mountings, piling rail, apparatus panel and terminal strips are assembled on the framework and wired in the factory so that the complete unit may be placed on the relay rack at the time of installation without disassembling. Wiring, external to the keyshelf unit required in connection with the testing equipment, is provided for in the local forms only in positions where testing equipment is specified. The jack equipment in a position may be wired for any of the standard types of line circuits or a combination thereof.

3.1 Line Circuits

The various types of standard line circuits for open-wire lines and cables are described below.

3.11 Open-Wire Line Circuits

These circuits include the following standard arrangements:

A terminating six-jack toll line circuit, not arranged for phantom, simplex, or composite apparatus is wired as shown on Drawing No. 213-B-27, page 127. A typical arrangement of

the jack equipment for six-jack line circuits is shown on Drawing No. 213-B-28, page 128.

The arrangement of wiring of a ten-jack toll line circuit is shown on Drawing No. 157-A-15, page 109. This circuit is intended for use when it is desired to provide jacks for patching equipment such as composite sets, etc. It may also be used for phantom circuits when jacks are required for patching the equipment in the phantom line. Furthermore, when the lines are both phantomed and composited a ten-jack circuit is ordinarily sufficient and the phantom set and composite set patched together as a single unit. Since considerable patching may be required on open-wire circuits, the jacks for superposed equipment on open-wire circuits are located in the same panels with the line circuits. This also distributes the lines over a larger number of positions than if the line jacks for all circuits were located together in positions such as primary testboards in cable offices and thus permits a larger number of testboard operators to work efficiently during periods of severe line breaks.

Drawing No. 157-A-16, page 110, shows in schematic form a terminating phantom group equipped with phantom and composite apparatus and employing a ten-jack phantom circuit. A typical position for these circuits is shown on Drawing No. 213-B-29, page 129. Where jacks are not required for equipment in the phantom circuit, the six-jack line circuit, Drawing No. 213-B-27, page 127, may be used for the phantom circuits.

Where open-wire lines are equipped with composite apparatus, the telegraph legs of the composite sets are terminated in jacks in the same position with the line circuits. These jacks are wired as shown on Drawing No. 213-B-30, page 130.

A terminating phantom group not arranged for composite apparatus is shown in schematic form on Drawing No. 154-A-24, page 105. The jack equipment for a typical position equipped with such circuits is shown on Drawing No. 213-B-31, page 131.

Where telephone repeater network jacks may be required at the testboard, the jack arrangement is shown on Drawings Nos. 202-B-63, 202-B-71 and 202-B-92, pages 166, 167 and 168.

The flexibility of jack arrangement of this type of testboard is well adapted to care for whatever requirements may be imposed by future developments. Where carrier telephone or carrier telegraph may be required either initially or at some future time the board will provide the necessary facilities for patching, service, etc. In so far as practicable, the standard telephone and telegraph circuits will be used. The circuits applying specifically to the carrier systems will be covered in detail together with the other information issued in the bulletins describing these systems.

3.12 Cable Circuits

Toll cable circuits are more uniform in their make-up than open-wire lines and since they are also less susceptible to line trouble less patching is ordinarily required on them than on open-wire lines. Consequently, fewer jacks are required for patching equipment. Also the fewer number of troubles in cable circuits makes it practicable to concentrate a relatively large number of circuits in one position. In view of this the jacks on toll cable circuits are grouped in primary testboard positions and secondary testboard positions as explained in Section 1.2. This primary and secondary grouping scheme provides adequate flexibility for patching and testing and in addition makes it possible to use economically the same testboard arrangements at both through repeater stations and at stations having a relatively large number of terminating circuits.

The primary testboard positions are provided for testing the cable pairs and for patching between the cable pairs and the line equipment. Each cable pair is wired through a four-jack cable circuit in the primary testboard as shown on Drawing No. 213-B-32, page 132. These jacks are arranged in the primary testboard positions as shown on Drawing No. 213-B-33, page 133.

The cable pairs are wired through the testboard consecutively in the order of the pair count.

Terminating two-wire circuits are wired through six jacks in the secondary testboard positions as shown on Drawing No. 213-B-27, page 127. These jacks are arranged in the face of the board as shown on Drawing No. 213-B-28, page 128. Terminating four-wire circuits are wired through fourteen jacks as shown on Drawing No. 213-B-34, page 134. These jacks are arranged in the face of the board as shown on Drawing No. 213-B-35, page 135.

Through circuits do not appear at the secondary testboard positions. If equipped with telephone repeaters, the jacks provided at the repeater racks, as described in connection with information relative to telephone repeater equipment, furnish facilities for testing or patching on the drop side of equipment such as repeating coils and composite sets. Drawing No. 157-A-19, page 111, shows schematically a typical arrangement of a through two-wire phantom group equipped with telephone repeaters and arranged for metallic telegraph; Drawing No. 154-A-31, page 106, shows a similar arrangement of a through four-wire phantom group (one-half of a four-wire circuit). Drawings Nos. 154-A-32, page 107, and 157-A-22, page 112, show typical arrangements of terminating two-wire and four-wire phantom groups, respectively. Jacks when required for metallic telegraph line circuits are located in separate positions as explained in Section 3.26.

Spare equipment such as repeating coils or composite sets may be wired to jacks in the primary testboard positions so that it may be substituted for the regular equipment when desired. The wiring of the jacks for spare equipment is shown on Drawing No. 213-B-36, page 136.

3.2 Telegraph Circuits

3.21 Telegraph Line Terminals

In positions provided for testing and patching terminating telegraph circuits and associated apparatus, telegraph line terminal circuits, as shown on Drawing No. 213-B-37, page 137, are provided for terminating and testing the telegraph subscribers' loops, and for connecting the loops to the desired telegraph repeater or duplex set. The telegraph line terminal circuit includes a calling signal relay arranged to operate a signal at the testboard and at the telegraph repeater set. This relay is differentially connected so that it is not affected by the normal operation of the telegraph circuit but will be operated when the subscriber's calling-in-key which connects a ground to the loop at the subscriber's station is depressed. Where the subscriber's loop normally operates with a ground at the subscriber's station or where the windings of the relay become separated on different circuits, one winding of the relay is cut out and the relay operated on a marginal rather than a differential basis.

Two series looping jacks are provided in the telegraph line terminal for connecting additional loops or single line

telegraph repeaters temporarily by means of patching cords.

3.22 Telegraph Subscribers' Loops

Telegraph subscribers' loops are terminated directly on the subscribers' loop jacks in the telegraph line terminal circuits. Provision is made for three subscribers' loops or single line repeaters in each telegraph line terminal. To operate more than three subscribers' loops in connection with one telegraph circuit, the extra loops are connected to the subscribers' loop jacks of a second telegraph line terminal circuit. The battery side of the first telegraph line terminal is then connected to the line side of the second telegraph line terminal, and battery connected to the second telegraph line terminal in the usual way. These connections, if permanent, are normally made at the distributing frame, or, if temporary, they can be made by patching the DROP-2 jack of the first telegraph line terminal to the DROP-1 jack of the second terminal. Where lamps at the duplex or repeater tables are wired to a local contact on the DROP-1 jack, a two-conductor patching cord should be used in connecting telegraph line terminals in series in order that the lamp signal at the duplex table may operate in conjunction with the signaling apparatus in the second telegraph line terminal circuit.

The contacts on the subscribers' loop jacks are arranged so that when a loop is taken up for test with the test cords or telegraph test sets or with a patching cord for patching to another circuit, the telegraph circuit will be closed

through with the loop removed. A subscriber's loop may be removed from the circuit by inserting a dummy plug in the subscriber's loop jack.

A telephone loop for use between the testboard and a printing telegraph subscriber's station is shown on Drawing No. 218-B-6, page 162. When the receiver is removed from the switchhook at the subscriber's station a signal is operated at the testboard which remains operated until a plug is inserted in the subscriber's loop jack to answer the signal. Battery supply is furnished the subscriber from the testing cord used to answer the signal. The telephone loop may be patched to a telegraph line terminal circuit for temporary use as a telegraph loop if desired.

3.23 Split Loops

To use one wire of a telegraph subscriber's loop for emergency or temporary service, the split telegraph loop circuit, shown in Figure 1, Drawing No. 213-B-20, page 120, may be used. The subscriber's loop jack should be patched into the looping jack of the split telegraph loop circuit and the tip or ring jack of the split loop circuit patched to the DROP-2 jack of the telegraph line terminal circuit. Under these conditions, it is not possible for the telegraph subscriber's operator to use the signaling relay in the telegraph line terminal circuit. If the signaling feature is required, the tip or ring jack of the split telegraph loop circuit should be patched to a LOOPING jack of a telegraph line terminal.

About 500 ohms resistance should then be added at the subscriber's station and the signal relay in the telegraph line terminal given a special adjustment to operate on a marginal basis as described above.

3.24 Polar Duplex and Telegraph Repeater Circuits

Polar duplex sets and terminal repeaters used in connection with grounded and metallic telegraph systems, and voice-frequency carrier and high-frequency carrier telegraph systems are wired to jacks in the telegraph positions as shown on Drawings Nos. 213-B-38, page 138, 213-B-39, page 139 and 213-B-40, page 140, respectively. These jacks are normally wired to telegraph line terminals for connection to the subscribers' loops so that patching cords are not ordinarily required. Where special arrangements or changes in layout are necessary, new telegraph line terminals or telegraph equipment are readily substituted by patching cords.

Telegraph subscribers' calling-in-signals at telegraph repeater sets and duplex sets are wired through the jacks associated with the set to the telegraph line terminal so that the signal is patched automatically whenever a set is patched.

The jacks for telegraph line terminals, telegraph repeaters, etc., are located in the testboard as shown on Drawing No. 213-B-41, page 141.

3.25 Single Line Repeaters

Single line repeaters are normally connected to subscribers' loop jacks in the telegraph line terminals. Spare

as described in Section 3.12 for patching in case trouble develops in the line equipment.

3.3 Trunks and Miscellaneous Circuits

3.31 Talking Trunks

Talking trunks are provided to such locations as the testboard operator may have occasion to call. These trunks are arranged for multipling to the different testboard positions and ordinarily appear in positions equipped with voltmeter testing equipment or telegraph testing equipment since cords adapted for talking on the trunks are available only in these positions. In voltmeter testing positions two jacks are provided in the trunk circuit as shown in Figure 1, Drawing No. 213-B-45, page 145, for use in connection with the test cords and connecting cords. In telegraph testing positions a single jack as shown in Figure 2, is provided for use with the looping test cord. Lamp signals are provided at the testboard which may be multipled at one, two or three positions as desired. Any trunk may be multipled at the voltmeter testing positions or telegraph testing positions or both; and jacks for all the different types of trunks are wired alike. The relay equipment required for the various types of trunk circuits differs depending on the service and is covered by the following drawings:

Type of Trunk	Drawing No.	Page
Two-Way Ringdown Trunk or Trunk to Step-by-Step or Panel Machine Switching Office	213-B-46	146
Trunk to Toll Switchboard No. 1 Incoming Automatic - Outgoing Ringdown	213-B-47	147

Type of Trunk	Drawing No.	Page
Trunk to Toll Switchboard No. 3 Incoming Automatic - Outgoing Ringdown	213-B-48	148
Trunk to Local Manual Exchange or Official PBX	213-B-49	149
Trunk to Toll Chief Operator's or Assistant Toll Chief Operator's Desk	213-B-51	150
Telephone Line to Main Distributing Frame	213-B-52	151

3.32 Interposition Trunks

For interposition patching purposes, trunks are provided between testboard positions as shown on Drawing No. 213-B-53, page 152. These trunks can be used for the patching telephone lines, composite sets, telegraph circuits, etc. The interposition trunks are arranged so that when a plug is inserted in a jack at one position a busy test will be obtained on all other positions where the trunk is multipled.

3.33 Auxiliary Signal Circuit

The auxiliary signal circuit is used in connection with the trunk signals, cord supervisory signals, and the telegraph line terminal signals. The lamp, key and buzzer for this signal circuit are shown on Drawing No. 218-B-1, page 157.

3.34 Ringing Circuit and Trouble Tone Circuit

Leads for the supply of 20-cycle ringing current for toll testboard No. 5 are wired as shown on Drawing No. 218-B-2, page 158. The wiring arrangement for the 1000-cycle and 135-cycle is covered in bulletins on these ringing systems.

The interrupted low-tone circuit for offices equipped with motor-driven interrupters is shown on Drawing No. 218-B-3, page 159. Where no motor-driven interrupter is available for supplying the tone a system of relays as shown on Drawing No. 218-B-4, page 160, may be provided if the interrupted low tone is required. Interrupted low tone will only be required when the test board is associated with a switchboard.

3.35 Test Line to Main Distributing Frame

The test line to the main distributing frame shown on Drawing No. 218-B-5, page 161, can be used in offices where all lines entering the office are not looped through the toll testboard and where it is desired to gain access to these circuits at the main distributing frame for testing purposes.

3.36 Combined Composite Set Jacks

Where combined terminal and intermediate composite sets are provided and it is desired to provide facilities for converting them quickly from terminal sets to intermediate sets or vice versa, jacks as shown in Figures 7 and 8, Drawing No. 213-B-20, page 120, are provided in the testboard. Figures 5 and 6 of the drawings show the arrangement of the corresponding jacks for combined terminal and intermediate composite balancing sets.

(4.0) OPERATION OF TESTING EQUIPMENT

The testing circuits of the toll testboard No. 5 are provided for the purpose of determining the nature and location of troubles occurring in the toll lines outside of the office and in the apparatus associated with them inside the office. The testing equipment includes a voltmeter test circuit, a Wheatstone bridge test circuit and a telegraph test circuit, as described in Section 2.

The type of testing apparatus provided in the No. 5 toll testboard permits a high degree of accuracy in the location of faults on cable circuits up to 60 miles in length and on open-wire lines up to 200 miles in length. The methods of making the various tests required for locating the more common faults are described below. The accuracy obtained in the location of a given fault depends to a considerable extent on the completeness and accuracy of the line records, the procedures followed in making the measurements made and on the interpretation of the results.

In taking up a line for test, care should be taken not to connect testing battery or ringing current to the line when linemen or cablemen are working on the line before notifying them. When inserting the test plugs all keys should be normal and the battery key should not be thrown before notifying the lineman if he is on the line. The shunt should be operated only long enough to make the necessary tests and should never be left in an operated position as this may result under certain conditions in rapid deterioration of the

testing battery.

Where resistance unbalances are suspected in line circuits not carrying grounded telegraph circuits, care should be taken not to connect a high voltage testing battery to the circuit until after a low voltage metallic Varley measurement has been made with the Wheatstone bridge. If the high voltage testing battery in the voltmeter testing position or the Wheatstone bridge position is connected to the circuit the resistance unbalance, if due to a poor connection, may temporarily disappear.

4.1 Methods of Using the Voltmeter Testing Circuit

The voltmeter is used to determine the nature of the trouble existing on the line, that is, whether the line is open, grounded, short-circuited, or crossed with another line or with a foreign potential. The usual voltmeter tests may be classified as follows:

1. Continuity tests.
2. Tests for grounds.
3. Rough resistance measurements.
4. Tests for insulation resistance and leakage.
5. Tests for crosses.
6. Tests for foreign or earth potentials.

Simplified diagrams of the circuit arrangements for the various tests made with the voltmeter are shown on Drawing No. 154-A-17, page 100. Page 2

4.11 Continuity Tests

In making a continuity test, the operator plugs into

the line with either the left or right test cord with all keys normal to monitor for a moment. If the line is not busy, the operator should proceed with the test by operating the BATT. ON key which applies positive metallic testing battery to the tip, as shown on Drawing No. 154-A-17, page 100, Figure 6. The test battery may be reversed as shown in Figure 7, by operating the REV. BATT. key. The tip and ring may be reversed by operating the REV. LINE key. If the external circuit connected to the tip and ring conductors is open, a momentary throw may be observed with a subsequent low or zero reading. If the circuit is closed a steady deflection will be noted.

Since non-grounded battery is used in making the above continuity tests, these tests should always be followed by tests for grounds.

4.12 Tests for Grounds

In testing for grounds, either test cord is plugged into the line or drop to be tested and keys operated as shown in Figure 9 or 10, Drawing No. 154-A-17, page 100, depending upon whether the ring or the tip is to be tested. This places either the tip or ring conductor in series with the voltmeter and testing battery. The polarity may be reversed by operating the REV. BATT. key and the tip and ring conductors may be interchanged by operating the REV. LINE key.

4.13 Tests for Crosses

Tests for crosses are usually made with the single cords associated with test cord "B" by connecting one of the

cords to the faulty wire and connecting the other cord momentarily to wires suspected of being crossed with it. Circuit arrangements as shown in Figures 6, 7 or 8, Drawing No. 154-A-17, page 100, may be used. A cross between conductors known to be open at the distant end will be indicated by a deflection of the voltmeter. An indication of the resistance of the cross may be obtained by operating the SHUNT key which converts the voltmeter into a milameter with a low or zero reading on high resistance crosses or leaks.

4.14 Tests for Foreign Potentials

For this test, either test cord is used with all keys normal. This arrangement places the voltmeter directly across the test cords without the battery. If foreign potential to ground is suspected, the keys may be operated to TEST TIP or TEST RING. In this test, the foreign potential may be an earth potential.

4.15 Holding

When the key of a test cord is thrown back to the HOLD position, the cord is disconnected from the voltmeter testing equipment and connected to a repeating coil which may have associated with it signaling apparatus responsive to 20-cycle, 135-cycle and 1000-cycle signals and the secondary of which is connected to interrupted low tone as shown in Figure 2, Drawing No. 154-A-17, page 100. The cord may then be used as a holding cord for linemen or distant testboards to call in on, the tone serving to identify the circuit and the signaling apparatus providing a ringdown signal.

7 [4.16] Talking

The operator's telephone circuit is normally connected to the test cords for monitoring as shown in Figure [4] [Drawing] [No. 154-A-17,] page [100] When the TALK key is operated the connections are changed for talking as shown in Figure [1.] The telephone circuit may be disconnected from the test cords by operating the TEL. DISC. key.

The telephone circuit may be connected to a cord used for holding by operating the TEL. ON HOLD key. The operation of this key also disconnects trouble tone from the holding cord, disconnects the telephone circuit from the other test cord and restores the signal associated with the holding cord.

Talking battery may be supplied on either the test cord or holding cord by operating the TALK. BATT. key.

When monitoring on working telephone circuits to determine their condition, a test cord may be used and the OPEN 3RD key or the HOLD and TEL. ON HOLD keys operated. Either of these conditions opens the sleeve circuit so that the busy signals at the toll switchboard will not be operated when the test cord is connected to the listening jacks.

8 [4.17] Ringing

Normall 20-cycle ringing current is connected to the ringing keys but a switching key is provided for substituting 135 cycles or 1000 cycles when desired. When the RING ON TEST key is operated, ringing current is supplied to the test cords if the TEL. ON HOLD key is normal, and to the

holding cord if the TEL. ON HOLD key is operated.

9 (4.18) Use of Connecting Cord

The connecting cord can be used in connection with the telephone set but can not be used with the voltmeter. It is a double-ended cord and is provided with a ringing key so that ringing current may be connected to either the right or left cord. When the TEL. ON CORD key is operated the operator's telephone circuit is connected to the connecting cord for monitoring as shown in Figure 4. If the TALK key is also operated the connections are changed for talking as shown in Figure 1. Talking battery may be supplied as shown in Figure 3, by operating the TALK BATT. key. When the TEL. ON CORD key is operated the telephone circuit is disconnected from the test cords and holding cord.

A 20-cycle relay is bridged across the cord mainly for receiving clearing out signals. The signals are restored by operating the TEL. ON CORD key.

In machine switching areas a dial may be associated with the right connecting cord. To dial a subscriber the right connecting cord is inserted in the jacks of a trunk to the machine switching office, the DIAL RIGHT key operated and the number dialed in the usual way. The dial key must be restored before the testboard operator can talk to the machine switching subscriber. A retardation coil is bridged across the right connecting cord in such cases to hold the connection after the dial key is restored. This coil also serves to trip machine

ringing when answering calls incoming from the machine switching office.

Series condensers are provided in the tip and ring conductors of the connecting cord so that the left cord may be used for connections to trunks where it is necessary to avoid the bridging of a direct-current path across the circuit on account of interference with supervisory signals in cords or trunks at the toll switchboard.

10 4.2 Methods of Using Wheatstone Bridge Test Circuit

The Wheatstone bridge test circuit is used in the location of faults after the general nature of the fault has been determined and the fault localized. The Wheatstone bridge tests which are usually employed in locating faults may be classified as follows:

1. Loop resistance measurements.
2. Single wire resistance measurements.
3. Insulation resistance measurements.
4. Varley loop tests.
5. Murray loop tests.
6. Open-location tests.

Simplified diagrams of the various tests made with the Wheatstone bridge are shown on Drawing No. 154-A-20, page 102.

One Wheatstone bridge may be associated with several voltmeter test positions. The Wheatstone bridge may be connected to either of the test cords in any of the voltmeter testing circuits with which it is associated by operating the

BRIDGE key in the voltmeter test position. The operation of any one of the BRIDGE keys lights a lamp at the Wheatstone bridge position and at each voltmeter test position with which the bridge is associated. After the general nature and approximate location of a fault has been determined by voltmeter tests, the test cord key is operated to BRIDGE. The operator may then proceed with the Wheatstone bridge measurements as described below. In general it will be desirable to use the single cords associated with test cord "B" when making Wheatstone bridge tests.

4.21 Loop Resistance Measurement

In making a loop resistance measurement, the line or pair to be tested is connected to the Wheatstone bridge test circuit as outlined above. The battery key in the Wheatstone bridge position is then operated to the 6-volt or 150-volt position which connects testing battery to the bridge and also lights the galvanometer scale lamp inside the bridge as indicated in Figure 2, Drawing No. 154-A-20, page 102. The "Multiply By" dial is set at the desired point and the rheostat arm, (the four dials on the right), is adjusted until no deflection is obtained when a galvanometer shunt key is depressed. No means are provided for using a voltmeter or other external instrument in place of the galvanometer while obtaining a preliminary balance and, therefore, the .001 shunt key should always be used until an approximate balance is obtained. A higher shunt may be employed as the balance becomes more

exact, until the most satisfactory balance possible is obtained.

12 [4.22] Single Wire Resistance Measurements

Single wire resistance measurements are made in the same way as loop resistance measurements, except that a ground return is employed. The single wire to be tested may be properly connected to the bridge circuit by throwing the TEST TIP or TEST RING key, as the nature of the trouble may require, the distant end of the circuit to be measured also being grounded. Single wire resistance measurements should be used only in the event that a loop or Varley measurement is impossible, because large errors may be expected as a result of ground potentials, high resistance between the fault and ground, or both.

13 [4.23] Insulation Resistance Measurements

Insulation resistance measurements are made with the same circuit set up as single wire measurements except that the distant end is opened, the leakage-to-ground serving as return path for the circuit. The ratio dial should be set at 100 or 1,000 and a key thrown to TEST RING or TEST TIP, as the nature of the trouble may require.

Similarly the insulation resistance between conductors can be measured with an ordinary loop connection, the loop being open except for mutual leakage.

14 [4.24] Varley Loop Tests

In making a Varley loop measurement, the connection is set up by operating the VARLEY key and operating the battery key to 150 volts or 6 volts, as shown in Figure [5] [Drawing]

No. 154-A-20, page 102. The "Multiply By" dial should be set on $\frac{1}{1}$ and a balance made in the same way as for a loop measurement. This arrangement connects the bridge to the line with tip-to-tip and ring-to-ring. If it is found that a balance is impossible with this arrangement, the REV LINE key should be thrown to connect the bridge to the line with tip-to-ring and ring-to-tip, in order that the ring of the bridge be connected to the side of the line or loop which has the largest resistance.

The so-called "Reversed Varley" measurement is made with the "Multiply By" dial set on some value less than $\frac{1}{1}$. The measuring procedure is the same as outlined for the regular Varley measurement, although the analysis of the results is more difficult.

The metallic Varley test is made exactly as described above, except that a metallic return line "X", as shown in Figure 7, is patched into the "Varley and Murray" jack. In making metallic Varley measurements to detect resistance unbalances, care should be taken not to throw the battery key to the 150-volt position before making the measurement.

15 4.25 Murray Loop Tests

Connections for the Murray loop test are set up by operating the MURRAY key and throwing the battery key to 150 volts or 6 volts. The circuit for the Murray loop test with the line normal is shown in Figure 8, Drawing No. 154-A-20, page 102. If the REV LINE key is operated the connections are as shown in Figure 9.

The metallic Murray loop test is made in the same

way as the tests described above, except that, in addition, a metallic return line "X" is patched into the "Varley and Murray" jack, as shown in Figure 10.

A reverse Murray is obtained by connecting the good wire to the ring.

16 4.26 Open-Location Tests

"Opens" are ordinarily located by comparing the capacity component of the impedance to ground of the wire in trouble with that of a good wire of known length, preferably its mate. A 1 mf. condenser is provided in the Wheatstone bridge circuit for balancing the capacity component of the line. A Murray connection is used with 1000 ohms as one ratio arm and the rheostat as the other ratio arm. The impedance to ground of the wire being measured and the 1 mf. condenser in series with a variable resistance (the condenser arm rheostat) form the other two arms of the bridge. These connections are shown in Figure 11, Drawing No. 154-A-20, page 102. The condenser arm rheostat (the three dials on the right, Drawing No. 219-B-65, page 164) in series with the 1 mf. condenser permits obtaining a phase balance which is necessary for an accurate location. A PHASE SHIFT key is provided to assist in securing the phase balance.

In making an open-location test the wire to be measured is connected to the ring side of the bridge. The MURRAY and OPEN LOCATION keys are operated and the MULTIPLY BY dial set at M1000. The battery key is operated to 150 volts or 6 volts, the condenser arm rheostat set at zero, and with the PHASE SHIFT key

normal, the rheostat arm is adjusted until an approximate balance is obtained. The PHASE SHIFT key is then operated and the condenser arm rheostat adjusted until a balance is again obtained, leaving the bridge rheostat set at the point obtained on the previous trial. The PHASE SHIFT key is then restored and the bridge rheostat again adjusted. These steps are repeated until the operation of the PHASE SHIFT key does not affect the balance.

When a true balance has been obtained the capacity component of the wire being measured is proportional to the setting of the bridge rheostat and the values obtained in the measurements on a good wire and on the wire in trouble are used in calculating the distance to the fault. The condenser arm rheostat is required only to secure a phase balance and its value is not required in the calculations.

17 4.3 Method of Using Telegraph Test Circuit

The voltmeter testing equipment in the telegraph test circuit is terminated in tip, ring and looping cords and is used in testing for continuity, crosses or grounds in telegraph subscribers' loops and in determining the polarity and potential of voltages in the various telegraph circuits and battery taps appearing at the testboard. The milameter is used in checking and adjusting the current in telegraph circuits. The usual tests made with the telegraph test circuit may be classified as follows:

1. Current measurements.
2. Measurement of line potential.
3. Test of "home battery."
4. Test of "distant battery."

5. Potential measurement of telegraph test battery.

6. Test of telegraph drop.

7. Test of telegraph line.

8. Telephone Set.

Simplified diagrams of the various tests are shown on Drawing No. 154-A-22, page 104.

18 4.31 Current Measurements

The milameter winding of the volt-milameter is normally wired to the test cords so that current measurements may be made without operating any keys by plugging the looping test cord into a looping jack or by connecting in series with the circuit by means of the single test cords.

Current measurements may be made with looping cords of telegraph test set No. 1 or No. 2 by operating the MIL-AM ON 1 or MIL-AM ON 2 key. When a telegraph test set is used for current measurements as shown in Figure 13, Drawing No. 154-A-22, page 104, the circuit includes a 100-ohm relay winding.

19 4.32 Measurement of Line Potential

Care should be taken in taking up a telegraph circuit for voltmeter tests to insure that the circuit is not in operation, for the high resistance of the voltmeter winding will interrupt the telegraph service if connected in series with the circuit. When it is desired to measure the potential across the telegraph line and drop the looping test plug should be inserted in the looping jack of the telegraph line terminal and the voltmeter winding connected in series with the circuit as shown in Figure 1, Drawing No. 154-A-22, page 102, by

throwing the TEST key.

20 [4.33] Test of "Home Battery"

The potential of this battery may be measured by throwing the TEST and TEST RING keys. This opens the tip and connects the voltmeter across ring and ground as shown in Figure [3]. The voltmeter reading will then indicate approximately the potential of the battery connected to the battery jack and through the subscriber's loop to the looping jack of the telegraph line terminal, and the direction of the deflection will indicate the polarity.

21 [4.34] Test of "Distant Battery"

For this test the looping plug is inserted in the looping jack of the telegraph line terminal or a duplex line jack, the ring side of the testing circuit is opened and the voltmeter connected to ground in series with the tip by throwing the TEST and TEST TIP keys as shown in Figure [2]. The voltmeter reading will then indicate the potential of the battery at the distant end and the direction of the deflection will indicate the polarity.

22 [4.35] Potential Measurement of Telegraph Test Battery

The potential of the telegraph test battery may be measured by operating the TEST and SHORT keys which short-circuit the tip and ring through the voltmeter. If the + BATT. or - BATT. keys are then operated the voltmeter will indicate the potential and polarity of the battery under test.

4.36 Test Line

This test made with a telegraph test set can be made by inserting the looping plug of telegraph test set No. 1 or No. 2 in the listening jacks of a telegraph line terminal and applying + BATT., - BATT. or GROUND in series with the telegraph relay as shown in Figures 17, 18 and 19.

4.37 Test Drop

This test is the same as the line test except that the connections are set up to test the ring instead of the tip. The connections are set up as shown in Figures 14, 15 and 16, Drawing No. 154-A-22, page 104.

4.38 Telephone Set

The operator's telephone circuit can be connected to the test cords as shown on Figure 9, by throwing the TEL. key. If in addition to the TLL. key, the TALK BATT. key is operated, talking battery may be supplied as shown in Figure 10. Ringing current can be applied to the test cords by throwing the TEL. and RING keys.

4.4 Patching Cords.

Patching cords are provided so that circuits terminating in jacks at the testboard may be connected to circuits other than those with which they are normally associated. The various kinds of patching cords and cordless plugs provided in connection with toll testboard No. 5 are shown on Drawing No. 318-B-7, page 163. The shells of the twin plugs have the tip side knurled and the ring side plain to enable the operator

to distinguish between the tip and ring wire terminals of the plug. When inserted horizontally the knurled edge is normally turned toward the left and when inserted vertically the knurled edge is normally turned toward the top.

#241-C Cordless plugs are provided for certain special uses. Plug "E" is used for short-circuiting lines, drops, composite sets, etc. Plug 241-B "F" is used for opening both sides of a circuit or for patching out line equipment by inserting two of these plugs vertically in the line and drop jacks. Plug 165-B "J" is used for opening signal wires, etc. Plugs "G" and "H" may be used as required. A black shell on a cordless plug indicates that the ring and tip of the plug are strapped as in plugs "E" and "H". A red shell indicates that the tip and ring are not strapped as in plugs "F" and "G".

Cord "A", Drawing No. 218-B-7, page 163, is used for patching a single conductor such as a grounded telegraph line circuit. Cord "C" is used where it is necessary to patch the conductor connected to the sleeve of a jack along with the tip conductor as in the case of telegraph subscribers' loops, telegraph repeaters where it is desired to patch the subscriber's signal along with the telegraph repeater set, etc. Cord "B" is used for patching telephone circuits, line equipment, or other apparatus or circuits where the tip and ring conductors are wired through adjacent jacks. Cord "D" is used similarly to cord "B" except that the sleeves of the plugs are connected. It is used principally in connection with telephone repeaters

where three-conductor patches are sometimes required. Cord "K" is used for certain special patches such as connecting a cable pair to a metallic telegraph circuit. Cord "L" is used only at the distributing frame. A white patching cord indicates that the sleeves of the plug are not connected and a red patching cord indicates that the sleeves are connected. Resistance plugs as shown in Drawing No. 38-Y-1468 are used for line terminations in transmission testing.

REFERENCES:

Bulletin No. 138 - Jack and Lamp Socket Mountings for Use on Relay Racks.

Bulletin No. 214 - Wheatstone Bridge per KS-3011.

AMERICAN TELEPHONE & TELEGRAPH CO
Department of
Development and Research

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Voltmeter Test and Connecting Cord Circuit
Simplified Diagrams

154-A-17
Standard
Replacing 704-3021

Engineer W.W.H.
Draftsman [illegible]
Checked by [illegible]
Mede Steners 3-18-26
Log No. P14423 1,26,28
[illegible] ISSUE 1

The battery convention was removed from Fig. 18
Log No. P17396 2-17-28
ISSUE 2

Was Prov. rated Std.
Log No. S-8428 3-18-28
ISSUE 3

Telephone Set

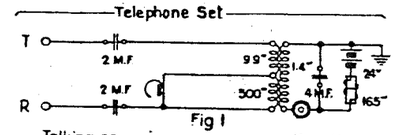

Fig 1

Talking on Test — Keys thrown: Talk
Hold — Hold, Tel. on Hold, and Talk
Connecting Cord — Tel. on Cord, and Talk.

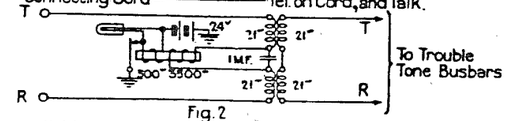

Fig. 2

Holding — Keys thrown: Hold

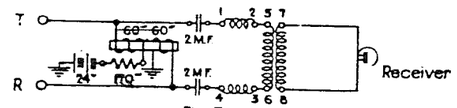

Fig. 3

Talking Battery on Test Cords — Keys thrown: Talk Batt
Connecting Cords — Tel. on Cord, and Talk Batt.

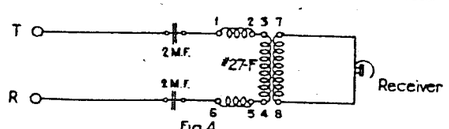

Fig. 4

Monitoring on Test — Keys thrown: All Normal
Hold — Hold and Tel. on Hold
Connecting Cords — Tel. on Cord

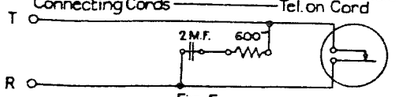

Fig. 5

Dial on right connecting cord.
Keys thrown. Dial right

Voltmeter Test. Keys thrown: BATT. ON

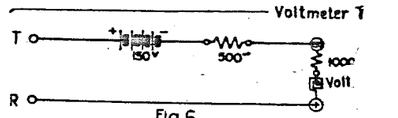

Fig. 6

Batt. Reversed. Keys thrown: REV. BATT.

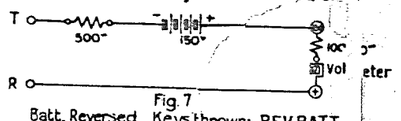

Fig. 7

Test Circuit Reversed. Keys thrown: BATT. ON and REV. LINE.

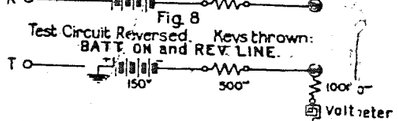

Fig. 8

Test Ring. Keys thrown: BATT. ON and TEST RING

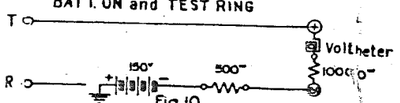

Fig. 9

Test Tip. Keys thrown. BATT. ON and TEST TIP

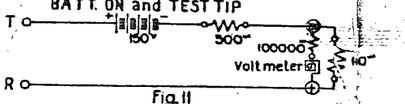

Fig. 10

Voltmeter Shunt. Keys thrown. BATT. ON and SHUNT

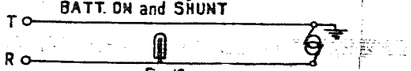

Fig. 11

Ringing — Keys thrown:
20~ — RING ON TEST CORDS.
135~ — RING ON TEST CORDS, AND 135~
1000~ — RING ON TEST CORDS, AND 1000~

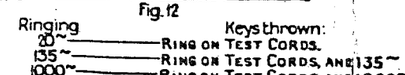

Fig. 12

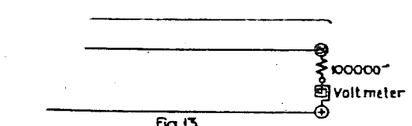

Fig. 13

Battery Off. All Keys Normal.

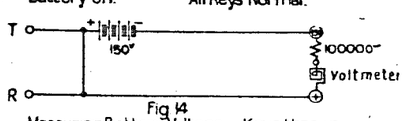

Fig. 14

Measuring Battery Voltage. Keys thrown: BATT. ON and SHORT

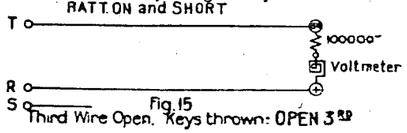

Fig. 15

Third Wire Open. Keys thrown: OPEN 3RD

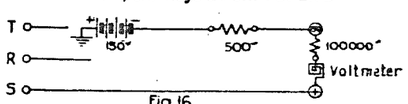

Fig. 16

Third Wire Test. Keys thrown: BATT. ON and TEST 3RD

Telegraph Set

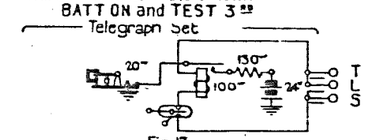

Fig. 17

Telegraph Test Set #1 on Telegraph Cords.
All Keys Normal.

Wheatstone Bridge

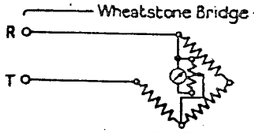

Fig. 18

Wheatstone Bridge Test. Keys thrown: Bridge

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO. 5

Wheatstone Bridge Test Circuit

154-A-19

Mfr. Disc.

Replacing 704 3070

Replaced by S.D. C2005-01

Engineer Draftsman Checked by Redrawn Made Standard 3-18-26 Log No. P11429 6-3-25 ISSUE 2
Was Provisional Std Log No. S-8423 3-18-26 ISSUE 3
Added note (4) Log No. S-9305 6,1,26 ISSUE 4
Was Standard rated Mfr Disc. Replaced by S D C2005-01 Log No S 11835 12.8.27 ISSUE 5
Scale Lamp Special 2-F Per D-85654" Was 2-F lamp. Log No. P21052 2-23-28 ISSUE 6

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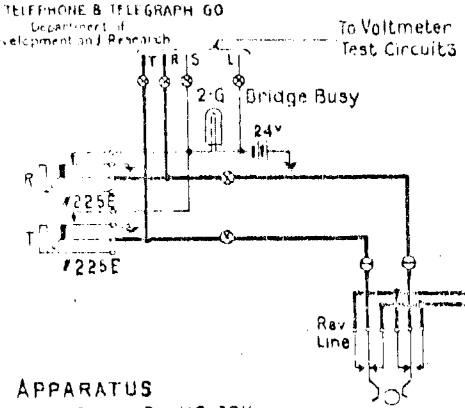
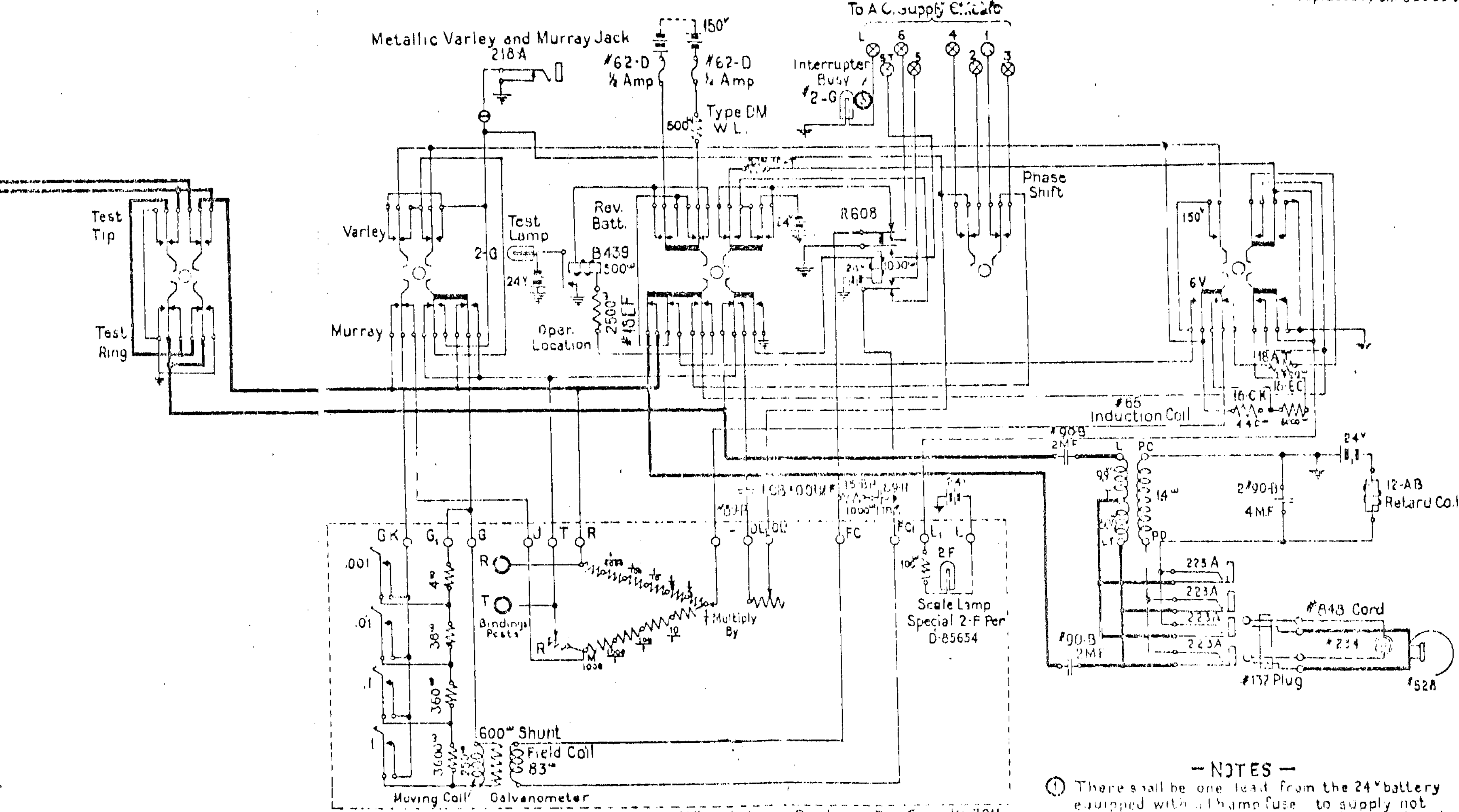
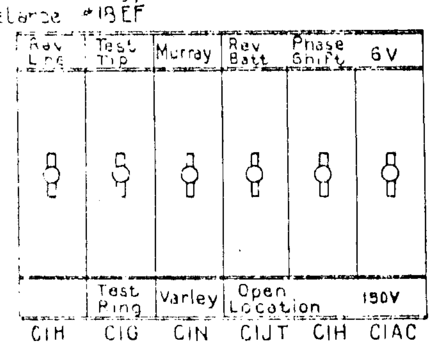
Department of Development and Research





APPARATUS

1 Wheatstone Bridge Per KS 3011
2 Keys C1H
1 Key C1G
1 Key C1N
1 Key C1JT
1 Key C1AC
3 Lamps #2 G
(2) 3 Lamps Sockets #15
3 Lamp Caps #2 AY
1 Lamp #2-F
1 Relay B 439
1 Relay R 608
2 Jacks #225 E
1 Jack #218 A
4 Jacks #223 A
1 Induction Coil #65
1 Retardation Coil #12-AB
1 Plug #137
1 Cord #87
1 Resistance #18-BH
1 Resistance #18-CK
1 Resistance #18-AT
1 Resistance #18-EC
1 Resistance #18-T
4 Condensers #90-B
1 Condenser #89-F
1 Condenser #89-H
1 Resistance W.L. Type DM
1 Resistance #18 EF



— NOTES —

(1) There shall be one lead from the 24V battery equipped with a 1½ amp fuse to supply not more than 8-2G lamps and one lead equipped with a 1½ amp fuse for all other circuits requiring signaling current.
(2) S indicates terminal at top of position.
(3) Interrupter Busy Lamp is necessary only where more than one bridge position employs the same interrupter.
(4) There shall be one lead of 24V talking battery equipped with 1½ ampere fuse for the operators telephone circuit.

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Department of
Development and Research

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO5

Wheatstone Bridge Test Circuit, Simplified Diagrams

154-A-20
Standard
Replacing 704-3045

Engineer J.W.
Draftsman A.H.
Checked by
Made Standard 3.18.26
Log No P14438126
ISSUE 1
The Galvanometer designation was added to Fig 11
Log No R17399 2-17-28
ISSUE 2
Was Pro rated Std
Log No S-8430 3.18.26
ISSUE 3

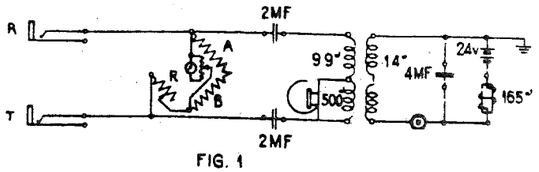

FIG. 1
Talking all keys normal.

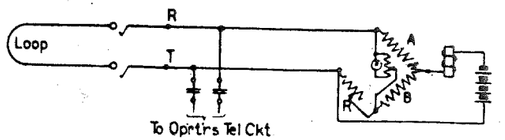

FIG. 2
Loop resistance measurement. Key thrown: 150 v. or 6 v

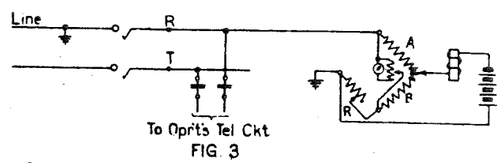

FIG. 3
Single grounded wire resistance measurement. Key thrown: TEST RING, 150 v or 6v

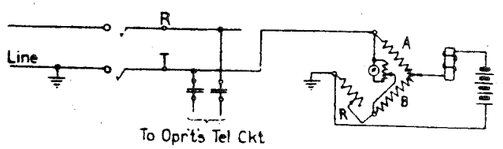

FIG. 4
Single grounded wire resistance measurement. Key thrown: TEST TIP, 150 v or 6 v

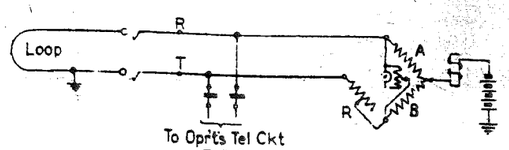

FIG 5
Varley loop test. Key thrown: VARLEY, and 150 v, or 6 v.

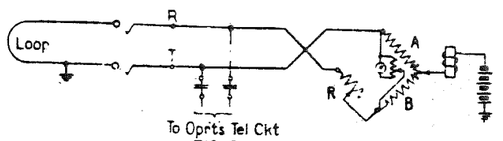

FIG. 6
Rev. Varley loop test. Keys thrown VARLEY, REV. LINE, and 150 v, or 6 v.

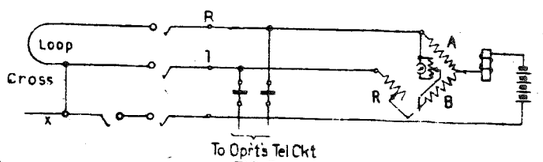

FIG 7
Metallic Varley test Keys thrown: VARLEY, and 150 v, or 6 v
Line x Patched to Varley Jack

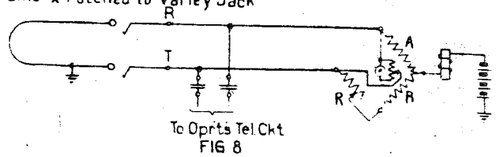

FIG 8
Murray loop test Keys thrown: MURRAY, and 150 v, or 6 v

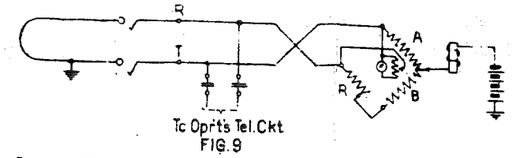

FIG. 9
Reversed Murray loop test. Keys thrown REV. LINE, MURRAY, 150 v. or 6 v

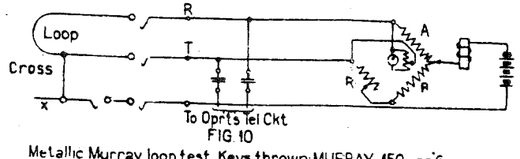

FIG. 10
Metallic Murray loop test. Keys thrown: MURRAY, 150 v or 6 v.
line X plug in MURRAY JACK.

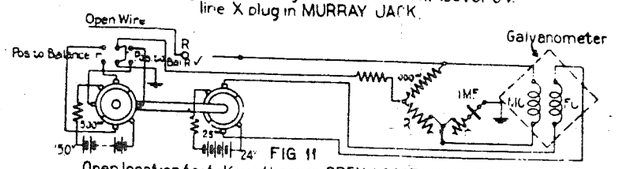

FIG 11
Open location test: Keys thrown OPEN LOCATION, MURRAY, 150 v, or 6 v. and
Multiply by M-1000

AMERICAN TELEPHONE & TELEGRAPH CO
Department of
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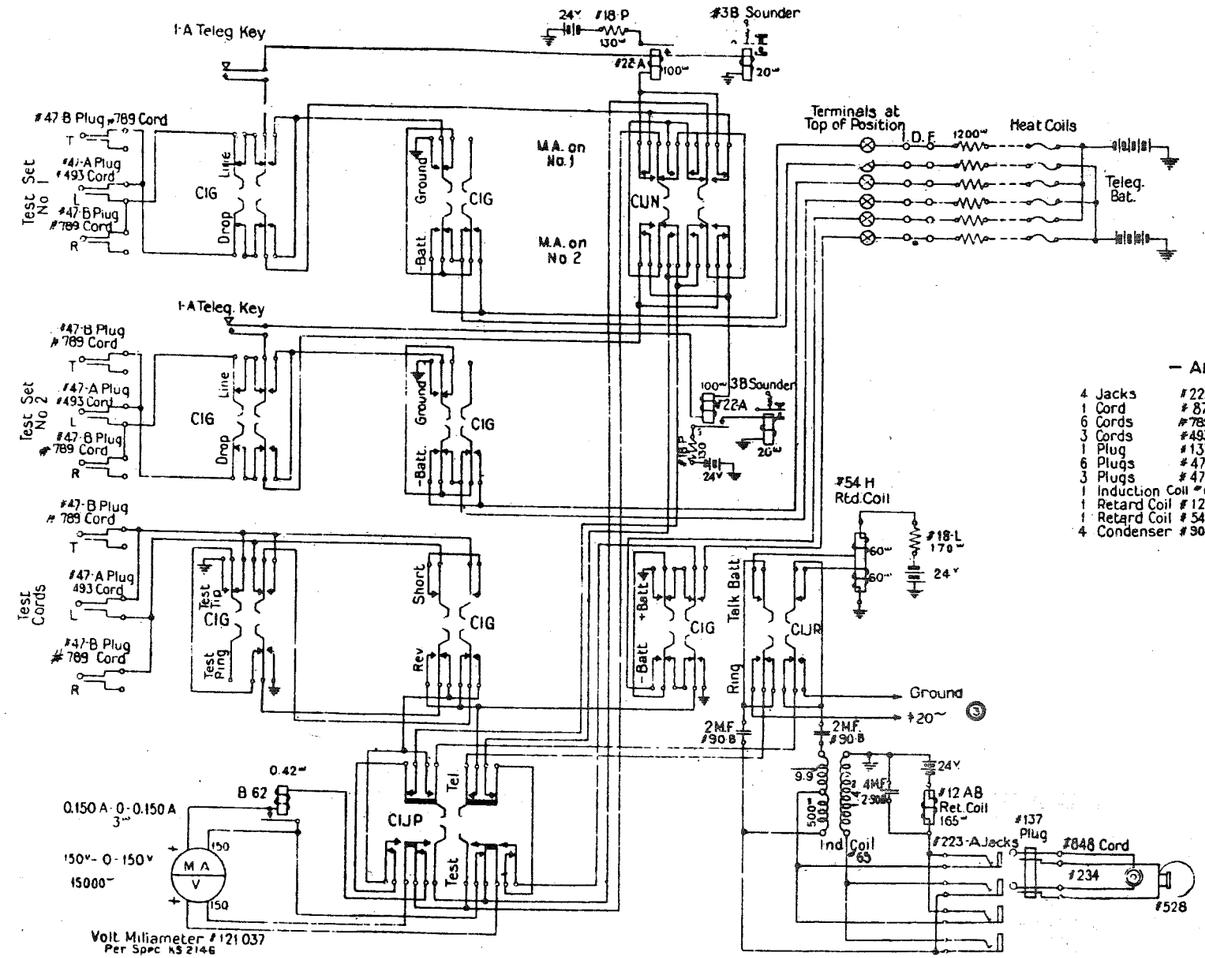
TOLL TEST BOARD EQUIPMENT

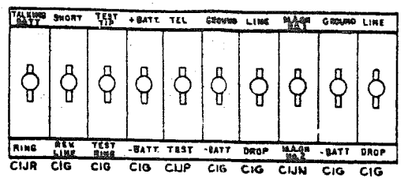
TOLL TEST BOARD NO 5
Telegraph Test Circuit.

154-A-21
Standard
Replacing 704-3037

Engineer
Draftsman
Checked by
Made Standard 3-16-26
Log No. R14549 2,2,28 ISSUE 1
Note 3 wire added.
Log No. R17397 2-17-28 ISSUE 2
Cords 789 were 544.
Log No. R17469 2-23-28 ISSUE 3
Was Prov. rated Std.
Log No. S-8431 3-16-28 ISSUE 4



Arrangement of keys



— APPARATUS —

4	Jacks	#223-A	1	Resistance	#18-L
1	Cord	#87	2	Resistances	#18-P
6	Cords	#789	2	Telegraph Sounders	#3-B
3	Cords	#493	2	Telegraph Keys	#1-A
1	Plug	#137	2	Telegraph Relays	#22-A
6	Plugs	#47-B	1	Telegraph Relays	B-62
3	Plugs	#47-A	1	Voltmiliameter	#121037 Per spec. K.S. 2146
1	Induction Coil	#65	1	Key	#CIJN
1	Retard Coil	#12-AB	1	Key	#CIJR
1	Retard Coil	#54-H	1	Key	#CIJP
4	Condenser	#90-B	7	Keys	#CIG

—NOTES—

1. There shall be one lead from 24 volt battery with 1 ⅓ ampere fuse for each circuit.
2. ⊗ Indicates Terminal at top of position.
3. There shall be one lead from 20 cycle generator equipped with a ⅓ amp. fuse for each two positions. There shall be one resistance lamp #E-B per position.

AMERICAN TELEPHONE AND TELEGRAPH CO.
Department of
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TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Telegraph Test Circuit
Simplified Diagrams

154-A-22
Standard
Replacing 704-3037

Engineer J.W.W.
Draftsman
Checked by
Made Standard 3-18-28
Log No. P14439 1,26,25
ISSUE 1
Fig. 20 was added.
Log No. R17394 2-17-28
ISSUE 2
Was Prov. rated Std.
Log No. S-6432 3-16-28
ISSUE 3

TEST CORDS

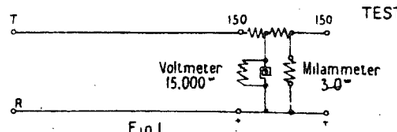

Fig 1
Voltmeter winding of Volt-Milammeter on Test Cord
Key thrown TEST.

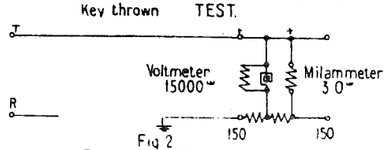

Fig 2
Test tip with Test Cords
Keys thrown: TEST and TEST TIP.

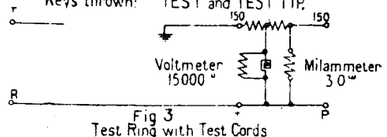

Fig 3
Test Ring with Test Cords
Keys thrown TEST, and TEST RING.

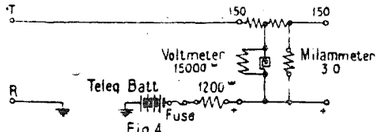

Fig 4
Telegraph Battery on Test Cords. Tip Negative, Ring Positive, Keys Thrown TEST, and - BATT.

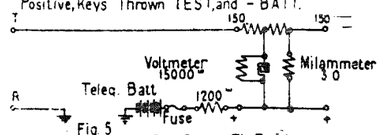

Fig 5
Telegraph Battery on Test Cords. Tip Positive, Ring Negative. Keys thrown TEST, and + BATT.

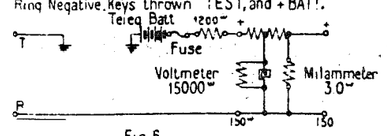

Fig 6
Telegraph battery on Test Cords Tip Positive, Ring Negative Test Cords Reversed.
Keys thrown TEST + BATT and REV.

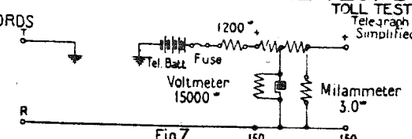

Fig 7
Telegraph Battery on Test Cords, Tip Negative, Ring Positive Test Cords Reversed. Keys Thrown. TEST, - BATT, and REV.

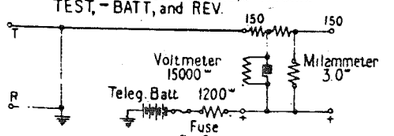

Fig 8
Measuring Test Battery Voltage, Keys thrown TEST, SHORT, - BATT or + BATT.

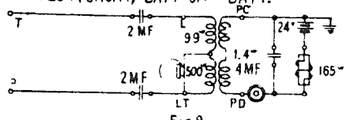

Fig 9
Talking on Test Cords. Key Thrown: TEL

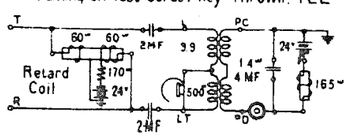

Fig 10
Talking on Test Cords with Talking Battery Supply. Keys Thrown TEL, and TALK BATT.

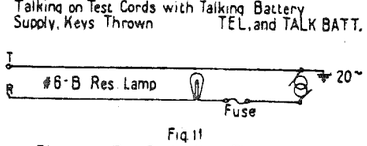

Fig 11
Ringing on Test Cords Keys Thrown
TEL, and RING.

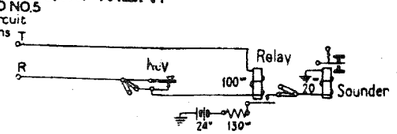

Fig 12
Telegraph Test Set No 1 or No 2 Test with Telegraph Relay, Battery Off. All Keys normal.

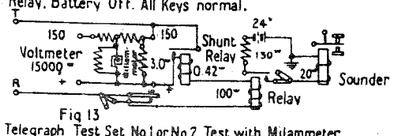

Fig 13
Telegraph Test Set No 1 or No 2 Test with Milammeter and Telegraph Relay, Battery Off. Keys thrown: MA on No 1 or MA on No 2.

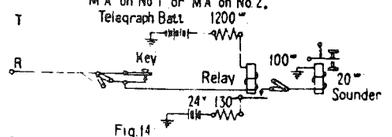

Fig 14
Telegraph Test Set No 1 or No 2 Test Drop with Positive Battery Key thrown: DROP.

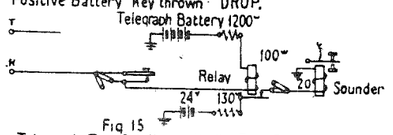

Fig 15
Telegraph Test Set No 1 or No 2. Test Drop with Negative Battery. Keys Thrown. DROP, and - BATT.

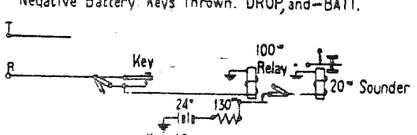

Fig 16
Telegraph Test Set No 1 or No 2. Test Drop with Ground
Keys Thrown: DROP, and GROUND.

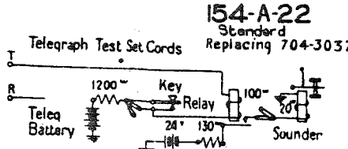

Fig 17
Telegraph Test Set No 1 or No 2. Test Line with Positive Battery. Key thrown: LINE.

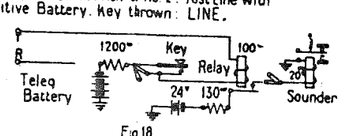

Fig 18
Telegraph Test Set No 1 or No 2. Test Line with Negative Battery. Keys thrown; LINE, and - BATT.

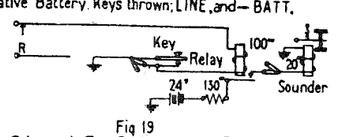

Fig 19
Telegraph Test Set No 1 or No 2 Test Line with Ground. Keys thrown. LINE and Ground.

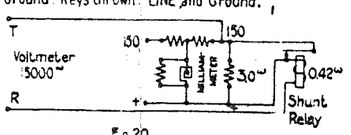

Fig 20
Milliammeter on Test Cords Keys normal.

AMERICAN TELEPHONE & TELEGRAPH CO.
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TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Phantom Group not Arranged for Composite Apparatus
10-Jack line circuit and 6-Jack Phantom Circuit
Schematic Diagram.

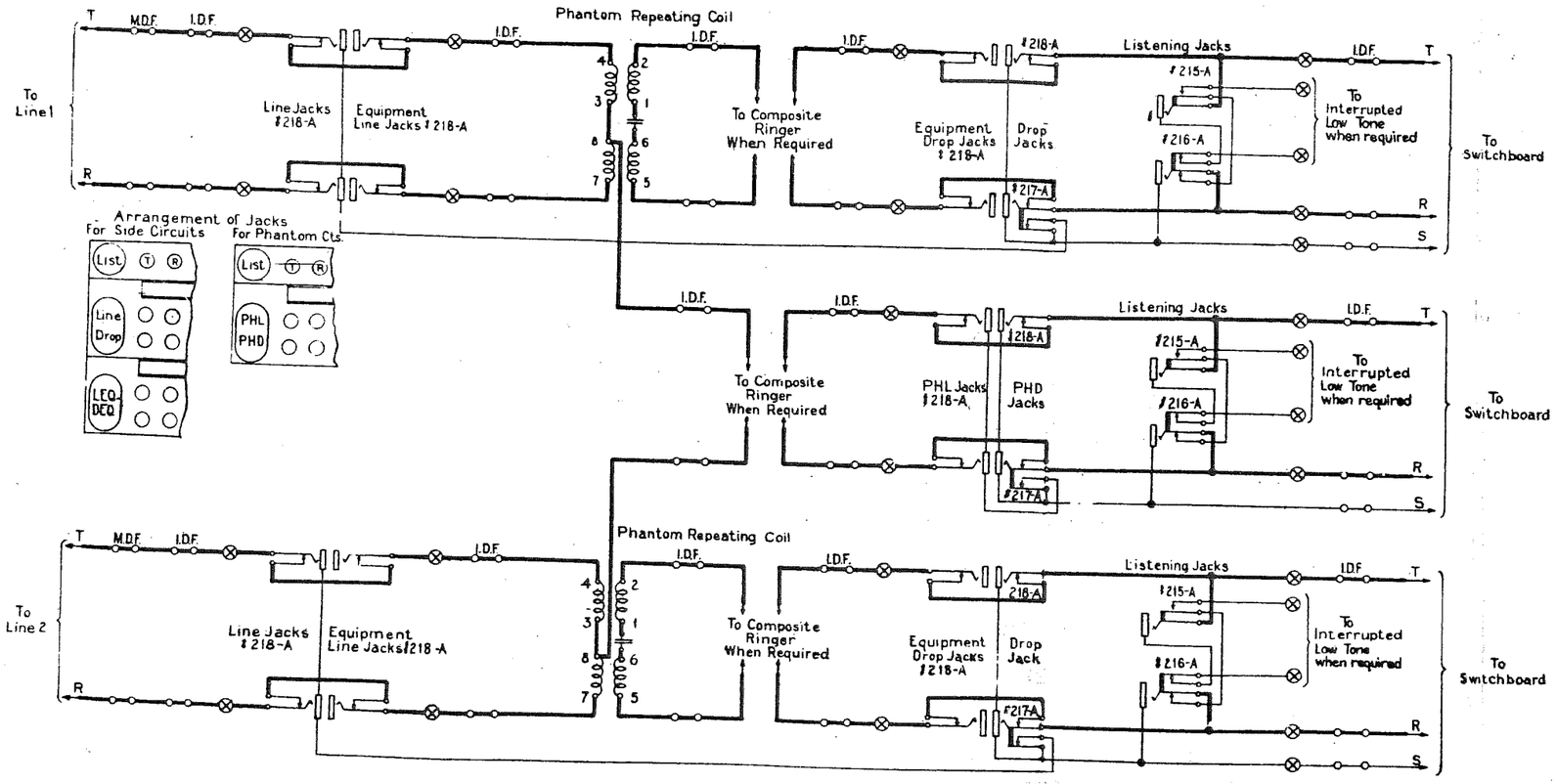
154-A-24
Standard

Engineer W. W. Jr.
Draftsman J. Dal
Checked by
Made Standard 9-11-26.
Log No. P-14437 1.26.25
W. W. ISSUE 1

The designation "interrupted low-tone punching" was "interrupted trouble-tone."
Log No. R-17396 2-17-28
W. W. ISSUE 2

"Interrupted low-tone" connections marked "when required."
Log No. R-17490 2-23-28
W. W. ISSUE 3

Wire Protected Std.
Log No. S-6433 3-19-28
W. W. ISSUE 4



AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
Development and Research.

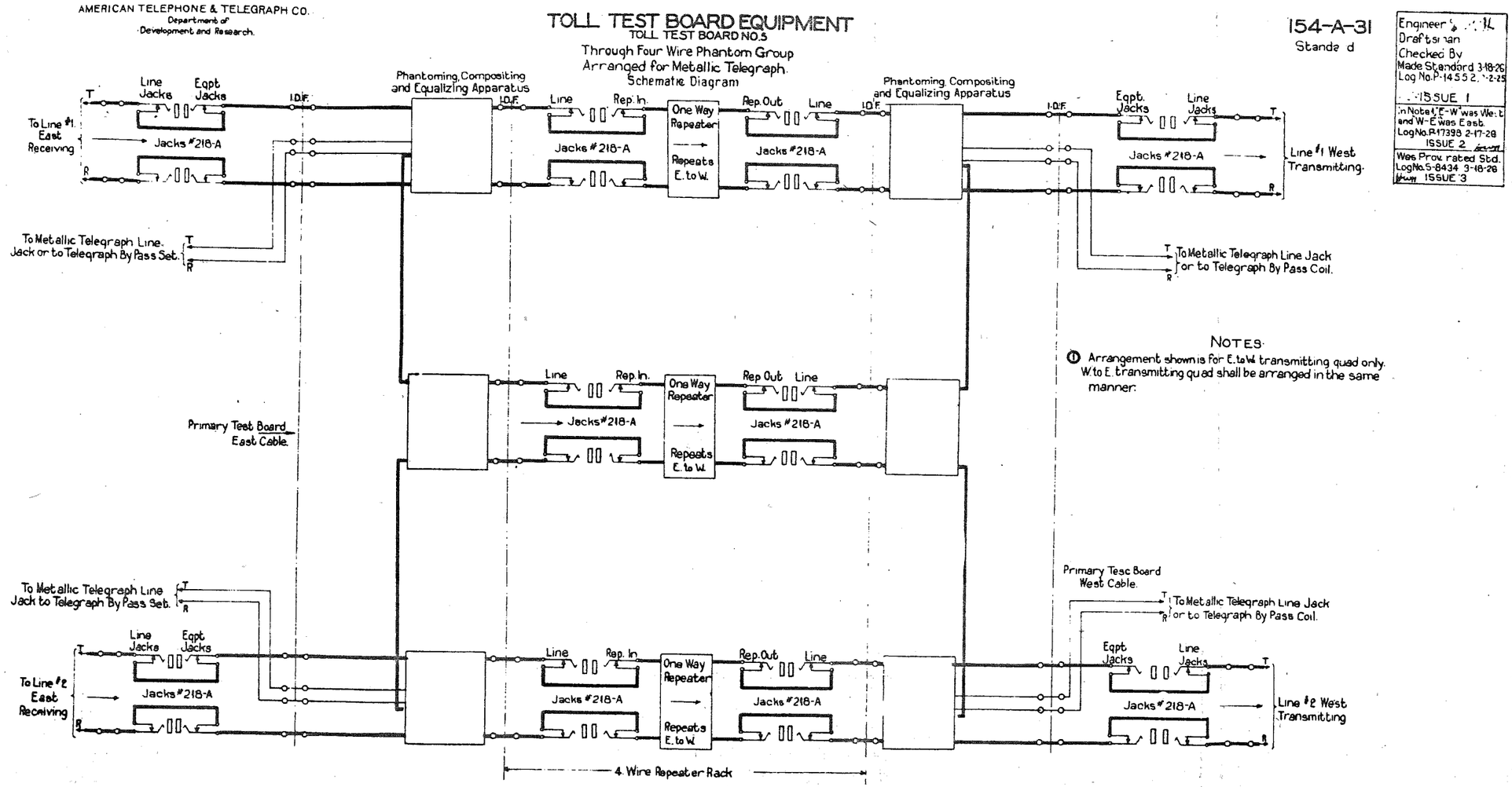
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Through Four Wire Phantom Group
Arranged for Metallic Telegraph.
Schematic Diagram

154-A-31
Standard

Engineer
Draftsman
Checked By
Made Standard 3-18-26
Log No.P-14552, 1-2-25
ISSUE 1
In Notes, E-W was West and W-E was East.
Log No.P-17398 2-17-28
ISSUE 2
Was Provisional Std.
Log No.S-8434 3-18-28
ISSUE 3



NOTES.

① Arrangement shown is for E. to W. transmitting quad only. W. to E. transmitting quad shall be arranged in the same manner.

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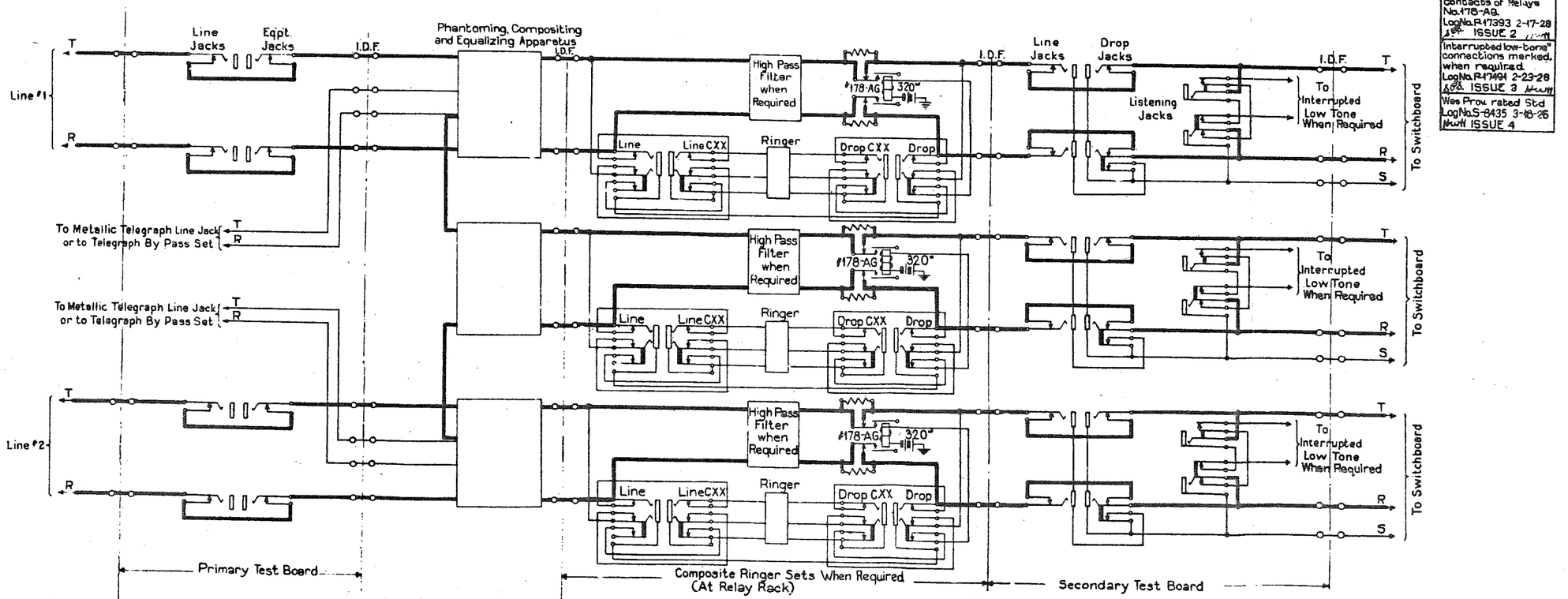
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5
Terminating Two Wire Phantom Group.
Arranged for Metallic Telegraph.
For Cable Offices where a Secondary Test Board is provided.
Schematic Diagram.

154-A-32
Standard

Engineer A.W.M
Draftsman W.J.H
Checked by
Made Standard 3-18-26
Log No. P-14551 2-2-25
ISSUE 1
Resistences were placed across the break contacts of Relays No. 178-AG.
Log No. P-17393 2-17-28
ISSUE 2
Interrupted low-tone connections marked, when required.
Log No. P-17494 2-23-28
ISSUE 3
Was Prov. rated Std
Log No. S-8435 3-18-26
ISSUE 4



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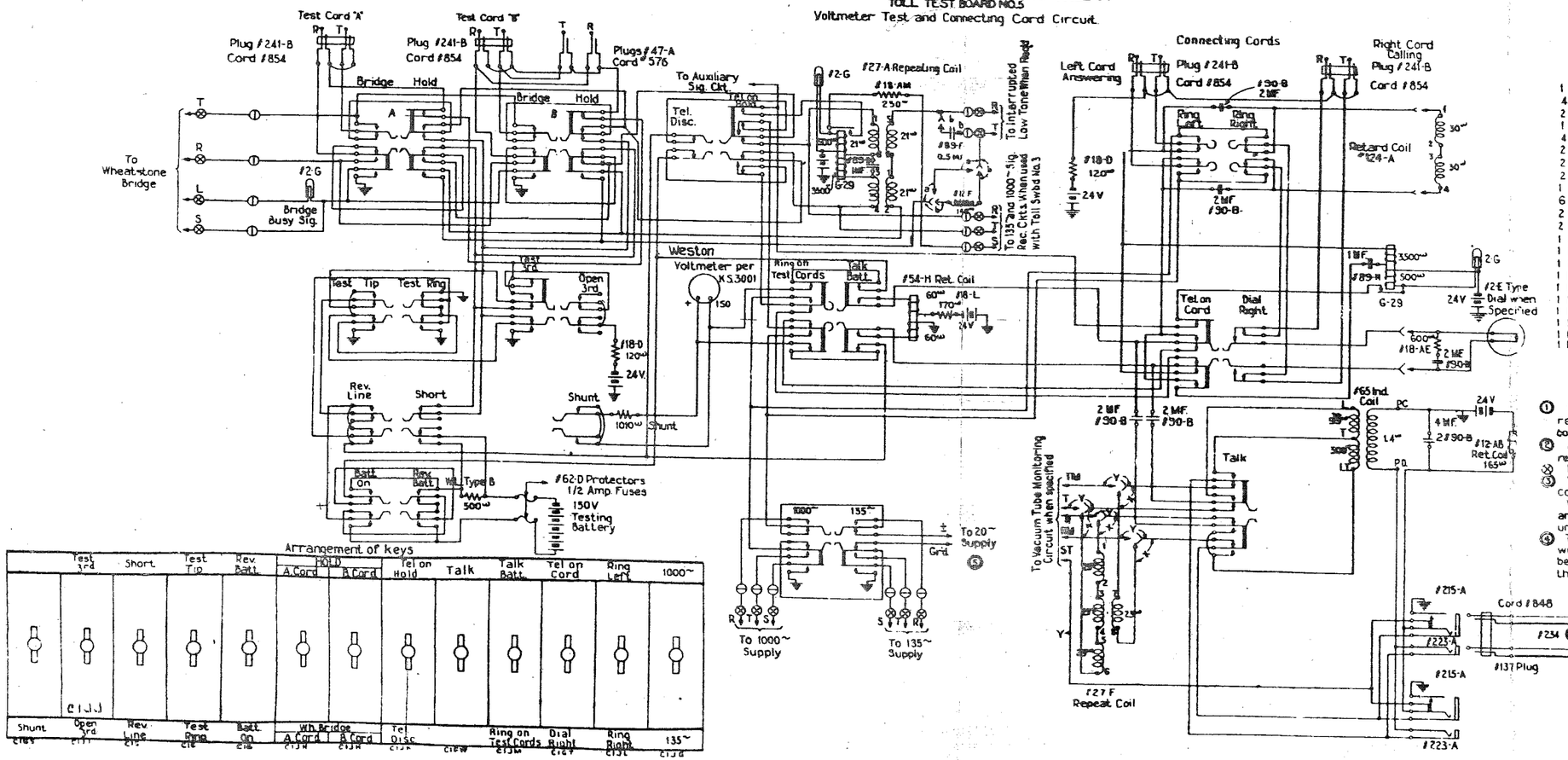
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Voltmeter Test and Connecting Cord Circuit



157-A-14
Standard
Replacing 704-3179

Engineer
Draftsman C.J.H
Checked by
Made Standard 3.18.25
Log. R9 F 14-4 24 1.28.25
4-63 ISSUE 1
Designations were assigned Test Cord "A" and Test Cord "B"
Log No. R47401 2-17-28
4-63 ISSUE 2
Interrupted low-tone connections marked "when required."
Log No. R74492 2-23-28
4-63 ISSUE 3
Was "Pro-rated" Std."
Log No. S-84-36 3.18.25
Now ISSUE 4

—APPARATUS—

1 Plug #137
4 Plugs #241-B
2 Plugs #47-A
1 Cord #87
4 Cords #854
2 Cords #493
2 Jacks #215-A
2 Jacks #223-A
1 Voltmeter Per K.S. 3001
6 Condensers #90-B
2 Condensers #89-H
2 Resistances #18-D
1 Resistance W.L. Type B
1 Resistance #18-L
1 Retard Coil #12-AB
1 Retard Coil #54-H
1 Retard Coil #124-A
1 Induction Coil #65
1 Repeat Coil #27-A ⊕
1 Resistance #18-AM
1 Condenser #89 F
1 Retard Coil #12 F ①

2 Relays G29
1 #2-E Type Dial
1 Condenser #21-E
1 Resistance #18-AE
Per Note #2
3 Lamps #2-G
3 Sockets #13
2 Cap #2-H
1 Key CIGW-
1 Key CIGT-
1 Key CIJL-
1 Key CIJG-
1 Key CIJM-
1 Key CIJK-
1 Key CIJJ
1 Key CIGS-
2 Keys CIJH-
3 Keys CIG-
2 Protectors #62-D

—NOTES—

① Strap "a" is normally provided. When a 1000-cycle signal receiving circuit is required, the strap a shall be omitted & retard coil #12-F & condenser #89 F shall be connected as shown by "b" wiring.

② #2-E type dial and retard coil #124-A, Condenser #90-B and resistance #18E, to be furnished only when specified.

⊗ Indicates terminal at top of position.

③ When vacuum tube monitoring is not required the repeat coil #27-F should be connected as shown by "X" wiring.
When vacuum tube is required omit the #27 F repeat coil and use "Y" wiring. The #27 F repeating coil shall be furnished unless otherwise specified.

④ There shall be one lead from 24 volt battery equipped with 1⅓ ampere fuse for suppling signaling battery. There shall be one lead of 24 volt battery equipped with 1⅓ ampere for the operators telephone circuit.

⊖ Indicates Terminal at Back of Keyshelf Unit.

Ⓖ There shall be one lead from 20 cycle generator equipped with a 1⅓ ampere fuse for each two positions. There shall be one resistance lamp #6-B per position.

AMERICAN TELEPHONE & TELEGRAPH CO
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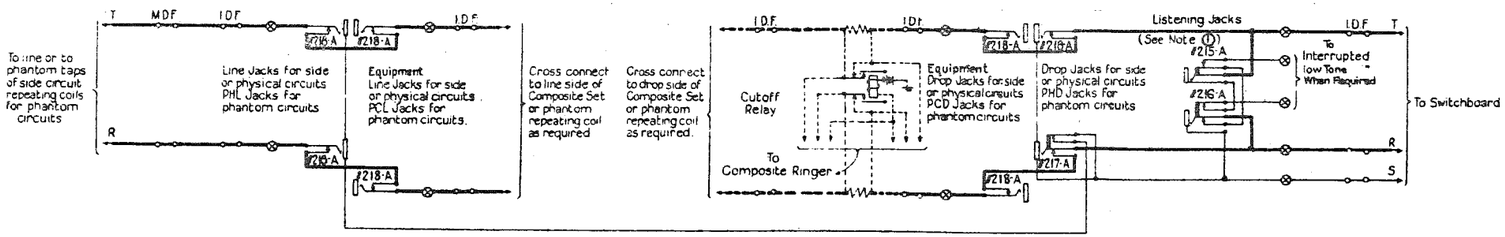
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5
10 Jack Toll Line Circuit
Arrangement of Wiring



157-A-15
Standard
Replacing 704-3005

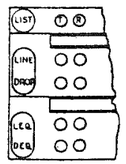
Engineer
Draftsman
Checked by
Made Standard 3.18.26
Log No P14447 1.26.26
Issue 1
"Any necessary wiring" in note B changed to read "the necessary wiring"
Log No P17336 2.13.26
ISSUE 2
"Interrupted low-tone" connections marked "When required."
Log No.P17493 2-23-26
ISSUE 3
Was Pro rated "Std"
Log No. S-84437 3.18.26
ISSUE 4

APPARATUS

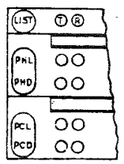
1	Jack	#215-A
1	"	#216-A
1	"	#217-A
3	Jacks	#218-A
4	"	#225A

Arrangement of Jacks

For 10 Jack Physical Circuit.



For 10 Jack Phantom Circuits



NOTES

① Designates terminal at top of position
To connect trouble tone across tip and ring insert a short-circuiting plug in the Ⓣ listening jack

② When the jack count does not follow the circuit arrangement at the I.D.F. the necessary wiring changes shall be made in the local cable.

AMERICAN TELEPHONE & TELEGRAPH CO.
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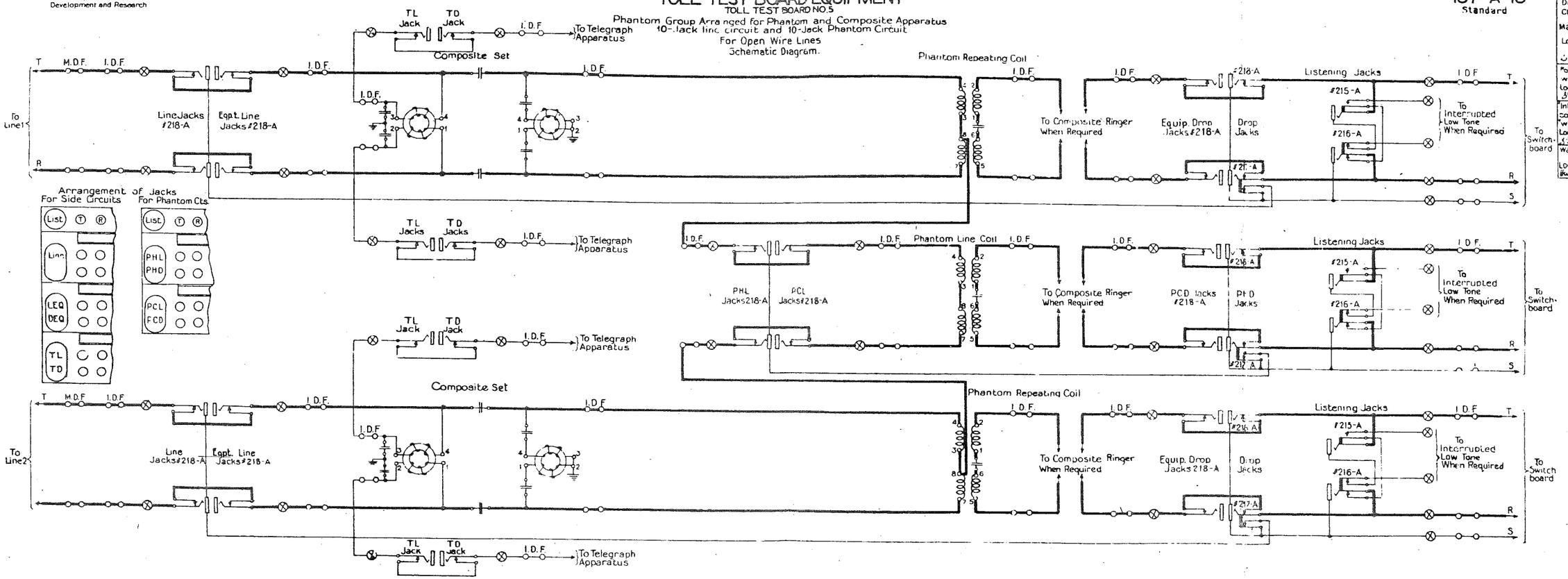
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Phantom Group Arranged for Phantom and Composite Apparatus
10-Jack line circuit and 10-Jack Phantom Circuit
For Open Wire Lines
Schematic Diagram.

157- A -16
Standard

Engineer
Draftsman
Checked by
Made Standard 3.18.26
Log No P14550 2.2.28 ISSUE
For open-wire lines was added to the title Log No. P17400, 2-17-28 ISSUE 2
Interrupted low-tone connections marked, when required. Log No. P17494 2-23-28 ISSUE 3
was Prorated Std. Log No. S 84-38 3.18.26 ISSUE 4



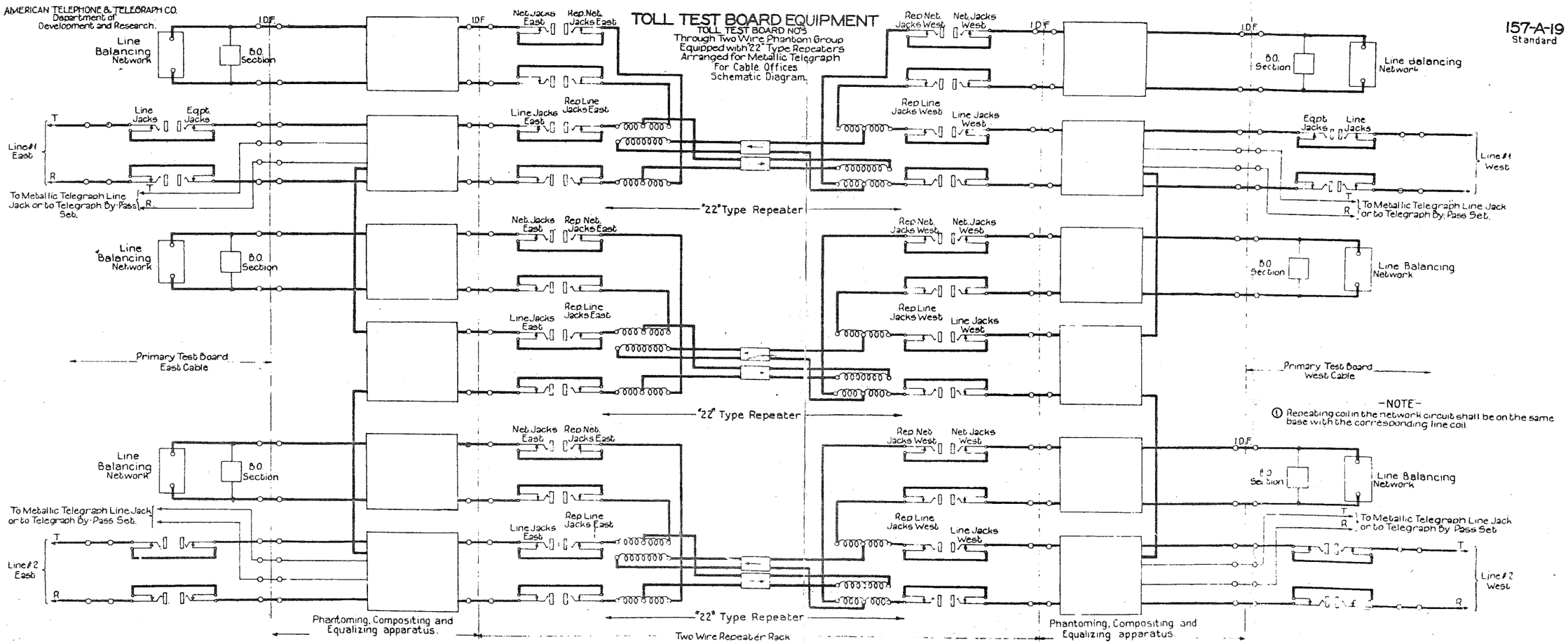
AMERICAN TELEPHONE & TELEGRAPH CO.
Department of Development and Research.

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO 5
Through Two Wire Phantom Group
Equipped with "22" Type Repeaters
Arranged for Metallic Telegraph
For Cable Offices
Schematic Diagram.

157-A-19
Standard

Engineer
Draftsman
Checked by
Made Standard 3.18.26
Log No P14553 2-27-26
ISSUE 1
Designation for cable offices was added to the bible.
Log No P17392 2-17-28
ISSUE 2
Was Provisional Std
Log No S 8459 3.18.26
ISSUE 3



-NOTE-

① Repeating coil in the network circuit shall be on the same base with the corresponding line coil.

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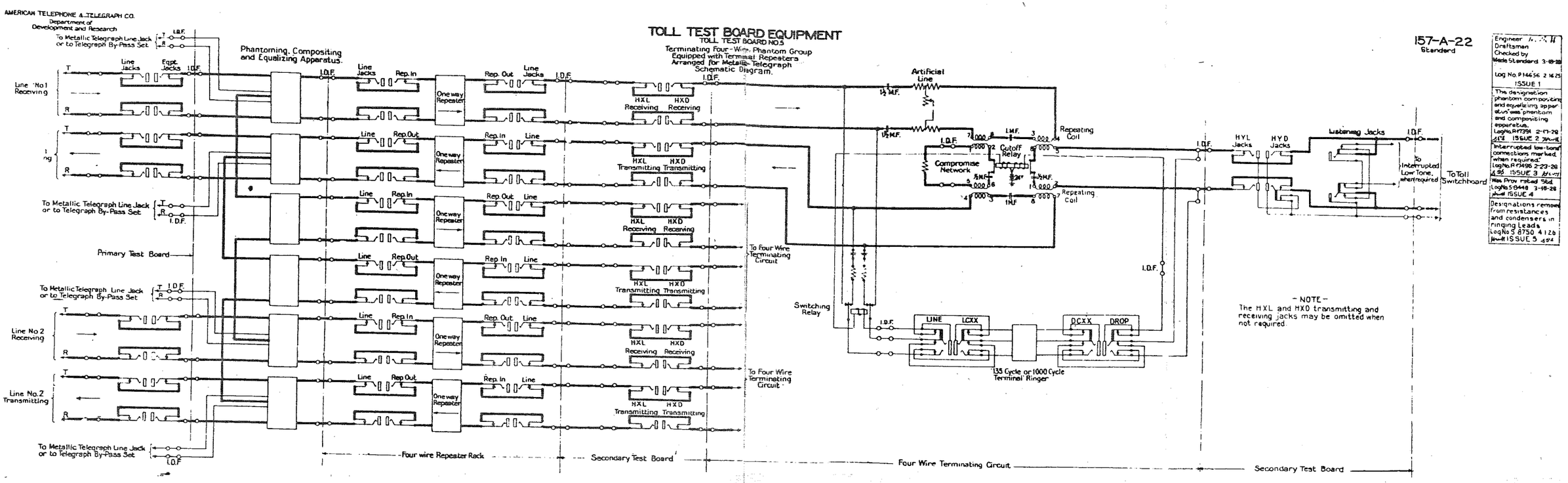
Department of Development and Research

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5
Terminating Four-Wire Phantom Group Equipped with Terminal Repeaters Arranged for Metallic Telegraph Schematic Diagram.

157-A-22
Standard



- NOTE -
The HXL and HXD transmitting and receiving jacks may be omitted when not required.

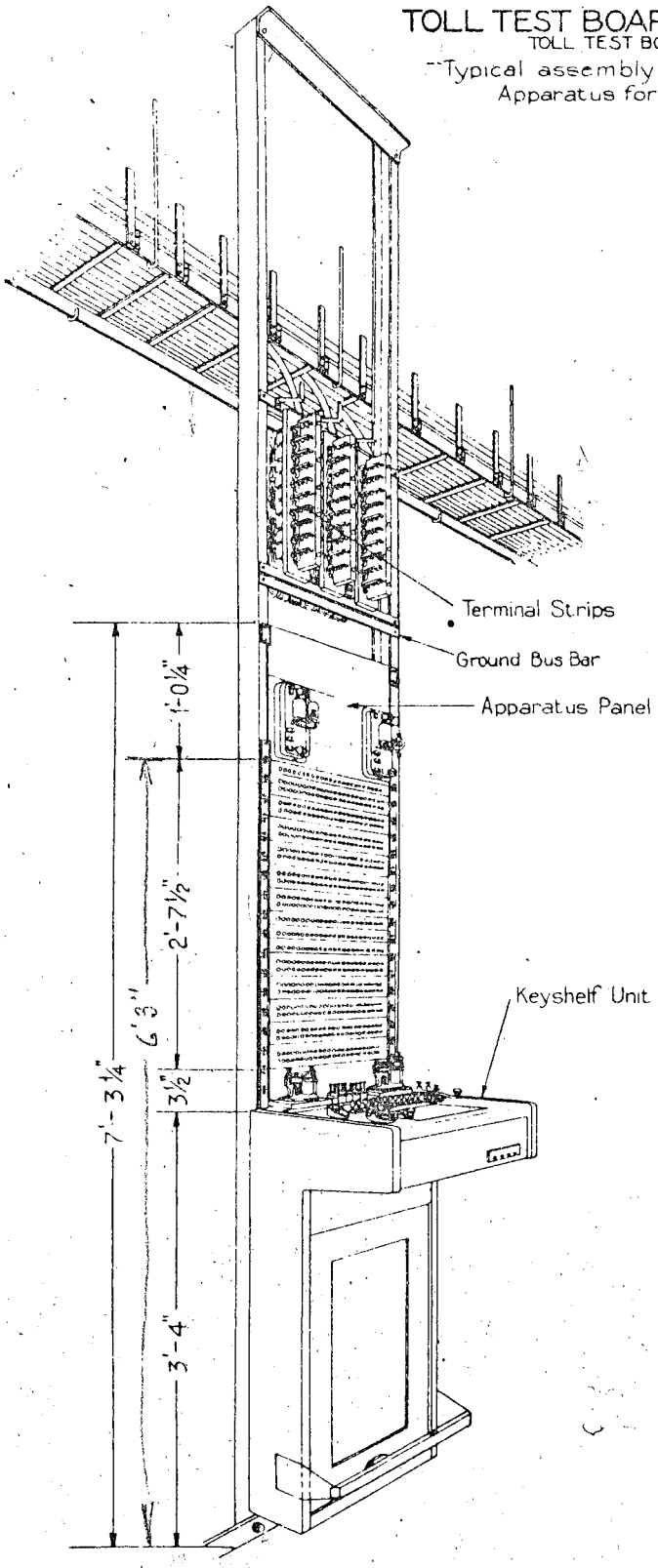
Engineer
Draftsman
Checked by
Made Standard 3-18-28
Log No. P 14656 2 16 25
ISSUE 1
This designation phantom compositing and equalizing apparatus was phantom and compositing apparatus.
Log No. P 17291 2-17-28
ISSUE 2
Interrupted low-tone connections marked, when required.
Log No. P 17498 2-23-28
ISSUE 3
Was Prov. rated 50cd.
Log No. S 19448 3-16-28
ISSUE 4
Designations removed from resistances and condensers in ringing Leads
Log No. S 8750 4 12 6
ISSUE 5

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO 5

Typical assembly of one position Apparatus for Voltmeter test.

213-B-13
Information



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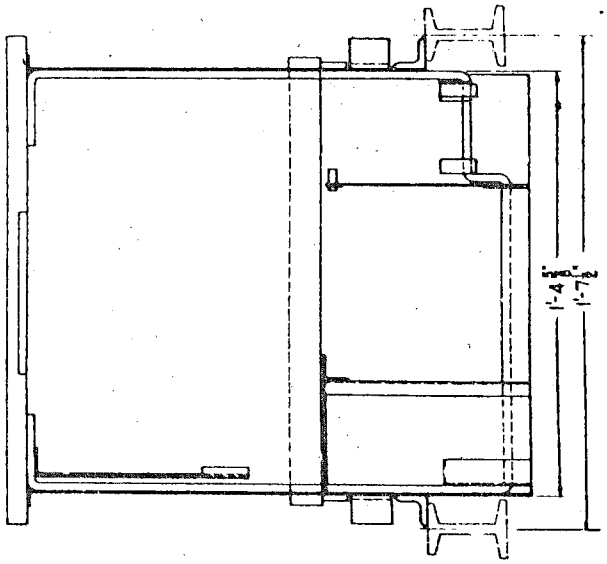
Dept of
Dev and Res

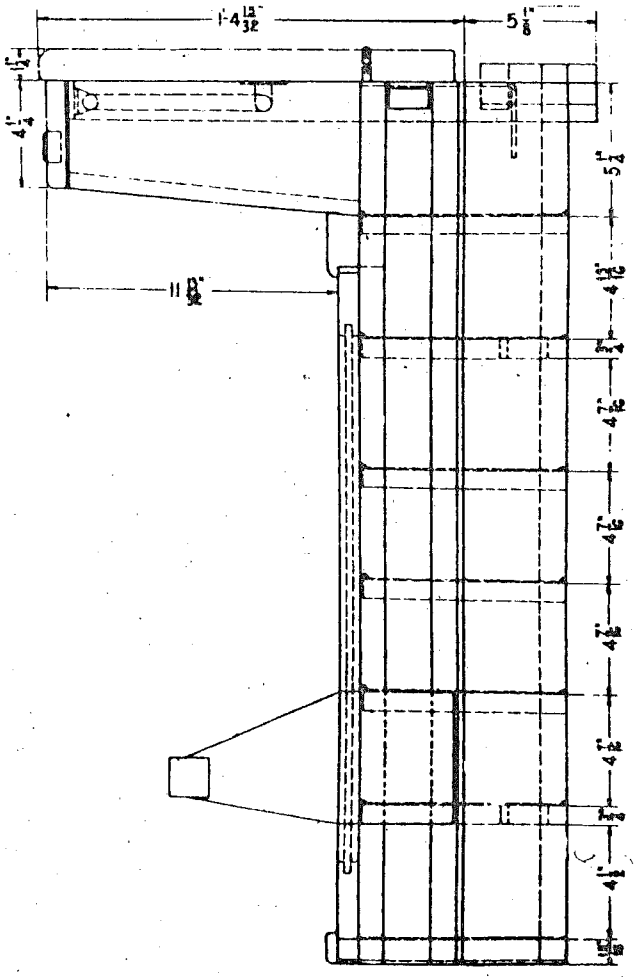
TOLL TEST BOARD EQUIPMENT

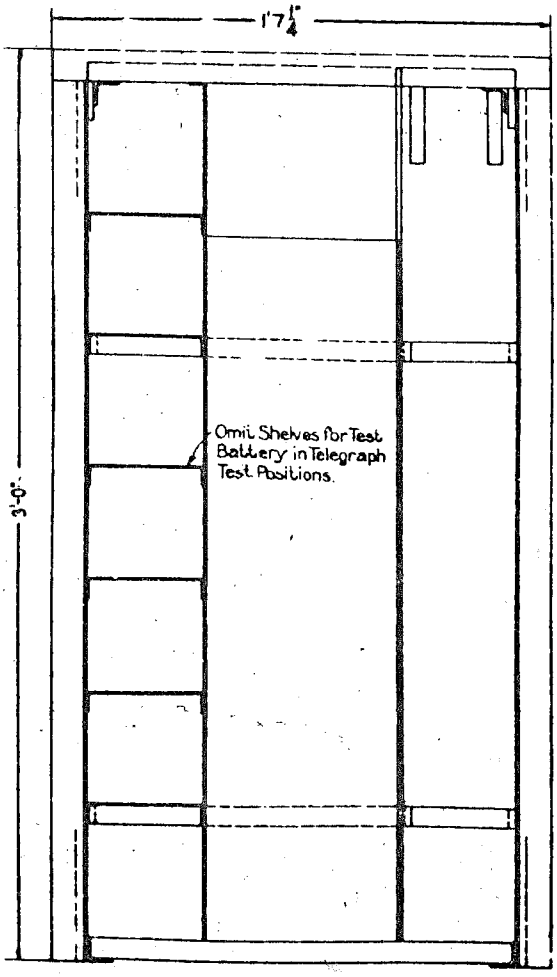
TOLL TEST BOARD NO. 5
Keyshelf Unit Section Assembly

213-B-14.
Standard
Replacing 704-2075

Engineer [illegible]
Draftsman A.J.L.
Checked by
Made Standard 3.18.26
Log No. P-14435 1.26.25
ISSUE 1
Specification added. "Omit keyshelves for test battery in telegraph test positions."
Log No. P-17521 2-23-26
ISSUE 2
Was "Provisional" Rated "Standard"
Log No. S-8441 3.18.26
ISSUE 3







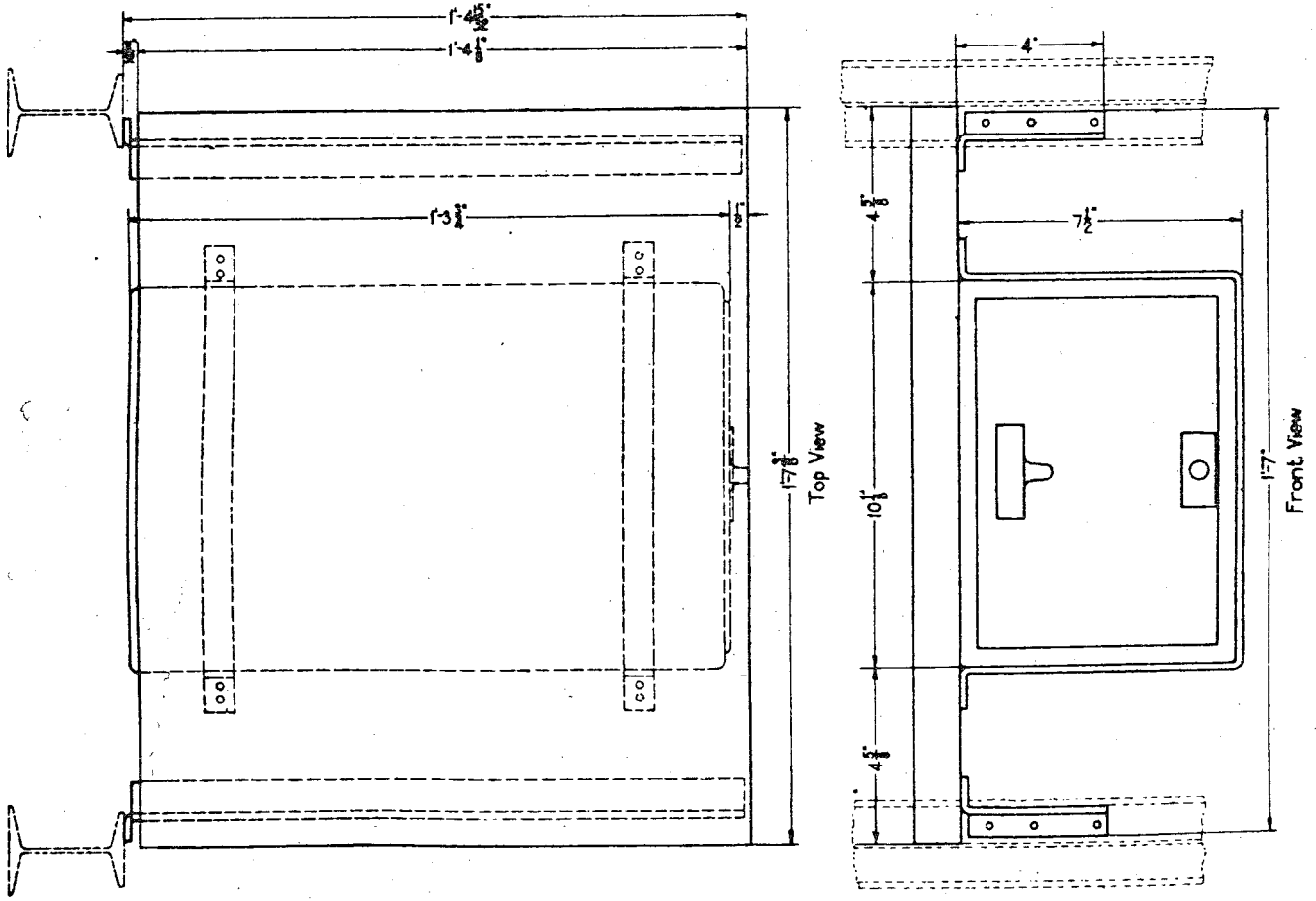
AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
Development and Research

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO. 5
Blank Keyshelf unit.

213-B-15
Standard

Engineer
Draftsman
Checked by
Made Standard 3,18,26
Log No. P-14434 1-26-26
ISSUE 1
was "Provisional"
Rated "Standard"
Log No. 5-8442 3,18,26
ISSUE 2



AMERICAN TELEPHONE & TELEGRAPH CO
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Development and Research

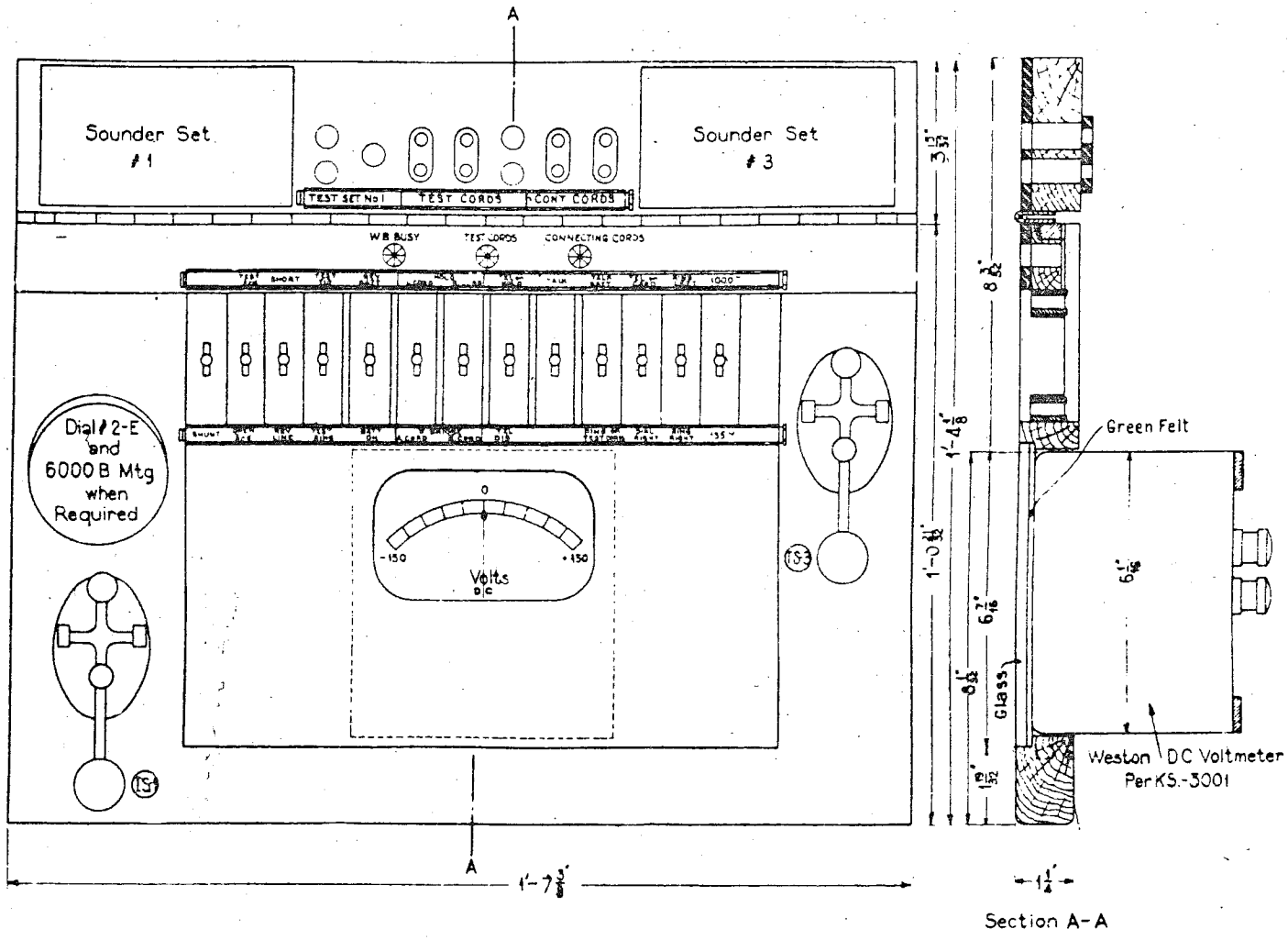
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Voltmeter Test Position Key Shelf

213-B-16
Standard
Replacing 704 2074

Engineer
Draftsman
Checked by
Made Standard 3.18.26
Log No P144.33 1.26.25
ISSUE 1
The designations "A Cord" and "B Cord" were changed to "L Cord" and "R Cord". Log No. P17522 2-23-28 ISSUE 2
Was Provisional Rated Standard
Log No S 8443 3.18.26 ISSUE 3



Section A-A

AMERICAN TELEPHONE & TELEGRAPH CO.
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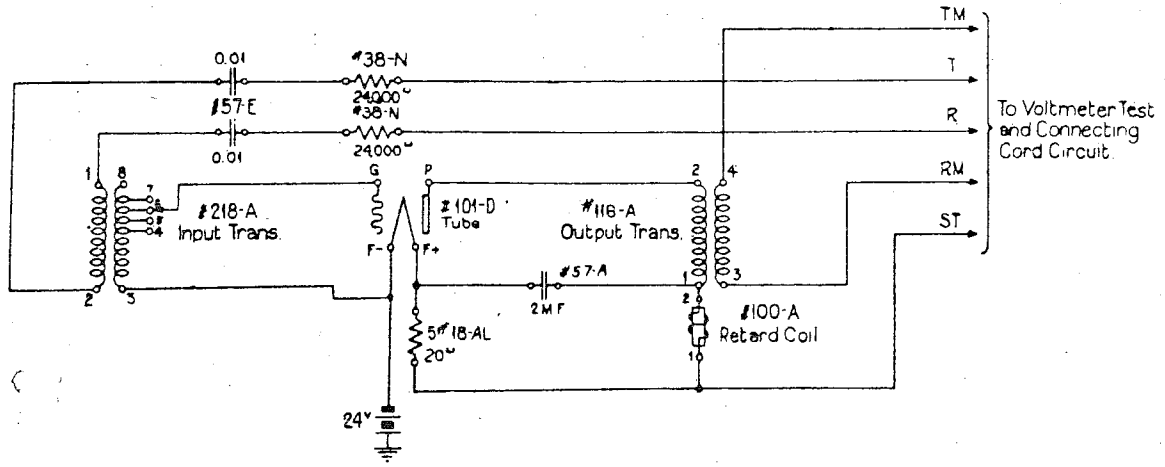
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Vacuum Tube Monitoring Circuit

213-B-17
Standard
Replacing 704 - 3047

Engineer [illegible]
Drafting [illegible]
Checked By [illegible]
Made Standard 3.18.26
Log No P-14432 1-26-25
ISSUE 1
215 A vacuum tube and associated equipment changed for vacuum tube 101-D.
Log No.P-17379 2-16-28
ISSUE 2
Was "Provisional" Rated "Standard"
Log No.5-8444 3.18.26
ISSUE 3



APPARATUS

1 Input Transformer	#218-A
1 Output Transformer	#116-A
1 Condenser	#57-E
1 Condenser	#57-A
1 Retard Coil	#100-A
5 Resistance	#18-AL
2 Resistances	#38-N
1 Socket	#100-R
1 Vacuum Tube	#101-D

NOTES

The Filament Current shall be taken from Lead supplying talking Battery to Operators Telephone Circuit.

AMERICAN TELEPHONE & TELEGRAPH CO
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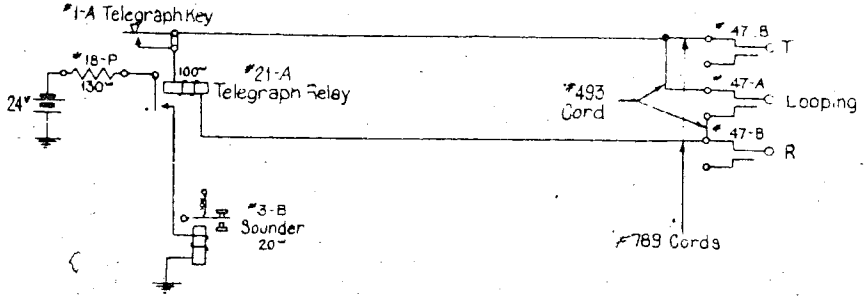
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO. 5
Telegraph Test Set No. 1
For Use at Voltmeter Test Positions

213-B-18
Standard
Replacing 704 - 2095

Engineer
Draftsman
Checked by
Made Standard 3.18.26
Log No. P-14431 1.26.25
ISSUE 1
Conversion of 3-B Sounder changed. Log No. R17372 2-16-28 ISSUE 2
Cords 789 were 511 Log No. R17498 2-23-26 ISSUE 3
Was "Provisional" Rated "Standard" Log No. S-8445 3.18.26 ISSUE 4



APPARATUS

2 Plugs #47-B
1 Plug #47-A
2 Cords #511
1 Cord #493
1 Telegraph Key #1-A
1 Sounder #3-B
1 Resistance #18-P
1 Telegraph Relay #21-A

NOTES

1. Battery for the sounder shall be taken from the lead supplying signaling battery to the voltmeter test and connecting cord circuit.
2. There shall be one lead from 24 volt battery equipped with a 1⅓ amp. fuse for each circuit.

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
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TOLL TEST BOARD EQUIPMENT

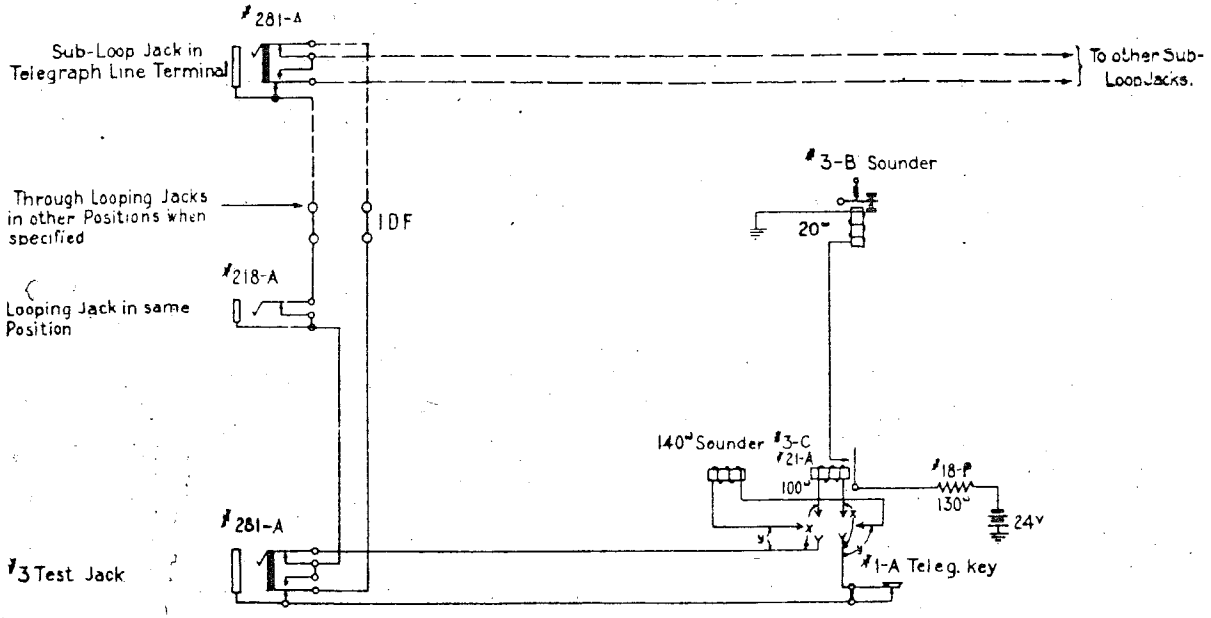
TOLL TEST BOARD NO.5
Telegraph Test Set No.3

213-B-19
Standard
Replacing 704-3017

Engineer
Draftsman
Checked by
Made Standard 3-18-26
Log No. P.14430:126,25
ISSUE 1

3-B Sounder convention changed.
Log No. P.17342 2-13-26
ISSUE 2

Was Prov. rated Std.
Log No. S-8446 3-18-26
ISSUE 3



—APPARATUS—

1 Jack #218-A
1 Jack #281-A
1 Telegraph Key #1-A
1 Sounder #3-B
1 Telegraph Relay #21-A } or
1 Resistance #18-P
1 Main line Sounder #3-C

- NOTE -

① When relay and sounder is desired use 'x' wiring, when main line sounder is desired use y wiring. Relay and sounder shall be furnished unless otherwise specified.

② The battery for the sounder circuit shall be taken from the lead supplying battery to Telegraph Test Set No. 1

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Department of
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TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO 5

Miscellaneous Jack Circuits

213-B-20
Standard

Engineer
Draftsman
Checked by
Made Standard 3.18.26
Log No. P144-29 1.26.25
ISSUE 1
Figures 5,6,7 and 8 added.
Log No. R17373 2-16-28
ISSUE 2
Was Pro rated "Std"
Log No S 8447 3.18.26
ISSUE 3

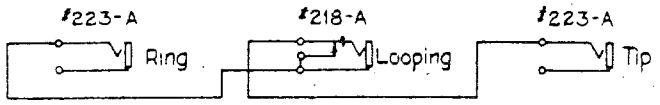
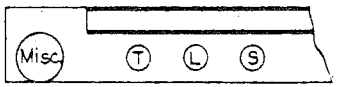


Fig.1 Split Loops



Assembly of Jacks

Fig 2 Grounds

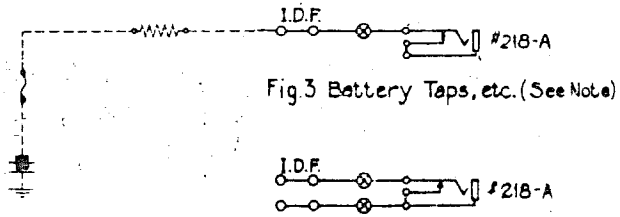


Fig.3 Battery Taps, etc. (See Note)

Fig.4 Spare Test Wires

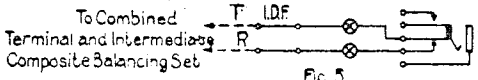


Fig.5

Jack for Combined Terminal and Intermediate Composite Balancing Set Arranged to be used Normally as a Terminal Balancing Set.

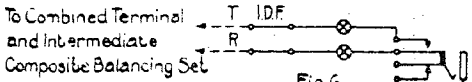
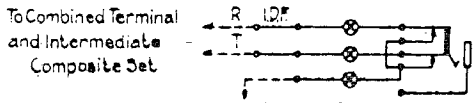


Fig 6

Jack for Combined Terminal and Intermediate Composite Balancing Set Arranged to be used normally as an Intermediate Balancing Set.



Cross-Connect to Composite Set Ground Terminal Block on Distributing Frame.

Fig.7

Jack for Combined Terminal and Intermediate Composite Set Arranged to be used normally as a Terminal Set.

Cross-Connect to Composite Set Ground Terminal Block on Distributing Frame.

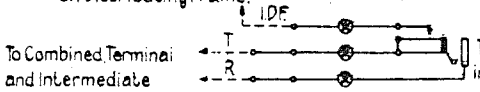


Fig 8

Jack for Combined Terminal and Intermediate Composite Set Arranged to be used normally as an Intermediate Set.

~ APPARATUS ~

Fig.1
2 Jacks #223-A
1 Jack #218-A
Fig.2
1 Jack #218-A
Fig.3
1 Jack #218-A
Fig.4
1 Jack #218-A
Fig.5 or Fig.6
1 Jack #225-A
Fig.7
1 Jack #216
Fig.8
1 Jack #215

~ NOTES ~

Battery Taps which are wired to Jacks shall include a Resistance of at least one Ohm per Volt. These shall not be connected to any line in such a way as to give more than 100 mils line current.

⊗ Indicates Terminal at Top of Position.

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
Development and Research

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO 5

Voltmeter Test Position Apparatus Panel and Piling Rail

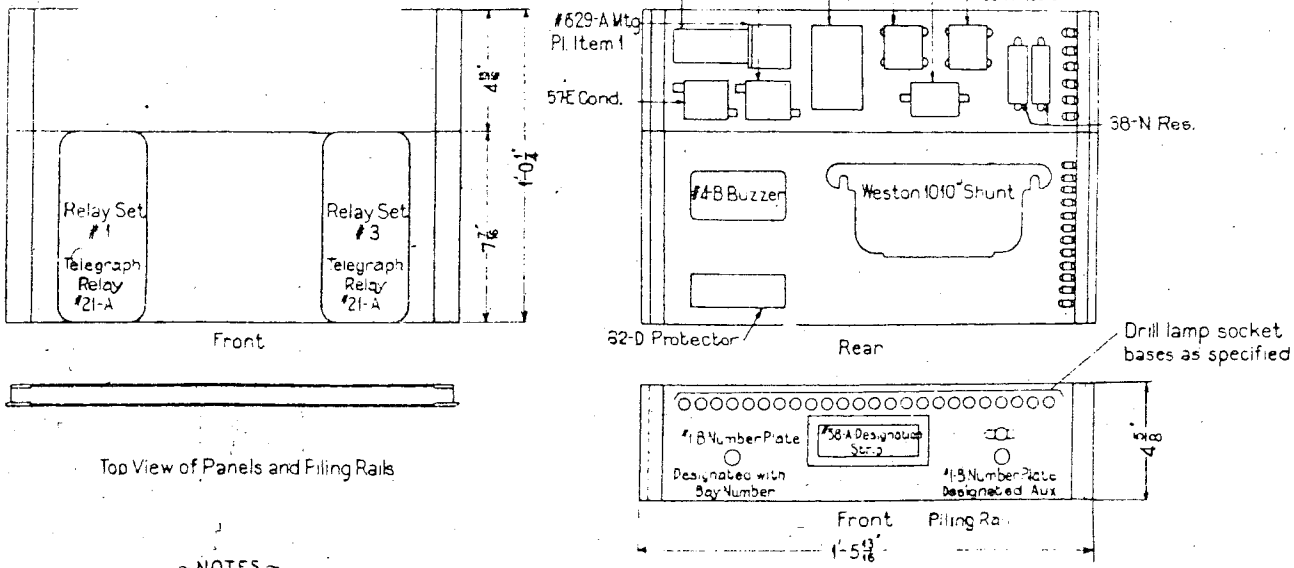
213-B-21
Standard

Engineer
Draftsman
Checked by
Made Standard 3-18-25

Log No P 14428 1-26-25
ISSUE 1

204-A vacuum tube and associated equipment changed for vacuum tube 101-D.
Log No. P-17359 2-18-28
ISSUE 2

Was "Provisional"
Rated "Standard"
Log No S 8448 3-18-28
ISSUE 3



Top View of Panels and Piling Rails

~NOTES~

The Apparatus at the Top of the Apparatus Panel shall be omitted when Vacuum Tube monitoring is not specified

AMERICAN TELEPHONE & TELEGRAPH CO.
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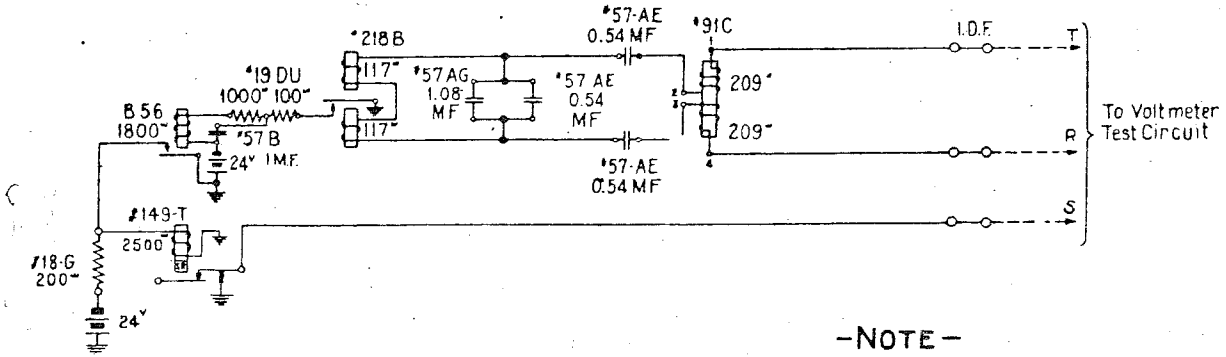
TOLL TEST BOARD EQUIPMENT
TOLL TEST BOARD No. 5
135 CYCLE SIGNAL RECEIVING CIRCUIT
For use with Toll Switchboard No 3

213-B-22
Standard

Engineer
Draftsman
Checked by
Made Standard 5 18 26
Log No. P144 27 1.26.25
ISSUE 1
Convention of relay 149-T changed.
Log No. R17488 2-23-28
ISSUE 2
Was "Provisional" Rated "Standard"
Log No. S-84449 3.18.26
ISSUE 3



—NOTE—

There shall be one lead from the 24 volt battery equipped with a 1⅛ ampere fuse for each circuit.

—APPAPATUS—

1 Relay *218 B
1 Relay B 56
1 Relay #149-T
1 Retardation Coil #91-C
1 Condenser *57 B
1 Condenser *57 AG
3 Condensers *57 AE
1 Resistance #19-DU
1 Resistance #18-G

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
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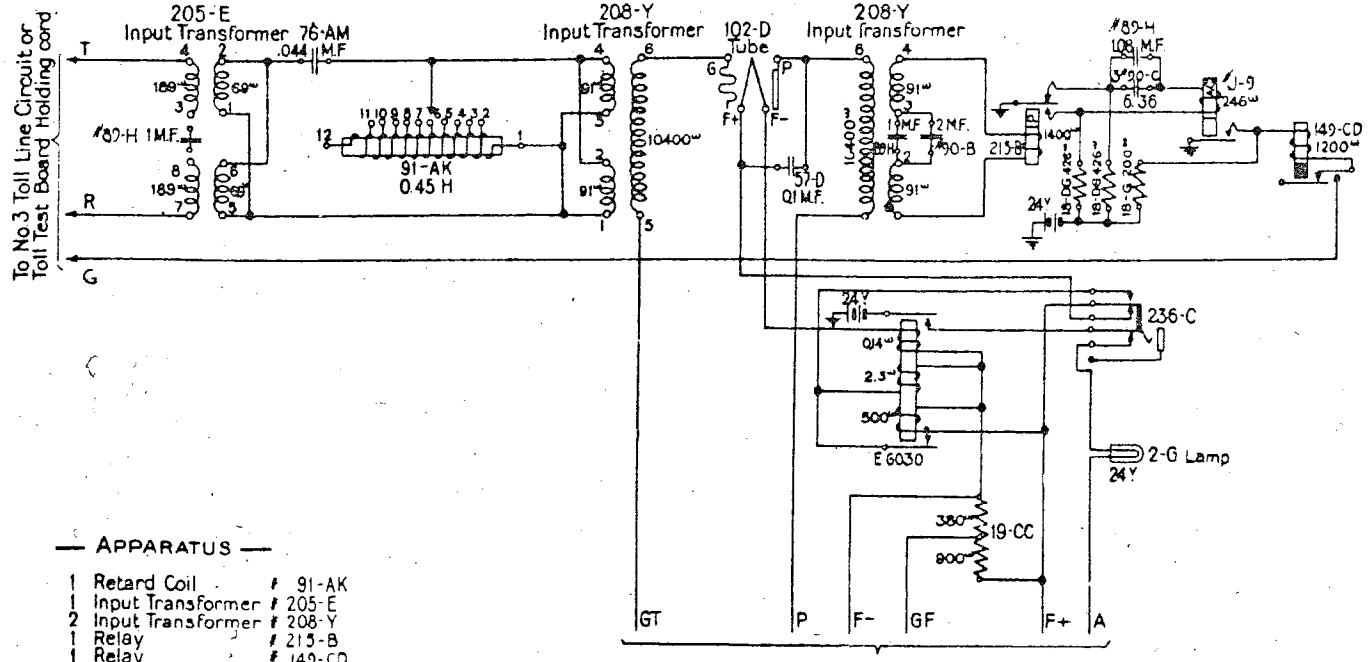
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO 5

1000 Cycle signal receiving Circuit

213-B-23
Standard

Engineer
Draftsman
Checked by
New Drawing
Made Standard 3,18,26
Log No P14426 1-26-25
ISSUE 1
Convention changed
for jack No.236-C
Log No. 17517 2-23-28
ISSUE 2
Was Provisional
Rated "Standard"
Log No. S-84-50 3,18,26
ISSUE 3



— APPARATUS —

1	Retard Coil	# 91-AK
1	Input Transformer	# 205-E
2	Input Transformer	# 208-Y
1	Relay	# 215-B
1	Relay	# 149-CD
1	Relay	# E6030
1	Relay	# J-9
1	Condenser	# 76-AM
3	Condensers	# 89-H
1	Condenser	# 90-B
1	"	# 57-D
3	Condenser	# 90-C
2	Resistance	# 18-DG
1	Resistance	# 18-G
1	"	# 19-CC
1	Jack	# 236-C
1	Lamp	# 2-G
1	Socket	# 13-
1	Lamp Cap	# 2-AY
1	Socket	# 100-L
1	Connecting Block	18-B

— NOTES —

1. Grid Lead shall not be in form with other wires and shall not be more than 8" Long.
2. One Lead from 24 V signaling battery equipped with one 1⅓ amp. fuse may be common to four circuits.
3. #76-AM Condenser should be mounted adjacent to 91-AK retardation coil.
4. Tap on #91-AK retard coil to be selected to resonate circuit to 1000~ ± 1.5 % before circuit is placed in service.

AMERICAN TELEPHONE & TELEGRAPH CO
Department of
Development and Research

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO 5

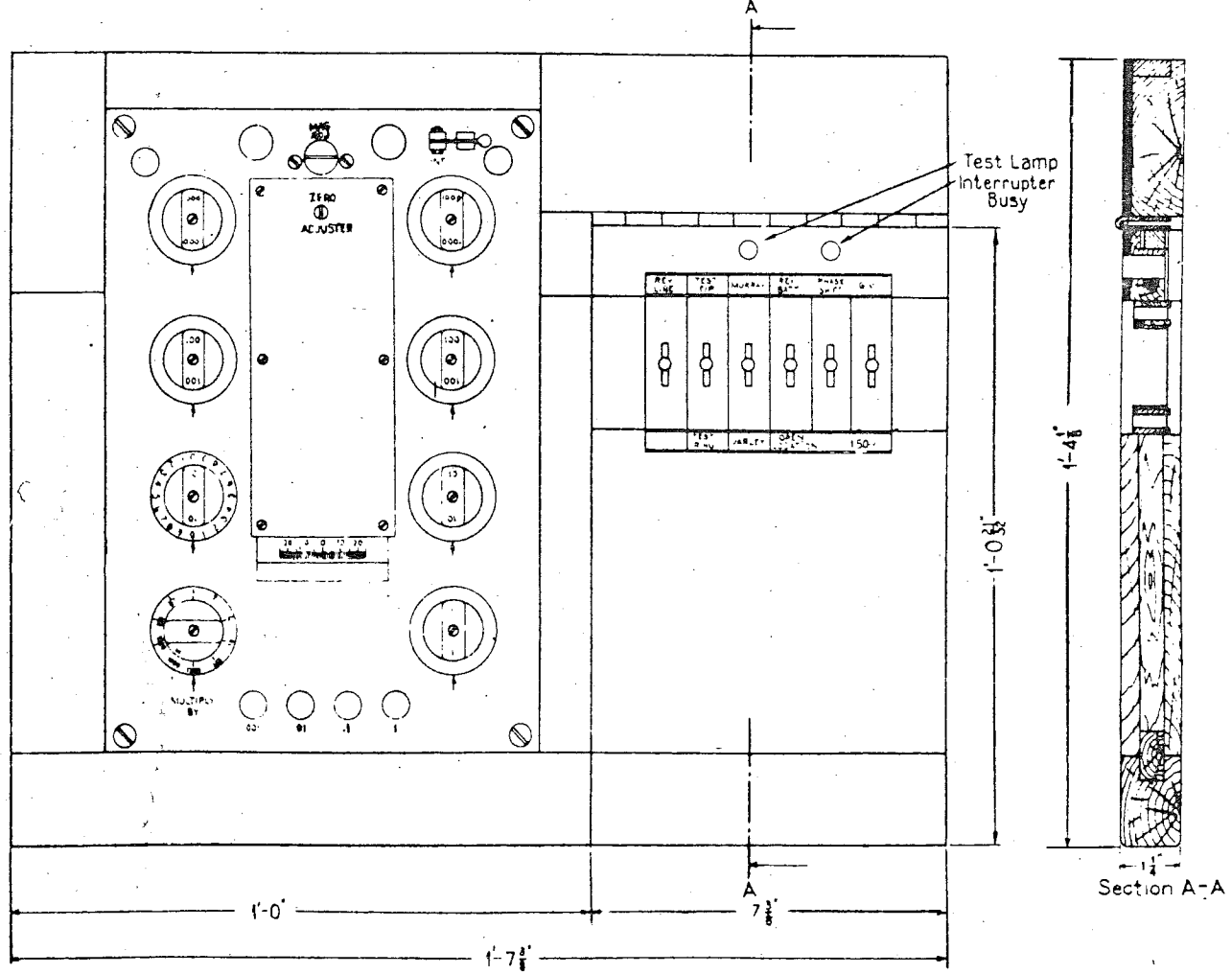
Keyshelf of Wheatstone Bridge Test Position
With Wheatstone Bridge per KS 3011

213-B-24
Standard
Replacing 704-2072

Engineer W. W.
Draftsman
Checked by
Made Standard 3.18.26
Log No. P-144 25, 126 25
ISSUE 1

Phase Shifter key was added.
Log No. R-175 48 2-23-28
ISSUE 2

Was Provisional
Rated Standard"
Log No. S 84 51 3.18.26
ISSUE 3



AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
Development and Research

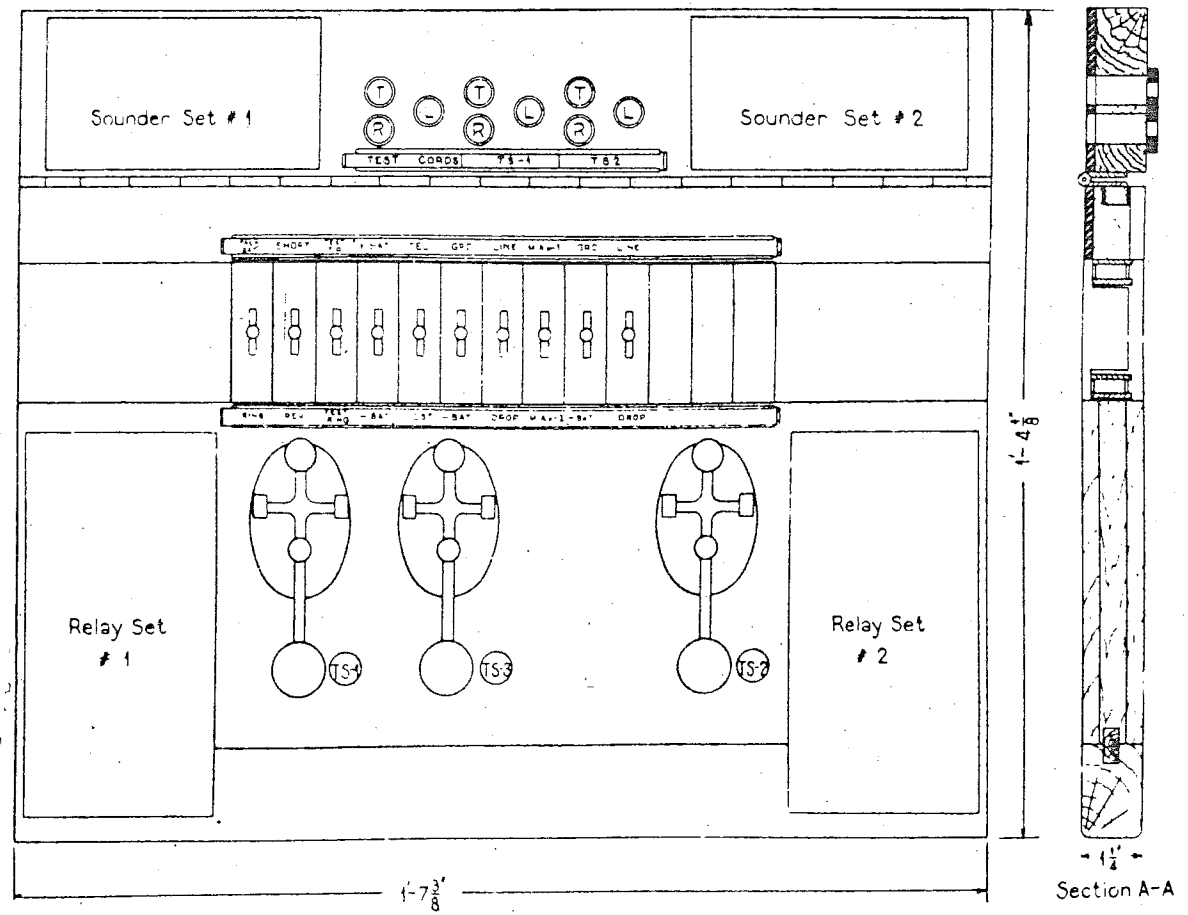
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO 5

Keyshelf of Telegraph Test Position

213-B-25
Standard
Replacing 704-2073

Engineer W. W. N.
Draftsman
Checked by
Media Standard 3-18-26
Log No P-144 20 1,26 25
ISSUE 1
Cords marked "T" "R" and "L"
Log No R-175 49 2-23-28
ISSUE 2
Was Provisional Std.
Log No S-8452 3-18-26
ISSUE 3



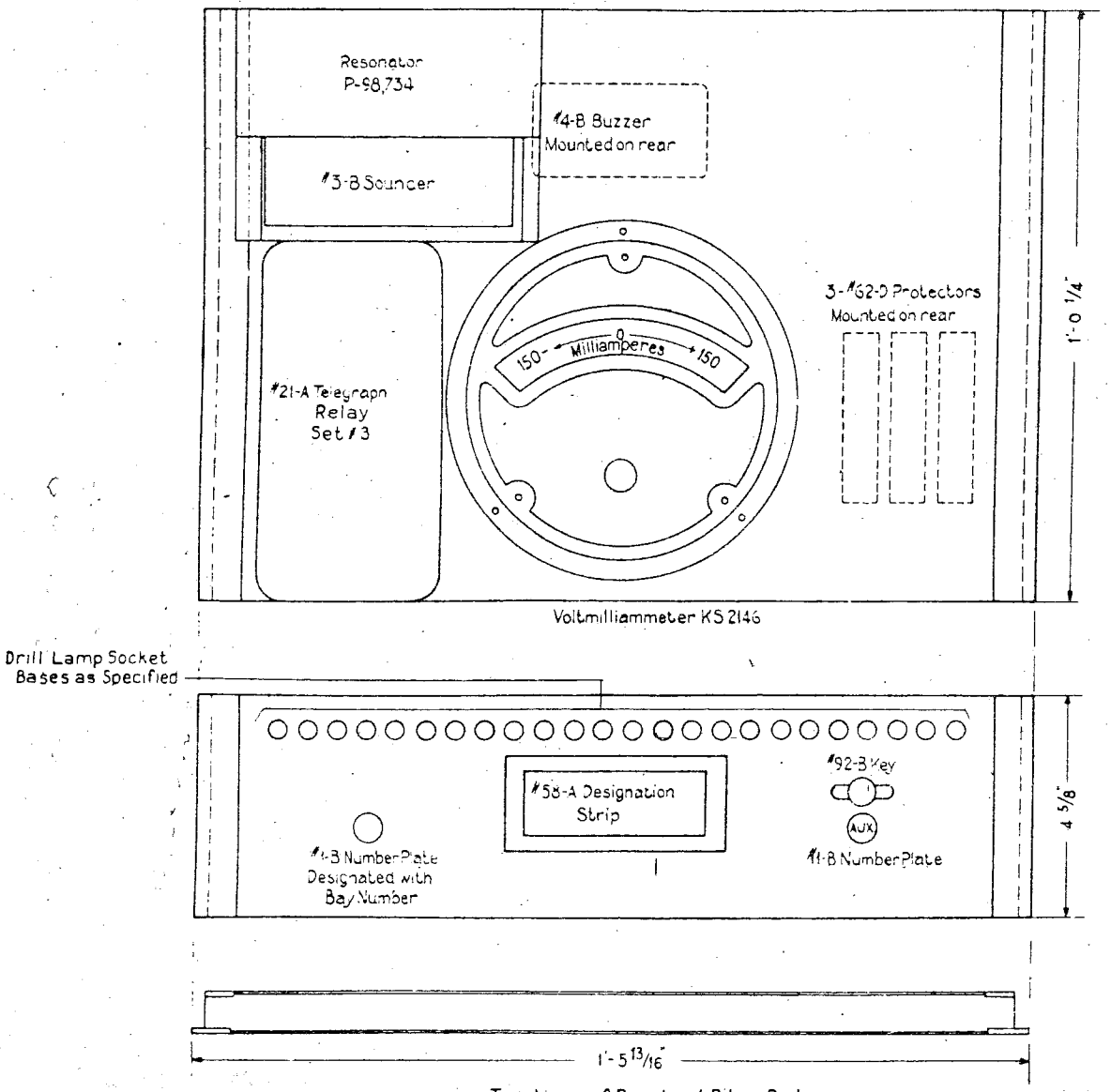
AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
Development and Research

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO. 5
Telegraph Test Position
Apparatus Panel and Piling Rail

213-B-26
Standard

Engineer W.W.N.
Draftsman C.H.J.
Checked by
Made Standard 3.18.26
Log No. P 14419 1.26.25
ISSUE 1
Number plates 1-B and protectors 62-D were added.
Log No. R 17520 2-23-28
ISSUE 2
Was Provisional Rated Standard
Log No. S 8453 3.18.26
ISSUE 3



1.26

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
Development and Research

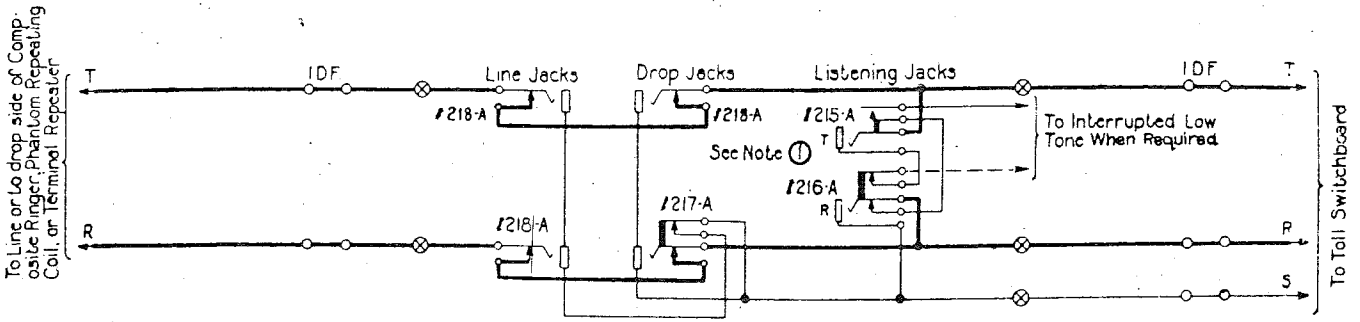
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

6 Jack Toll Line Circuit

213-B-27
Standard
Replacing 704-3003

Engineer
Draftsman
Checked by
Made Standard 3-18-26
Log No. P.14456 1,26
ISSUE 1
Fig.2 and Note 2 added
Log No. P17337 2-13-28
ISSUE 2
Interrupted low-tone" connections marked "when required"
Log No. R17497 2-23-28
ISSUE 3
Was Prov. rated Std.
Log No. S-8454 3-18-26
ISSUE 4



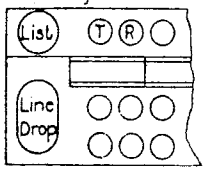


Fig. 1

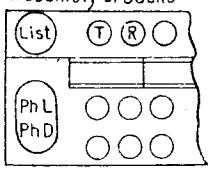


Fig. 2

-APPARATUS-

1 Jack /215-A
1 " /216-A
1 " /217-A
3 Jacks /218-A

Terminal Strip Arrangement
At Top of Position

R	T	R	T	R	T	R	T	
8	7	6	5	4	3	2	1	
O	O	O	O	O	O	O	O	L
8	7	6	5	4	3	2	1	
O	O	O	O	O	O	O	O	D
15-16	13-14	11-12	9-10	7-8	5-6	3-4	1-2	
O	O	O	O	O	O	O	O	S
16	15	14	13	12	11	10	9	
O	O	O	O	O	O	O	O	L
16	15	14	13	12	11	10	9	
O	O	O	O	O	O	O	O	D

Fig. 5

Terminal Strip Arrangement
At V.I.D.F.

R	T	R	T	
4	3	2	1	
O	O	O	O	L
4	3	2	1	
O	O	O	O	D
7-8	5-6	3-4	1-2	
O	O	O	O	S
8	7	6	5	
O	O	O	O	L
8	7	6	5	
O	O	O	O	D

Fig. 6

-NOTES-

① To connect Trouble Tone across tip and ring of line insert a /116 plug in the Tip listening jack.

② For secondary cable boards the designations of Fig.1 shall be used. For non-composited open wire phantoms the designations of Fig. 2 shall be used.

⊗ Indicates terminal at top of position.

American Tel & Tel Co.
Dept of
Dev. & Res.

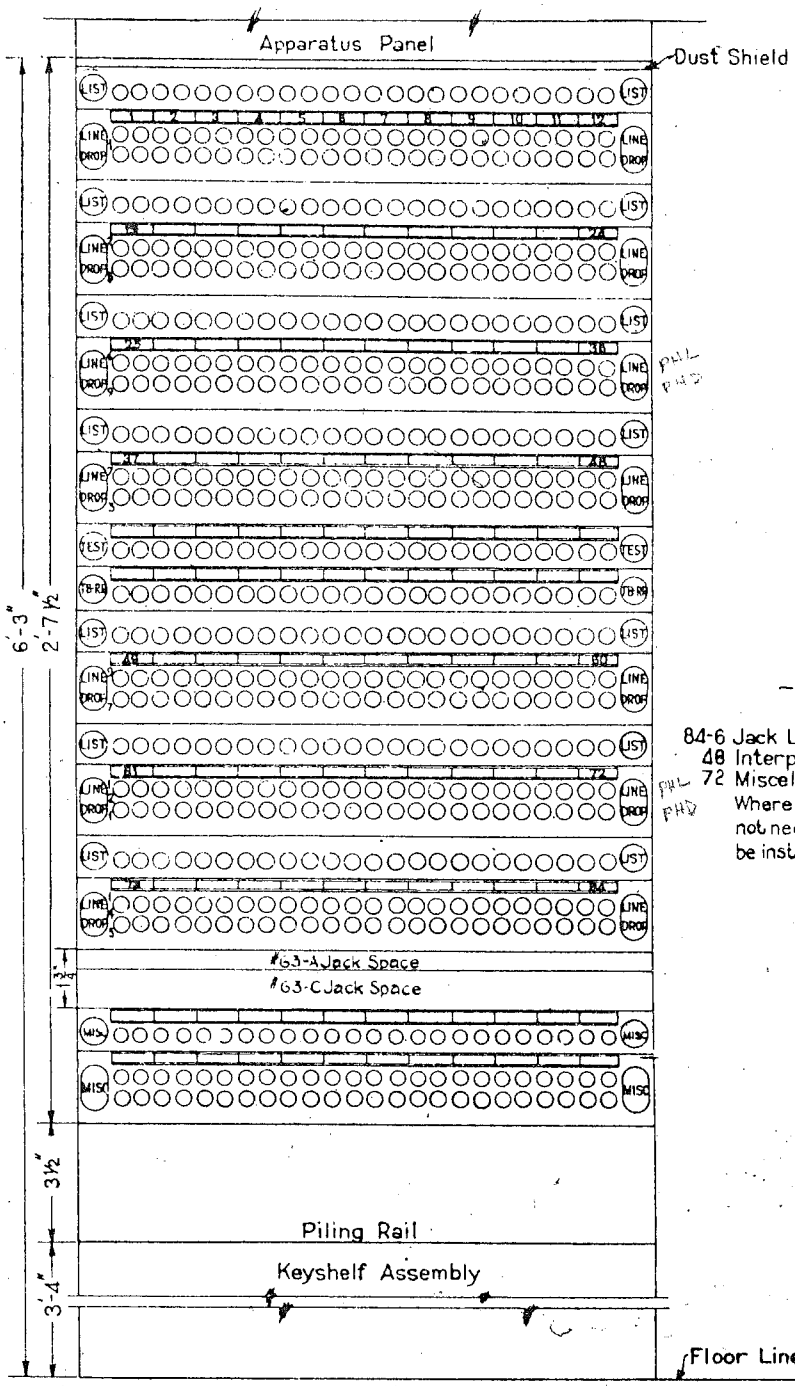
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Typical Arrangement of Jack Panel for 6 Jack Line Circuits

213-B-28
Standard
Replacing 704-3014

Engineer W.H.H.
Draftsman
Checked by
Made Standard 3.18.26
Log No. P.14454; 1.26.25
ISSUE 1
Was "Provisional"
Rated "Standard"
Log No S 8455 3.18.26
ISSUE 2



— NOTES —

Capacity
84-6 Jack Line Circuits
48 Interposition Trunk Jacks
72 Miscellaneous Jacks
Where Miscellaneous Jacks are not needed Jack Spacers may be installed in their Place.

Amer. Tel. & Tel. Co.
Dept. of
Dev. & Res.

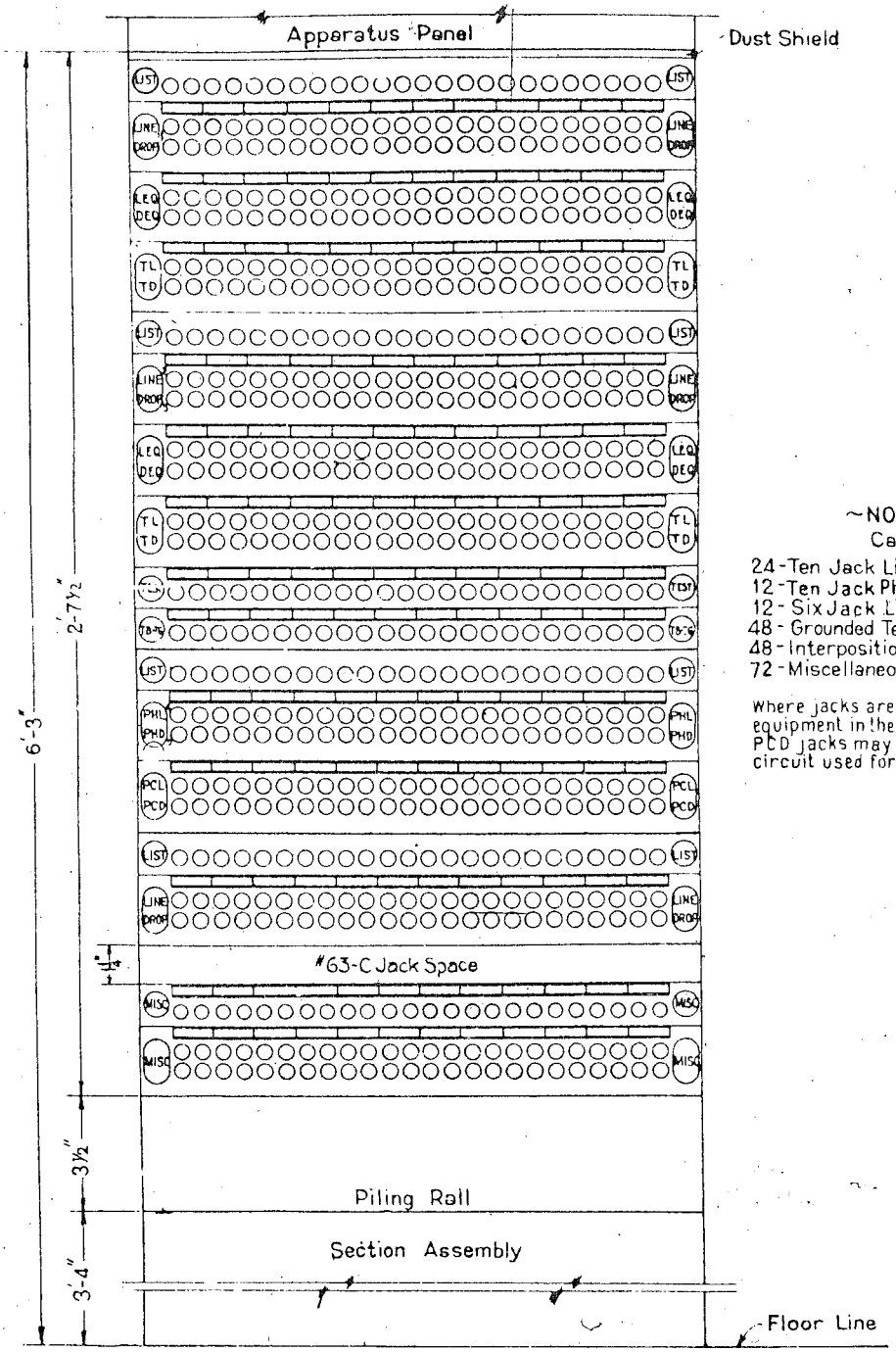
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Typical Arrangement of Jack Panel for Composited Open Wire Lines With 10 Jack Line Circuits and 10 Jack Phantom Circuits.

213-B-29
Standard

Engineer W.W.W.
Draftsman
Checked by
Made Standard 3.18.25
Log No. P144451 1.26.25
ISSUE 1
Designations strips were removed from "List" jack mountings.
Log No. R47513 2-23-28
ISSUE 2
Was "Provisional Std."
Log No. S 8456 3.18.26
ISSUE 3



~NOTES~

Capacity

24 - Ten Jack Line Circuits
12 - Ten Jack Phantom Circuits
12 - Six Jack Line Circuits
48 - Grounded Telegraph Circuits
48 - Interposition Trunk Jacks
72 - Miscellaneous Jacks

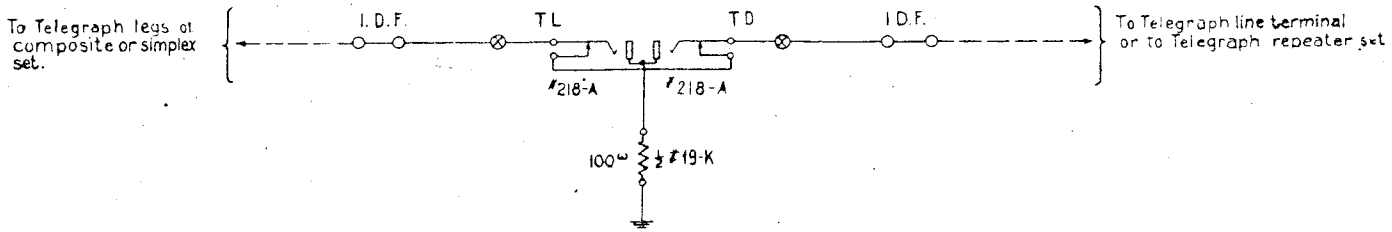
Where jacks are not required for terminating equipment in the phantom circuit the PCL and PCD jacks may be omitted and a six-jack line circuit used for the phantom circuits.

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
Development and Research

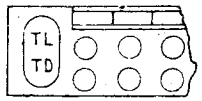
TOLL TEST BOARD EQUIPMENT
TOLL TEST BOARD NO. 5
Grounded Telegraph Line

213-B-30
Standard

Engineer J.W.B.
Draftsman
Checked by
Made Standard 3-18-26
Log No. P.14467, L.2&25
ISSUE 1
Designations TL and TD were ML and MD
Log No. P.17377 2-16-28
ISSUE 2
Was Prov. rated Std.
Log No. S-8457 3-16-26
ISSUE 3



Arrangement of Jacks



APPARATUS

2 Jacks #218-A
1/2 Resistance #19-K
per Strip of 48 Jacks

—NOTE—

⊗ Indicates terminal at top of position

Amer. Tel. & Tel. Co.
Dept. of
Dev. & Res

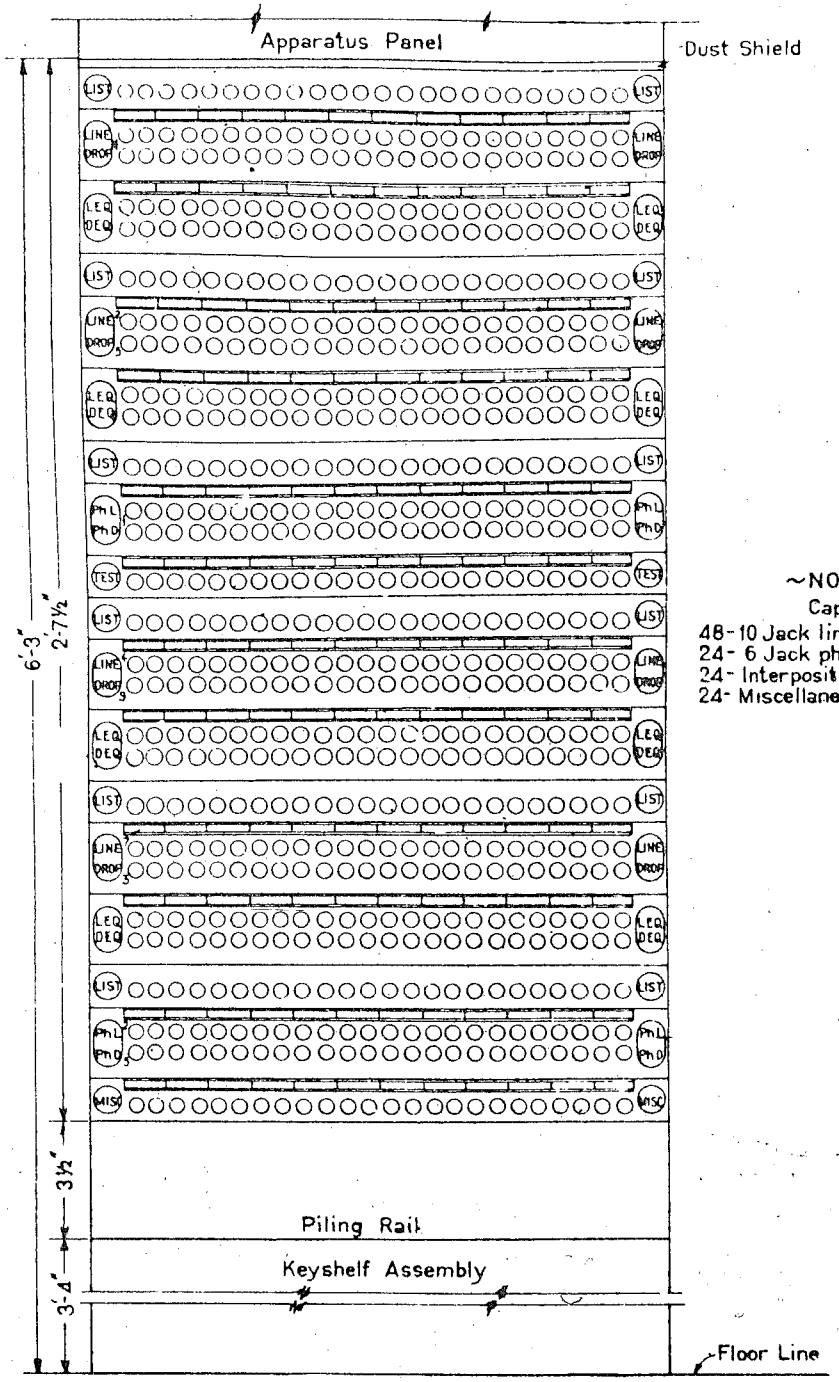
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Typical Arrangement of Jack Panel for non-composited Open Wire Lines With 10-Jack Line Circuits and 6-Jack Phantom Circuits.

213-B-31
Standard

Engineer
Draftsman
Checked by
Made Standard 3.18.26
Log No. P.14-4-59 1.2625
ISSUE 1
In the title "Non-Composited Open-Wire Lines" was "Phantom"
Log No. P.17614 2-23-28
ISSUE 2
Was "Provisional" Rated "Standard"
Log No. 3-84-58 3.18.26
ISSUE 3



~NOTES~

Capacity

48-10 Jack line circuits
24- 6 Jack phantom circuits
24- Interposition trunk jacks
24- Miscellaneous jacks.

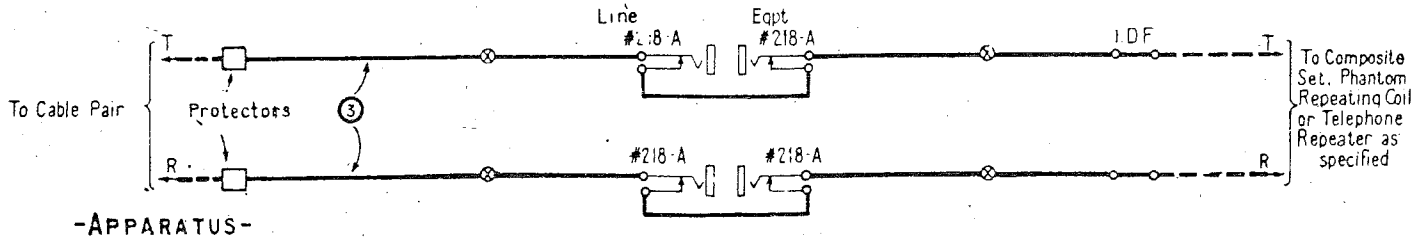
AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
Development and Research

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5
Four Jack Cable Circuit.

213-B-32
Standard
Replacing 704 - 3004

Engineer W.W.S.
Draftsman
Checked by
Made Standard 3-18-26
Log No P-14461 1.2625
ISSUE
Note 3 added.
Log No. R-1343 2-13-26
ISSUE 2
Was Prov. rated Std.
Log No. S-8459 3-18-26
ISSUE 3



-APPARATUS-

4-Jacks #218-A

Terminal Strip Arrangement at Top of Position

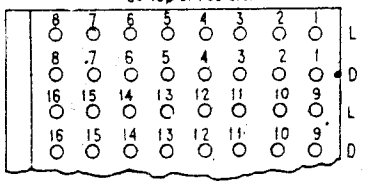


Fig. 2

Terminal Strip Arrangement at V.I.D.F.

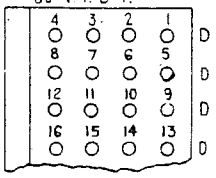


Fig 3

Assembly of Jacks

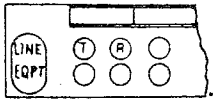


Fig 1

-NOTES-

① The number of cables to be used in each Primary test board position shall be as specified to secure the proper separation between "east" transmitting and "west" transmitting pairs of four wire circuits

⊗ Designates terminal at top of position

③ This cable pair may be wired through the I.D.F. when specified.

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
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TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO. 5

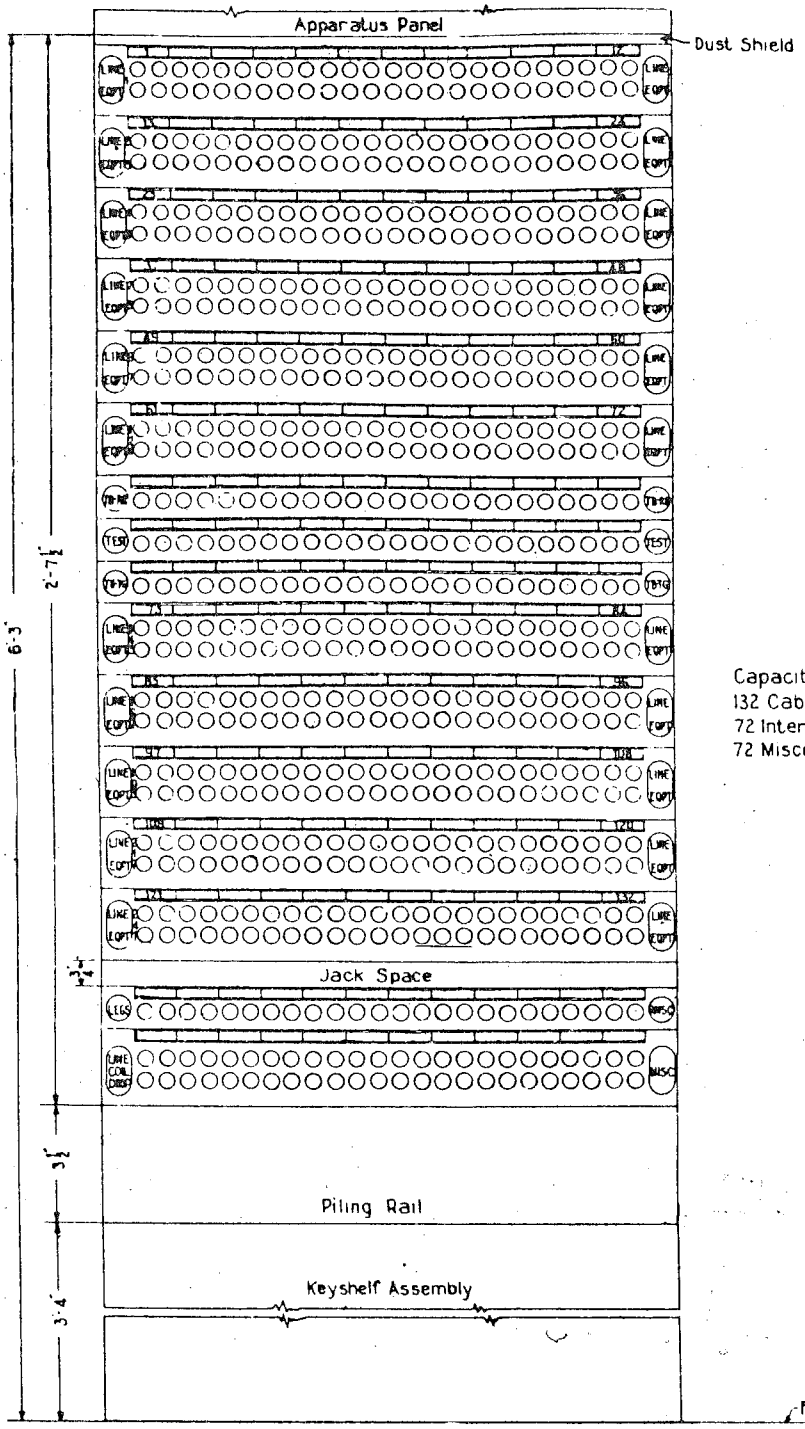
Typical Arrangement of Jack Panel
For Primary Testboard Positions

213-B-33
Standard
Replacing 704-3013

Engineer
Draftsman
Checked by
Made Standard 3.18.26
Log No P.144 57.1.26.28
ISSUE 1

Designations "TB-RR" and "TB-TG" were interchanged.
Log No R-17515 2-23-28
ISSUE 2

Was "Provisional Rated "Standard"
Log No S-8460 3.18.26.
ISSUE 3



NOTES

Capacity
132 Cable pairs
72 Interposition trunk Jacks
72 Miscellaneous Jacks

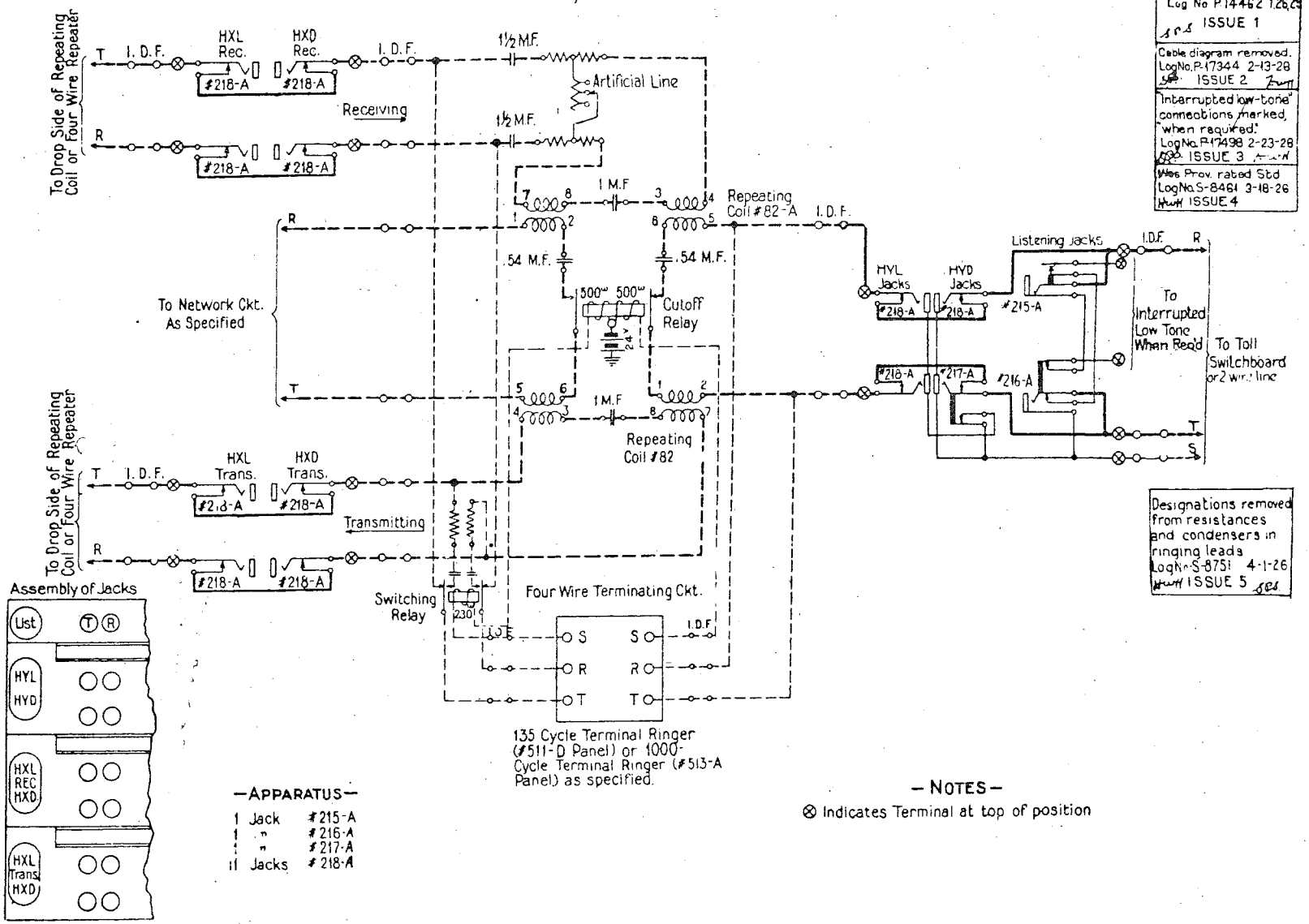
AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
Development and Research

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO. 5
Four Wire Terminating Circuit
Wiring of Jacks at Toll Test board.

213-B-34
Standard
Replacing 704-3001

Engineer H. W. N.
Draftsman
Checked by
Made Standard 3-18-26
Log No P-14462 1-26-26
ISSUE 1
Cable diagram removed.
Log No. P-17344 2-13-28
ISSUE 2
"Interrupted low-tone" connections marked, "when required."
Log No. P-17498 2-23-28
ISSUE 3
Mtce Prov. rated Std
Log No. S-8461 3-18-26
ISSUE 4



Designations removed from resistances and condensers in ringing leads
Log No. S-8751 4-1-26
ISSUE 5

—APPARATUS—

1	Jack	#215-A
1	"	#216-A
1	"	#217-A
11	Jacks	#218-A

—NOTES—

⊗ Indicates Terminal at top of position

AMERICAN TELEPHONE & TELEGRAPH CO
Department of
Development and Research

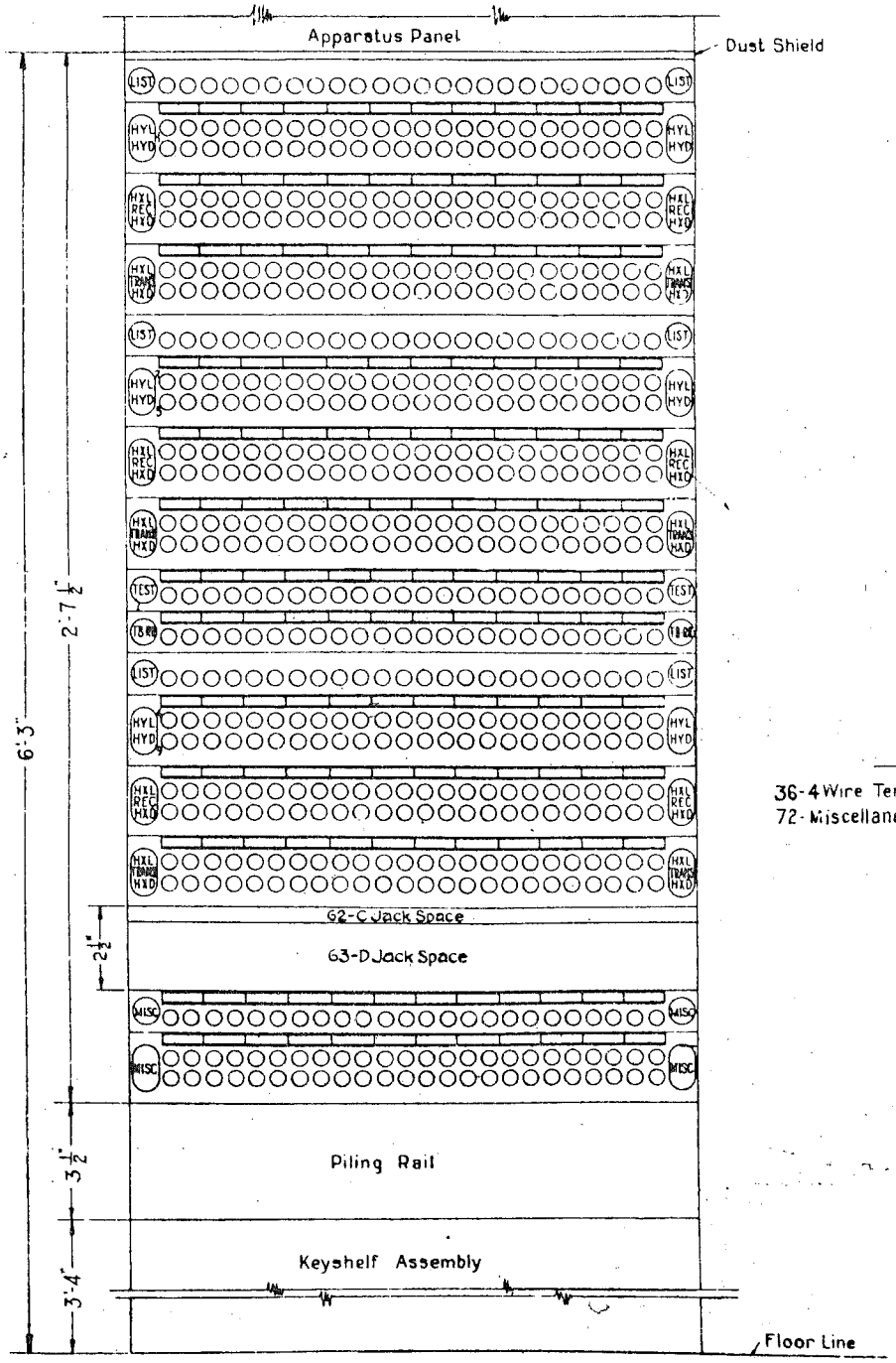
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Typical Arrangement of Panel for 4 Wire Terminating Circuits.

213-B-35
Standard

Engineer W. ... K
Drafter ... GK
Checked By
Made Standard 3.18.26
Log No. P144 Sc.1.2629
ISSUE 1
Designations strips were removed from list jack mountings.
Log No. P17546 2-23-28
ISSUE 2
Was "Provisional" Rated "Standard"
Log No. S-8462 3.18.26
ISSUE 3



—NOTE—
36-4 Wire Terminating Circuits
72-Miscellaneous Jacks

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
Development and Research

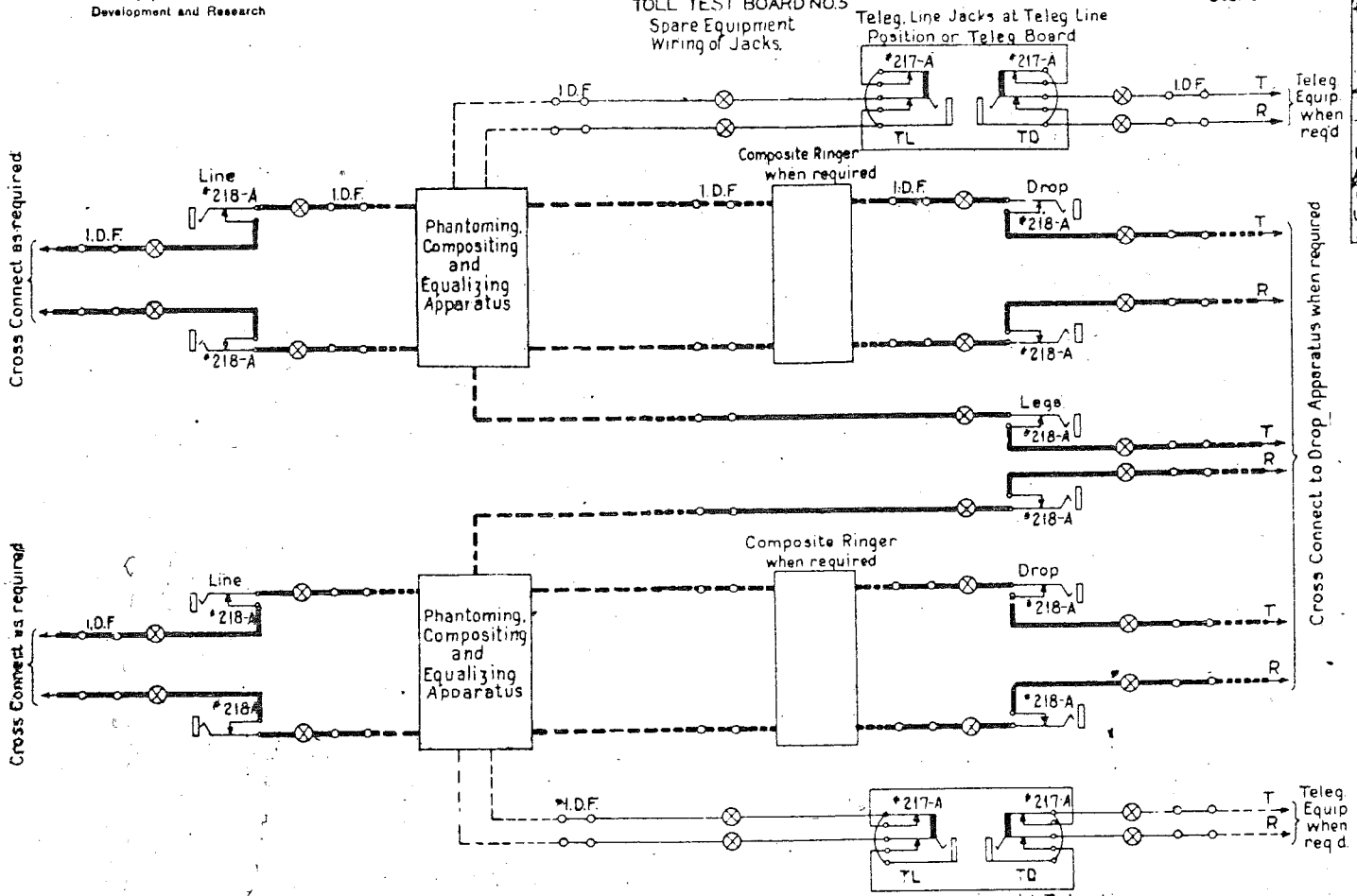
TOLL TEST BOARD EQUIPMENT

213-B-36
Standard

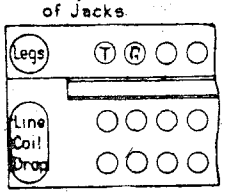
Engineer W. W. H.
Draftsman
Checked By
Made Standard 3-18-26
Log No P 14469 1-26-25
ISSUE 1
TL and TD designations were ML and MD
Log No P.17345 2,13,26
ISSUE 2
Was Prov. rated Std.
Log No S-8463 3-18-26
ISSUE 3

TOLL TEST BOARD NO. 5

Spare Equipment
Wiring of Jacks.



Arrangement of Jacks.



—APPARATUS—

At Primary Test Board Position
10 Jacks #218-A

At Telegraph Test Position
4 Jacks #217-A

—NOTES—

1. Composite sets, repeating coils or composite ringer sets to be connected to jacks as required
2. Where spare composite sets are provided the teleg. legs shall be connected to jacks in the teleg. line position or teleg. board
3. #19 guage duplex cable shall be used between the test board and the I.D.F.

⊗ Indicates terminal at top of position.

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
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TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO. 5

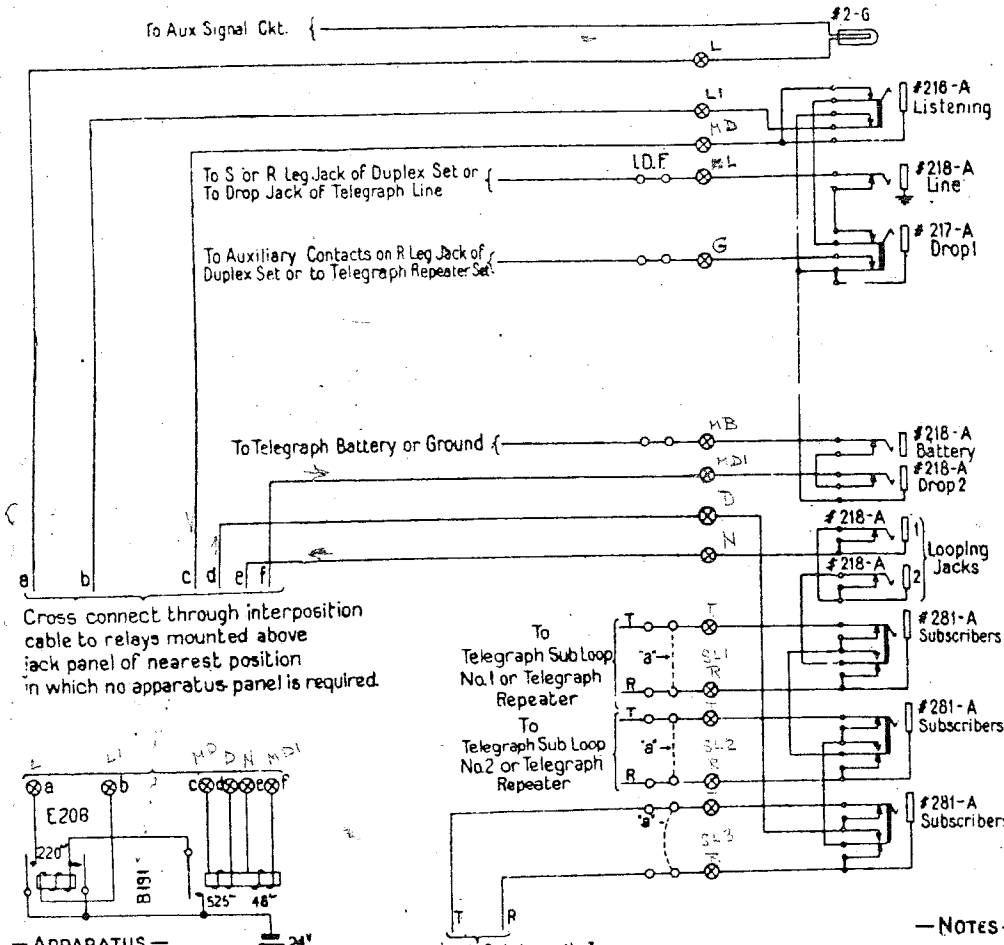
Telegraph Line Terminal

213-B-37
Standard
Replacing 704-3019

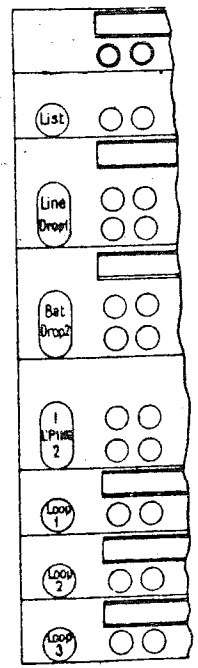
Engineer J.W.M.
Draftsman
Checked by
Made Standard 3,18,26
Log No P-14455, 1,26,25
ISSUE 1

Terminals shown for relays E-208 and B-191
Log No. R17374, 2-16-26
ISSUE 2

Was "Provisional"
Rated "Standard"
Log No. S-8464 3,18,26
ISSUE 3



Assembly of Jacks



— APPARATUS —

1	Relay	E 206
1	"	B 191
1	Jack	# 216-A
1	"	# 217-A
5	Jacks	# 218-A
3	"	# 281-A
1	Lamp	# 2-6
1	Lampcap	# 2-AY
1	Lampsocket	# 13

— NOTES —

1. Telegrah subscribers Loop Jacks shall be short circuited at the I.D.F. as shown by straps "a" when not connected to a Loop or a repeater.
3. To remove a subscriber's Loop or repeater from the circuit, insert a cordless plug in the corresponding subscriber's Loop Jack.
4. There shall be one lead from 24 volt battery equipped with 1½ ampere fuse for each two Telegraph Line terminals.
5. ⊗ Indicates terminals at top of position.

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
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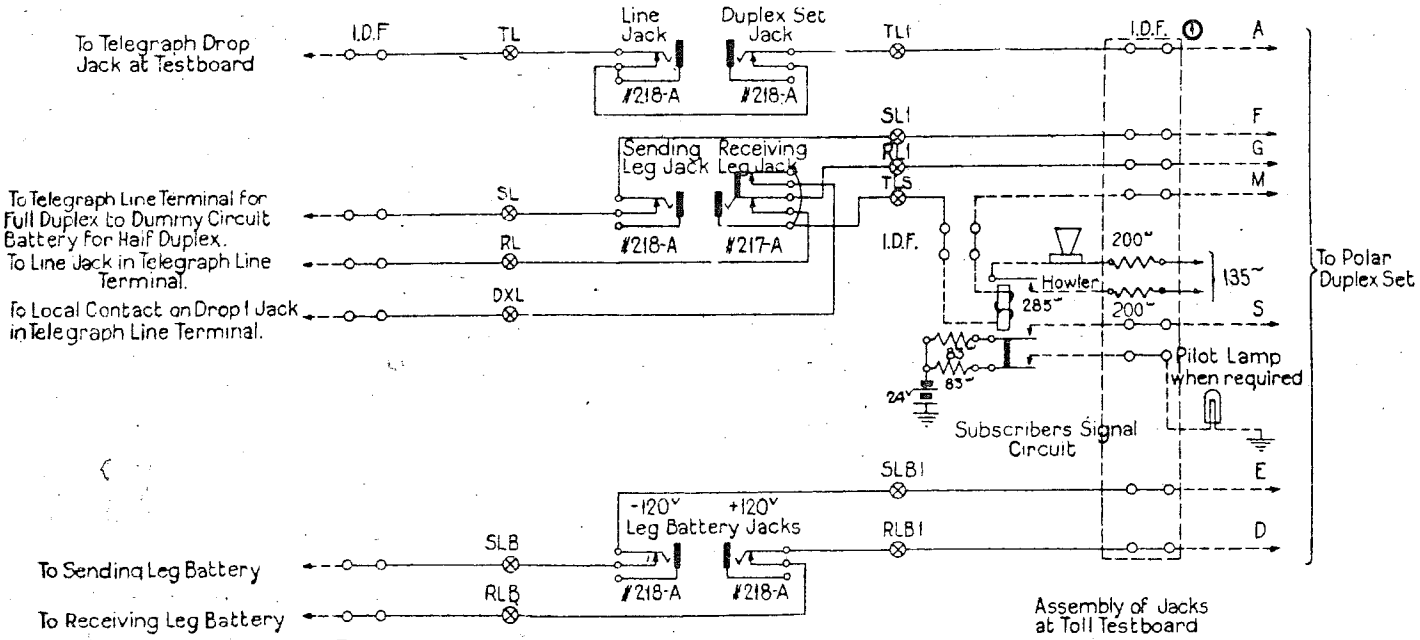
TOLL TEST BOARD EQUIPMENT

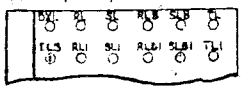
TOLL TEST BOARD NO.5
Polar Duplex Circuit
Wiring of Jacks

213-B-38
Standard
Replacing 704-3121

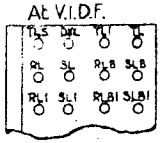
Engineer W. L. H.
Draftsman LFF
Checked by
Made Standard 3.13
Log No. P-14471; 1,27,25
ISSUE 1
Howler convention changed
Log No P-17340 2.13.2
ISSUE 2
Note 1 added.
Log No. P-17498 2-23-28
ISSUE 3
Was Pro "rated "Std."
Log No. S-8465 3.18.26
ISSUE 4



TERMINAL STRIP ARRANGEMENT
At top of positions

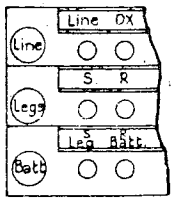


At V.I.D.F.



APPARATUS
5 Jacks #218-A
1 Jack #217-A

Assembly of Jacks at Toll Testboard



NOTES

⊗ Indicates terminal at top of position.
① The I.D.F cross connections may be omitted in installations where not specified.

AMERICAN TELEPHONE & TELEGRAPH CO.
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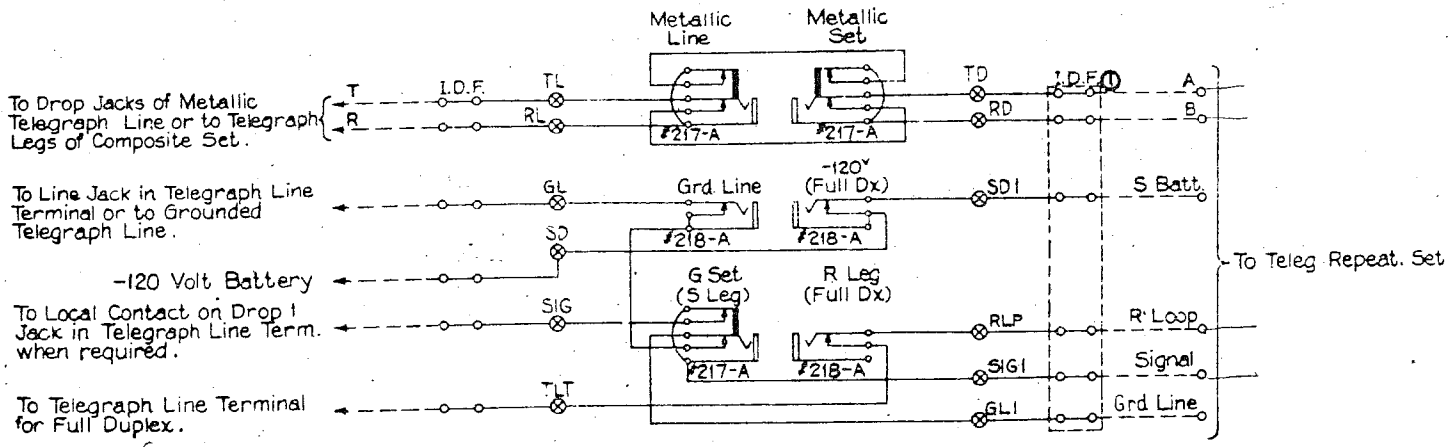
TOLL TEST BOARD EQUIPMENT

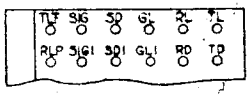
TOLL TEST BOARD NO.5
Terminal Metallic Telegraph Repeater Set
Wiring of Jacks

213-B-39
Standard

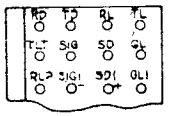
Engineer
Draftsman
Checked by
Mode Standard 3-18-26
Log No P-14487 T-2725
ISSUE 1
Note 1 added.
Log No.P-14487 2-23-26
ISSUE 2
Was Prov. rated Std.
Log No.S-8466 3-18-26
ISSUE 3



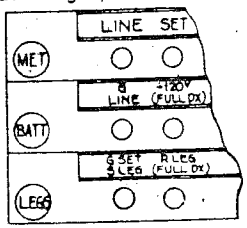
Terminal Strip Arrangement at Top of Position



At V.I.D.F.



Assembly of Jacks at Telegraph Board



APPARATUS

3 Jacks #217-A
3 #218-A

NOTES

⊗ Indicates terminal at top of position.
① The I.D.F. cross connections may be omitted in installations where not specified.

AMERICAN TELEPHONE & TELEGRAPH CO.
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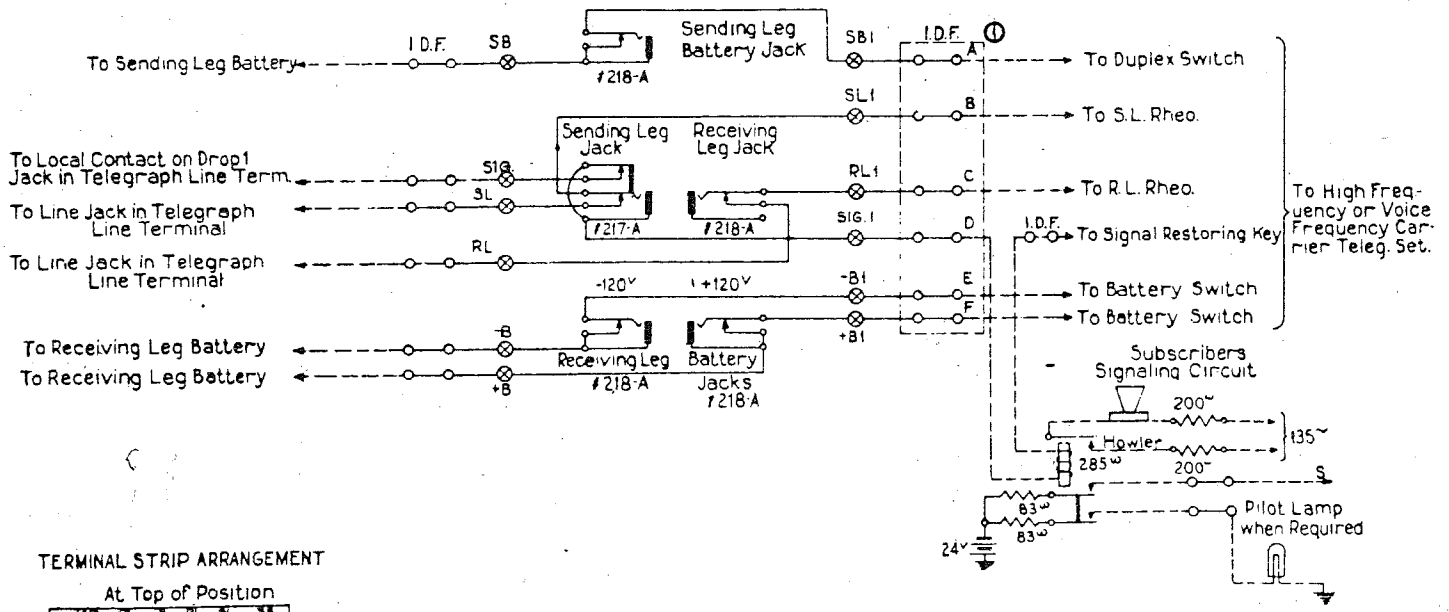
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Wiring of Jacks for Voice Frequency and High Frequency Carrier Telegraph Systems

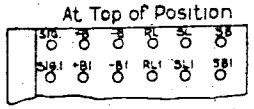
213-B-40
Standard
Replacing 704-3122

Engineer
Draftsman
Checked by
Made Standard 3-18-26
Log No P14470 1,26,25
ISSUE 1
Howler connection changed
Log No P17339 2-13-26
ISSUE 2
Note 1 added.
Log No P17500 2-23-26
ISSUE 3
Was Prov rated Std
Log No S-8467 3-18-26
ISSUE 4

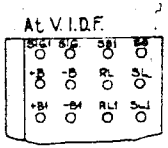


TERMINAL STRIP ARRANGEMENT

At Top of Position



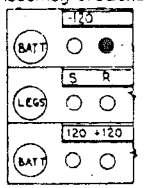
At V.I.D.F.



APPARATUS

4 Jacks #218-A
1 Jack #217-A

Assemoly of Jacks



NOTE

⊗ Indicated terminal at top of position
① The I.D.F cross connections may be omitted in installations where not specified.

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Dept. of
Dev. & Res.

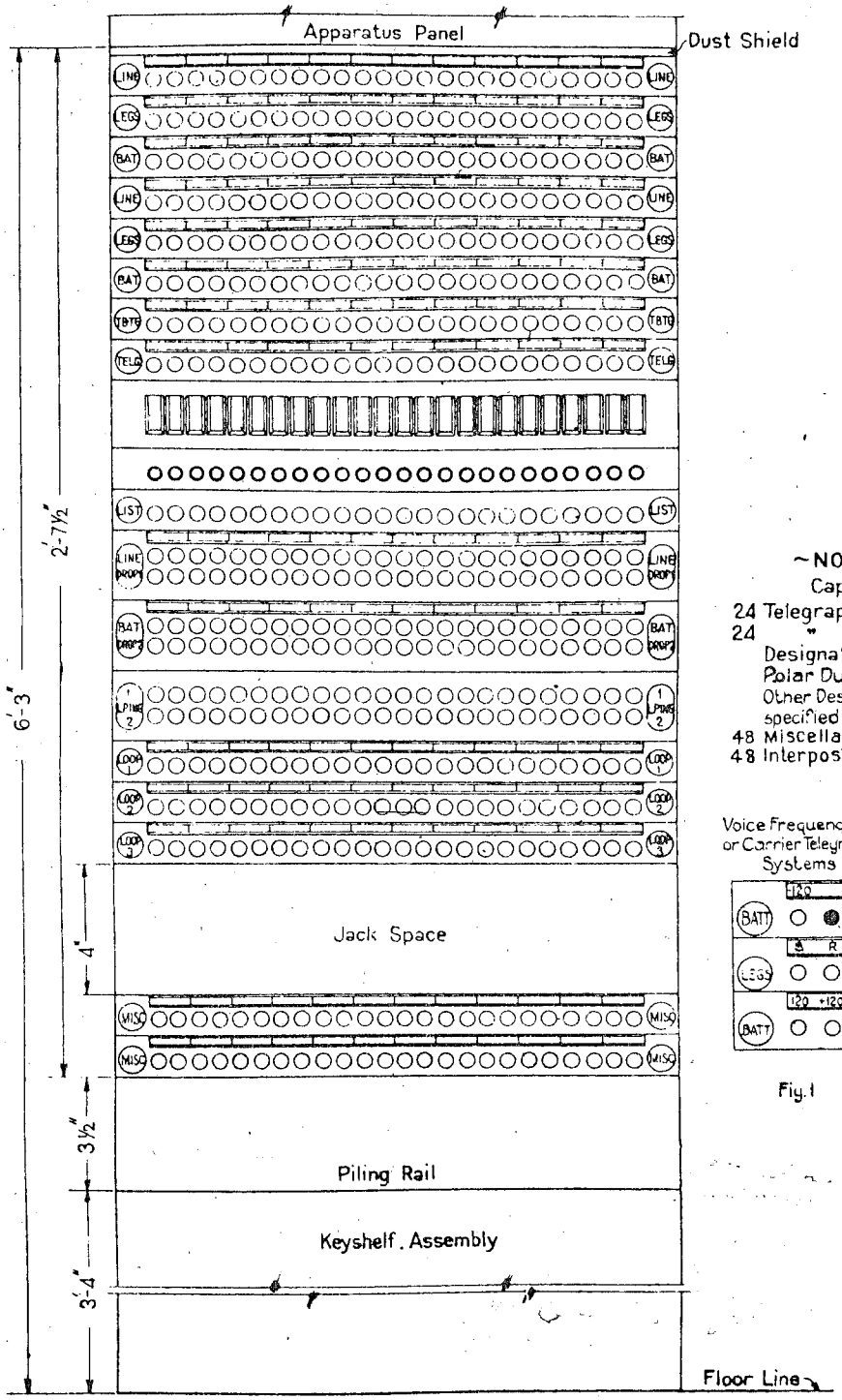
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Typical Arrangement of Jack Panel for Terminal Telegraph Test Positions.

213-B-41
Standard
Replacing 704-2070

Engineer W.W.
Draftsman
Checked by
Made Standard 3.18.26
Log No P-14452 1,2625
ISSUE 1
Figures 1 and 2 were added
Log No. R-17378 2-16-28
ISSUE 2
Was "Provisional"
Rated "Standard"
Log No. S-8468 3.18.26
ISSUE 3



~NOTES~

Capacity
24 Telegraph Repeaters
24 " Line Terminals
Designations shown are for Polar Duplex Telegraph.
Other Designations may be specified as follows.
48 Miscellaneous Jacks
48 Interposition Trunks

Voice Frequency or Carrier Telegraph Systems

Fig. 1

No. 102-A Metallic Telegraph Repeater Set Jacks

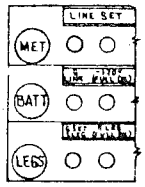


Fig. 2

AMERICAN TELEPHONE & TELEGRAPH CO.
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TOLL TEST BOARD EQUIPMENT

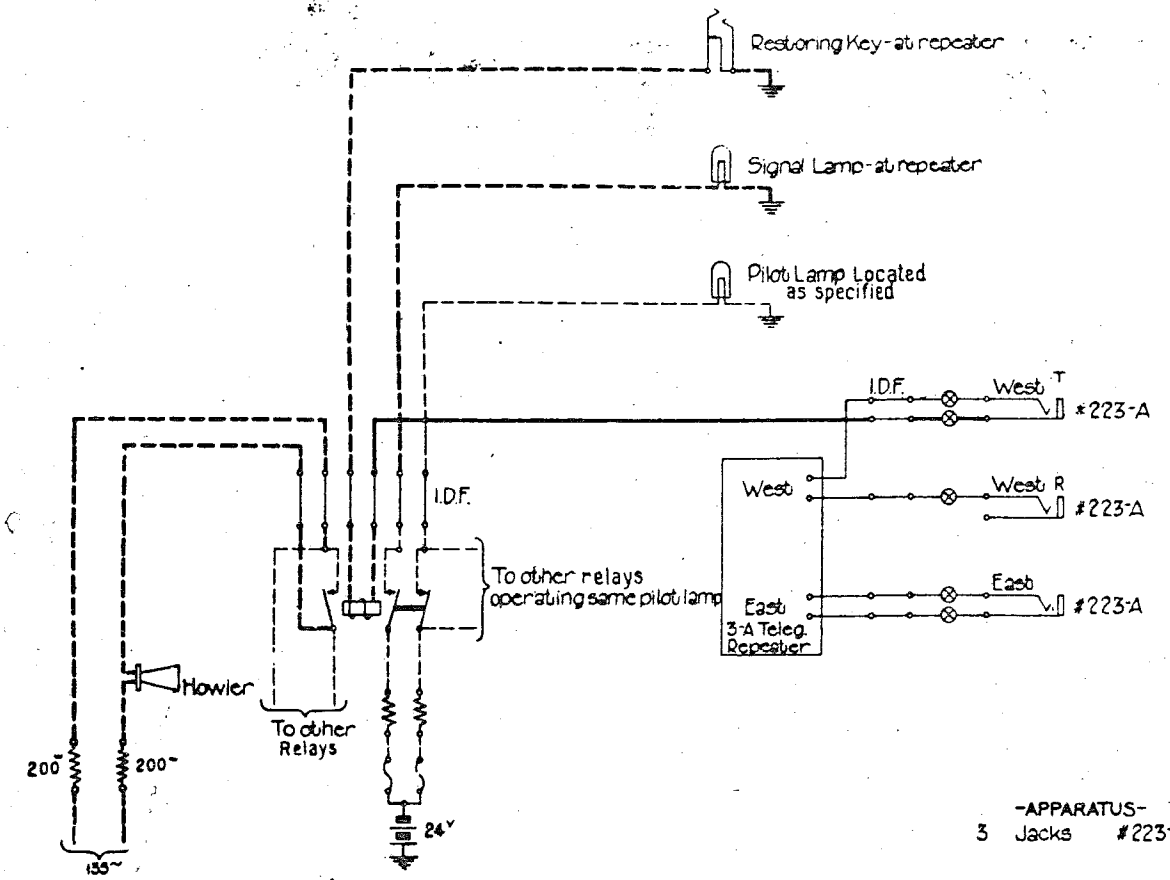
TOLL TEST BOARD NO.5
Spare Telegraph Repeater Jacks

213-B-42
Standard

Engineer W. W. K.
Draftsman GD
Checked by
Made Standard 3.18.26
Log No. P.14453 1.26.25
ISSUE 1
J.P.A.

Conventions changed for res. in 135 cycle leads.
Log No. R.17382 2-16-28
ISSUE 2

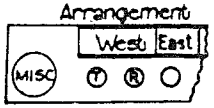
Was "Provisional" Rated "Standard"
Log No. S-8469 3.18.26
ISSUE 3



-APPARATUS-
3 Jacks #223-A

-NOTE-
⊗ Indicates terminal at top of position

Arrangement



AMERICAN TELEPHONE & TELEGRAPH CO.
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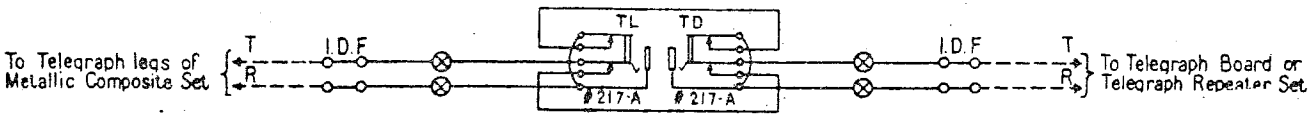
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

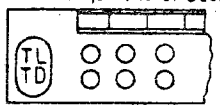
Metallic Telegraph Line

213-B-43
Standard
Replacing 704-2093

Engineer A.W.L.
Draftsman
Checked by
Made Standard 3.18.26
Log No P.1-466 1.26.29
ISSUE 1
Designations "TL" and "TD" were "ML" and "MD"
Log No. P1738 2-19-28
ISSUE 2
Was "Pro. rated" Std.
Log No. S-8470 3.18.26
ISSUE 3



Arrangement of Jacks



— NOTES —

⊗ Indicates terminal at top of position

— APPARATUS —

2 Jacks # 217-A

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TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Typical Arrangement of Jack Panel for Metallic Telegraph Line Circuits

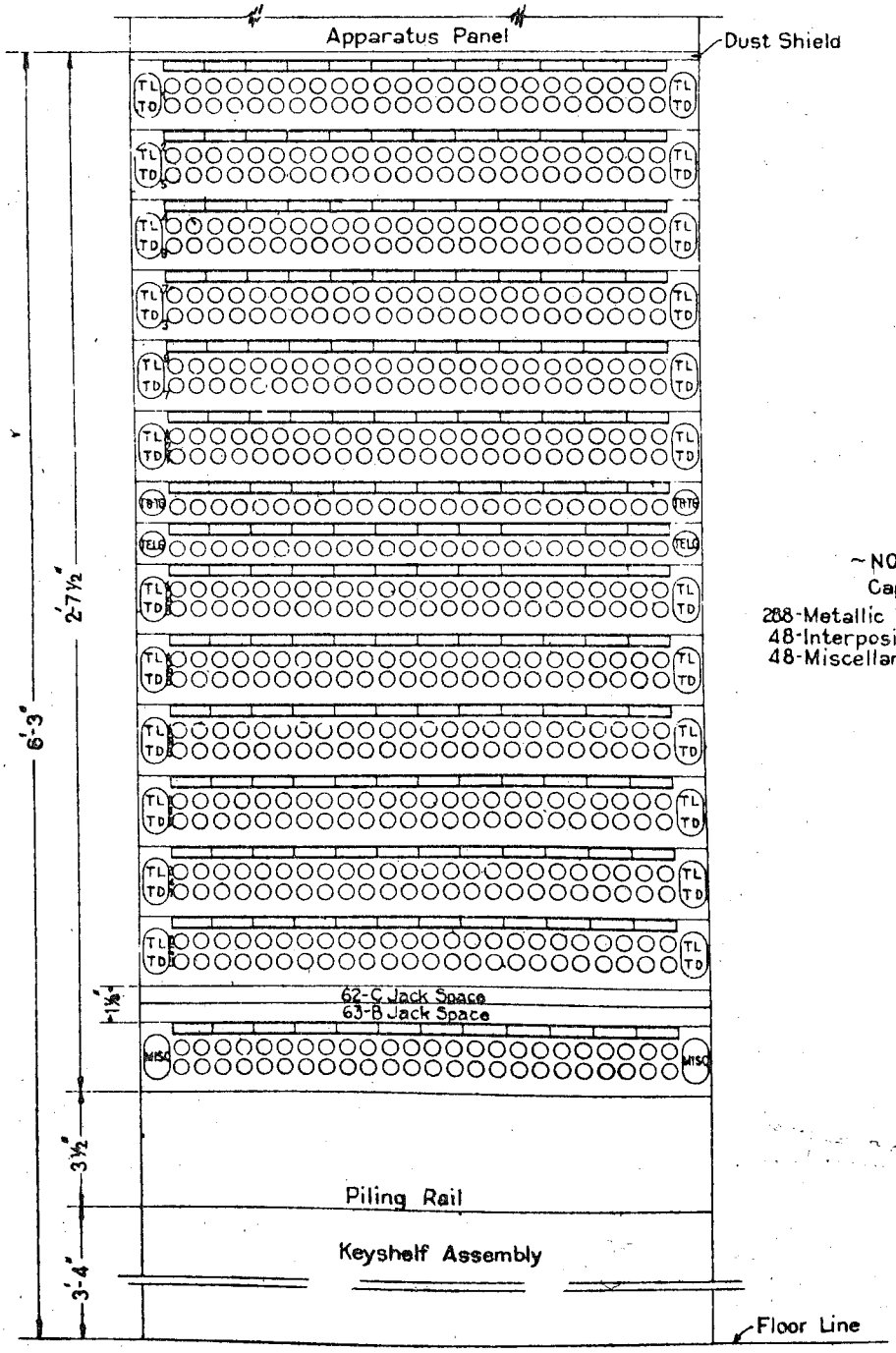
213-B-44
Standard
Replacing 704.3011

Engineer A.W.K
Draftsman
Checked by
Made Standard 3.18.26
Log No P14449 1.26.25
ISSUE 1

Designations "TL and TD were "ML and "MD"
Log No. R17530 2-24-26
ISSUE 2

Was "Provisional"
Rated "Standard"

Log No. S-8471 3.18.26
ISSUE 3



~NOTES~
Capacity
288-Metallic Telegraph Lines
48-Interposition Trunk Jacks
48-Miscellaneous Jacks

AMERICAN TELEPHONE & TELEGRAPH CO.
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Development and Research

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5
Talking Trunk Jack Circuits

213-B-45
Standard
Replacing 704-2097

Engineer H.W.T. W.
Draftsman
Checked by
Made Standard 3.18.26
Log No. P-14465 1.26.28
ISSUE 1

Title of Fig.1 "Test Board" was "Line Testing"
Log No. P-17534 2-24-28
ISSUE 2
Was "Pro." rated "Std."
Log No. S-8472 3.18.26
ISSUE 3

FIG. 1
Jacks at Test Board Positions.

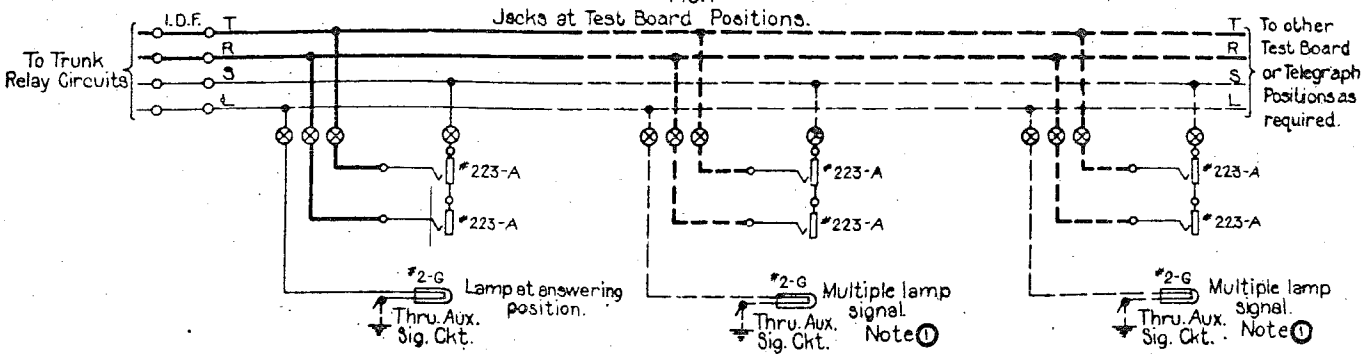
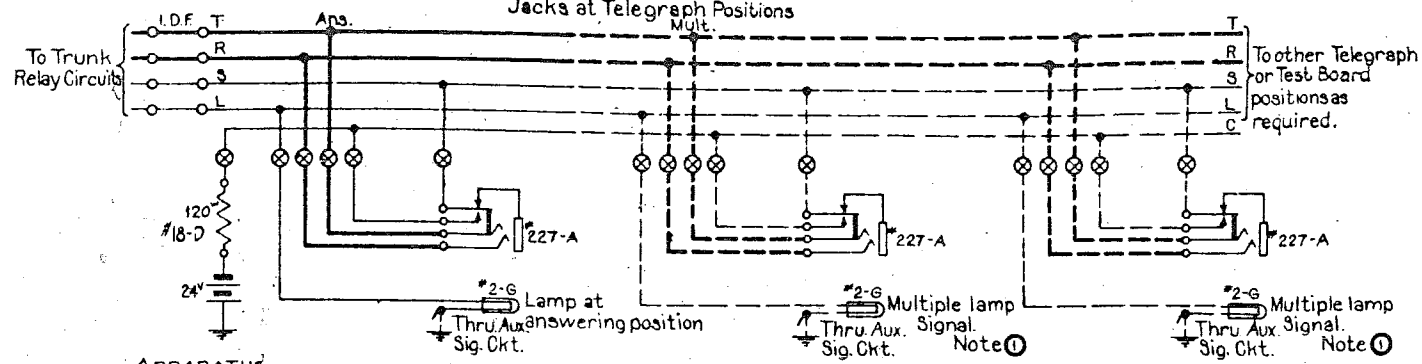


FIG. 2
Jacks at Telegraph Positions



APPARATUS

FIG. 1
2 #223-A Jacks per Position
1 #2-G Lamp
1 #2-AY " Cap } Per Note No. 1
1 #13 Lamp Socket

FIG. 2
1 #227-A Jack per Position
1 #18-D Resistance
1 #2-G Lamp
1 #2-AY " Cap } Per Note No 1
1 #13 Lamp Socket

NOTES

1. Multiple Lamp Signals shall be furnished only when specified. Not more than 5 #2-G Lamps are to be bridged on "L" lead.
2. Where trunks are multipled in the telegraph testing positions there shall be a lead from the 24 volt battery equipped with a 1½ ampere fuse per 10 circuits.

⊗ Designates terminal at top of position.

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
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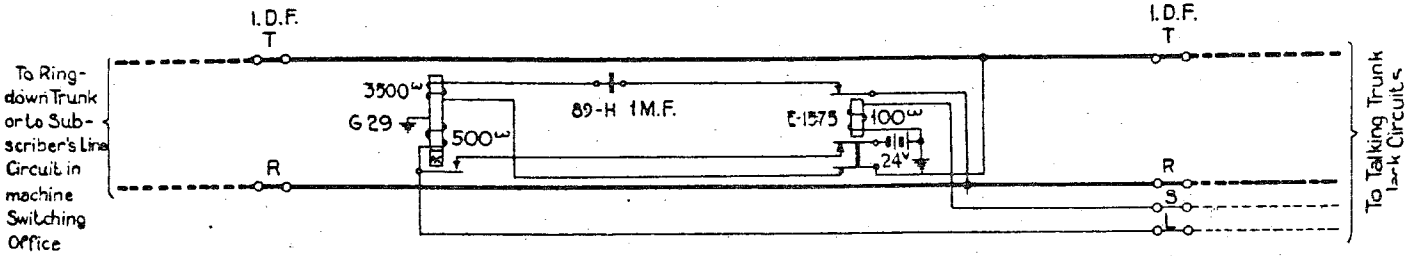
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Relay Circuit for Two Way Ringdown Trunk Circuit or for Trunk to Step-by-Step or Panel Machine Switching Office.

213-B-46
Standard
Replacing 704-2098 Fig 1

Engineer
Draftsman
Checked by
Made Standard 3-16-26
Log No. R14443 1,26,25
ISSUE 1
Condenser 89-H was 57-B
Log No. R17532 2-24-28
ISSUE 2
Was Prov. rated Std.
Log No. S-8478 3-16-28
ISSUE 3



— APPARATUS —

1 89-H Condenser
1 G-29 Relay
1 E-1575 Relay

— NOTES —

1. There shall be one lead from the 24 volt battery equipped with 1½ ampere fuse per each three trunks.
2. When used as a Trunk to Step-by-Step machine Switching Office, connect to Line Switch with multiple on a non-reversing Connector to give free incoming Service from the Step-by-Step Office.
3. When used as a Trunk to Panel Machine Switching Office, a standard free Line Circuit should be used in the Machine Switching Office to give incoming Service to the Test Board.

AMERICAN TELEPHONE & TELEGRAPH CO.
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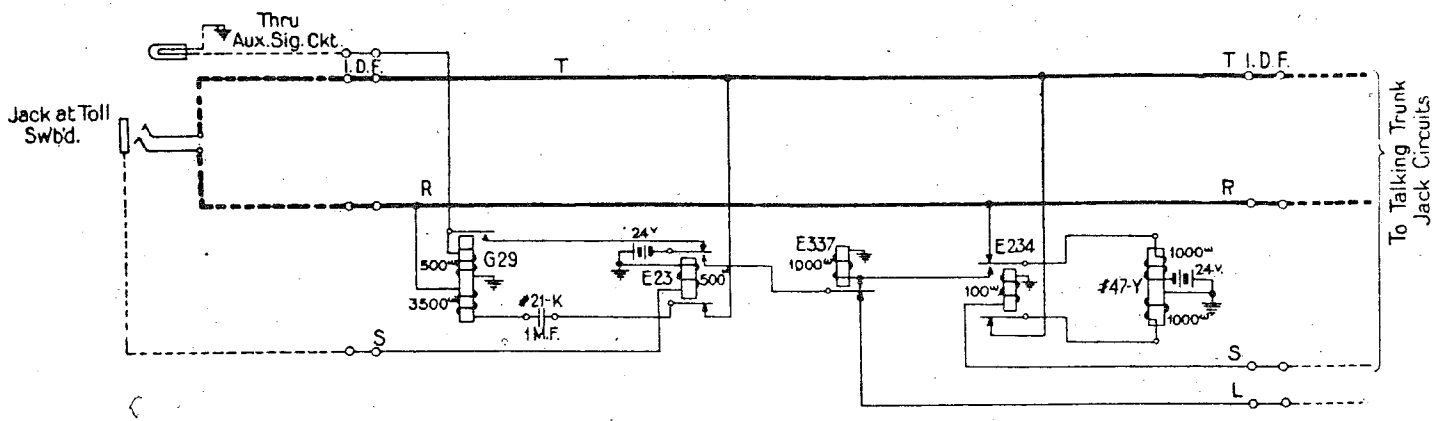
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO. 5

Relay Circuit for Two Way Trunk to Toll Switchboard No 1

213-B-47
Standard
Replacing 704 - 2098
Fig. No. 3

Engineer
Draftsman
Checked by
Made Standard 3.18.26
Log No. P-144+5 1.26.25
ISSUE 1
Relay E-337 was E-24
Log No. P-17511 2-23-26
ISSUE 2
Was "Provisional"
Rated "Standard"
Log No. S-8474 3.18.26
ISSUE 3



— APPARATUS —

1 Relay E 23
1 Condenser # 21-K
1 Relay G 29
1 Relay E 337
1 Relay E 234
1 Retard Coil #47-Y

— NOTES —

① There shall be one lead of 24 volt battery equipped with 1/3 ampere fuse for each 3 circuits.

AMERICAN TELEPHONE & TELEGRAPH CO.
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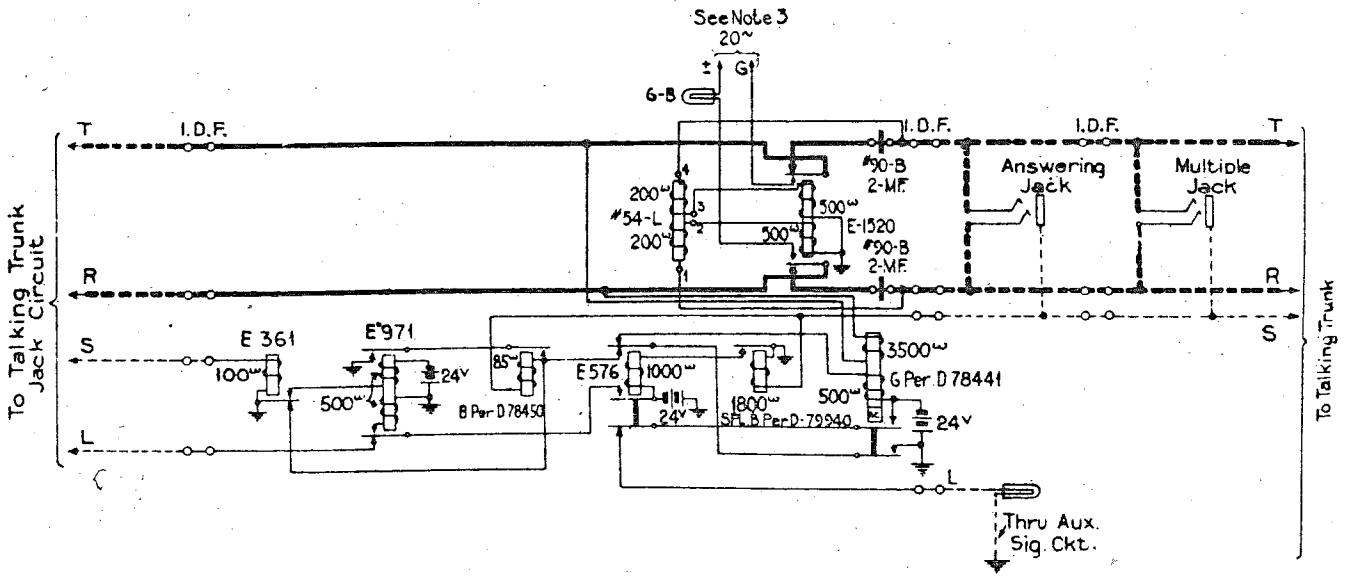
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Relay Circuit for Two Way Trunk to Toll Switchboard N93
Outgoing Ringdown Incoming Automatic

213-B-48
Standard

Made Standard 3.18.26
Log No. P144441262E
ISSUE 1
Notes 2 and 3 added.
Relay SPL. B per D-79940 was B-58
Log No. R17512 2-23-28
ISSUE 2
Was "Provisional"
Rated Standard
Log No. S-8475 3.18.26
ISSUE 3



— APPARATUS —

1 Relay E 971
1 Relay E 576
1 Relay E 1320
1 Relay E 361
1 Relay spl. G per D 78441
1 Relay spl. B per D 78450
1 Relay spl. B per D 79940
1 Retard Coil #54-L
2 Condensers #90-B

~ NOTES ~

① There shall be one Lead from 24 Volt Battery equipped with a 1⅓ Amp. Fuse for each 3 Relay Circuits.

② Not more than three 2-G Lamps are to be bridged on "L" Lead.

③ There shall be one Lead from the AC Bus Bar equipped with a 1⅓ Amp. Fuse per 25 Trunk Circuits. There shall be one 6-B Res. Lamp per each 5 Circuits.

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
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TOLLTEST BOARD EQUIPMENT

TOLLTEST BOARD NO.5
Relay Circuit for two way trunk to Local manual exchange or official PBX.

213-B-49
Standard
Replacing 704-2098 Fig 4 & 5

Engineer K.W.H.
Draftsman
Checked b,
Made Standard 3.18.26
Log No P14441 1.26.23
ISSUE 1
Condensers 89-H were 57-B and Condensers 90-B were 57-A.
Log No. P-17523 2-23-28
ISSUE 2
Was "Provisional" Rated "Standard"
Log No. S-84476 3.18.26
ISSUE 3

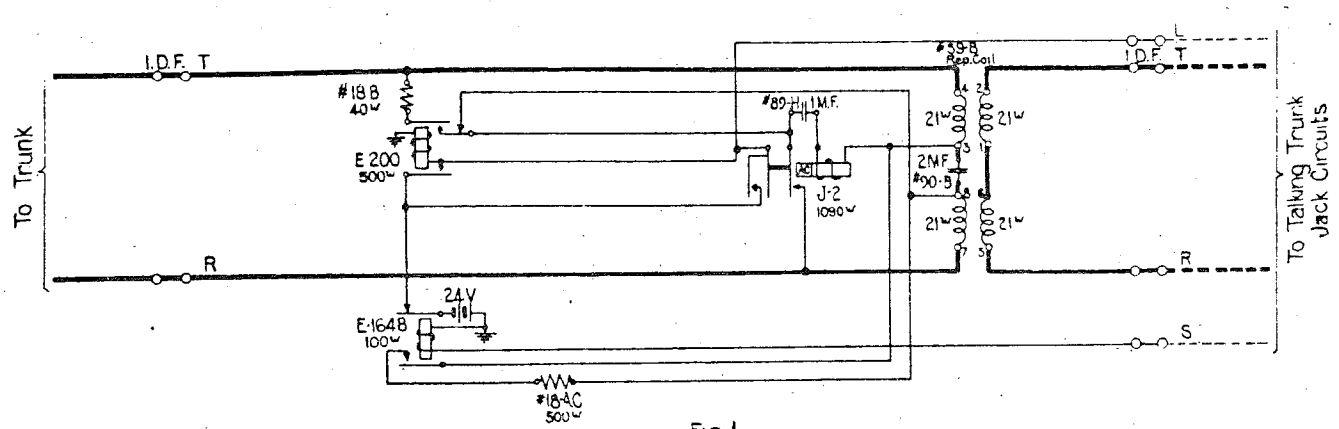

Fig. 1.
Equipped with machine ringing "A" Cords.

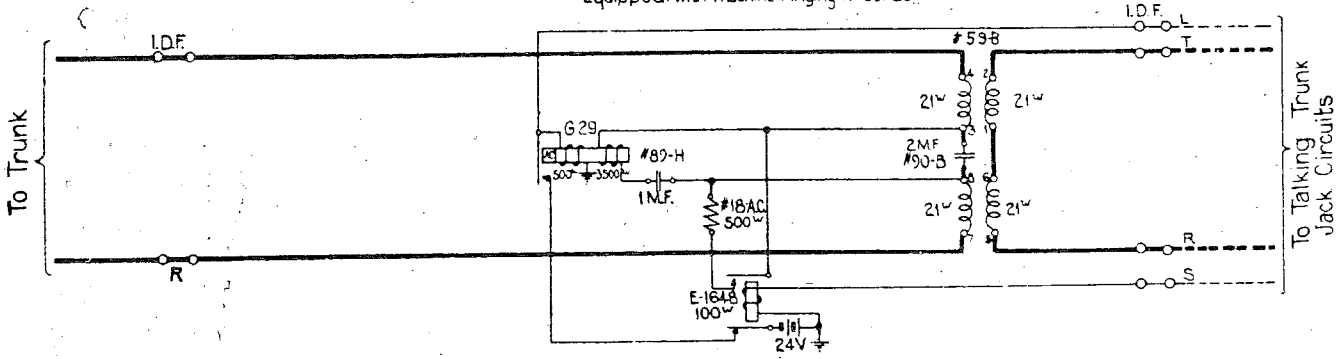

Fig. 2.
Without machine ringing "A" Cords

Fig. 1.
-APPARATUS-
1 #18-B Resistance
1 #18-AC Resistance
1 #89-H Condenser
1 #90-B Condenser
1 #59-B Repeat Coil
1 E 200 Relay
1 E 1648 Relay
1 J-2 Relay

NOTES
(1) There shall be one lead of 24 volt battery equipped with a 15 ampere fuse for each 3 circuits.

Fig. 2.
-APPARATUS-
#89-H Condenser
#90-B "
1 #18-AC Resistance
1 #59-B Repeat Coil
1 G29 Relay
1 E1648 Relay

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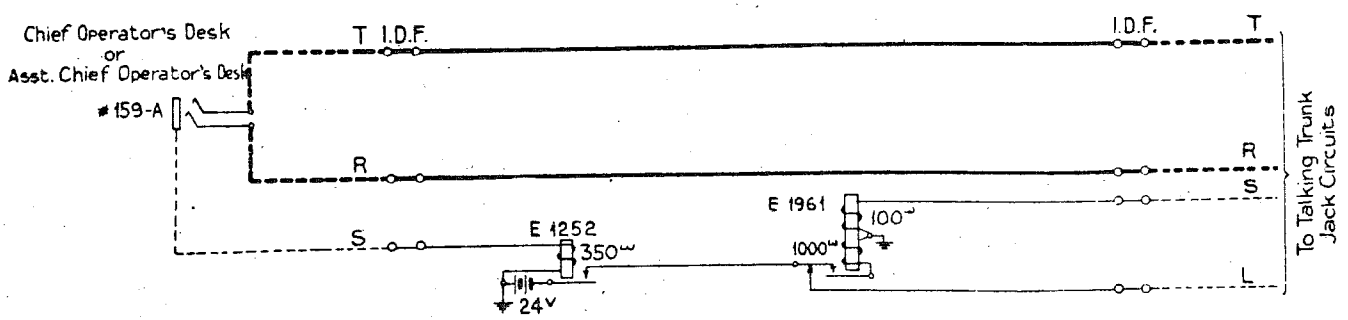
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5

Relay circuit for Local Automatic Trunk Incoming from
Desk of Toll Chief Operator or desk of Assistant Chief Oper.

213-B-51
Standard
Replacing 704-2098 Fig 6

Engineer
Draftsman
Checked by
Mode Standard 5.18.26
Eng No P14148 T 6279
ISSUE 1
Was "Provisional" Rated "Standard"
Log No S-84477 5.18.26
ISSUE 2



— APPARATUS —

1 E 1252 Relay
1 E 1961 Relay

— NOTES —

There shall be one lead from the 24 volt Battery equipped with a 1⅓ ampere fuse for each 3 circuits.

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Development and Research

TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO. 5

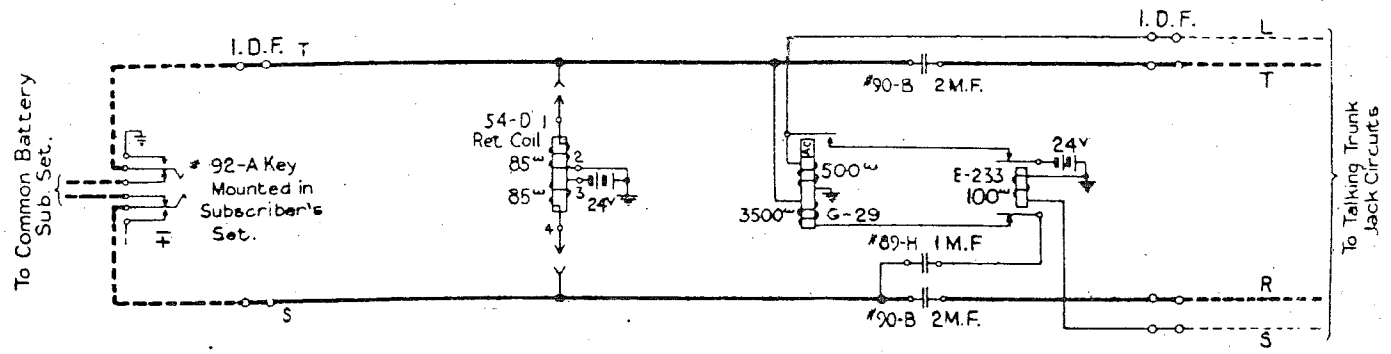
Relay circuit for Two Way Trunk to Main Distributing Frame

213-B-52
Standard
Replacing 704 - 2098
FIG. 2

Engineer
Draftsman
Checked by
Made Standard 3,18,26
Log No. P-14440 1,25,28
ISSUE 1

Condensers 90-B were 21-E and condensers 89-H were 21-H
Log No. P-17524 2-23-28
ISSUE 2

Was "Provisional" Rated "Standard"
Log No S-8478 3,18,26
ISSUE 3



— APPARATUS —

2 #90-B Condensers
1 #89-H Condenser
1 G-29 Relay
1 E-233 Relay
1 # 54-D Ret. Coil or

— NOTES —

① There shall be one lead of 24 volt battery equipped with a 1½ ampere fuse for each 3 circuits.

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
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TOLL TEST BOARD EQUIPMENT

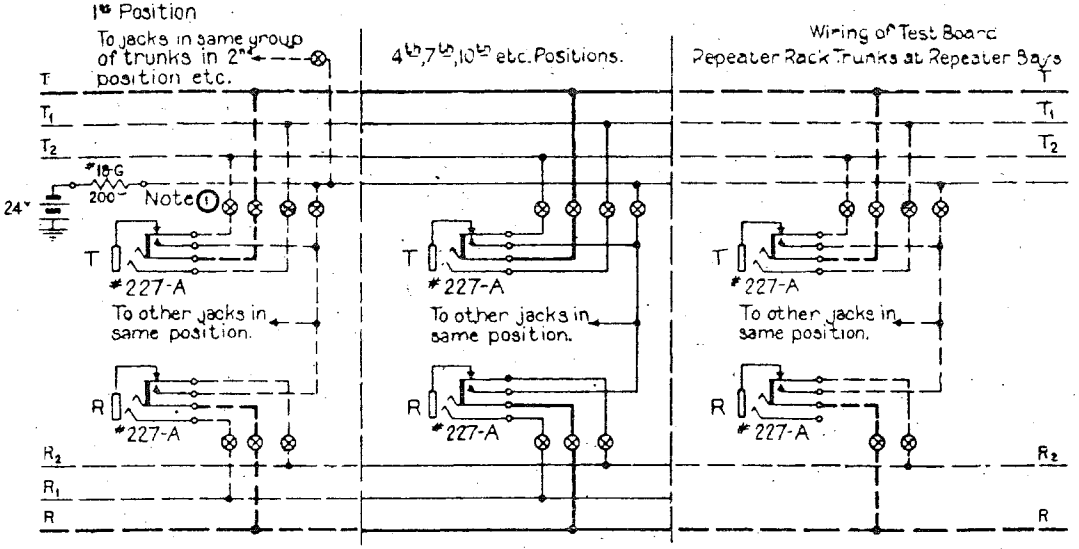
TOLL TEST BOARD NO.5
Interposition Trunks

213-B-53
Standard
Replacing 704 · 3000

Engineer [illegible]
Draftsman [illegible]
Checked by
Made Standard 3.18.26
Log No. P144601 26.25
[illegible] ISSUE 1

"Output Trunks" was added to Fig. 4.
Log No. R17525 2-23-26
[illegible] ISSUE 2

Was "Provisional"
Rated "Standard"
Log No. S 8479 3.18.26
[illegible] ISSUE 3



Jack Designations for different Groups of Trunks

Fig. 1
Designation for Trunks Multipled in Line Testing positions only.

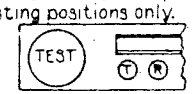


Fig. 2
Designation for Trunks Multipled in Telegraph Testing Positions

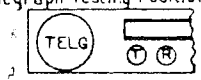


Fig. 3
Designation for Trunks Multipled in Line Testing and Telegraph Testing positions.

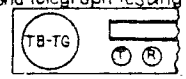


Fig. 4
Designation for Trunks Multipled in Line Testing positions and at Repeater Bays.

— Apparatus —
2 #227-A Jacks for each position where Trunks are Multipled.
1 #18-G Resistance per Group of Trunks.

— NOTES —

(1) Interposition Trunks between the Test Board positions and the Repeater Bays shall be wired direct or through the I.D.F. as specified.

(2) In offices where four-wire Repeaters are to be used the TB-RR Trunks shall divided into two equal groups designated "IN" and "OUT." The former are for patching circuits on the input side of four-wire Telephone Repeaters and shall not be included in any cables carrying circuits on the output side of four-wire Repeaters. The latter are for patching circuits on the output side of four-wire Repeaters and shall not be included in any cables carrying circuits on the input side of four-wire Repeaters.

(3) There shall be a lead from the 24 volt battery equipped with a 1/4 ampere fuse for the #18-G Resistances.

⊗ Indicates Terminal at top of position.

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
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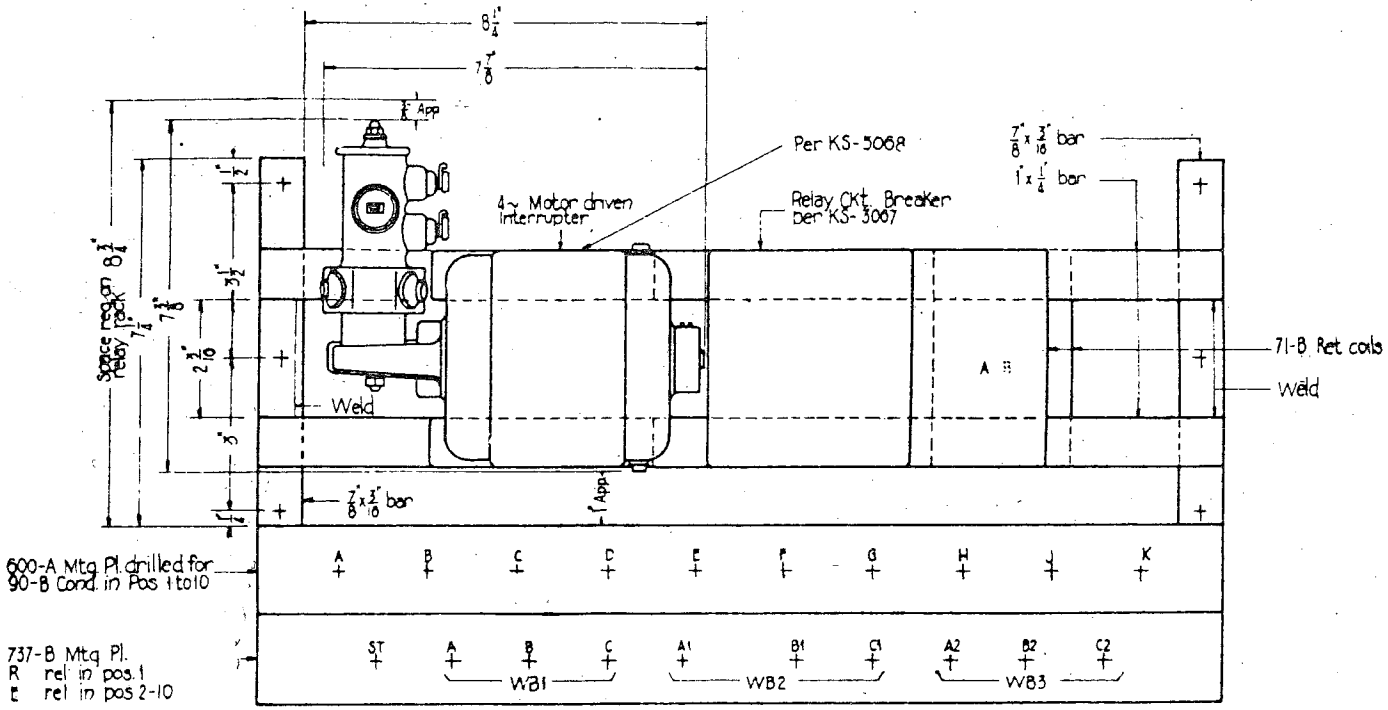
TOLL TEST BOARD EQUIPMENT

OPEN LOCATION TEST
Assembly and Equipment
4 Cycle A.C. Supply Circuit

214-B-36
Standard
Replacing 214-B-36
of 2-2-25

Engineer
Draftsman AKS
Checked by
Made Standard 3,18,26
Redrawn to show
Interrupter per
Spec. KS-5068
Log No. P16598 1-925
ISSUE 3
SPS

Was "Provisional"
Rated "Standard"
Log No 58480 3,18,26
ISSUE 4



AMERICAN TELEPHONE & TELEGRAPH CO.
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TOLL TEST BOARD EQUIPMENT

OPEN LOCATION TEST

4 Cycle Alternating Current Supply Circuit

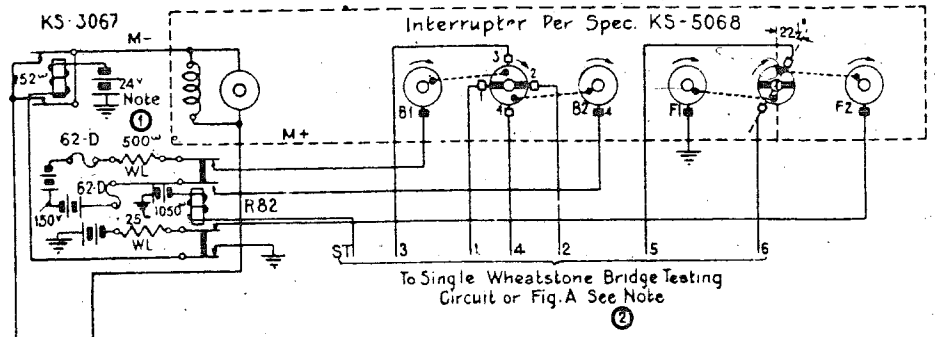
214-B-37
Standard

Engineer Case
Draftsman
Checked by
Redrawn. Added Filter in motor supply circuit. Made Standard 9-11-25 Log No P16113 & 20-25
ISSUE 2

Was Provisional
Rated Standard
Changed fuse notes
Log No. S7820 - 9. 11. 25
ISSUE 3

Removed Fig. B.
changed Note (3)
Log No. S-7910 10.14.25
ISSUE 4

FIG. 1



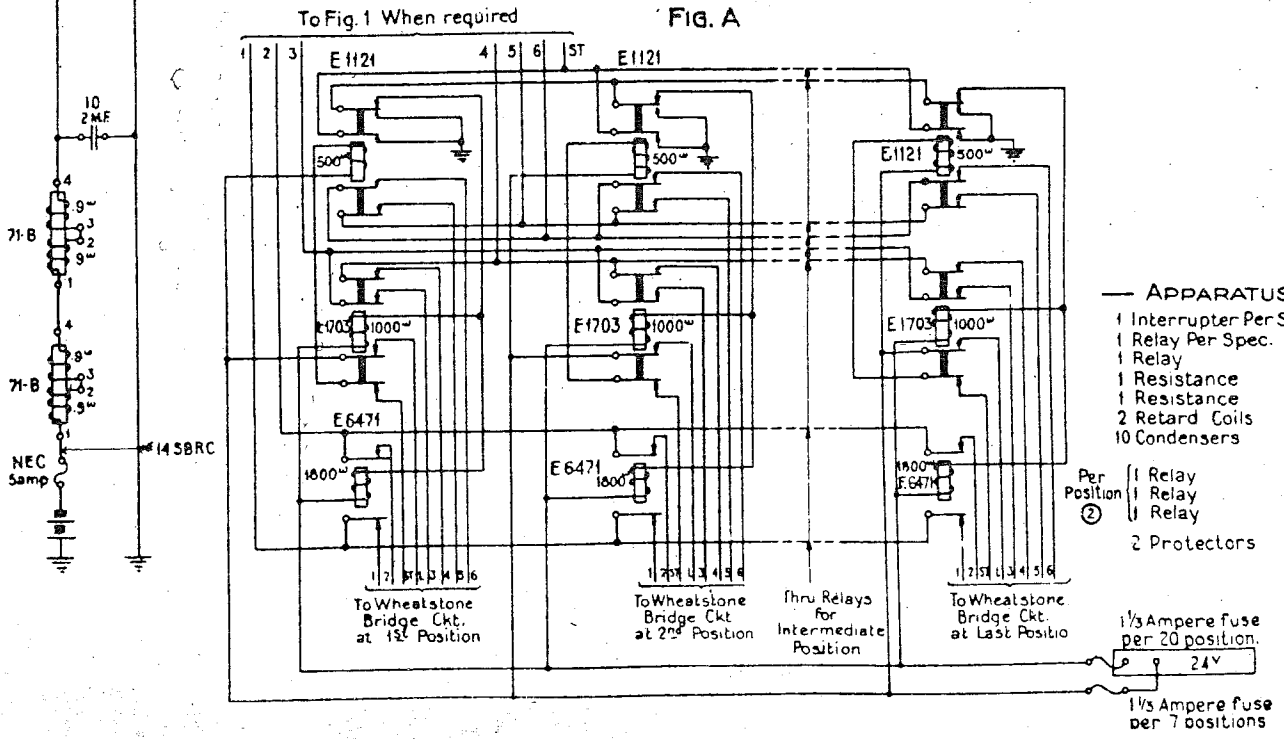
NOTES

(1) There shall be one lead from the 24V battery equipped with a 1⅓ amp fuse for Fig. 1.

(2) When this interrupter is used to supply current to one Wheatstone bridge, Fig. 1 is to be used. When this interrupter is used to supply current to more than one Wheatstone bridge circuit Fig. A is to be used with Fig. 1.

(3) There shall be two leads from the miscellaneous bus bar at the fuse panel to supply 24 volt battery and ground. These leads shall be #14 twin conductor lead covered cable and the battery lead shall be equipped with a 5 ampere N.E.C. fuse.

FIG. A



APPARATUS

1	Interrupter Per Spec	KS-5068
1	Relay Per Spec.	KS-3067
1	Relay	R-82
1	Resistance	W.L. 500ω
1	Resistance	W.L. 25ω
2	Retard Coils	# 71-B
10	Condensers	90-B
Per Position (2)	1 Relay	E-1121
	1 Relay	E-1703
	1 Relay	E 6471
2	Protectors	#62-D

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TOLL TEST BOARD EQUIPMENT

OPEN LOCATION TEST

20 Cycle A. C. Supply Circuit

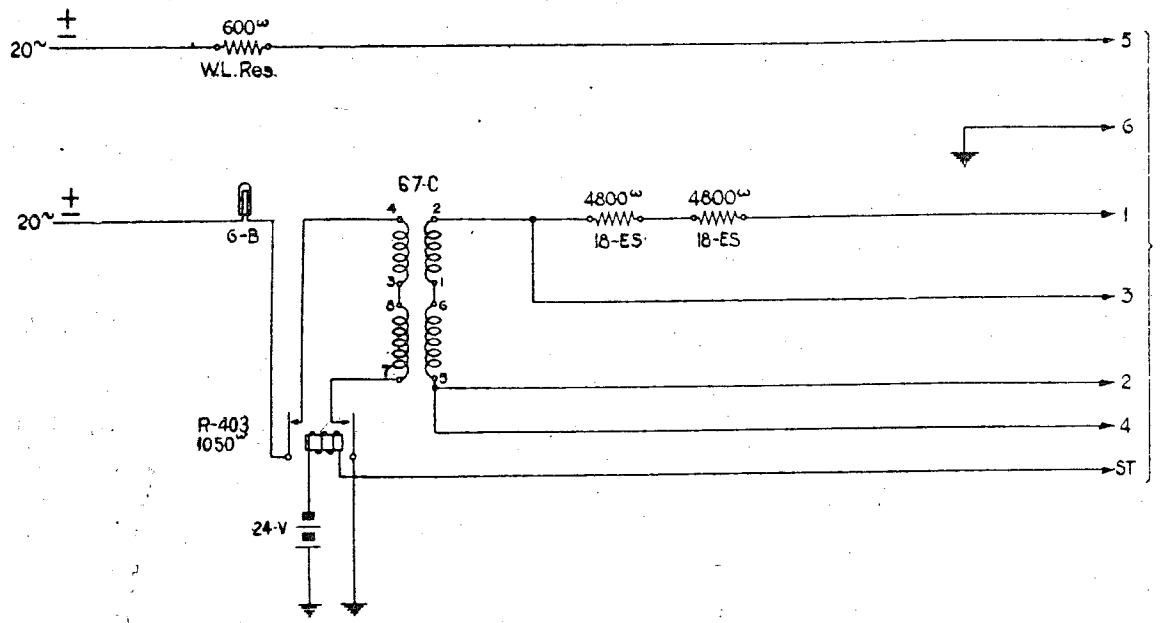
214-B-39
Standard

Engineer
Draftsman
Checked by
Made Standard 9-11-25
Log No. P15883 7,21,25
ISSUE 1

Made R-39 Relay R-403.
Made 46-A Coil 77-A
Log No. P16116 8-20-25
ISSUE 2

Was Provisional
Rated Standard
Log No. S7818 – 9-11-25
ISSUE 3

77-A Coil replaced by
67-C coil.
Log No. S8349 2-13-28
ISSUE 4



~APPARATUS~

1 Repeat Coil 67-C
2 Resistances 18-ES
1 Relay R-403
1 Res. W.L. 600ω

~NOTE~

There shall be one Lead from 24 Volt Battery equipped with a 1/3 Amp. Fuse.

AMERICAN TELEPHONE & TELEGRAPH CO.
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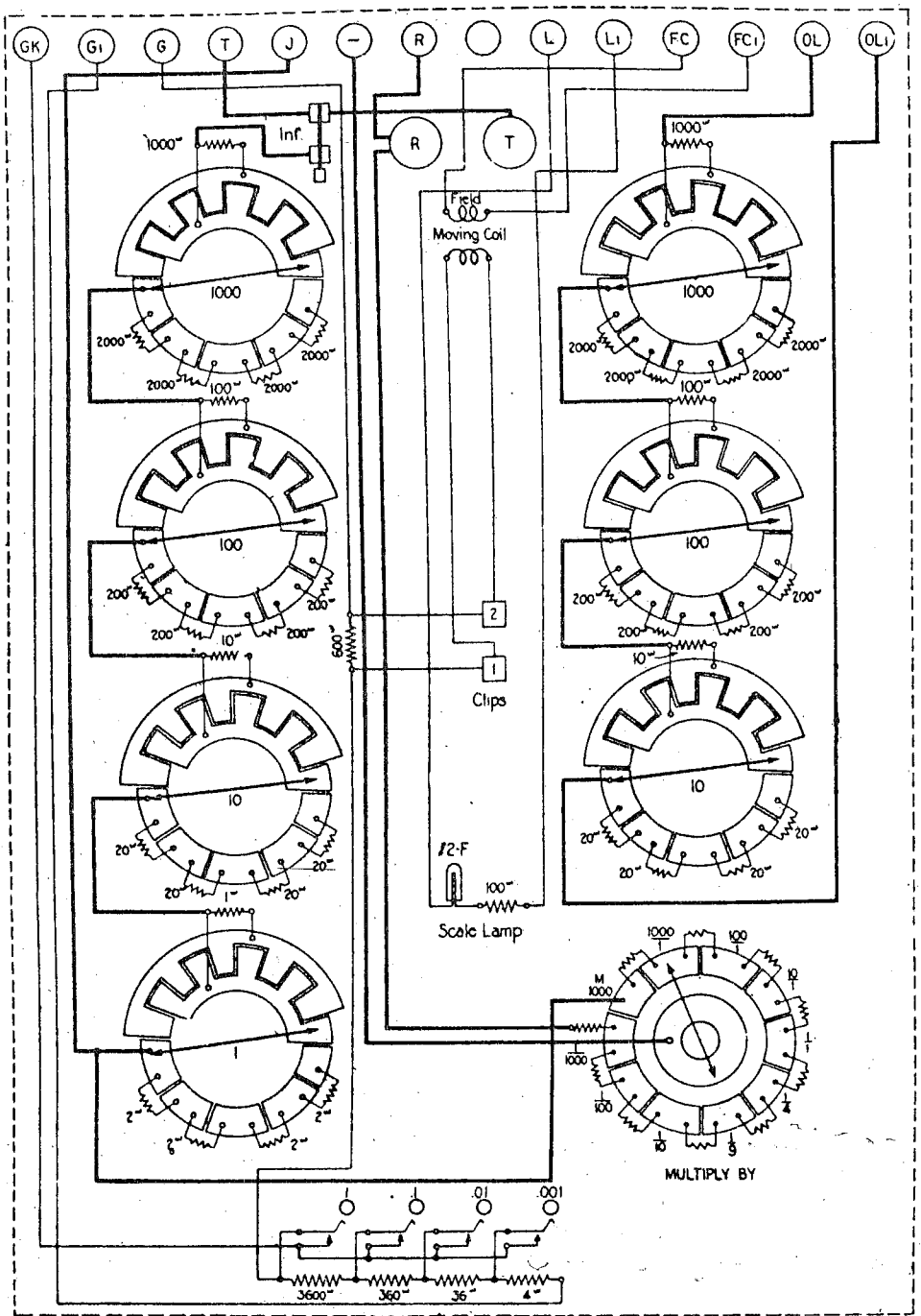
TOLL TEST BOARD EQUIPMENT

WHEATSTONE BRIDGE PER KS-3011
Circuit Diagram

214-B-100
Standard

Engineer O.B.G
Draftsman K.S.K
Checked by
Made Standard 9-11-25
Log No. P14568 2.2.25
S.P.S. ISSUE 1
Was Provisional
Made Standard
Log No. S7819-9.11.25
S.P.S. ISSUE 2



NOTE: This drawing shows relative position of apparatus as viewed from bottom.

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TOLL TEST BOARD EQUIPMENT

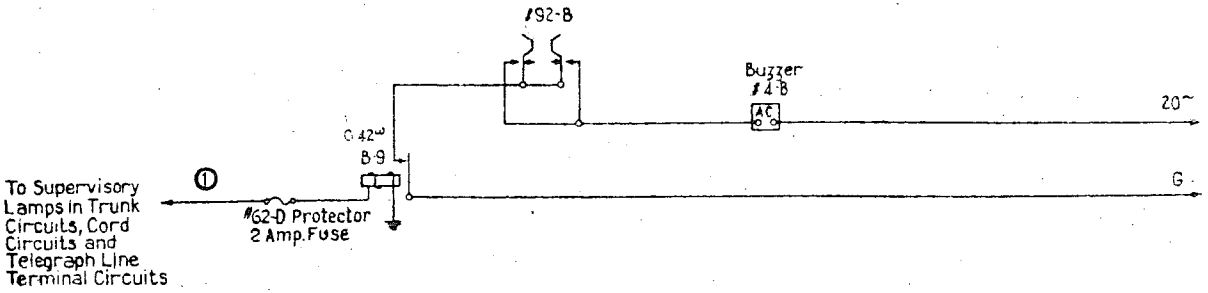
TOLL TEST BOARD NO.5
Auxiliary Signal Circuit

218-B-1
Standard
Replacing 704-3018

Engineer
Draftsman
Checked by
Made Standard 3.18.26
Log No P14464 1 2C 2
ISSUE 1

Convention was added for 62-D protector
Log No P17528 2-24-28
ISSUE 2

Was "Provisional"
Rated "Standard"
Log No S-8481 3.18.26
ISSUE 3



— APPARATUS —

1 Relay B-9 Per Note ①
1 Key #92-B } For each
1 Buzzer #4-B } 10 Positions

— NOTES —

① One B-9 relay and one 2 amp fuse shall be provided for each 12 supervisory lamps.

② Ringing current for the buzzer shall be taken from the lead supplying ringing current to the position in which the buzzer is located.

③ The key and buzzer shall be located in the position specified.

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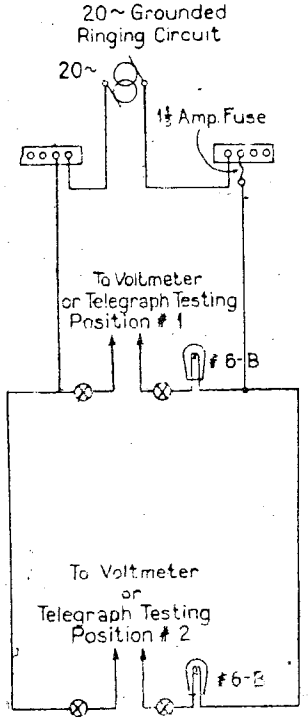
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO 5
Ringing Circuit

218-B-2
Standard
Replacing 704-3025

Engineer
Draftsman
Checked by
Made Standard 3,18,26
Log No P14403 1.26.25
ISSUE 1
Was Provisional
Rated Standard
Log No S-8482 3.18.26
ISSUE 2



APPARATUS

For Each Position
1 Resistance Lamp # 6-B
1 Bryant Receptacle # 101401

NOTES

⊗ Indicates terminal at the top of position.

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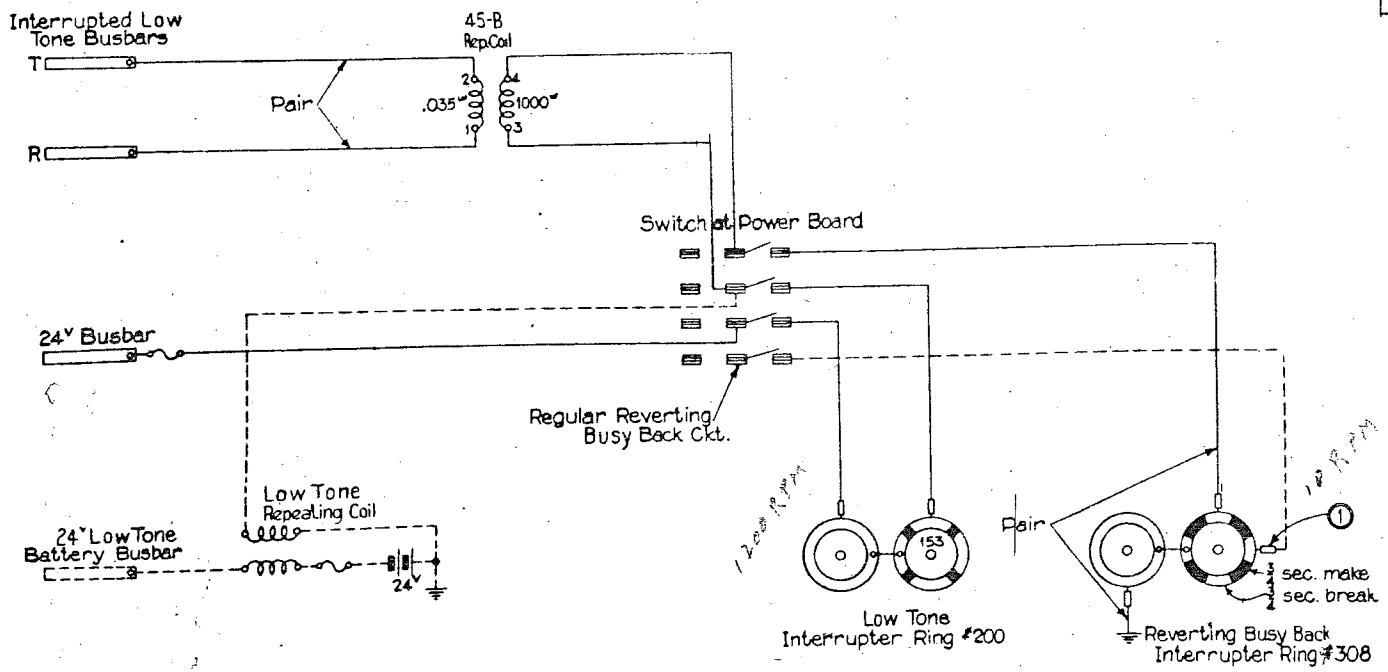
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5
Interrupted Low Tone Circuit
For offices where motor driven interrupters are provided

218-B-3
Information

Engineer W. W. H.
Draftsman
Checked by
Log No. B14468 1.26.25
ISSUE 1
Title was "Trouble Tone Circuit"
Log No. B17527 2-24-26
ISSUE 2
Ref. Inf. was Prov.
Log No. P17599. 3-3-26
ISSUE 3



APPARATUS

1 Repeating Coil #45-B
1 Interrupter Ring #200 } When
" " #308 } Specified

NOTES

(1) The extra brush is required only at offices where the reverting busy back signals are used. There shall be two leads (twisted pair) from the interrupted low tone busbars, each equipped with 1½ ampere fuse for each section of test board.

AMERICAN TELEPHONE & TELEGRAPH CO.
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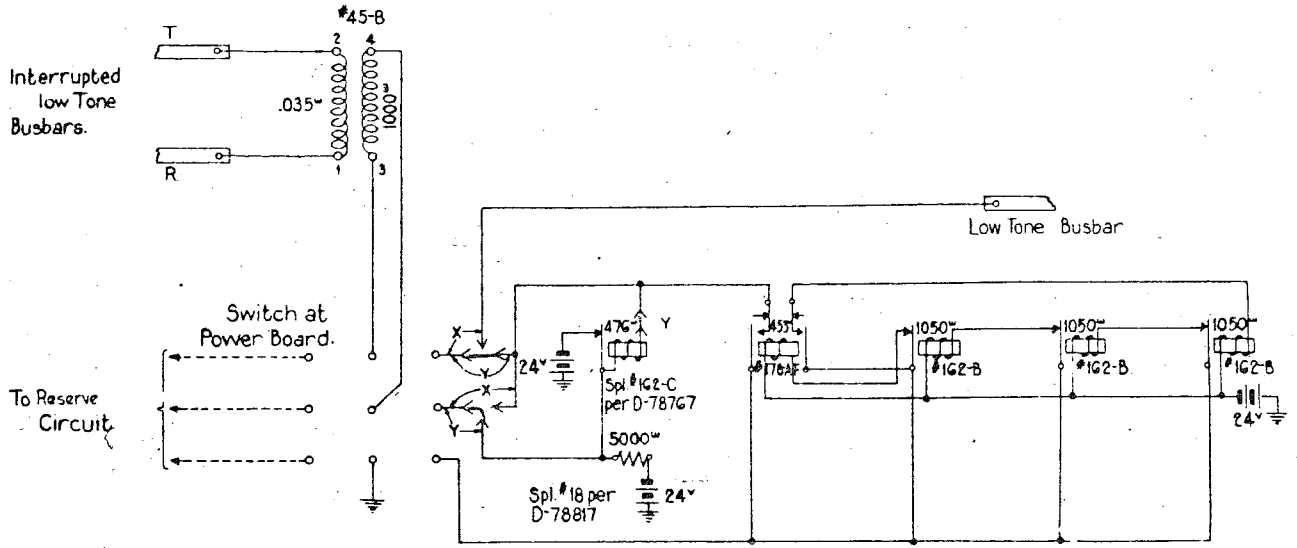
TOLL TEST BOARD EQUIPMENT

TOLL TEST BOARD NO. 5

Interrupted low tone circuit for offices where motor driven interrupters are not provided.

218-B-4
Standard

Engineer [illegible]
Drawn [illegible]
Checked by [illegible]
Made Standard 3,18,26
Log No P-14548 2-2-25
ISSUE 1
Title was "Trouble Tone Circuit for offices without Ringing Machine."
Log No. R17528 2-24-28
ISSUE 2
Was "Provisional" Rated "Standard"
Log No. S 8483 3,18,26
ISSUE 3



APPARATUS

Per Circuit.

1 Relay #178-AF.
3 Relays #162-B.
1 Relay Spl. #162-C per D-78767.
1 Resistance #18 per D-78817.

Per Office

1 Repeating Coil #45-B

Special Relay Adjustment.

Relay	Operate	Non-Operate	Release
#162-C per D-78767	.036	.027	.010

NOTES.

There shall be one lead from 24" battery equipped with a 1⅓ ampere fuse for each circuit.

In offices where an interrupter is provided for supplying 153 PPS tone omit the spl. #162-C relay and spl #18 type resistance and use "X" wiring. Where no tone is available use "Y" wiring.

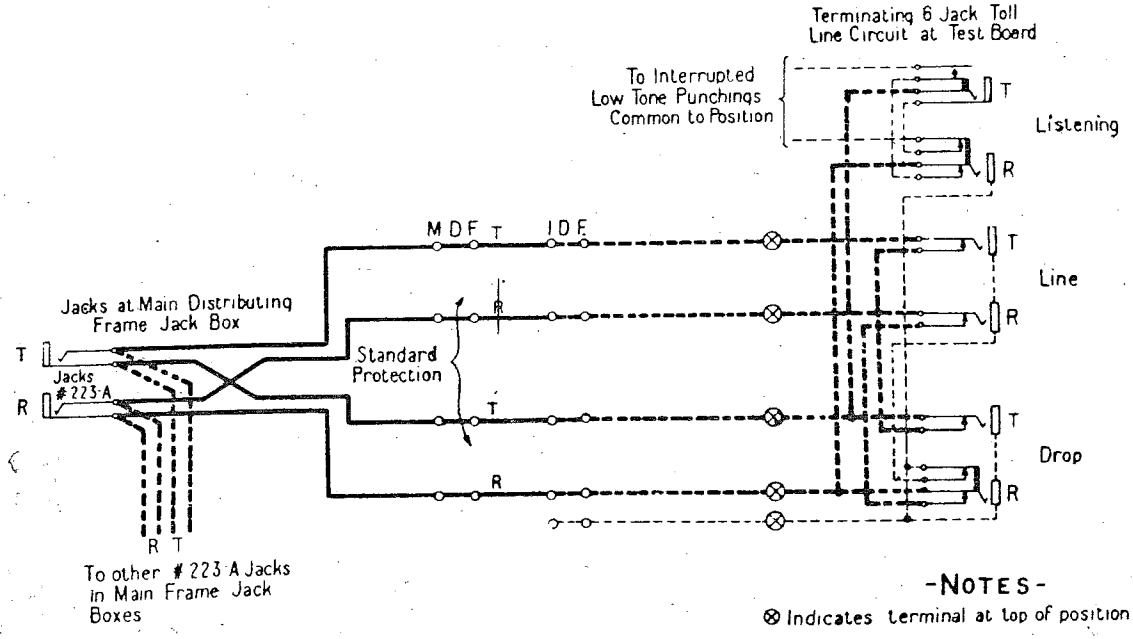
AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
Development and Research

TOLLTEST BOARD EQUIPMENT

TOLL TEST BOARD NO.5
Test Line
To Main Distributing Frame

218-B-5
Standard
Replacing 704 3023

Engineer
Draftsman
Checked by
Made Standard 3,18,26
Log No.P14442 1,26,25
ISSUE 1
Sleeve connection to ground removed.
Log No.R47529 2-24-28
ISSUE 2
Was "Provisional" Rated "Standard"
Log No.S-8484 3,18,26
ISSUE 3



-APPARATUS-

2 Jacks #223-A (Mounted in #151 Jack Mtg.)

-NOTES-

⊗ Indicates terminal at top of position

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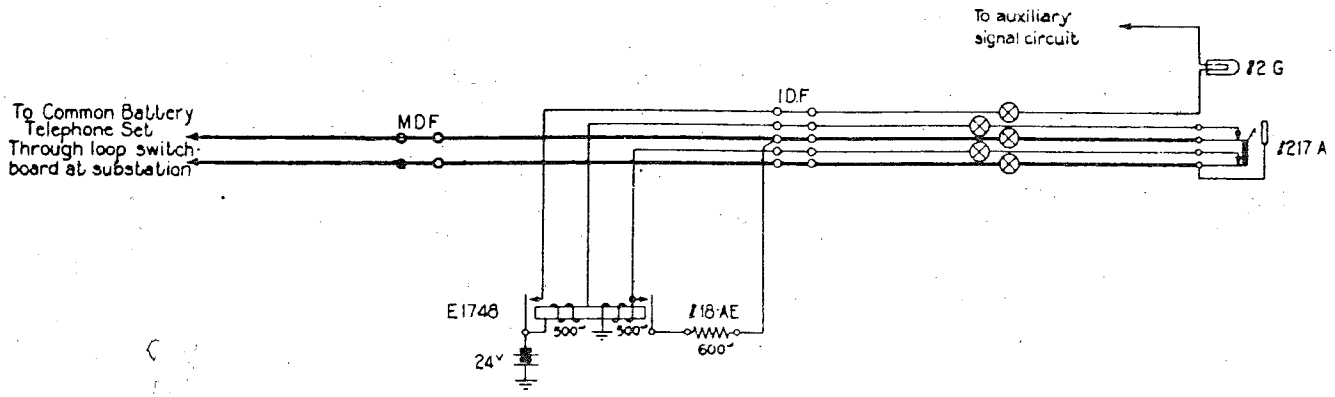
TOLL TEST BOARD EQUIPMENT

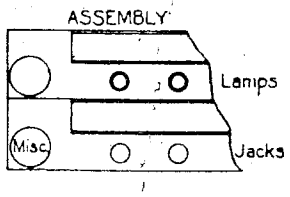
TOLL TEST BOARD NO.5

Telephone Loop For Printing Telegraph Subscribers.

218-B-6
Standard

Made Standard [illegible]
P14430 [illegible]
M.D.F. Convention changed
Log: P47338 2 [illegible]-28
ISSUE 2
Was "Provisional" Rated Standard"
Log No. S-84-85 3,18,26
ISSUE 3





NOTES

There shall be one lead from 24 volt battery equipped with a 1⅓ ampere fuse for each 5 circuits.
⊗ Designates terminal at top of position.

APPARATUS

1 Jack 1217-A
1 Lamp 12 G
1 " Socket 13
1 " Cap 12-N

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
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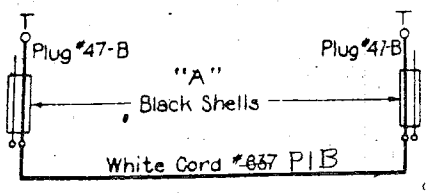
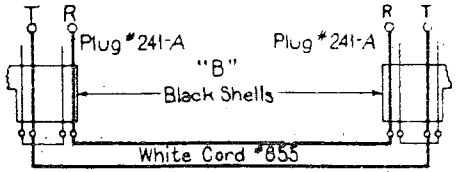
TOLL TEST BOARD EQUIPMENT

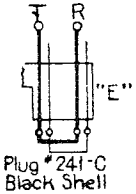
TOLL TEST BOARD NO.5
Patching Cords and Plugs

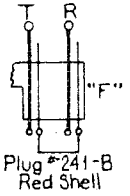
218-B-7
Standard
Replacing 704-3046

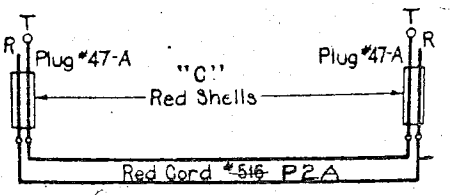
Engineer W. W. L.
Draftsman
Checked by
Made Standard 3,18,26
Log No. P-14448 1,26,25
ISSUE 1
No.241-Type plugs were No.441-Type.
Log No. R-17380 2-16-28
ISSUE 2
Was "Provisional" Rated "Standard"
Log No. S-8486 3,18,26
ISSUE 3

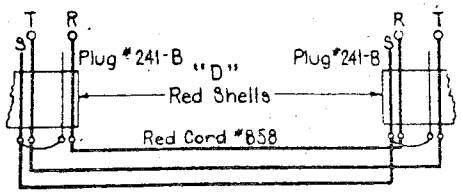


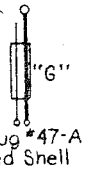


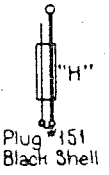


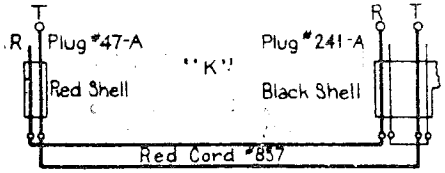


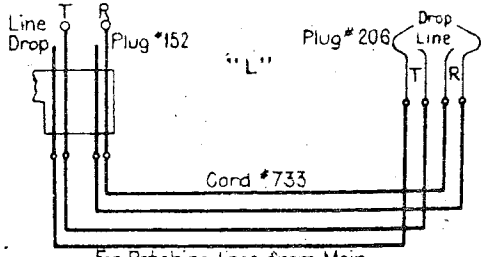




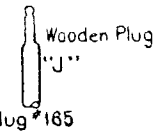








For Patching lines from Main Frame to Main Frame Box only.



— APPARATUS —

Cord "A"
1 Cord #637 (Length as specified) equipped with:
2 Plugs #47-B

Cord "B"
1 Cord #855 (Length as specified) equipped with:
2 Plugs #241-B

Cord "K"
1 Cord #857 (Length as specified) equipped with:
1 Plug #47-A
1 Plug #241-A

Cord "D"
1 Cord #858 (Length as specified) equipped with.
2 Plugs #241-B

Cord "C"
1 Cord #516 (Length as specified) equipped with.
2 Plugs #47-A

Cord "L"
1 Cord #733 (See Note (1)) equipped with:
1 Plug #152
1 Plug #206

— NOTES —

(1) Cord #733 shall be 9½ feet in length unles otherwise specified. All other Cords shall be furnished only in 1ft., 2ft., 3ft., 4ft and 6ft. lengths as specified.

AMERICAN TELEPHONE & TELEGRAPH CO.
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TOLL TEST BOARD EQUIPMENT

ASSEMBLY OF WHEATSTONE BRIDGE

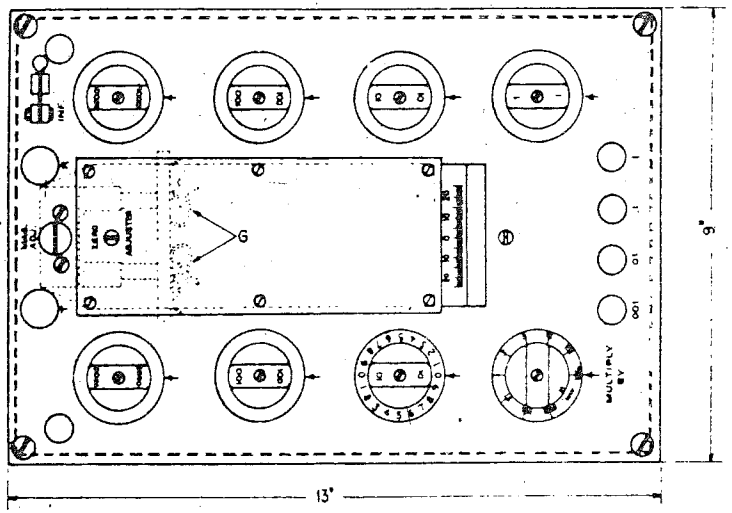
Per. spec. KS-3011

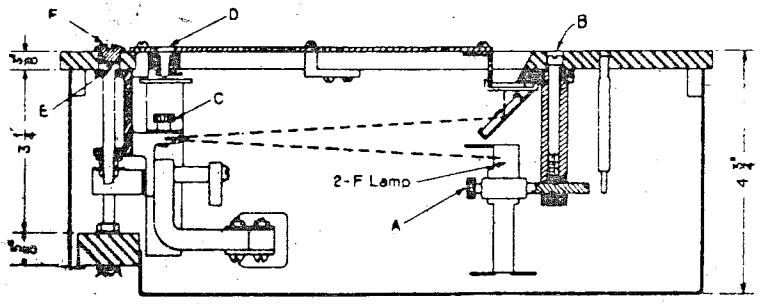
219-B-65
Standard
Replacing 154-A-16
of 1-26-25

Engineer PSG
Draftsman PS
Checked by
Made Standard 9 11 25
Log No. S 7595 5-27-25
SP ISSUE 1

Was Provisional
Made Standard
Log No. S 7821-9 11 25
PSG ISSUE 2 SP

Mounting for 2-F lamp improved.
Log No. S 8679 3,23,26
PSG ISSUE 3 SPA





NOTES

Thumb screw A provides adjustment of elevation of 2-F Lamp holder and rotation of lamp to show single image.

Screw B provides adjustment to keep lamp in vertical position and regulate distance from mirror.

Screws D and E provide mechanical and electrical zero adjustment respectively of galvanometer.

Thumb screw C and clips G provide for removal of galvanometer element.

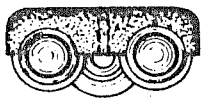
Cap F must be removed to provide access to screw E.

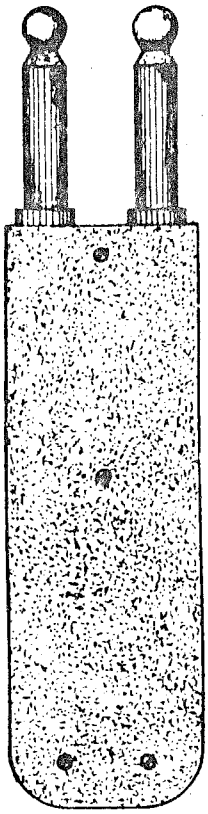
Am. Tel. & Tel. Co
Dept. of
Dev. and Res.

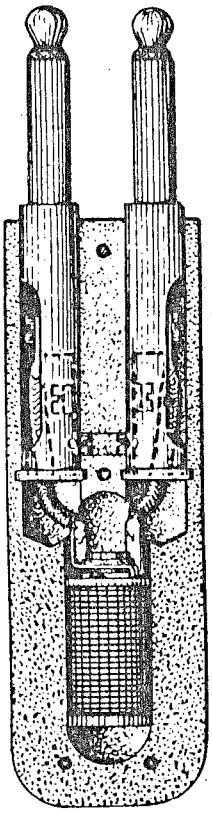
No. 217 Resistance Plug 38-Y-1468

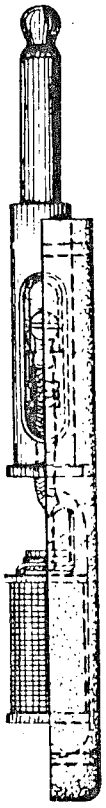
Information

Engineer E.O.J Draftsman P.W. Checked by E.O.J. April 5, 1922 ISSUE 1
Added Assembly May 9, 1922 E.O.J. ISSUE 2
Added No. 217-D Plug Log No. P-10105 4-25-23 ISSUE 3
Added precision accuracy of plugs. Log No. R11026 9-4-23 G.P.S. ISSUE 4



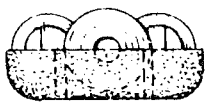






SECTIONAL VIEWS

ASSEMBLY



NOTE

700 ω #	217-A	± 1	ohm
1130 ω #	217-B	± 1.6	"
1800 ω #	217-C	± 2.6	"
600 ω #	217-D	± 1	"

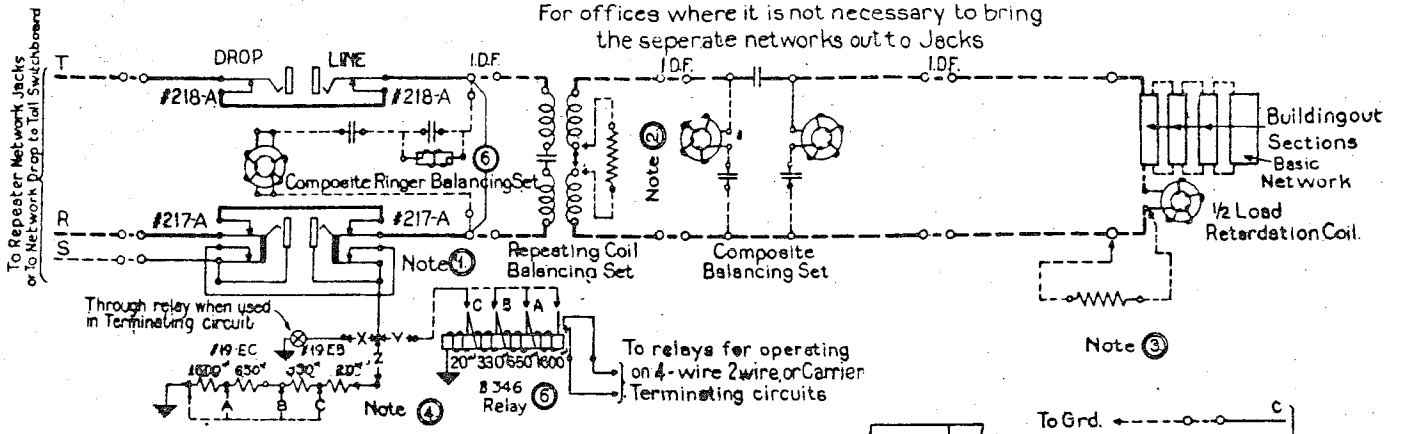
AMERICAN TELEPHONE & TELEGRAPH CO.
Department o.
Development and Research

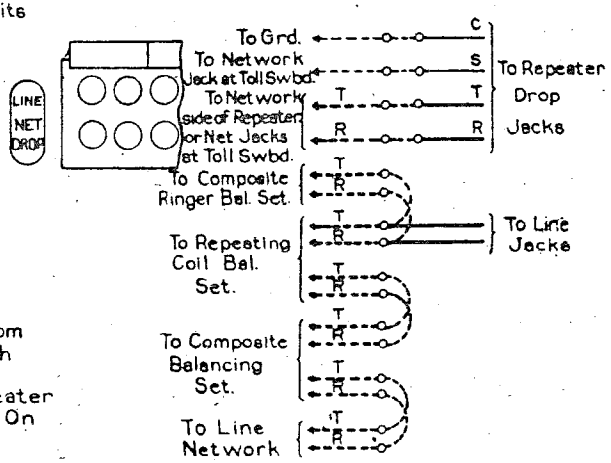
202-B-63
Standard

TELEPHONE REPEATER EQUIPMENT

NETWORK JACK CIRCUIT

For offices where it is not necessary to bring the seperate networks out to Jacks





NOTES

The Composite Ringer, Repeating Coil and Composite Balancing Sets, Building out sections, Basic Network and half Load Retardation coils shall be furnished as specified

1. In offices where Cord Circuit Repeaters are not used, use No. 218-A jacks in place of the No. 217-A-Jacks.
2. When this network is used to balance a phantom circuit with composited side circuits which requires a resistance for balancing the resistance of the repeating coils on the side circuits the proper resistance shall be connected between terminals 3 and 8 of the phantom repeating coil balancing set.
3. When this network circuit is used to balance a composited phantom circuit the proper resistance shall be connected in series with the line network for the case mentioned in Note (2)
4. When this circuit is used for balancing lines for cord circuit repeater operation using Automatic Gain selection omit X wiring in all cases. On circuits for use with 4-wire, 2-wire repeater or carrier terminating circuits provide the No. B-346 relay using Y wiring omit Z. When using with circuits not specified above provide resistances and use Z wiring omit Y. When using for Cord Circuit repeaters using Manual Gain Control and this network circuit is used with 4 wire or Carrier Terminating circuits or where relays are provided for removing composite ringer balancing sets use X wiring omit Y and Z.
5. In offices where this network circuit is used for balancing lines used with through line repeaters only omit the jacks when specified using only the repeater net and net jacks associated with the repeater circuit for picking up the repeater net drop or network equipment
6. When the B-346 Relay is used, the 2-wire repeater, 4-wire or carrier terminating circuit shall be connected in place of the balancing network equipment
7. Three conductor patching cords shall be used with this circuit.

— APPARATUS —

2 — Jacks - No 218-A-
2 — Jacks No. 217-A- (Note 1)

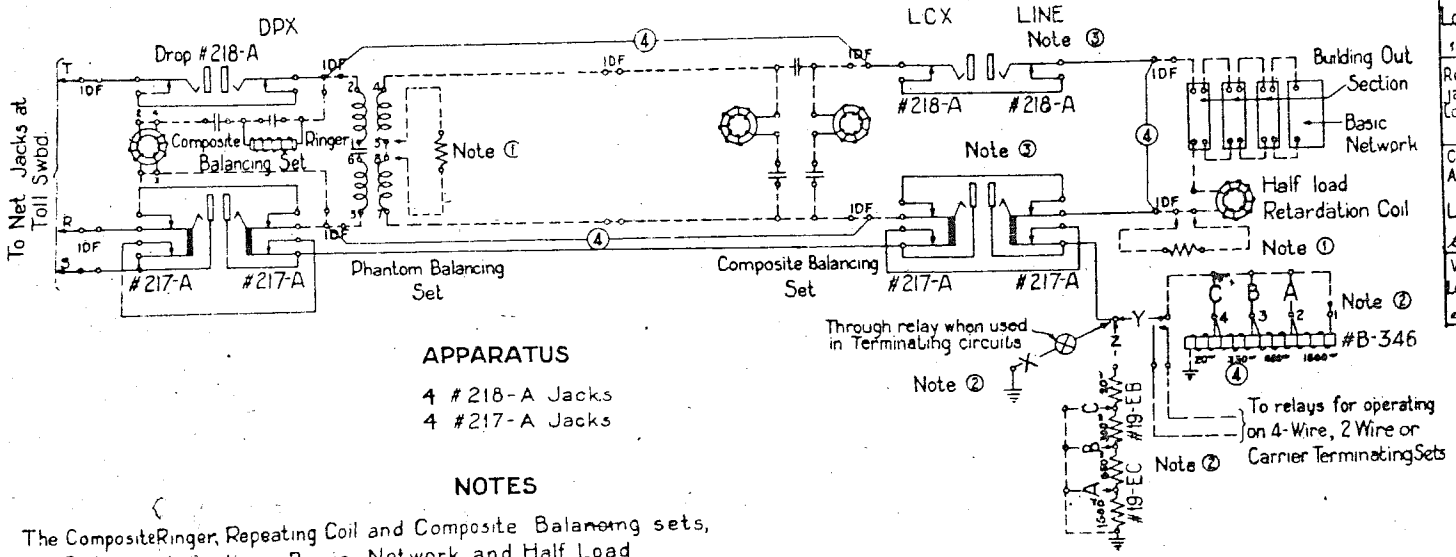
Engineer
Draftsman
Checked by
Made Standard 8-1-24
Log No. E 10 155. 6-2-23
ISSUE 1
Added jack designation.
Log No. P 11056, 9-4-23
ISSUE 2
Corrings
Log No. P 11949 2-14-24
ISSUE 3
Chgd. Notes 4 & 5
Added " 6 & 7
Log No. P 12970 6-21-24
ISSUE 4
Was Prov. made Std.
Log No. S-6331 8-1-24
ISSUE 5

AMERICAN TELEPHONE & TELEGRAPH CO.
Department of
Development and Research

TELEPHONE REPEATER EQUIPMENT
NETWORK JACK CIRCUIT
For use with Cord Circuit Repeater Operation

202-B-71
Standard

Engineer Draftsman C.J.A. Checked by Made Standard 8-1-24 Log No. P-10443 6-19-23 ISSUE 1
Reversed resistance in sleeve leads. Log No. P-11057, 9-4-23 ISSUE 2
Removed LPx & DCx Jacks. Added Note 3 Log No. P-11950 2-14-24 ISSUE 3
Chgd Notes 1 & 2 Added " 4 & 5 Log No. P-12971 6-21-24 ISSUE 4
Was Prov made Std. Log No. S-6334 8-1-24 ISSUE 5



APPARATUS

4 #218-A Jacks
4 #217-A Jacks

NOTES

The Composite Ringer, Repeating Coil and Composite Balancing sets, the Building out Sections, Basic Network and Half Load Retardation Coils shall be furnished as specified.

① When this network is used to balance a phantom circuit with composited side circuits when a resistance is specified for balancing the resistance of the repeating coils on the side circuits the proper resistance shall be connected between terminals 3 and 8 of the phantom repeating coil balancing set. When this network circuit is used to balance a composited phantom circuit the proper resistance shall be connected in series with the line network

② When this network circuit is used to balance lines for cord circuit repeater operation using automatic gain selection omit X wiring in all cases For use with 4 wire, 2 wire repeater or carrier telephone terminating circuits provide the B-346 relay using Y wiring omit Z when using with circuits not specified above provide the resistances and use Z wiring omit Y

When using manual gain control for cord circuit repeaters and this circuit is used with 4 wire, 2 wire repeater or carrier telephone terminating ckts, or with circuits where relays are provided for removing composite ringer balancing equipment use X wiring omit Y and Z

③ Omit these jacks when specified
④ When the B-346 relay is provided, the 2-wire repeater, 4-wire or carrier terminating circuit shall be connected in place of the balancing network equipment
⑤ Three conductor patching cords shall be used with this circuit.

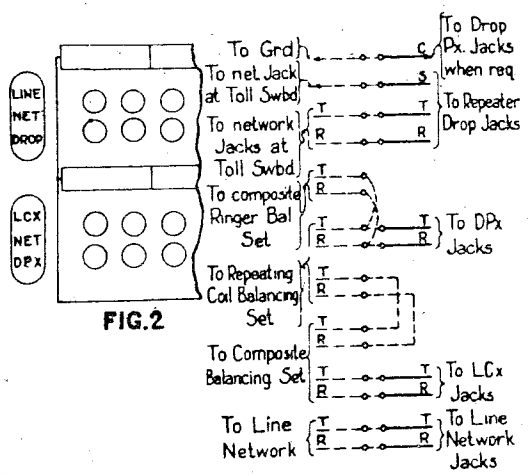


FIG.2

AMERICAN TELEPHONE & TELEGRAPH CO
Department of
Development and Research

TELEPHONE REPEATER EQUIPMENT
NETWORK JACK CIRCUIT
For Through Line Repeater Operation

202-B-92
Standard

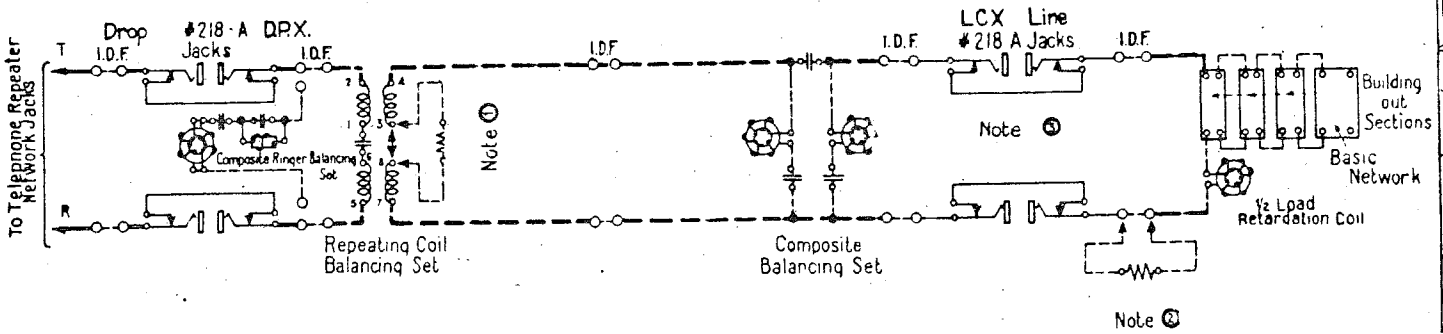
Engineer
Draftsman
Checked by
Made Standard 8 1924
Log No. P-10534 7-3-25
ISSUE 1

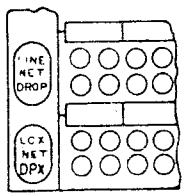
Added jack designation.
Log No. P-11060 9-5-25
ISSUE 2

Changed D.P.X. & D.P.X. Jacks to LCX Jacks Note 3
Log No. P-11601 2-14-27
ISSUE 3

Chgd Notes 1 & 2
Log No. P-12972 6-21-28
ISSUE 4

Was Prov. made Std.
Log No. S-6335 8-1-24
ISSUE 5





-NOTES-

The Composite Ringer, Repeating Coil, and Composite Balancing Sets, Building Out sections, Basic Network and Half Load Retardation coils shall be furnished as specified

① When this network is used to balance a phantom circuit with composite side circuits which requires a resistance for balancing the resistance of the repeating coils on the side circuits the proper resistance shall be connected between terminals 3 and 8 of the repeating coil Balancing Set when specified.

② When this network circuit is used to balance a composited phantom circuit the properresistance shall be connected in series with the line network as and when specified.

⑤ Omit these jacks when specified.

-APPARATUS-

8 - Jacks No 218-A