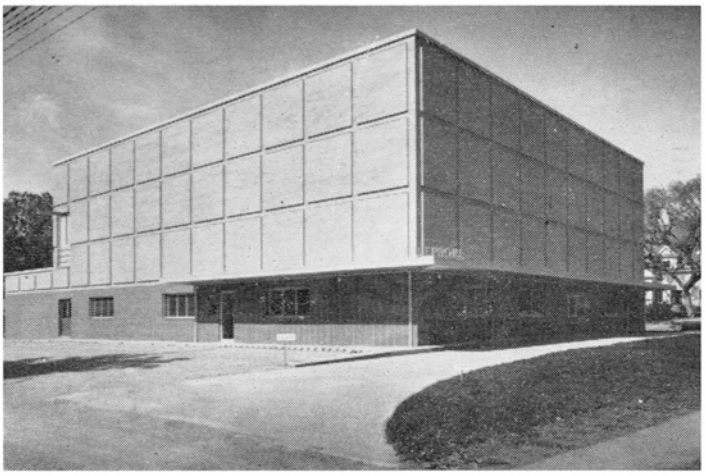
Part 1

The Beatrice SATT Equipment

by K. E. VERSAW

This article is the first of several to be written by Mr. Versaw, who is the engineer assigned to all phases of COE for the new Beatrice building. The articles are designed to acquaint employees, particularly plant men, with the function and operation of some of the equipment and devices now being brought, for the first time, into LT&T-land. Though not intended as a training text, this series will cover the essential features of SATT and those of our people who are interested in the mechanics of direct distance dialing will find it worth their while to save the several issues in which these articles will appear.—Editor.



The new Beatrice building, viewed from the southeast.

The members of the LT&T family are becoming quite familiar with the terms "Cutover" and "Conversion to Dial Operation," and as each year passes, more of the manual exchanges within our territory make way for progress with the Company's announcement of new "conversions to dial operation."

This conversion program has progressed until nearly all of us are familiar with the names of the common components in any central dial office. Most of the men throughout LT&T-land have become well acquainted with linefinders, selectors and connectors. These switches are the basic components which form the backbone of any Strowger dial office.

The casual visitor in many of our central dial offices would observe that one office looks exactly like the other, and quite often he would be correct. In many instances, however, outward appearances can be deceiving. The manufacturers of automatic equipment are continually making circuit changes and designing new equipment to improve the type and quality of service that a telephone company can provide its customers. These new equipment designs may also result in more efficient utilization of central office space.

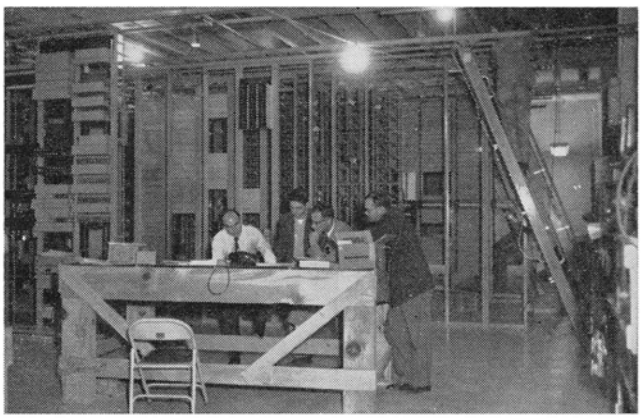
The automatic equipment in any dial office is provided to permit a subscriber within that exchange area to call any other subscriber in the same area by dialing the number listed in the telephone directory. The subscriber thereby completes the connection himself, without the assistance of a telephone operator. When the subscriber picks up his telephone handset, a linefinder switch finds his line and connects it through to a waiting selector, which provides the familiar "dial tone." Dialing the directory number causes the selector and connector switches to select the called subscriber's line and ring his telephone.

When our subscriber desires to make a call to a friend in a distant city, it is necessary for him to reach the long distance operator to complete the connection for him. Just a few years ago the completion of this call may have required the services of long distance operators in several cities along the way. It took time to pass information from one operator to the next along the line.

Our first big step toward faster long distance dial service came in 1950 with the cutover to new local and toll switching equipment at Hastings. With this conversion we were introduced to the new phrases "Intertoll Dial" and "Operator Toll Dialing." This new long distance service was not too obvious to our subscriber. He still must reach the long distance operator whenever he wished to talk to his friends in a distant city, but here the similarity ended. The new equipment installed in Hastings made it possible for the operators to complete toll connections to distant dial exchanges without the services of any other operators. All the toll circuits to connecting toll centers are accessible from the banks of the intertoll switch train. The routing information provided for the Hastings long distance operators specifies the special digits which must be dialed to reach the called exchange. After the operator has obtained the name of the city and the telephone number of the party our subscriber wishes to reach, she needs only to check the Intertoll Code for the desired city, then dial or key this code and the telephone number into the intertoll equipment. The call is then promptly completed by the intertoll switching equipment. As long as idle circuits to the called exchange are available, these long distance calls are completed almost as quickly as a local call. In addition to completing the long distance call, our operator must record the telephone number of the calling subscriber, the city and telephone number called, the time and the length of the conversation on a toll ticket. This information is required in order to bill our customer for his toll call.

Operator toll dialing service was extended to include most of the remaining subscribers in LT&T territory with the cutover of the intertoll dial switching equipment and the new toll switchboard in our big, new equipment building at 15th & M streets in Lincoln in late 1953.

Our conversion program is a continuing process, with dial service for all of our subscribers as an ultimate objective. As the new equipment is ordered for each exchange, consideration is given to any new equipment that may enable us to provide better and



The spacious equipment room on the second floor is rapidly filling with racks, panels and bays. The installation is being made by a crew from Automatic Electric. The camera found a group of our folk in an exchange of information while keeping abreast of developments. Left to right: K. E. Versaw, engineer; W. L. Eckles, Jr., chief switchman; Dan W. Smith, district wire chief; and G. L. Oglesby, area manager.

more modern service to our customers. Equipment is now being delivered and installed in several of our exchanges, but the center of interest, both because of its size and the type of equipment provided, is at Beatrice.

The local switching equipment now being installed in Beatrice may look much the same as that now in service in Lincoln or Hastings, but it includes special features not previously used in any other exchange in our territory.

The initial installation will provide equipment for 3110 lines and 4700 connector terminals arranged as follows:

Class of Service	BankTerms. Conn.	Line Eqpt.
Indiv. & 2 Party	4000)	
Trk. & Level Hunting	400)	3000
Rural, 10 Party	100)	
Paystation	100	60
Telephone Co. PABX	100	50
Total	4700	3110

The equipment will be mounted on single sided frames 11'-8" high. This is the standard arrangement in our larger offices.

Now let us take a look at the individual ranks of local switches as provided at Beatrice, and compare with those with which we are familiar.

The linefinder shelves are arranged for 200-line equipments, consisting of one "Line" and one "Cutoff" relay per line, and for 20 linefinder switches, a standard arrangement, but this shelf has felt the impact of Automatic Electric Company's "New Design" forces. The line and cutoff relays are quite small and require much less mounting space than before. A group of these new relays are shown in Fig. 1. Compare them with the standard type relays shown in the linefinder switch in the same figure. As a result of this new design it is now possible to install five linefinder shelves, 1000 lines, in one 11'-8" bay where only four shelves with 800 lines could be mounted previously.

The local and toll first selectors used here are referred to as 2L-5N type selectors. Beatrice will be our first large office completely equipped with this type of selector, and consequently our first office to use "Universal" seven-digit telephone numbers. These telephone numbers will consist of the first two letters of the exchange name, and five digits. For example, the exchange name for Beatrice will be Canal, and a typical telephone number might be CA2-2222.

This numbering plan is also the result of many years of study by committees composed of telephone men from the Bell System and Independent companies. Previously, we referred to the special routing digits that the long distance operator must have available to complete a long distance call over the intertoll dial system. The universal numbering system will provide a distinctive telephone number for every subscriber. The telephone number will provide all the information required for the automatic equipment to complete the call. This means, of course, that no two numbers, anywhere, can be the same. It is not possible to provide everyone in the United States, and parts of Canada, with a distinctive telephone number by using only seven digits. In order to make a workable numbering system, the United States and Canada were divided into about 100 separate areas, each identifed by its own three-digit area code. Nebraska is divided into two such areas. All of the seven-digit telephone numbers assigned within each area will be different. When this network is completed it will be possible to complete a call to any telephone within an area by dialing only the subscriber's telephone number. When the call is from one area to another, it can be completed by dialing only the three-digit area code and the telephone number.

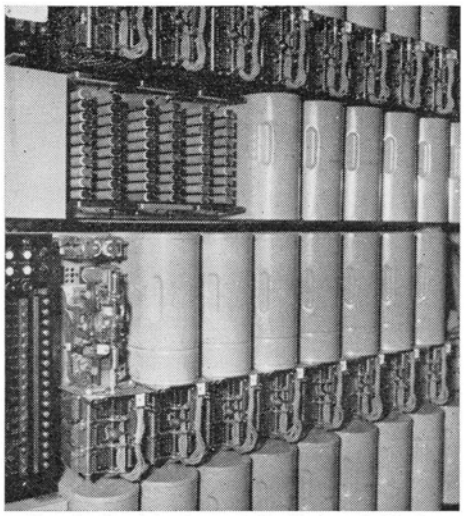


Fig. 1: Partial view of linefinder shelf showing miniature line and cut-off relays with cover removed.

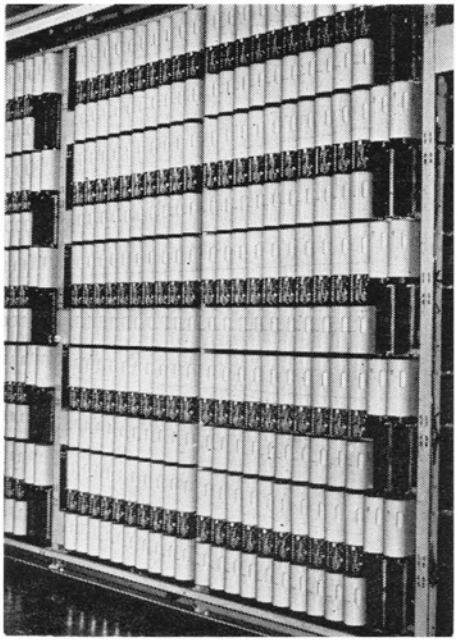


Fig. 2: As a result of improved factory design with miniature relays the Beatrice linefinder equipment is installed in five shelves totalling 1,000 lines per bay instead of four shelves with 800 lines as used in previous installations.

These special 2L-5N selectors were developed so that the smaller telephone exchanges that do not require the use of all seven digits to reach the called subscriber could take advantage of the universal numbering plan without installing additional ranks of local selectors with no other purpose than to use up the dialed numbers. These switches are arranged to "absorb" digits once only, or repeatedly, as the circumstances in each office require. To illustrate, subscribers in several of our dial exchanges, such as Valparaiso, Milford, Friend, etc., now have four digit telephone numbers. As each of these digits is dialed to reach a subscriber within that exchange, it performs a useful function in the local switch train. If these exchanges were to be assigned universal seven-digit numbers and included in the nationwide dialing plan, the equipment could be arranged to accept the seven-digit numbers by replacing the existing first selectors with 2L-5N type selectors. These selectors would absorb the first three digits of the new seven-digit number and then proceed to trunk through the local equipment on the last four digits to select the called subscriber.

Now to proceed with our local switch train. Since our first selectors are special and "absorb" some of the seven digits dialed, the next selector ranks are identified by their effective digits. At Beatrice we then have fourth and fifth selectors and connectors. These switches perform functions common to all dial offices.

The equipment, with the exception of the ten-party group, is arranged on a terminal-per-station basis with the connector bank terminals cabled to the horizontal side of the line I.D.F. where they are cross-connected to the line equipment terminals on the vertical side of the line I.D.F.

Two-party service is on a full-selective basis using divided ringing.

Ten-party lines are arranged on a terminal-per-line basis and are full-selective using five-frequency divided ringing. The third digit dialed into a ten-party connector (the final digit of the subscriber's number) determines the frequency and side of line for the ringing. The five frequency ringing current will normally be provided by an AC operated subcycle ringing machine. The frequencies provided are 20, 30, 42, 54 and 66 cycles per second. These ringing currents will be provided by battery operated vibrator ringing machines in case of AC power failure.

Trunk and level hunting connectors are supplied for PBX trunk groups. These switches respond to the last two digits of the dialed station's number, and thereafter automatically hunt for and seize the first idle trunk in the selected group.

Continued on Page 13

Der Bottelpost Vas Goot Stuff

Otto Andresen

Vollerwiek 2th Oktober 1956
uber Garding (Schlesw.)
Germany

Dear Sir or Madam !

Yor bottelpost has ben found on the Shor of the Eider river Oktober 2th by the Peninsul Eiderstedt Germany, near the Town Tönning, sharp, by the Village Vollerwiek on the mouths of the Eider. Pleas drop a line whence Jou dropt the bottel.

truly Your

Otto Andresen

Florence Tatman, associate editor, and Marilyn Sutton, Supply, reading Otto Andresen's letter, which is reproduced at left.

Almost stranger than fiction is the story of the wandering voyage of a message carried in its own glass ship.

Marilyn Sutton, stenographer in the Supply office, was exhibiting the letter pictured above, which was received by her father, LaVerne Sutton, of Alvo. It was written October 2 by Otto Andresen of Vollerwiek, Germany. Mr. Andresen found a note in a bottle which had been cast into the Missouri River three years ago by Mr. Sutton. The bottle was found on the shore of the Eider River in ancient Schleswig-Holstein, near the city of Tonnig in the northernmost part of Germany.

The bottle apparently floated down the Missouri-Mississippi watercourse and into the Gulf of Mexico. In due time it was wafted into the Gulf Stream, thence across the Atlantic, through the English Channel and into the North Sea.

Mr. Sutton remembers that the bottle was thrown into the Missouri near Rulo at about this time of year, in 1953.

Neighbors Come For a Visit

Part of the connecting company guests in the operating room, 15th and M. Left to right: Mabel Volpp, Lincoln; Jessie Seng, Hallam; Mrs. Hilda Burton, Palmyra; Elvin Seng, Hallam; Mrs. R. F. Phillips, Eagle; Walter H. Paschold, Firth; Bertha Wismer, Firth; Clarence Moothart, Firth; Anastasia Murphy, Falls City; E. H. Towle, Falls City; Mrs. J. A. Bonebright, Cortland; Mrs. Walter Winters, Martell; R. B. Hobson, Lincoln; J. A. Bonebright, Cortland; Melba Richards, Lincoln.

LT&T acted as host to a family gathering October 23 when representatives of several connecting companies responded to an invitation to come to Lincoln for an office visit.

The group met at mid-morning and were taken on a conducted tour of the new equipment building by Merl Sherman and Chauncey Eggerss of Lincoln Commercial. Our neighboring telephone people had an ample opportunity to inspect the local traffic department where Melba Richards, Mabel Volpp and Dick Hobson were able to assist them in some of the problems of adjusting their service to changing operating methods brought about by new developments and equipment.

They were joined at luncheon at the Cornhusker Hotel by company officials, after which they visited other operating departments and saw the motion picture "Milestones of Service." All were in agreement that the meeting was of high interest and mutual assistance.

Beatrice SATT Equipment

Continued from Page 3

PBX trunks or consecutively numbered lines of the same group must be assigned to adjacent connector terminals in the same hundred group. These terminals need not be on the same level; however, if a group is split between two levels, assignment must be made on the last terminals of the first level and first terminals of the next higher level. Directory listing of the rotary terminals will be that of the first terminal in the group (lowest bank number of the group).

The rotary connectors are provided with a "night service" feature. If any number of the group other than the first is dialed, the connectors stop on that contact in the same manner as a regular connector. This arrangement allows any or all trunks within a PBX group, with the exception of the first, to be assigned as a night number and to be listed as such in the directory.

This completes the list of basic local equipment required for our new office. Additional equipment is required before it can be placed in service. This includes power and test equipment. Beatrice will be well supplied. The power room will include five separate sets of batteries, ranging in capacity from 760 ampere hour to 8 ampere hour, each with its associated charging equipment. An emergency diesel engine generator set is also provided. This generator can provide electric power for all lights and equipment in the building in case of failure of the commercial power supply. Testing equipment provided will include test distributors, test connectors and a four position combination local and toll test board as well as various portable test instruments.

Beatrice will also have the toll equipment required to provide our customers with the finest and fastest long distance service in Nebraska. We will have the necessary automatic switching equipment to extend intertoll dialing service to all LT&T subscribers in the Beatrice area. The Automatic Electric Company's six position Type 31 Toll Switchboard will be equipped with key senders for efficient operator toll dialing service. In addition, Beatrice will be our first exchange and the first in the state of Nebraska to be fully equipped to permit our subscribers to complete their own long distance calls. This cutover will permit us to add "Direct Distance Dialing" to our growing list of "firsts" for the Independent telephone industry in Nebraska.

Part 2

The Beatrice SATT Equipment

by K. E. VERSAW

This is the second of a series of articles by Mr. Versaw designed to inform employees of the innovations we shall encounter in equipment and practices with the inauguration of direct distance dialing at Beatrice. The first article appeared in the November issue.

"Direct Distance Dialing" is the term that has been selected by the telephone industry to describe the long distance toll service where the call is completed in direct response to the telephone number dialed by subscribers from telephones in their own homes.

The equipment being installed in Beatrice to make this service possible is manufactured by the Automatic Electric Company of Chicago and is known as Strowger Automatic Toll Ticketing equipment, now commonly referred to as SATT equipment.

Automatic Electric obtained its first automatic toll ticketing patent in 1928. The first nationwide toll ticketing system was developed for the Belgian Telephone Administration, and accepted by them in 1938. The first SATT installation made in the United States was at Santa Monica, California in 1944.

During the past ten years, developments in long distance dialing have proceeded at a particularly rapid rate, and this period has also seen the development and use of facilities for dialing of toll calls by telephone users as well as operators. Several SATT installations have now been completed in different parts of the United States, but the system is still such that each installation must be carefully analyzed and the equipment manufactured particularly for each location.

SATT or Strowger Automatic Toll Ticketing refers to that portion of the automatic equipment that is required for the automatic completion of a customer-dialed toll call and for the recording of all information concerning this call. The SATT equipment performs all the functions that have previously been performed by the long distance operator. This includes routing the call to its completion, recording the telephone numbers of both the called and calling subscriber, the time the call was placed and the length of the conversation. This equipment may also be arranged to select an alternate route to the called exchange when all the trunks on the normal routing are busy. After each call has been concluded, the stored information concerning the call is passed on to special equipment that records the information on a reel of paper tape. This information is recorded on the tape by means of a series of coded punched holes. The perforated tape can then be fed into several different types of equipment according to the results required. This may be a printed toll ticket or a completed monthly statement for the customer.

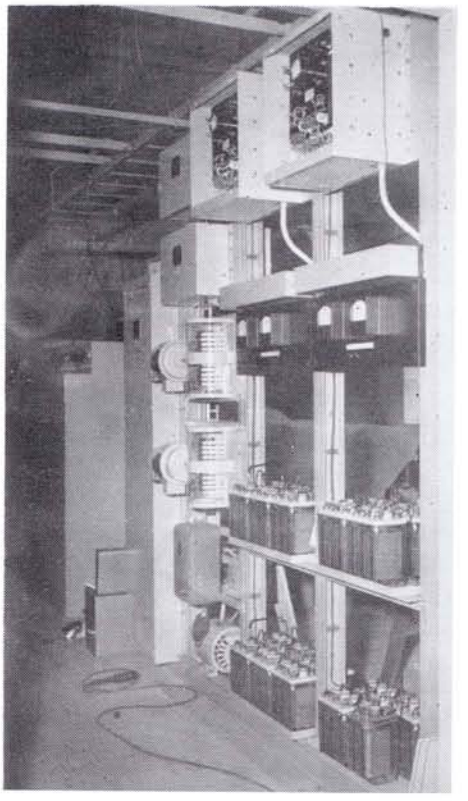
There are four general types of SATT equipment, and they are identified generally as Types A, B, C & D. Briefly these can be described as follows:

Type B: Completely automatic. The subscriber dials only the seven or ten digit number of the party he wishes to call. The equipment determines whether the call is local or toll and, if it is toll, identifies the calling subscriber's telephone number and routes the call to completion.

Type B: The subscribers must dial a special access code to reach the SATT equipment for the toll call and then the seven or ten digit number for the party he wishes to call. His telephone number is automatically identified by the equipment, which also proceeds to route the call to its destination.

Type C: This system requires the subscriber to dial an access code to reach the SATT equipment for his toll call, the telephone number of the party he wishes to call, and then his own telephone number. The Type C system then records this information and completes the call.

Type D: When the SATT equipment provided is of this type the subscriber dials the SATT access code and the telephone number of the party he wishes to call. The equipment calls in a toll operator to identify the calling subscriber and key his number into the equipment. The call is then routed to completion.



The special 80-volt detector battery and 50-volt spotter battery required for the SATT equipment are provided in the self-contained power and charger racks shown here. These batteries are used in conjunction with the regular battery during the process of identifying the calling subscriber's number.

The equipment now being installed in Beatrice is a combination of the Type B and Type D SATT systems and is being referred to as Type BD SATT.

The initial installation in Beatrice will include detector equipment, for the automatic identification of the calling subscriber's telephone number, for business stations only. The local and rural Beatrice subscribers' telephone numbers will be recorded into the SATT equipment by the Beatrice toll operator.

The central dial offices at Filley, Pickrell, Plymouth and DeWitt will also have access to the Beatrice SATT equipment. The Beatrice toll operator will be required to identify the calling number from each of these exchanges for the SATT equipment. To facilitate this identification the directory numbers for all these exchanges will be the full seven digit number even

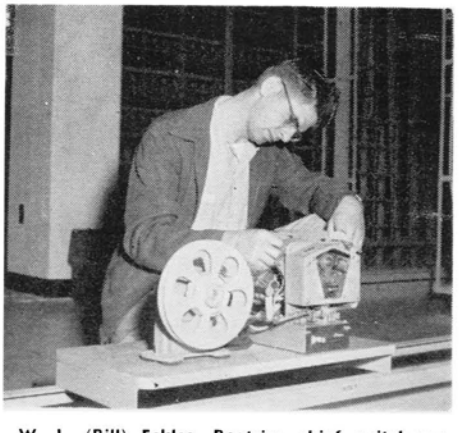
though the subscribers at Plymouth, DeWitt and Filley will still be required to dial only a four digit number to complete their local call. The seven digit number will completely identify the station number and the exchange for the SATT equipment.

Let us take a look at this new telephone service as it will be used by the subscribers in the Beatrice area. We must remember that to many of our subscribers in Beatrice, even local dial service is new. The importance of knowing the correct telephone number and then the proper use of the dial must be stressed in all instructions to the subscribers. This becomes even more important with the introduction of direct distance dialing.

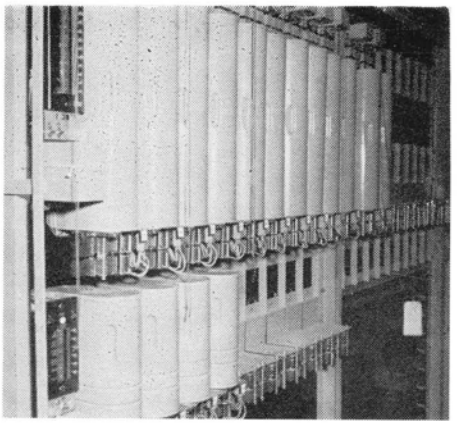
The SATT equipment will be used by our subscribers for all station-to-station toll calls to most dial offices in LT&T territory and to Omaha. Eventually, when the proper equipment has been installed in Omaha, they will be able to take part in nationwide dialing. The equipment in Beatrice will require no changes other than providing to it the identifying codes for these aditional exchanges as they become available.

A local subscriber who desires to place a person-to-person or a collect toll call will dial the single digit "O" to reach the long distance operator. The operator will record the necessary information and complete the call for the subscriber. She will be required to complete a toll ticket for each call.

A local subscriber who desires to establish a toll call to a distant automatic office, station-to-station, may dial the call direct. A special directory is provided which lists the exchanges that may be reached by direct distance dialing and the routing digits required to reach each exchange. These special digits are required to make a six or seven digit number for all exchanges, even though the present directory listing is only a three, four or five



W. L. (Bill) Eckles, Beatrice chief switchman, ponders the intricacies of a tape perforator unit. The primary record of all completed SATT toll calls is the punched tape produced by the machine.



The ticketer selector repeaters, shown here, select the proper toll circuit group to route the subscriber dialed toll call to completion.

digit number. As our program progresses and each exchange is identified by its proper seven digit directory number, no special routing digits will be required.

Since the Beatrice SATT equipment is a combination of B & D Types, our subscribers must first dial a SATT access code to seize the toll ticketing equipment. This code for Beatrice and tributaries is "90." Next the subscriber will dial the special routing digits provided by his SATT directory and then the listed telephone number for the called party. If this call is placed from a telephone with automatic detector equipment (business phones only), the calling number is recorded automatically in the ticketer, and the automatic switching equipment extends the call to the distant exchange and to the called station.

If this call was placed from a local residence telephone without automatic detector equipment, a Beatrice Long Distance operator will ask the calling subscriber for his telephone number. This number will be keyed into the ticketer by the operator, and the call will then be extended by the automatic equipment to the called station in the distant exchange.

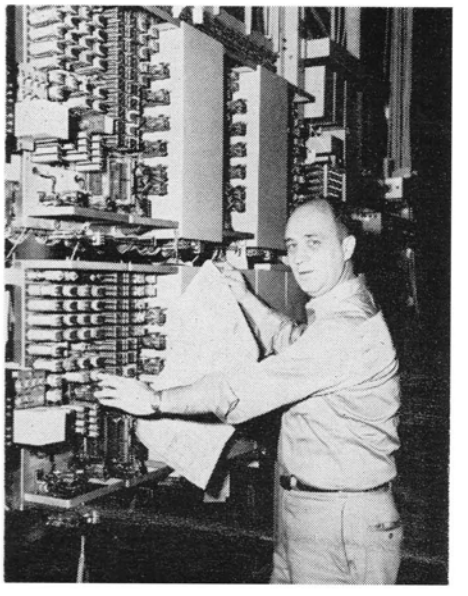
The SATT equipment will automatically record all the essential information concerning this toll call. Timing of the conversation is started when the called subscriber answers his telephone, and is stopped when the calling party hangs up his telephone. When the call has been completed, the ticketing equipment will collect all the required information, which will then be recorded on the tape in the form of coded punched holes.

All toll calls from paystation telephones must be routed through the Long Distance operator for completion. The paystation phones will not have access to the SATT equipment.

As previously stated, the central dial offices of Filley, Pickrell, Plymouth and DeWitt will also have access to the SATT equipment in Beatrice.

Subscribers in these dial tributaries desiring to place person-to-person long distance calls either to Beatrice subscribers or to distant LT&T dial offices, or to place any toll call to manual exchanges or most points beyond our company territory, dial the operator code. This seizes the Beatrice trunk circuit and signals the operator at the toll board in Beatrice. The Beatrice operator answers this call and, after recording the information provided by the subscriber, extends the call to completion.

Dial tributary subscribers desiring to place a station-to-station toll call either to Beatrice subscribers or to authorized distant dial offices may complete their own calls. The subscriber dials the SATT access code provided for his exchange, plus the required routing digits for the exchange desired, plus the called party's directory number. The Beatrice toll operator is signaled after the subscriber's dialing is completed, and asks the calling party for his telephone number. This number is keyed into the ticketer by the operator to complete the identification for this call. The ticketer then forwards the digits provided by the subscriber and extends the call to the desired exchange and the called station. Timing of this call is started when the calling station answers. When this call has been completed, the ticker will collect all the information regarding the call and forward it to the tape perforators for recording. This tape becomes the primary record of the toll call placed in this manner.



Already on the job at Beatrice are experienced switchmen Lambert Eitel (shown here), formerly of Lincoln, and R. M. Drake, who transferred from Hastings. They will form the nucleus of the equipment forces following conversion.

The Beatrice SATT Equipment

by K. E. VERSAW

The descriptions that I have provided for the new Beatrice equipment in the first two articles of this series have been of a general nature. I have tried to give all our readers a general understanding of what the new SATT equipment will be able to do for our subscribers. I now wish to "dig a little deeper" and try to tell more about the individual units of equipment that are being provided to make up our first SATT installation. K.E.V.

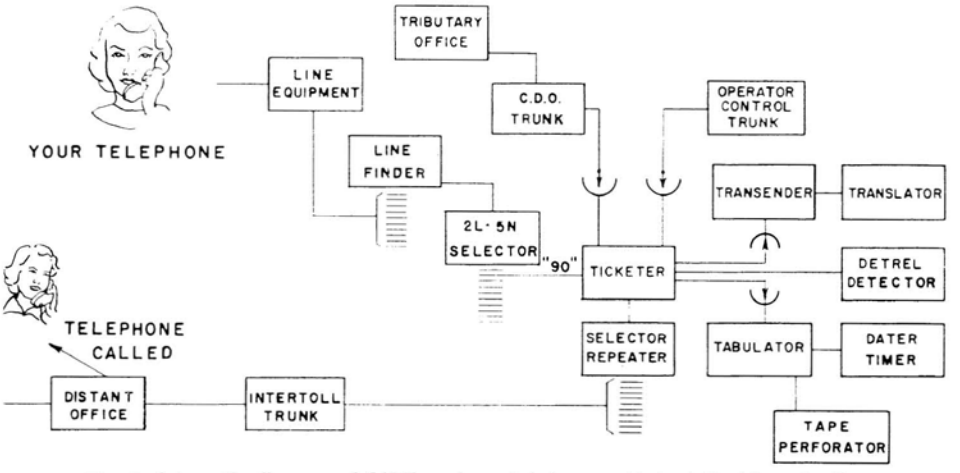


Fig. 1: Schematic diagram of SATT equipment being provided at Beatrice, charting the course of a long distance call from a subscriber at Beatrice or a tributary office.

It might be well to pause here for a moment to look at the general plan for this SATT installation.

Since we have had no previous experience with SATT equipment in any of the LT&T exchanges, Beatrice will not only be the first to offer Direct Distance Dialing, but it will enable us to make studies of the equipment and its functions so that we will be able to make the best use of it in our future dial conversions.

In this initial installation, it has been planned to provide all the basic SATT common equipment with features that will permit Beatrice to become a part of the Nationwide Direct Distance Dialing network as soon as such facilities are available.

Automatic detector equipment is being provided at first for only part of our Beatrice subscribers. The 700 terminals of detrel detector equipment now being installed will be assigned to business telephones only. The station-to-station toll calls dialed by the rest of our Beatrice subscribers and by the subscribers in Pickrell, Plymouth, Filley and DeWitt will rely on the "BD" operator to identify their telephone numbers to the ticketers. This will permit us to make comparisons between the two methods of operation which will determine the pattern for the future. Detector equipment can be provided for the remainder of the Beatrice subscribers should it prove advisable. Detector equipment is not planned for tributary offices.

The major components of equipment included for Strowger Automatic Toll Ticketing, and the quantities, are as follows:

12 Ticketers
12 SATT Selector Repeaters
3 Transenders
1 Translator
1 Dater-Timer
1 Ticket Printer
1 Spotter Battery, 50-Volt
1 Detrel Detector
3 Operator Control Trunks
1 Monitor Rack
2 Tabulators
2 Tape Perforators
24 Ticketer Hunter Control Relays
1 Detector Battery, 80-Volt

This equipment has been arranged in a schematic functional diagram in Fig. 1. I will attempt to describe the general operation of each of these units, how it is associated with the other equipment, and the part it plays when our subscriber places his station-to-station toll call by Direct Distance Dialing.

The ticketers are made up of two components. These are the control unit and the storage unit. The ticketers and associated selector repeater are the only parts of the SATT equipment which are associated with the calling station for the duration of this toll call. The ticketers call for and are associated with the other units of the SATT equipment for specific functions during the processing of the call.

The ticketer requires the services of the detector for a very small fraction of a second to identify the calling station. A transender is called into use only during the time the connection is being established. During a portion of the time that the transender is working with the ticketer, it requires the added services of the translator.

A Tabulator is associated with our ticketer for a short period at the completion of the call, and it in turn requires the assistance of a tape perforator.

Each ticketer is directly associated with a ticketer selector repeater and a transender hunter. The specific functions of each of these units of SATT equipment will be described as we follow a subscriber dialed toll call through the SATT equipment.

The first step for the subscriber in placing this call is to consult the special Direct Distance Dialing directory provided for all subscribers in the Beatrice area. This directory will provide a list of all the exchanges that can be dialed directly by the subscribers, and the special code required to reach that exchange. For example, the code shown for Lincoln is 55. In order to place a station-to-station toll call to Lincoln, we must first dial "90" for SATT access, then "55," then the 5-digit telephone number of the Lincoln subscriber we wish to call.

When this call is originated from a Beatrice telephone, the first digit "9" selects an idle ticketer connected directly to the ninth level of the local first selectors.

The "9" dialed by a subscriber in one of the dial tributaries of Beatrice will select a toll trunk circuit to Beatrice. As-

sociated with this trunk in the Beatrice office are ticketer hunter control relays and ticketer hunters. An idle ticketer is selected and associated with this trunk by the ticketer hunter.

The "0" digit serves a different purpose in each of the previous situations. Beatrice party line business phones are equipped with SATT station-identity dials. The dial provides a special pulse to identify each party on a party line.

When the digit "O" is dialed on a station-identity dial, a single ground pulse is impressed on the line loop at a time when the regular impulse springs are closed. This is the "spotter" pulse. It may follow after any one of the ten line pulses. The location of the spotter pulse indicates the calling party line station. These spotter pulses are effective only when dialing the "O" of the SATT access code. Initially we will be concerned only with 2-party lines at Beatrice; however if the digit "O" is not dialed into the ticketer, it will record as an incomplete identification and will call in the BD operator to complete the calling party identification. The "0" must be dialed into the ticketer even though the call may be from a station without automatic detection.

When the "O" is dialed over the trunk circuit from the tributary office it serves mainly as a time interval for the ticketer hunters to select and associate a ticketer with the calling station.

In both of the instances above, the ticketer, once selected, is associated with the calling station for the duration of the call. On station lines equipped with automatic identification, the detection cycle is completed shortly after the "O" digit is completed.

Each station equipped for automatic identification has the "c" terminal of its line equipment connected through a detrel relay and an associated neon lamp to the detector relay equipment.

After the "0" digit has been dialed, the 80-volt detector battery is momentarily returned from the ticketer over the selector and linefinder "c" lead and causes the associated neon lamp to fire. This permits the associated detrel relay to operate and identify the connector terminal. Thousands and hundreds group relays associated with this detrel relay are also operated, thus identifying the terminal number. If the person originating this call was one party on a party line, the spotter battery and station identity dial would also function during the dialing of the digit "O" to identify the party on the line.

Each digit dialed by the subscriber, as well as the digits of the calling party's telephone number, must be recorded by the ticketing equipment and held in storage until the call has been completed. This information is stored by register relays known as codel units. One codel unit is required for each digit that must be registered and stored. Each codel unit consists of four small relays identified as W, X, Y and Z. The digit registered is determined by the combination of the codel relays that are operated, according to the following plan:

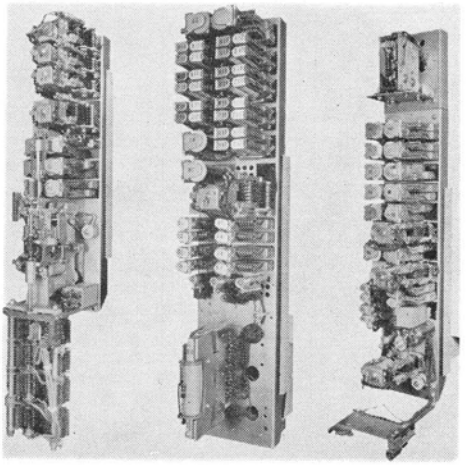
WX	WY	WZ	XY	XZ	YZ	W	X	Y	Z
1	2	3	4	5	6	7	8	9	0

The transfer of registered information from unit to unit of the SATT equipment is on the basis of four wire circuits, W, X, Y & Z, marked to identify the digits according to this same plan.

During the time that the "O" was dialed, a transender from the common pool has become associated with the ticketer. The transender is required while the called number is being dialed, and will be retained under the control of the ticketer until it has obtained a routing directive from the translator, and until it completes the required sending. Upon completion of the sending, the ticketer switches through and frees the transender for use on other calls.

The transender circuit is composed of three separate units. These are the transender codexer, trensender coder and transender sender. These units operate in direct conjunction with each other.

The digits of the called number dialed by the originating subscriber are stored by the codel units in the ticketer and are repeated to the transender codexer unit. The codexer unit is a Strowger type switch with 800 point banks. It registers the three digit office code as it is repeated through the ticketer. The first digit is registered on the banks of a rotary switch, and the second and third digits are marked by the vertical and horizontal position of the transender codexer wipers on the 800 point banks. The transender now calls for association with the common translator. One translator relay is required for each different routing directive to be provided by the SATT equipment. There are 40 translator relays provided at Beatrice, with mounting space available for thirty additional relays.

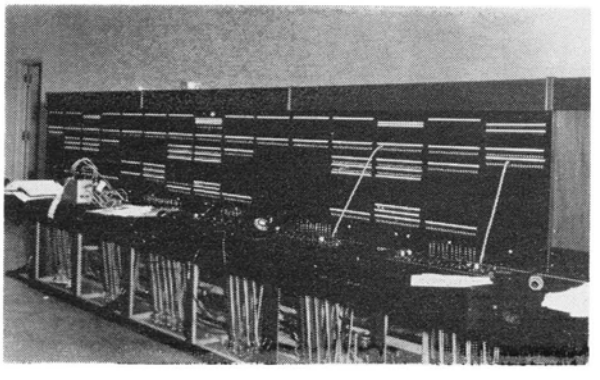


CODEXER CODER SENDER
The three units which make up the Transender.

When the translator is seized, a circuit is closed from the transender to one of the multi-contact relays in the translator. This relay operates and extends the leads connected to it from the Code Assignment Jumper Field through to the Translator Jumper Field. Only one of these leads is grounded in the codexer. This ground is connected to the Translator Jumper Field and then to the required Translator Relay. Translator Relay Terminal Block Strapping is provided by the Installer to identify the routing information required for the Translator Relay associated with each office code.

All the codel and miscellaneous leads from the transender coder are extended to the translator for a brief period. At this same instant the Translator Relay, operated because of the office code dialed, grounds some of these leads and operates the corresponding relays in the coder, The operation of these relays in the coder places a ground on codel leads making the routing directive available to the transender sender. The transenders and translator are arranged to provide a routing directive with a maximum of six digits. Usually fewer than this are required. In addition to the possible 6-digit routing directive, a single control digit is provided. The control digit determines how many of the subscriber digits are to be pulsed forward by the ticketer, and how many are to be absorbed.

Note: Mr. Versaw will continue the story of the functions of individual units of the Beatrice SATT equipment in the next issue. Editor.



In rapid process of installation on the first floor of the new Beatrice building is the six-position toll board.

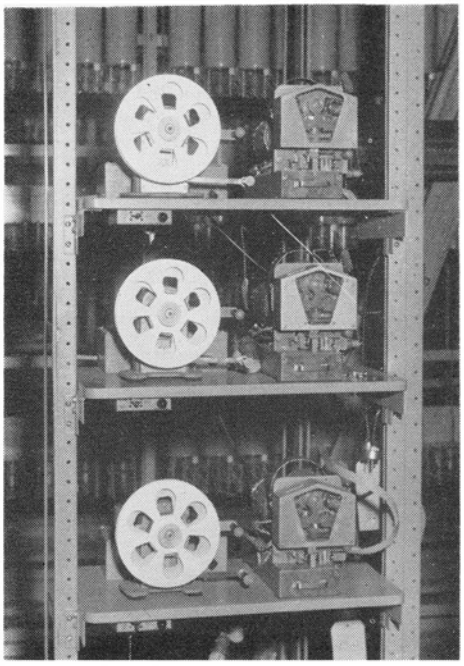
The Beatrice SATT Equipment

by K. E. VERSAW

If this is a normal type "B" call, identification of the calling station has been completed and the sending of the routing directive will start as soon as it is received from the translator.

Should this call originate from a type "D" subscriber station, the start sending signal is delayed until after the subscriber has completed the dialing of his number. The ticketer now calls for a "BD" operator. Upon receiving the signal on her "BD" operator's trunk, the operator presses her "accept" key and her position telephone circuit is connected through to the ticketer. The only function of the operator on this type "D" SATT call is to determine the telephone number of the calling subscriber, and identify it to the ticketer. The operator asks the calling subscriber for his telephone number. This information is passed on to the ticketer by means of the operator's keyset. The ticketer sending sequence is started as soon as the calling station has been identified to the ticketer by the operator. Even though the calling subscriber passes his telephone number verbally to the "BD" operator, she has automatic equipment available in the office over which she may verify the calling station.

When calling station identification has been completed, either automatically or by the BD operator, the transender starts sending. First the control digit is passed to the ticketer to determine the number of subscriber dialed digits that are to be forwarded over the toll trunk circuit. The next digit provided is the first digit of the translated routing directive, and represents the bank level of the SATT selector repeaters assigned for the desired toll trunk. The digits of the routing directive, and all subsequent digits, are sent in the form of loop pulses over the SATT selector repeater to the dialed office.



Information required for the preparation of toll tickets is punched on paper tape by the Tape Perforators, shown here.

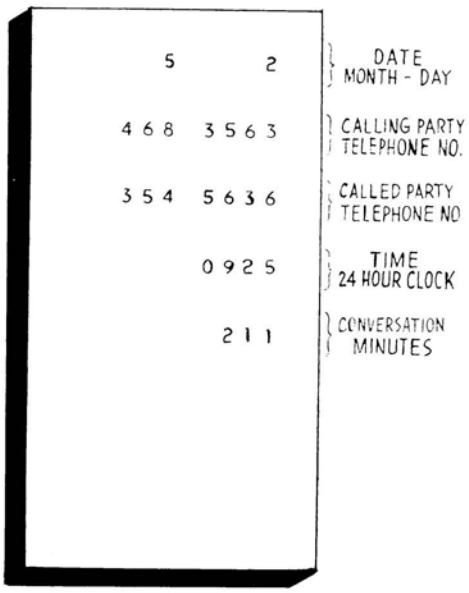


Fig. 1: Essential information, shown on the toll ticket, is obtained from information recorded on perforated tape.

The pulses used by the transender for routing this call are generated by a small constant speed motor. This provides pulses of a uniform speed and pulse ratio. The pulses sent by this circuit are determined from the information stored in the ticketer and transender coder. When the last stored digit of the directive has been sent, the digits of the called telephone number which are stored in the ticketer are sent, thus completing the call to the subscriber in the distant dial exchange.

When the called party answers, "answer" supervision is relayed through the connecting toll circuits and ticketer selector to the ticketer. This signal starts the timing equipmen in the ticketer for timing the length of conversation. Provisions are made for a maximum timing interval of 309 minutes. The conversation time is accumulated on rotary switches. The timing cycle begins as soon as answer supervision is received by the ticketer; however, a short "grace period," approximately five seconds, is allowed before any conversation time is actually registered. This interval is provided to prevent the ticketing of calls to wrong numbers. It is still recommended that the subscriber call the long distance operator and report when a call has been completed to a wrong number. It will be helpful if the caller can give the operator the number that was reached on such a call. This will provide a means of identifying a ticket that may be recorded should the grace period elapse before our caller hangs up his telephone.

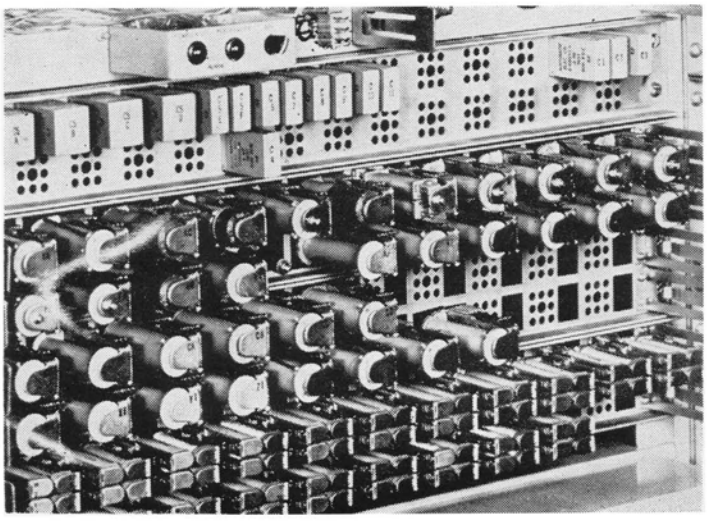
As was mentioned previously, the ticketer is capable of registering a conversation time of 309 minutes. Should the conversation timing reach 309 minutes, an alarm is sounded. If the call is extended beyond the 309 minutes, the 310 minute is registered as "000" and the 311th as "001."

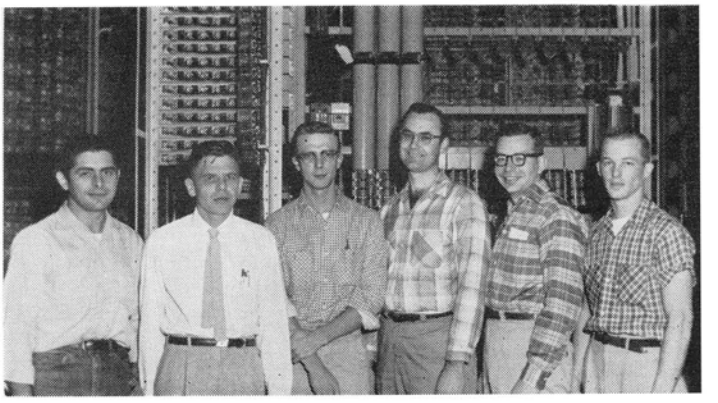
When the calling party disconnects, the ticketer selector and trunk circuit are released, as is all equipment preceding the ticketer. The ticketer will not release until the stored information concerning this call has been transferred to a tabulator. Here again the information stored in the ticketer is transferred to the tabulator over W, X, Y and Z leads, the numerals transferred being determined by the combination of markings on these leads. The information passed from the ticketer to the tabulator includes the called number, conversation time, ticketer identify number and the calling number. Since there are only two tabulators provided in the office, Allotter circuits are required to associate the tabulators with the ticketer calling for the services of a tabulator.

In order to complete all of the information concerning this call, the tabulator must obtain data from equip-

About the Author

Kenneth E. Versaw found his preparation for an engineering career rudely interrupted by World War II, but he returned to the University of Nebraska, majoring in electrical engineering, and graduated with a Bachelor of Science degree in January 1949. Two months later he became an employee of LT&T, first as a shopman at 21st and L and transferring, after a couple of months, to the engineering department. Mr. Versaw received his present rating as engineer in September 1954. He has been assigned to the Beatrice conversion project since the plans were in their preliminary stage.





Above: The Automatic Electric Company installation crew at Beatrice, from left: Bill Haberman, John Young, foreman, Jim Childs, Jack Paulsen, Gene Densmore, Clarence Forst.

Left: The Tabulator collects the toll ticket information which is then passed to the Tape Perforator for recording.

ment units other than the ticketer. The following information is obtained from the dater-timer circuit; calendar date including day and month, the time of day in hours and minutes, and a day or night rate indication. The tabulator may also record a two digit tabulator identity code which is provided from itself. All of the information that the tabulator obtains from the ticketer is stored on relays in the tabulator prior to being forwarded to the tape perforator. When the ticketer information has been passed on to the tabulator, the ticketer is released.

Provisions are made on the tabulator terminal block for strapping to control the sequence in which ticket information is passed from the tabulator to the perforator. This sequence determines the order that the information will appear on the finished printed ticket. The information is passed from the tabulator to the tape perforator in reverse numerical order; that is, units-tens-hundreds-thousands digits rather than thousands-hundreds-tens-units. This makes it possible to further process the punched tape roll without rewinding.

The motor circuit for the tape perforator is closed when the associated tabulator has received the call data. As the motor revolves the ticket information is passed to the perforator and operates the punch magnets according to the stored digits. As each digit is punched in the tape, a feed wheel advances it one notch to place it in position for the next digit. All the information pertaining to one toll call requires approximately two inches of tape for recording.

The perforator is arranged to provide an alarm signal when a roll of tape has been used up. In addition to providing a visual and an audible signal when it is out of tape, the perforator will also busy the associated tabulator to prevent it from being associated with a ticketer at the end of a ticketed call.

The information recorded on this completed tape can be processed by various means. The equipment for Beatrice includes a ticket printer. This machine will be used by the Accounting Department in Lincoln. The completed reels of tape will be sent to Lincoln for processing. The tape will be run through the ticket printer and a printed toll ticket will be produced. This ticket will be processed by the Accounting Department and included with the subscribers monthly statement in the same manner as are the toll tickets now made by the long distance operators. As long as the subscribers are placing and receiving person-to-person and collect calls, as well as making direct distance dialed calls, they will receive both the automatic and manually prepared toll tickets with their statements. The information recorded on the tickets, as shown in Fig. 1, will include:

1. Date, month and day
2. Calling number
3. Called number
4. Time of day
5. Conversation time (length of call)

The SATT equipment to be used in Beatrice will also include special testing equipment, and, of course, the monitor panel referred to previously, to enable the switchman to detect faulty circuit operation. To facilitate these testing operations, the completed tape will contain punched information that is not transferred to the ticket. This information will include the number of the ticketer and tabulator used on the call, so that the recording of any information that is erroneous can be referred back to the equipment actually used on the call in question.

The monitor panel provides a means of observing the progress of a customer dialed call through the ticketing equipment, as well as facilitating the tracing of trouble throughout the SATT equipment when it is encountered.

The observation of the progress of a call through the ticketing equipment is by means of supervisory lamps on the monitor bay. They are arranged to convey information as follows:

When ticketer is seized	Bright, steady lamp
When call has been answered, but before conversation time has been recorded (grace period)	Dim flashing lamp (60 IPM)
Ticketer timing conversation	Dim steady lamp
When call has been completed, ticketer calling for tabulator and transferring ticket data to it	Dim flashing lamp (120 IPM)
When ticket data has been transferred and ticketer is in process of releasing	Bright flashing light (120 IPM)
Conversation interval 300 minutes or longer	Bright flashing light (60 IPM)

For those of you who may be called upon to help maintain this new equipment, do not become too alarmed. These units are made up of the same relays, rotary switches and Strowger switches which are familiar in all our present dial offices. The equipment is the same; it has only been arranged to perform new and slightly more complicated functions.

I hope I have succeeded in presenting the story of our first SATT installation in enough detail to give our interested readers an idea of what this equipment will do and without getting too involved in the various units of equipment. I hope you will all feel that you have at least been introduced to the new names that will be encountered in this and the other SATT installations which are now in various stages of planning and ordering.

I am sure all of the LT&T family will be working together to make this another successful "first" offered by The Lincoln Telephone and Telegraph Company to its subscribers.