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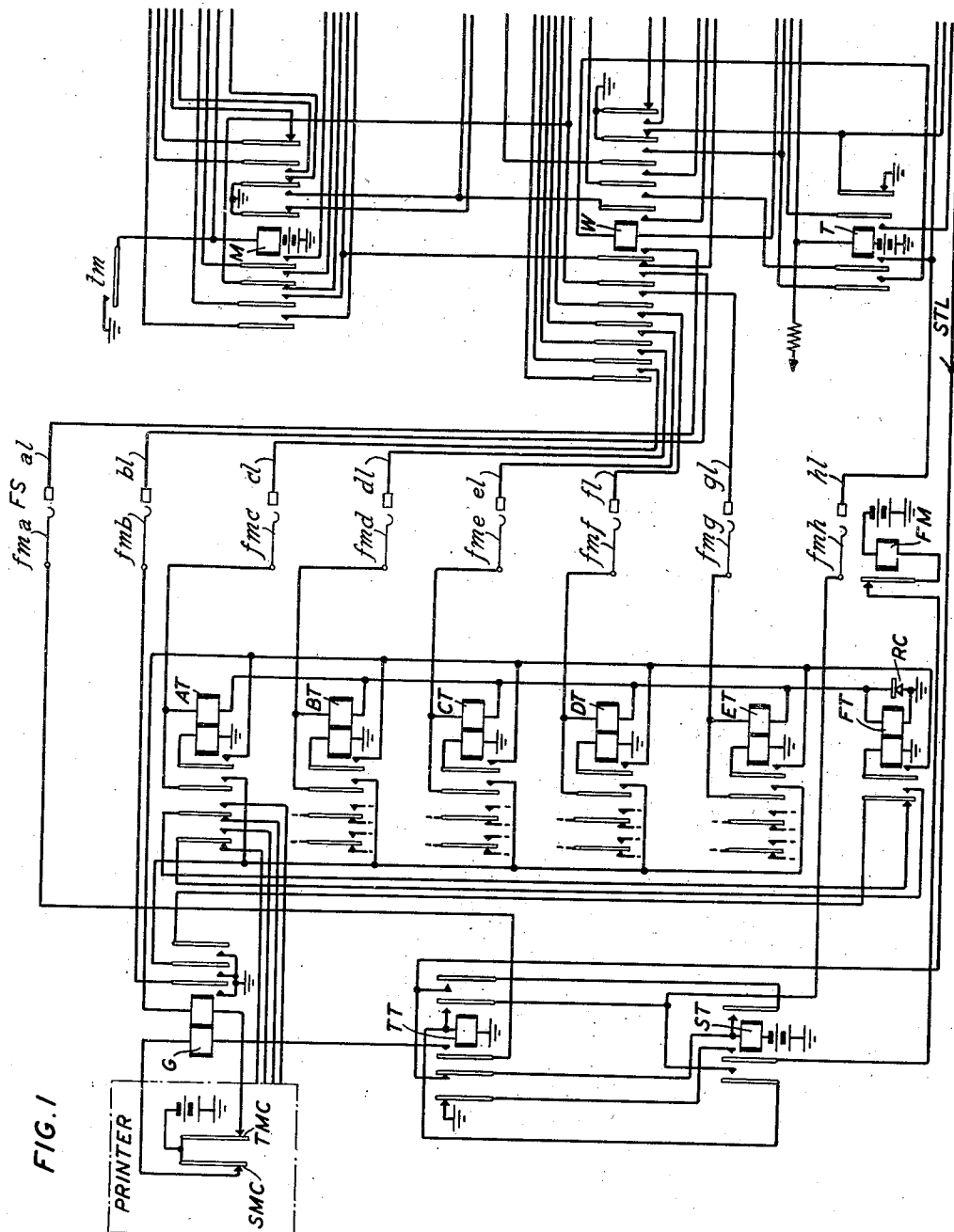
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AUTOMATIC TOLL TICKETING SYSTEM

Filed Jan. 19, 1939

2 Sheets-Sheet 1



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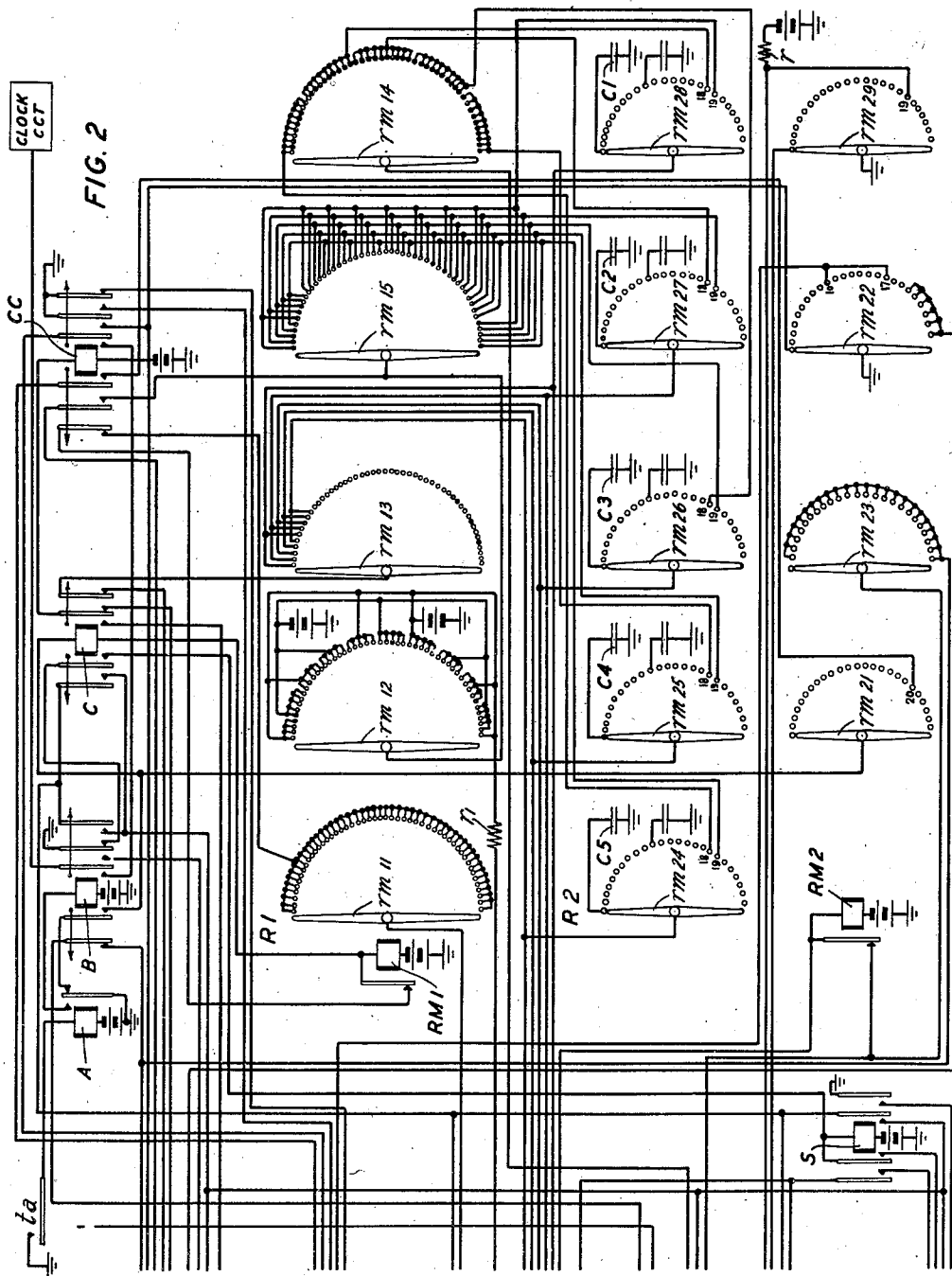
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AUTOMATIC TOLL TICKETING SYSTEM

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This invention relates to telephone exchange systems and more particularly to toll ticketing equipment therefor.

It is becoming the practice to record tariff particulars regarding connections between substations by printing or punching equipment which automatically records the identity of the calling and called substations and the duration of connections. The term "printing equipment" is to be understood to include other recording equipment such as punching equipment. Such equipment has previously received digits of the substation numbers direct from the dial or register controller and from calling substation identifying equipment and has received the tariff and the duration of the connection during and/or at the end of a connection. Such systems are described in British Patent 440,348, accepted December 27, 1935, and British Patent 484,568, accepted May 2, 1938. In these systems printing equipment has been associated with each connection during the recording of some of the call data or throughout the setting up and duration of the connection.

It is the object of the present invention to arrange that the printing equipment is only associated with the connection for a very short period of time irrespective of the length of the connection and consequently a much smaller number of printing equipments is required. The printing equipment is seized at the end of a connection and in order to shorten the time during which a printing equipment is in use, the calling substation identity is determined and recorded before the end of a connection in a manner convenient for quick transfer to a printing equipment.

According to the main feature of the invention, storage equipments are arranged to be associated with connections and to store information regarding the identity of the calling and called substations and the duration of the connections and automatic transfer equipment is arranged to be put into operation at the end of a connection to seize a printing equipment and to cause the transfer thereto of the information recorded on the storage equipment.

Preferably the digits are stored on cheap condenser storage groups. The provision of relay or switch storage for large numbers of digits would not be economical but might be more practical when the number of digits to be recorded is small. This might be the case in recording outgoing toll calls from a private branch exchange when the calling subscriber's number has only two or three digits and it is sufficient to record,

say, the identity of the area or exchange in which the called substation is located but not the complete identity of the called substation. Such a record together with the time of day and date would enable the firm to whom a private branch exchange belongs to determine the extension from which each toll call billed to them originated.

The printing equipment may be an ordinary tape teleprinter or teleprinter printing movement, for example, the Creed No. 10 tape teleprinter having an aggregate motion mechanism. The movement would comprise the type case or cases and the translating unit, five magnets being added controllable over five wires to set the transfer bars. The invention will be clearly understood from the following description of one embodiment of the invention shown on the accompanying drawings, in which:

Fig. 1 shows in the left portion thereof, transfer equipment for controlling a teleprinter in accordance with stored digits, a finder switch for associating the transfer equipment with a storage equipment, such as shown in Fig. 2 which has been seized for use and, in the right portion thereof, relays of the storage equipment; and

Fig. 2 shows digit and call duration storage equipment individual to a toll line, certain relay contacts of which are schematically indicated.

The digit storage equipment is provided with two step-by-step switches R1 and R2, switch R1 being responsive to impulses indicative of the calling and called line designations and to impulses indicative of the duration of the call and switch R2 serving as a sequence switch for successively associating groups of storage condensers with the switch R1 and for successively associating the groups of storage condensers and the setting of switch R1 in accordance with the call duration with the transfer equipment of Fig. 1.

The banks of switch R1 are provided with fifty terminals each and the wipers *rm1* to *rm15* associated therewith are advanced by the stepping magnet RM1 over one or more of the first ten off-normal terminals in response to digit series identifying calling and called line designations or over a plurality of all of the terminals in response to impulses transmitted from an associated clock circuit in accordance with the duration of the call.

The terminals of the bank associated with wiper *rm12* are divided into groups of ten, the first to fourth and tenth terminals of each group being connected to positive battery and the intervening five terminals being connected to nega-

tive battery, while the first ten terminals of the bank associated with wiper *rm13* are divided into two groups of five terminals each, the corresponding terminals in each group being connected to one of five conductors connected with wipers *rm24* to *rm28* of switch R2. These banks are effective for controlling the registration of digits of calling and called line designations on the condenser storage groups associated with the banks of switch R2 to which wipers *rm24* to *rm28* have access.

For registering digits indicative of the call duration, terminals of the bank associated with wiper *rm14* are divided into groups of ten terminals each, the terminals in each group being strapped together and connected to eighteenth position terminals of the banks associated with wipers *rm24* to *rm28* of switch R2 and the terminals of the bank associated with wiper *rm15* are divided into groups of ten terminals each, the first and sixth, second and seventh, third and eighth, etc., of each group being multiplied together and connected to five marking conductors connected to the nineteenth position terminals of the banks associated with wipers *rm24* to *rm28* of switch R2.

Connected to the normal terminals of the banks associated with the wipers *rm24* to *rm28* of switch R2 are five storage condensers C5, C4, C3, C2, C1 which may be charged either positively or negatively in accordance with the setting of wipers *rm12* and *rm13* of switch R1 to store the first digit of a called line designation. Similar groups of condensers (not shown) are connected to the succeeding terminals of these banks for storing the remaining digits of the called line designation. One or more terminals in each bank are then left vacant and groups of condensers, only the first group of which is shown, are connected to succeeding terminals for storing digits identifying the calling line designation and the tariff rate if required.

The circuits function in the following manner: When the toll line is seized for use, the relay contacts *ta* are closed thus causing the operation of relay A which in turn causes the operation of relay B. It will be assumed that to identify the called line designation, a maximum of nine series of impulses are transmitted to the toll line, each impulse causing a momentary opening of contacts *ta* and the consequent momentary release of relay A.

Relay B being slow to release remains operated during the momentary releases of relay A and therefore each release of relay A in response to the first digit series transmitted establishes a circuit from ground over the back contact of relay A, the left front contact of relay B, thence in series through the winding of slow-to-release relay C and the winding of stepping magnet RM1 of switch R1 to battery and ground. In response to the releases of relay A, the magnet RM1 advances the wipers of switch R1 step by step but relay C being slow to release remains operated through the digit series and maintains relay CC operated over a circuit extending from battery through the winding of relay CC, the right front contact of relay to ground over the next to inner right back contact of relay M.

When the first digit series has been received, relay C and relay CC release in turn and a charging circuit for one of the first group of storage condensers is established in accordance with the digital value of the first digit series. For example, if it be assumed that the first digit series

has a numerical value of 3, a circuit will be established from the positive battery over the third off-normal terminal of the bank associated with wiper *rm12*, outer left front contact of relay CC, outer right back contact of relay M, outer right back contact of relay C, wiper *rm13* and the third terminal of its bank, wiper *rm26* of switch R2 and the normal terminal of its bank through the condenser C3 connected thereto to ground thereby charging such condenser positively. Had the first digit had a numerical value of 5 and the wipers *rm12* and *rm13* been advanced to the fifth off-normal terminals of their banks, then current from the negative battery would have become applied over the circuit previously traced over wiper *rm12* to wiper *rm13* and thence over wiper *rm24* through the condenser C5 connected to the normal terminal of its bank thereby charging such condenser negatively.

By tracing the charging circuits from condensers C1 to C5, inclusive, over the wipers *rm12* and *rm13* of switch R1, it will be apparent that condensers C1 to C5 are charged positively to store the digits 1 to 4 and 0, respectively, and that condensers C1 to C5 are charged negatively to store the digits 5 to 9, respectively.

As soon as relay CC releases, the charging circuit of the condenser is opened and a restoring circuit for switch R1 is established from battery through the winding and interrupter contacts of magnet RM1, left back contact of relay CC, strapped terminals of the bank associated with wiper *rm11* to ground at the inner right back contact of relay M. As soon as the wipers of switch R1 reach their normal positions, the circuit of magnet RM1 is opened at wiper *rm11* and the switch comes to rest in readiness to receive impulses in accordance with the second digit of the called line designation.

During the reception of the first digit series, stepping magnet RM2 of switch R2 was energized over a circuit extending from battery through its winding, the next to inner left back contact of relay M to ground over the outer right front contact of relay CC and releases upon the release CC to advance the wipers of switch R2 one step in readiness to store the second digit of the called line designation upon the second group of storage condensers. The succeeding digits of the called line designation are stored in successive groups of condensers in a similar manner, the switch R1 being advanced in response to each series of impulses and restored to normal upon the termination of each series and the switch R2 being advanced one step upon the termination of each series of impulses.

Assuming that nine digits of the called line designation are to be registered, switch R2 steps to position 10 after registering the ninth digit, in which position a circuit is established from battery through the winding and interrupter contacts of magnet RM2, inner left back contact of relay W, the tenth terminal of the bank associated with wiper *rm22*, wiper *rm22* to ground thereby immediately stepping the wipers of switch R2 into position 11 in which position the wipers *rm24* to *rm28*, inclusive, engage terminals of their banks connected to condensers for storing the first digit of the calling line designation.

When the calling line number is required, a signal is sent back to the originating office, by means not shown, to request the transmission of impulses of said number, for example by calling line identifying equipment as described in British Patent 440,343 hereinbefore referred to.

It is assumed that the calling line number will be stored in the manner previously described in connection with the storing of the called subscriber's number before the response of the called subscriber and that thereafter the switch R1 is used for recording the duration of the call. Alternatively separate duration recording means could be provided or a preliminary duration recording device for the first minute or so of the connection could be provided until the switch R1 is available. Yet another alternative would be to defer the recording of the calling line identification until the conversation is finished, the calling line number being sent either to condenser storage groups, as above described, before being transferred to the teleprinter or to the teleprinter by way of the transfer equipment only.

It will be assumed that the calling line number has been registered immediately after the registering of the called line number on condenser storage groups connected in positions 11 to 16, inclusive, of switch R2. When the called subscriber responds, a relay associated with the toll line operates to close contacts *tm* thereby causing the operation of relay M. With relay M operated, a circuit is established for restoring switch R2 to its normal position which may be traced from battery through the winding and interrupter contacts of magnet RM2, wiper *rm23* and the strapped terminals of its bank, the outer left front contact of relay M to ground at the outer right back contact of relay CC. When the switch R2 reaches its normal position, the circuit of magnet RM2 is opened at the wiper *rm23* and a circuit is established for operating relay CC which may be traced from battery through the winding relay CC, the inner right back contact of relay C, the outer right front contact of relay M, the normal terminal of the bank associated with wiper *rm22* and wiper *rm22* to ground. Relay CC, thereupon operating, locks over its operating circuit to ground at its middle right front contact.

When relay CC operates, magnet RM2 is operated intermittently at three second intervals by clock operated contacts to advance the wipers of switch R2 to their twentieth position terminals so that the wipers reach such position after the expiration of one minute. The circuit of magnet RM2 may be traced from battery through the winding of magnet RM2, the next to inner left front contact of relay M, inner right front contact of relay CC, the inner right front contact of relay B to the clock circuit. When the switch R2 has thus been advanced a momentary circuit is established for advancing switch R1, which may be traced from battery through the winding of magnet RM1, winding of relay C, wiper *rm21* and the twentieth terminal of its bank, the inner left front contact of relay CC, the inner left front contact of relay M to ground at the middle right front contact of relay B. As soon as relay C operates, it opens the operating circuit of relay CC at its inner right back contact and relay CC releases in turn opening the operating circuit of relay C and magnet RM1 which release, magnet RM1 advancing the wipers of switch R1 one step.

As soon as switch R2 advances its wipers to the twentieth position terminals of their banks, a restoring circuit is established for rapidly returning switch R2 to normal, which may be traced from battery through the winding and interrupter contacts of magnet RM2, the inner

left back contact of relay W, the next to outer left front contact of relay M, the strapped terminals 20 to 25, inclusive, of the bank associated with wiper *rm22* and over wiper *rm22* to ground. With switch R2 in its normal position, relay CC again operates, locks and again connects the winding of magnet RM2 to the clock circuit whereby switch R2 is advanced to count another minute. When the second minute is counted, switch R1 is advanced another step and switch R2 is restored to normal in the manner previously described. Thus switch R1 is advanced one step each minute. It will be noted that the record on switch R1 is anything up to a minute less than the actual duration of a connection.

On the termination of the connection contacts *ta* open and relays A and B release in turn. During the time following the release of relay A and before slow-to-release relay B has released, a circuit is established from battery through the winding of magnet RM1 and relay C in series, the left front contact of relay B to ground at the back contact of relay A, and when relay B finally releases, this circuit is opened to release relay C and magnet RM1 whereby magnet RM1 advances its wipers one step to record the uncompleted minute of conversation. After relay B releases but before relay C releases, a circuit is closed for operating relay S which may be traced from battery through the winding of relay S, inner left front contact of relay C to ground at the right back contact of relay B. Relay S upon operating locks over its inner left front contact to ground over the right back contact of relay T or over the next to outer right back contact of relay W. Switch R2 is restored to its normal position from any position to which it may have been advanced at the termination of the conversation over a circuit from battery through the winding and interrupter contacts of magnet RM2, wiper *rm23* and the strapped terminals of its bank, left back contact of relay B to ground at the outer right back contact of relay W.

Relay S upon operating closes a start circuit for start relay ST of Fig. 1 which may be traced from battery through the winding of relay ST, next to outer left back contact of relay TT, conductor STL to ground at the outer right contact of relay S. Relay ST upon operating closes an operating circuit for the stepping magnet FM of the finder switch FS extending from battery through the winding and interrupter contacts of magnet FM, the inner left front contact of relay ST to ground at the outer left back contact of relay TT. When the wipers of the finder switch FS engage the terminals of their banks connected to the calling storage equipment, a circuit is established from battery through the winding of relay T, the outer left front contact of relay S, conductor *hl*, wiper *fml*, outer left front contact of relay ST through the winding of relay TT to ground. Relays T and TT both operate, relay TT opening the circuit of magnet FM to arrest the hunting movement of switch FS and relay T establishing an operating circuit for relay W extending from battery through resistance *r*, winding of relay W, the outer left front contact of relay T to ground over the normal terminal of the bank associated with wiper *rm29* and thence to ground over wiper *rm29*. Relays T and TT are now held operated over a circuit extending from battery through the winding of relay T the next to inner right front contact to relay W, the inner left front contact of relay T, conductor *hl*, wiper

fmb and inner right front contact and winding of relay TT to ground. With relays W and T both operated, the holding circuit of relay S is opened and relay S releases followed by the release of relay ST of Fig. 1.

With relay W operated and switch R2 in its normal position, the first group of storage condensers C1 to C5 is connected in discharge paths over the five outer left front contacts of relay W, conductors *cl* to *gl* and wipers *fmd* to *fmg* to one terminal of the right or operating windings of relays AT to ET, inclusive, the other terminals of which are connected to the right or operating winding of relay FT to ground or to ground through the rectifier unit RC. Depending upon which of the condensers has been placed in a charged condition, one of the relays AT to ET, inclusive, will be operated by the discharge of the charged condenser and relay FT will also operate if the charge on the condenser is of a particular polarity. The relay or relays when operated lock from ground through their left windings and inner left front contacts, through the right winding of relay G to the contacts TMC controlled by the teleprinter printing magnet (not shown), relay G operating in this locking circuit.

Relay G upon operating closes over its outer contact a circuit for operating a transfer bar of the teleprinter to cause the printing of a digit, dependent upon the operated condition of transfer relays AT to FT, the circuits controlled by relays AT and FT being disclosed.

Relay G upon operating also establishes a circuit from ground over its middle contact and over the next to inner front contact of the operated transfer relay AT, etc., and thence over the condenser discharge path connected thereto through the condenser connected in such path to ground to insure that any charge remaining in such condenser is completely dissipated, and at its inner contact establishes a circuit from ground over wiper *fmb*, conductor *bl*, next to inner left front contact of relay W, winding of magnet RM2 to battery, preparatory to advancing switch R2.

When the teleprinter prints the first digit of the called line designation, its printing magnet opens contacts TMC, thus releasing relay G and the operated transfer relay or relays of the group AT to FT, inclusive. Relay G upon releasing now opens the previously traced circuit of magnet RM2 and switch R2 thereupon advances its wipers one step to connect the next group of storage condensers to the transfer equipment. The stored digits of the called line designation are thus instrumental in turn to control the teleprinter.

When all of the digits of the called line designation have been printed, switch R2 will have advanced its wipers into position 10 and a circuit will be established from ground over wiper *rm22* and the tenth terminal of its bank, the inner left front contact of relay W, conductor *al*, wiper *fma*, the left front contact of relay TT, through the left winding of relay G and thence over contacts SMC to battery. With no transfer relays AT to FT operated at this time, relay G transmits a tape stepping signal to the teleprinter and establishes the previously traced circuit for stepping magnet RM2. The operation of the tape stepping magnet of the teleprinter moves the tape in readiness for printing a second group of digits on the tape and also opens contacts SMC thereby releasing relay G which in turn releases magnet

RM2 to advance the wipers of switch R2 into position 11.

It having been assumed that the digits of the calling line designation have been stored on groups of condensers connected to the eleventh to sixteenth position terminals of banks of switch R2, the teleprinter is now controlled in the manner previously described to print the corresponding digits on the tape. Following the printing of the last digit of this group, the wiper *rm22* of switch R2 will engage the seventeenth terminal of its bank strapped to the tenth terminal which will cause relay G to transmit another tape stepping signal after which relay G will be released, and as before described, advance the wipers of switch R2 into their eighteenth position in readiness to control the teleprinter to print digits indicative of the duration of the connection.

The values of the digits of the connection duration record to be printed are determined by the cross-connections between the banks associated with wipers *rm14* and *rm15* of switch R1 and the eighteenth and nineteenth position terminals of the banks associated with wipers *rm24* to *rm28* of switch R2 as previously described, the position of wiper *rm14* on its bank marking an eighteenth position terminal in a bank of switch R2 to determine the tens digit 0 to 4 of the number of minutes the connection has lasted and the position of wiper *rm15* on its bank marking a nineteenth position terminal in a bank of switch R2 to determine the units digit 1 to 0 of the number of minutes. It is to be noted in this connection that switch R1 having fifty bank terminals is capable of registering a maximum conversational period of 48 minutes. Wiper *rm14* is connected over the middle right front contact of relay W through resistance *r1* to positive battery to simulate the storage of tens digits 0 to 4, inclusive, and wiper *rm15* is tied to wiper *rm12* so that in accordance with the position of wipers *rm12* and *rm15*, either positive or negative battery is applied to the nineteenth position terminals of the banks associated with wiper *rm24* to *rm28* to simulate the storage of units digit 1 to 0, inclusive.

When therefore these wipers of R2 are advanced into position 18 in readiness to control the printing of the tens digit of the duration of the conversation, if it be assumed that the connection lasted for six minutes and the wipers of switch R1 are standing on their sixth position terminals, a circuit will be established from positive battery connected as previously described to wiper *rm14*, thence over the sixth position terminal of its bank, the eighteenth position terminal of the bank associated with wiper *rm24*, wiper *rm24*, the outer left contact of relay W, conductor *cl*, wiper *fmc*, through the right windings of transfer relays AT and FT to ground. These relays will thereupon operate in turn operating relay G in the manner previously described to control the teleprinter to print the tens minutes duration digit 0. As soon as the teleprinter has printed the digit, relay G releases in turn releasing the operated transfer relays and causing the advance of the wipers of switch R2 into position 19.

A circuit is now effective from negative battery over the sixth position terminal of the bank associated with wiper *rm12*, wipers *rm12* and *rm15*, the sixth position terminal of the bank with which wiper *rm15* is engaged, the nineteenth position terminal of the bank associated with wiper *rm28*, wiper *rm28*, the third left front

contact of relay W, conductor *gl*, wiper *fmg*, the right winding of transfer relay ET to ground through the rectifier unit RC. Relay ET now operates but relay FT being shunted by rectifier unit RC does not operate and relay ET causes the operation of relay G. With relays ET and G operated, the teleprinter is controlled to print the units minutes duration digit 6. As soon as the teleprinter has printed the digit, relay G releases in turn releasing the operated transfer relay ET.

When switch R2 was advanced to position 19, a circuit was established from ground over wiper *rm29* to a point between the winding of relay W and resistance *r* and the winding of relay W being thus shunted, relay W releases slowly in turn opening the holding circuit of relays T and TT which also release. With relays B, C, T, S and W all normal at this time, the locking circuit of relay M is opened and relay M releases in turn releasing relay CC. A restoring circuit for switch R1 is now effective from battery through the winding and interrupter contacts of magnet RM1, the left back contact of relay CC, strapped terminals of the bank associated with wiper *rm11*, wiper *rm11* to ground at the inner right back contact of relay M, this restoring circuit being opened at wiper *rm11* when the switch R1 moves its wipers to their normal positions. A restoring circuit for switch R2 is also effective from battery through the winding and interrupter contacts of magnet RM2, wiper *rm23* and the strapped terminals of its bank, left back contact of relay B to ground at the outer right back contact of relay W. The storage equipment and transfer equipment are now in their normal condition in readiness to control the printing of another call record.

Should it be found desirable to print a record of the tariff rate, digits of such tariff rate could be stored in terminal positions of the banks associated with wipers *rm24* to *rm28* of switch R2, following the positions in which the calling line designation digits are stored and the teleprinter would be controlled to print such digits in the manner previously described in connection with the called and calling line identification digits. In this case, the cross-connections from the banks of switch R1 now extending to the eighteenth and nineteenth position terminals in banks *rm24* to *rm28* of switch R2 would be connected to terminals subsequent to the terminals used for storing the last digit of the tariff rate. The terminal in the bank associated with wiper *rm22* immediately following the last terminal position used for the last digit of the tariff rate would be multiplied to terminals 10 and 17 to control the tape stepping magnet of the teleprinter as previously described and the connection from the nineteenth terminal of the bank associated with wiper *rm29* would be advanced to a terminal corresponding to the units minutes recording position of switch R2.

What is claimed is:

1. In a telephone exchange system, a storage equipment for storing information regarding the destination and origin of a connection and the duration of said connection, means operable during the time that the conversational connection remains established for operating said storage equipment to store all of said information, a printer, a transfer equipment individual thereto, means operable upon the termination of each connection for associating said transfer equipment with said storage equipment, and means for

operating said transfer equipment in accordance with said stored information to control said printer to make a printed record of said information.

2. In a telephone exchange system, a plurality of storage equipments, each provided with means operable for storing information regarding the destination and origin of a connection and the duration of said connection during the time that the conversational connection remains established, a printer, a transfer equipment individual thereto, means operable upon the termination of each connection for associating said transfer equipment with the storage equipment employed on said terminated connection and means for operating said transfer equipment in accordance with the storing means of the storing equipment associated therewith to control said printer to make a printed record of the stored information.

3. In a telephone exchange system, a storage equipment comprising groups of condensers, means operable for selectively charging the condensers of said group to register the digits of the designations of the called and the calling lines connected in an established connection during the time that the conversational connection remains established, and means for registering the elapsed time of said connection, a printer, a transfer equipment individual thereto comprising a group of transfer relays, means operable upon the termination of each connection for associating said transfer equipment with said storage equipment, means for successively associating said groups of condensers and said elapsed time registering means with said transfer relays and means controlled by said transfer relays to control said printer to make a printed record of the called and calling line designations and the elapsed time of said connection.

4. In a telephone exchange system, a storage equipment comprising a first multibank switch, a plurality of groups of condensers for storing digits, said groups of condensers being connected to bank terminals of different wiper positions of said switch and the condensers of each group being connected to corresponding wiper position terminals of the banks, a second switch, means for repeatedly setting said second switch to register successive digits, condenser charging circuits rendered selectively effective in accordance with each setting of said second switch and means for advancing said first switch one step following each setting of said second switch to successively associate said groups of condensers with said charging circuits whereby successive groups of condensers are selectively charged to store the successive digits registered by said second switch.

5. In a telephone exchange system, a storage equipment comprising a first multibank switch, a plurality of groups of condensers for storing digits, said groups of condensers being connected to bank terminals of different wiper positions of said switch and the condensers of each group being connected to corresponding wiper position terminals of the banks, a second switch, means for repeatedly setting said second switch to register successive digits, condenser charging circuits rendered selectively effective in accordance with each setting of said second switch and means for advancing said first switch one step following each setting of said second switch to successively associate said groups of condensers with said charging circuits whereby the successive groups of condensers are selectively charged

to store the successive digits registered by said second switch, a printer, a transfer equipment associated therewith having a group of transfer relays and means for controlling said first switch to establish discharge circuits successively from said groups of condensers to said relays whereby said relays control said printer to make a printed record of the digits stored in said groups of condensers.

6. In a telephone exchange system, a storage equipment comprising a first multibank switch, a plurality of groups of condensers for storing digits, said groups of condensers being connected to bank terminals of different wiper positions of said switch and the condensers of each group being connected to corresponding wiper position terminals in the banks, a second switch, means for repeatedly setting said second switch to register successive digits, condenser charging circuits connected to the wipers of said first switch and multiplied to the terminals of a bank of said second switch, sources of positive and negative potential, means controlled in accordance with each setting of said second switch for selectively connecting one of said sources of potential with one of said charging circuits to charge one of the condensers of the group either positively or negatively to store a digit, and means for advancing said first switch one step following the storing of each digit whereby successive groups of condensers are successively associated with said charging circuits.

7. In a telephone exchange system, a storage equipment comprising a first multibank switch, a plurality of groups of condensers for storing digits, said groups of condensers being connected to bank terminals of different wiper positions of said switch and the condensers of each group being connected to corresponding wiper position terminals in the banks, a second switch, means for repeatedly setting said second switch to register successive digits, condenser charging circuits rendered selectively effective in accordance with each setting of said second switch, means for advancing said first switch one step for each setting of said second switch to successively associate said groups of condensers with said charging circuits whereby the successive groups of condensers are selectively charged to store the successive digits registered by said second switch, and means for thereafter setting said second switch to register the duration of a connection.

8. In a telephone exchange system, a storage equipment comprising a first multibank switch, a plurality of groups of condensers for storing digits, said groups of condensers being connected to bank terminals of different wiper positions of said switch and the condensers of each group being connected to corresponding wiper position terminals in the banks, a second switch, means for repeatedly setting said second switch to register successive digits, condenser charging circuits rendered selectively effective in accordance with each setting of said second switch, means for advancing said first switch one step following each setting of said second switch to successively associate said groups of condensers with said charging circuits whereby the successive groups of condensers are selectively charged to store the successive digits registered by said second switch, and means for thereafter setting said second switch to register the duration of the connection, a printer, a transfer equipment associated with said printer having a group of

transfer relays and means for controlling said first switch to establish discharge circuits successively from said groups of condensers to said relays and to thereafter establish operating circuits from bank terminals of said second switch to said relays whereby said relays control said printer to make a printed record of the digits stored on said groups of condensers and a printed record of the setting of said second switch in accordance with the duration of the connection.

9. In a telephone exchange system, a first switch, means responsive to the completion of a connection between a calling and a called line to advance said first switch through one complete cycle for each minute during which the connection endures, a second switch, means for advancing said second switch one step in response to each cycle of said first switch whereby the number of steps taken by said second switch registers the elapsed time in minutes, marking conductors extending between bank terminals of said first and second switches, sources of positive and negative potential, and means for selectively applying potential from said sources over said marking conductors to register the tens and units digits of the number of minutes of elapsed time on the bank terminals of said first switch.

10. In a telephone exchange system, a first switch, means responsive to the completion of a connection between a calling and a called line to advance said switch through one complete cycle for each minute during which the connection endures, a second switch, means for advancing said second switch one step in response to each cycle of said first switch whereby the number of steps taken by said second switch registers the elapsed time in minutes, marking conductors extending between bank terminals of said first and second switches, sources of positive and negative potential and means for selectively applying potential from said sources over said marking conductors to register the tens and minutes digits of the minutes of elapsed time on the bank terminals of said first switch, a printer, a transfer equipment associated therewith having a group of transfer relays and means for controlling said first switch to successively establish operating circuits from the marking terminals of said first switch to said relays, whereby said relays control said printer to make a printed record of the tens and units digits of the minutes of elapsed time for the connection.

11. In a telephone exchange system, a storage equipment comprising a multibank switch, a first plurality of groups of condensers for storing the digits of the called line designation, said groups of condensers being connected to bank terminals of successive wiper positions of said switch and the condensers of each group being connected to corresponding wiper position terminals of the banks, and a second plurality of groups of condensers for storing the digits of a calling line designation similarly connected to other bank terminals of said switch, said pluralities of groups of condensers being spaced by the interposition of blank terminals in the banks of said switch, means for selectively charging the condensers of said groups, a printer and a transfer equipment associated therewith having a group of transfer relays, means for controlling said switch to establish discharge circuits successively from said groups of condensers to said transfer relays whereby said relays control said printer to make a printed record of the digits

stored in said groups of condensers, and means made effective by said switch in its wiper position corresponding to said blank terminals for controlling said transfer equipment to transmit a record tape advancing signal to said printer.

12. In a telephone exchange system, a storage equipment comprising a multibank switch, a plurality of groups of condensers for storing digits, said groups of condensers being connected to bank terminals of different wiper positions of said switch and the condensers of each group being connected to corresponding wiper position terminals of the banks and means for selectively charging the condensers of said groups to register digits, a printer, a transfer equipment associated therewith having a group of transfer relays, means for advancing said switch step-by-step to establish discharge circuits successively from said groups of condensers to said relays whereby said relays control said printer to make a printed record of the digits stored in said groups of condensers and means controlled by said printer in response to printing each digit to operate said switch advancing means.

13. In a telephone exchange system, a storage equipment comprising a multibank switch, a plurality of groups of condensers for storing digits, each group comprising five condensers, said groups of condensers being connected to bank terminals of different wiper positions of said switch and the condensers of each group being connected to corresponding wiper position terminals of the banks, sources of positive and negative potential and means for selectively charging condensers of said groups either positively or negatively to register digits, a printer, a transfer equipment associated therewith comprising a group of five non-polarized condenser discharge responsive relays and a polarized condenser discharge responsive relay multiplied thereto, means for advancing said switch step-by-step to successively establish discharge circuits from the five condensers of said groups in turn to said five non-polarized relays and to said polarized relay whereby in each position of said switch, one of said non-polarized relays will be operated by the discharge of the charged condenser of the group while the polarized relay will be operated by the discharge of the charged condenser if the charge was of a predetermined polarity and means controlled by said relays to control said printer to make a printed record of the digits stored in said group of condensers.

14. In a telephone exchange system, a storage equipment comprising a first multibank switch, means responsive to the completion of a connection between a calling and a called line to advance said switch through one complete cycle for each minute during which the connection endures, a second switch, means for advancing said second switch one step in response to each cycle of said first switch whereby the number of steps taken by said second switch registers the elapsed time in minutes, marking conductors extending between bank terminals of said second switch

and groups of tens and units marking terminals in two wiper positions of banks of said first switch, sources of positive and negative potential and means for selectively applying potential from said sources over said marking conductors to said tens and units marking terminals, a printer, a transfer equipment associated therewith comprising a group of five non-polarized relays and a polarized relay multiplied thereto, means for advancing said first switch step by step to successively connect the groups of tens and units marking terminals in turn to said five relays and to said polarized relay whereby in each position of said first switch one of said non-polarized relays will be operated and said polarized relay will also be operated if a marking terminal is at a predetermined polarity, and means controlled by said relays to control said printer to make a printed record of the tens and units digits of the elapsed time in accordance with the digits registered by the set position of said second switch.

15. In a telephone exchange system, a storage equipment comprising a multibank switch, a plurality of groups of condensers for storing digits, said groups of condensers being connected to bank terminals of different wiper positions of said switch and the condensers of each group being connected to corresponding wiper position terminals of the banks, a second switch, means for repeatedly setting said second switch to register successive digits, condenser charging circuits rendered selectively effective in accordance with each setting of said second switch, means for advancing said first switch one step following each setting of said second switch to successively associate said groups of condensers with said charging circuits whereby successive groups of condensers are selectively charged to store the successive digits registered by said second switch, means for thereafter setting said second switch to register the duration of a connection and means for marking groups of terminals in two wiper positions of said first switch in accordance with the tens and units values of the call duration registered by said second switch, said groups of marking terminals being spaced from the groups of terminals to which the last group of condensers are connected, a printer, a transfer equipment associated therewith having a group of transfer relays, means for controlling said first switch to successively connect said groups of condensers with said relays whereby said relays control said printer to make a printed record of the digits stored in said groups of condensers, means made effective by said first switch in its wiper position corresponding to said blank terminal spacings for controlling said transfer equipment to transmit a record tape advancing signal to said printer, and means for thereafter controlling said first switch to successively connect said groups of marking terminals with said relays, whereby said relays control said printer to make a printed record of the tens and units digits of the elapsed time.

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