

April 18, 1933.

A. B. DICKINSON

1,904,278

MESSAGE REGISTER CIRCUIT FOR TELEGRAPH EXCHANGES

Filed Jan. 27, 1932

4 Sheets-Sheet 1

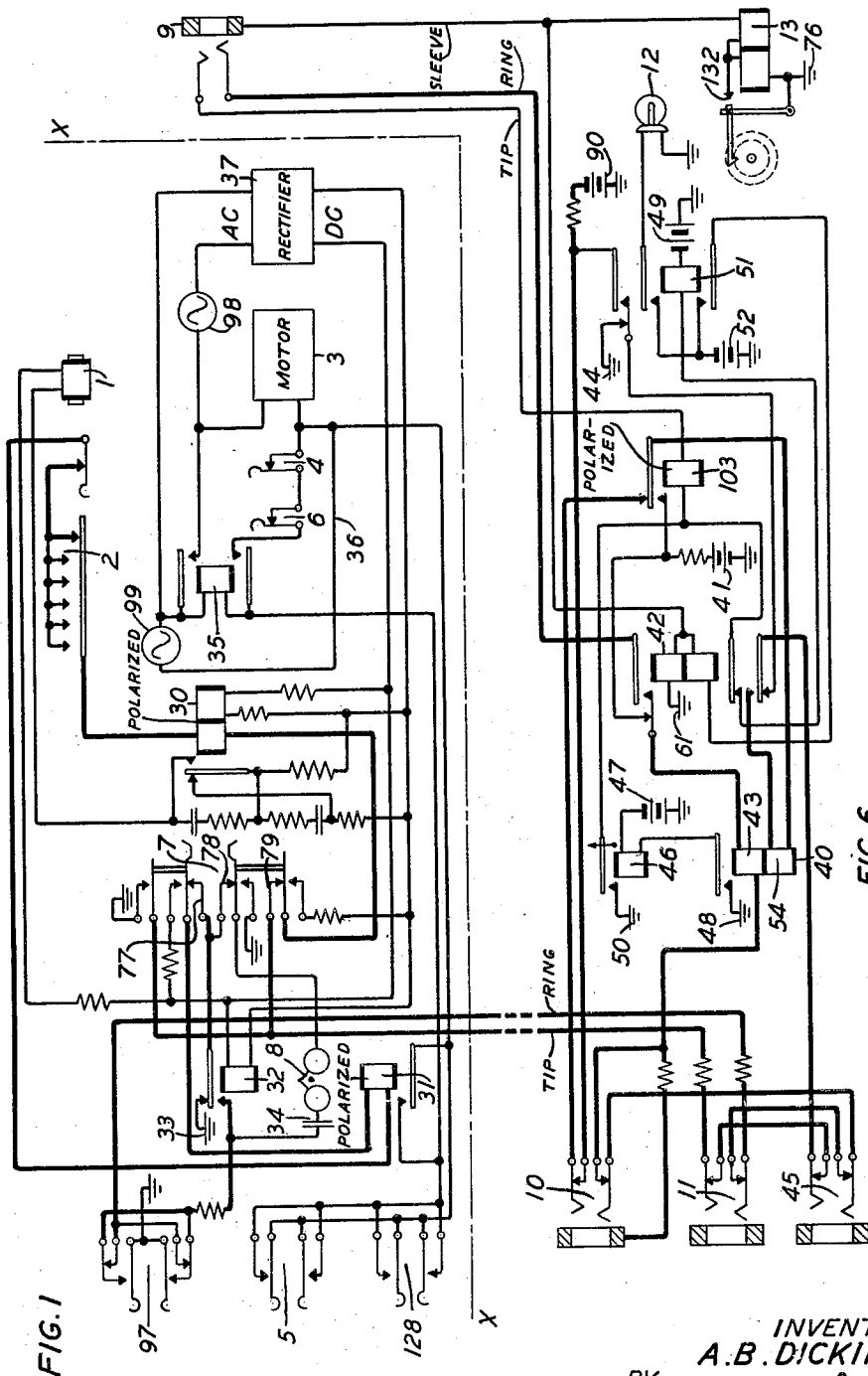


FIG. 6

FIG. 1	FIG. 2	FIG. 3
		FIG. 4

INVENTOR
A. B. DICKINSON
BY *E. V. Briggs*
ATTORNEY

April 18, 1933.

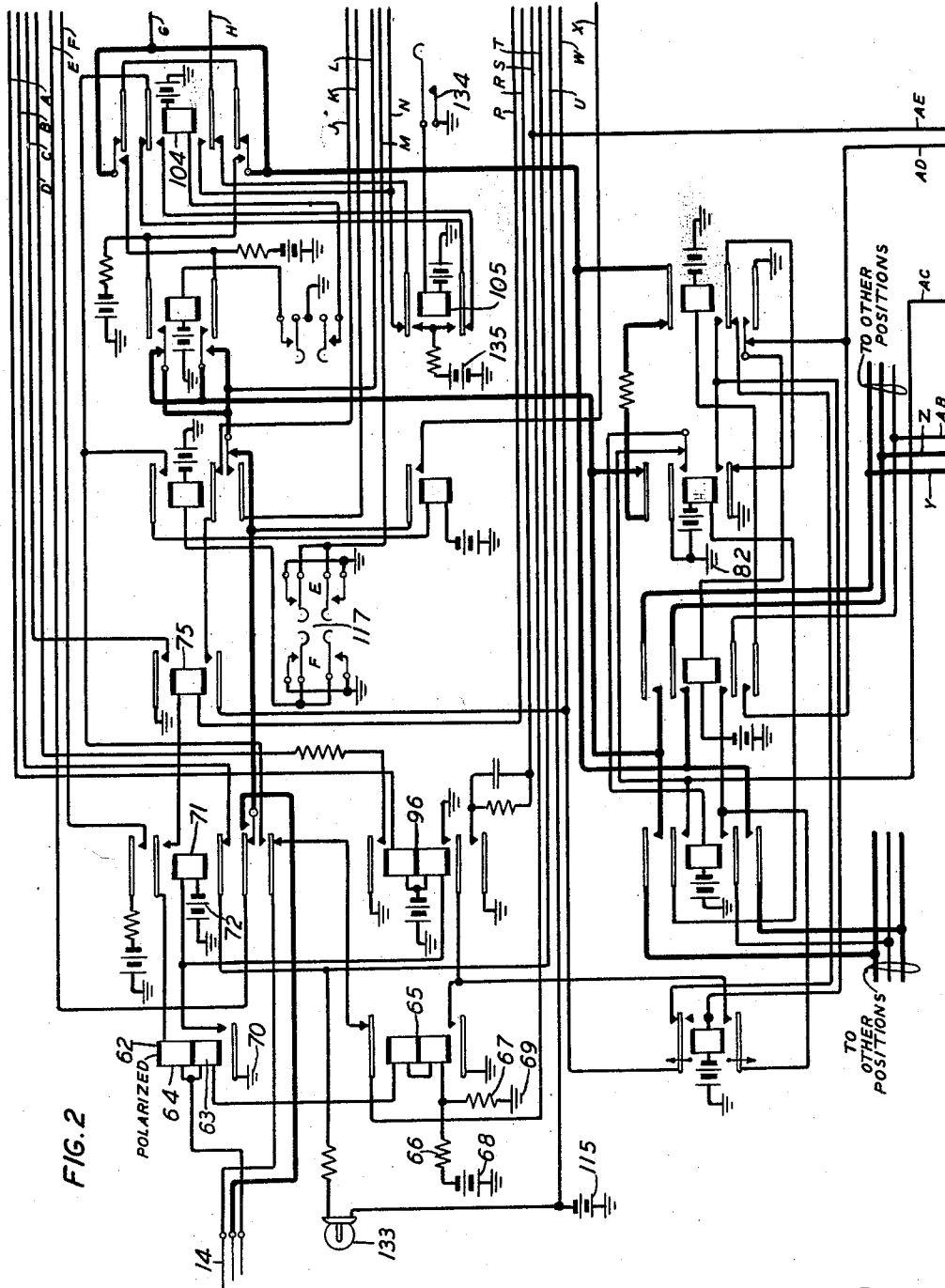
A. B. DICKINSON

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4 Sheets-Sheet 2



INVENTOR
A. B. DICKINSON

BY

E. V. Griggs

ATTORNEY

April 18, 1933.

A. B. DICKINSON

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4 Sheets-Sheet 3

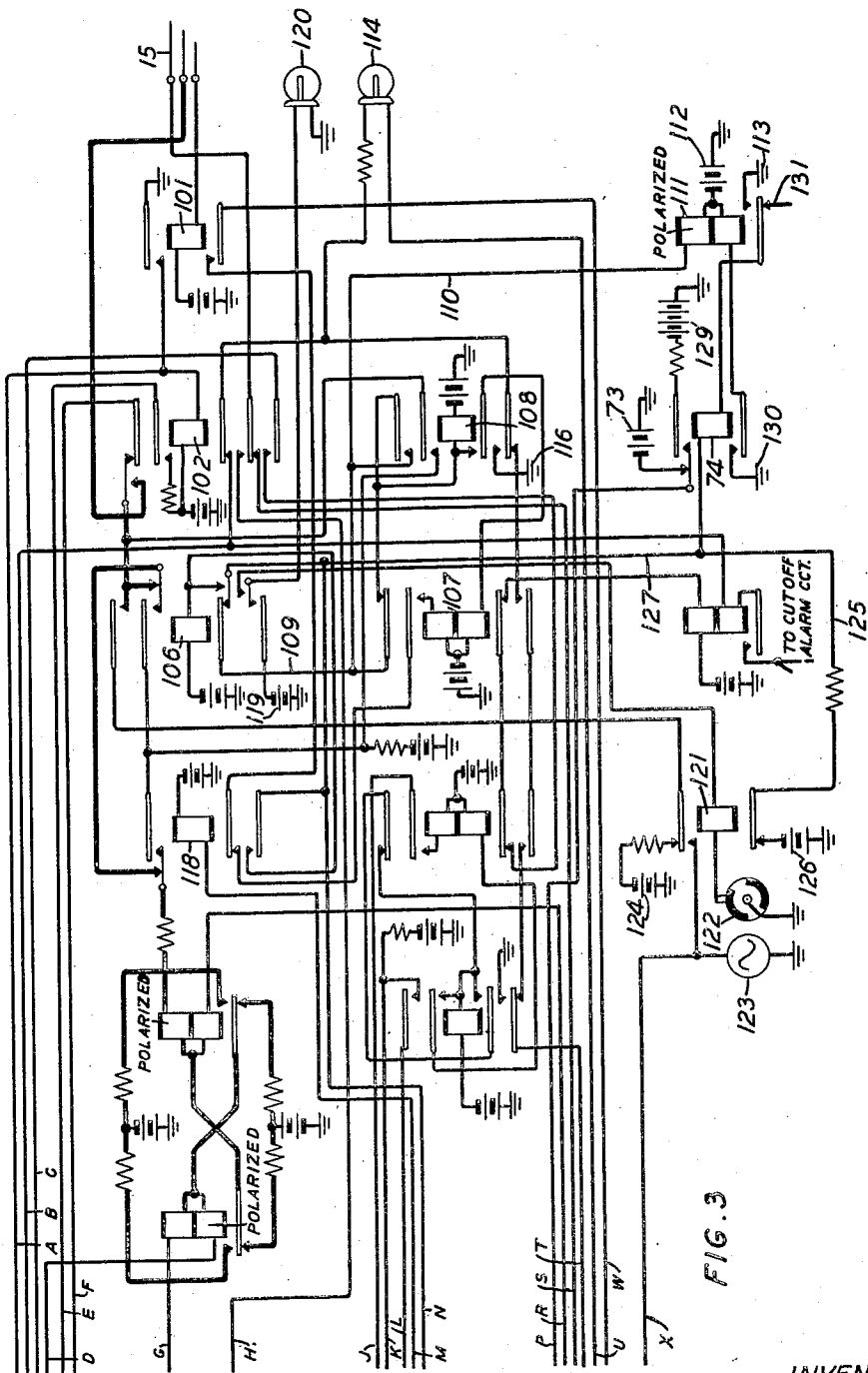


FIG. 3

INVENTOR
A. B. DICKINSON

BY
E. V. Griggs
ATTORNEY

April 18, 1933.

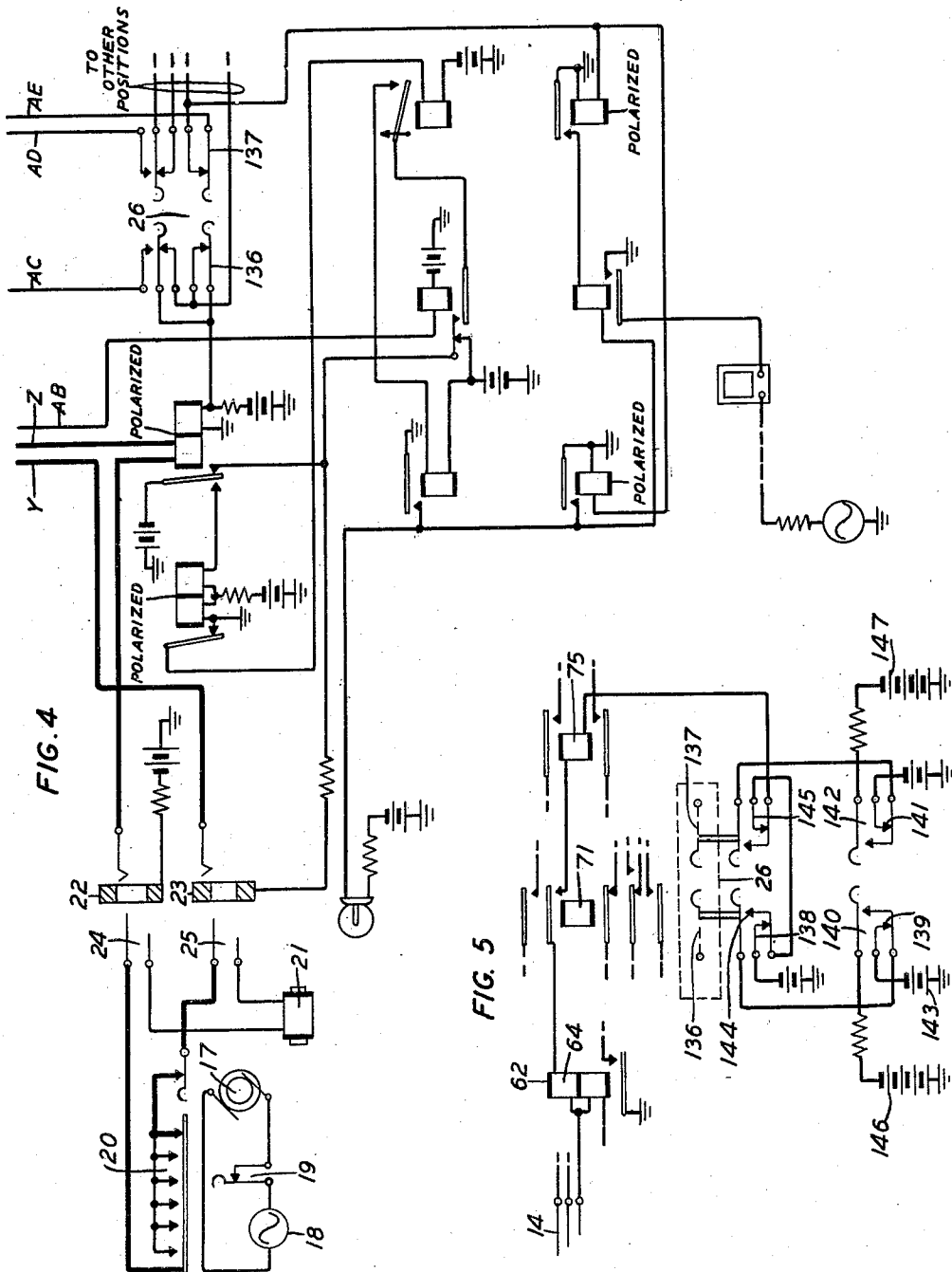
A. B. DICKINSON

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MESSAGE REGISTER CIRCUIT FOR TELEGRAPH EXCHANGES

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4 Sheets-Sheet 4



INVENTOR
A. B. DICKINSON
BY
E. V. Sniggo
ATTORNEY

UNITED STATES PATENT OFFICE

ALLAN B. DICKINSON, OF BROOKLYN, NEW YORK, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

MESSAGE REGISTER CIRCUIT FOR TELEGRAPH EXCHANGES

Application filed January 27, 1932. Serial No. 589,196.

This invention relates to printing telegraph exchange systems and particularly to message register circuits for use in connection therewith.

An object of the invention is to register each local call completed by a subscriber through a printing telegraph exchange.

The important part played by the modern telephone exchange in our daily lives is of course well understood and it is known that each subscriber may secure a connection with another subscriber by signaling the exchange operator and verbally giving her the number of the desired party.

There have recently been developed printing telegraph exchanges which provide to printing telegraph subscribers the same service as is provided to telephone subscribers by the telephone exchange. That is, each printing telegraph subscriber may secure a connection with another subscriber by signaling the printing telegraph exchange operator and informing her concerning the identity of the party desired.

The printing telegraph exchange system differs from the telephone exchange system, however, in that all communications are by printing telegraphy and this includes the transmittal by the calling party to the exchange operator of the number of the desired party as well as any acknowledgments, instructions or other information which the operator may wish to transmit to either calling or called subscriber. For a complete description of a printing telegraph exchange system of the above nature which embodies features similar, broadly, to those of the system in connection with which the present invention is to be described, reference may be made to the copending application of George A. Locke and Fullerton S. Kinkead, Serial No. 459,684, filed June 7, 1930.

In connection with a printing telegraph exchange of this nature, it is desirable, in order that each subscriber may be charged a fee in proportion to the service which has been rendered him, that means be provided for recording upon a register individual to his line, each call which has been initiated from his station and successfully completed

through the exchange and, as stated above, it is an object of this invention to provide such a service.

According to one feature of the invention the calling subscriber's register is operated automatically during the initiation and completion of a connection; that is, no action is required on the part of the operator to register the call other than the usual steps of answering the call and completing the connection.

As described in the copending application of Locke and Kinkead, above referred to, if a called subscriber be absent from his station the operator may by remote control start the printer at the called station in order that the calling party may transmit a message thereto and, according to a second feature of this invention, a connection completed in this manner may be recorded on the register of the calling party.

Other features of the invention will be apparent from the following description when considered in connection with the appended drawings in which:

Fig. 1 shows a subscriber's line and station circuits;

Figs. 2 and 3 show the central office cord circuit;

Fig. 4 shows the operator's circuit;

Fig. 5 shows in schematic form a modification of the message register circuit arranged for manual control; and

Fig. 6 shows how Figs. 1, 2, 3 and 4 should be arranged to disclose the system described in the specification.

In order to illustrate the operation of the message registering arrangement wherein this invention resides, the progress of a local connection, i. e., a connection between two subscribers having loop circuits which terminate in the same central office, will be traced.

The features of the system apart from the message registering arrangement will be described only to such length as appears necessary to properly illustrate the invention. For example, in connection with the description of the operations at the central office in answering a call and in connecting the operator's monitoring printer to the calling party's line,

it is not thought necessary to go into detail concerning the different contacts through which the latter connection is made inasmuch as none of these connections are involved in the circuit which controls the operation of the message register. The complete system is, however, shown in the drawings.

Referring to Fig. 1 which shows the subscriber's loop circuit, the equipment above line X—X is located at the subscriber's station while that below the line is located at the central office. The equipment at the subscriber's station comprises, in general, a printing telegraph sending and receiving unit comprising a printer magnet 1, a set of sending contacts 2, and a printer motor 3 with which is associated a key 4 which is so designed that it may be operated by transmitting two impulses known as shift signals from the central office. External of the printer telegraph unit, but also located at the subscriber's station are keys 5 and 128 for starting the printer set motor when answering or initiating a call, emergency stop key 6 for stopping the motor, a test key 7, a ringer 8 by means of which the central office attendant may signal the subscriber's station, sources of alternating current 98 and 99, a rectifier 37 and various relays and other apparatus which will be mentioned when tracing the connection.

As shown below the line X—X of Fig. 1, the subscriber's line terminates at the central office in a jack 9. Other jacks 10, 11 and 45 for testing purposes are also provided as well as a line lamp 12 by means of which the subscriber may signal the exchange attendant. A message register 13 is provided individual to the subscriber's line for the purpose of registering each connection completed from the line through the central office. The winding of this registering device is of such a resistance that the 24 volt battery of the central office supply will not energize the winding sufficiently to attract the armature thus registering a call. 48 volts will, however, when passed through the winding operate the armature to register a call. Various relays are also shown in this figure, the operation of which will be described when tracing the progress of the connection.

Figs. 2 and 3 show the repeater cord circuit, located at the central office and used in establishing a connection between two local subscribers' stations of the type shown in Fig. 1. This circuit includes an answering plug 14, calling plug 15 and the necessary relays, signals, batteries, etc., for answering a call and completing a connection including an arrangement for repeating the signal impulses which may be one of several well known types, for example, that disclosed in Patent 1,479,430 issued January 1, 1924 to J. M. Fell. Included also are certain relays and sources

of current provided for the specific purpose of bringing about the operation of message register 13 of the subscriber's line (Fig. 1) each time a connection has been completed from said line through the central office.

Fig. 4 shows the operator's printer telegraph circuit used for communicating, by means of printing telegraphy, with the subscribers during the establishment of a connection. The operator's telegraph set consists of a printer motor 17, an alternating current source 18, therefore, a stop key 19, sending contacts 20, and a printer magnet 21, the set being connected to the operator's circuit by jacks 22 and 23 and plugs 24 and 25. The operator's circuit is in turn connected to the cord circuit of Fig. 2 through key 26. Other similar keys known as "team" keys are usually provided for each operator's position but as this invention is not concerned with this feature of the system, only one key has been shown in order to avoid complication of the figures.

Having briefly discussed the various circuits involved, the establishment of a connection between two local subscribers will now be traced. Referring to Fig. 1, under normal conditions the tip side of the subscriber's loop passes through contact 79 of test key 7, one winding of relay 30, the sending contacts 2 of the printer, winding of relay 31, contact 77 of key 7, upper break contact of relay 32 to ground 33. The ring is also connected to ground through key 97, condenser 34, ringer 8, contact 78 of key 7, upper break contact of relay 32 to ground 33. Assume now that the subscriber presses key 5 in order to initiate a call. The operation of this key closes a circuit from one side of alternating current power supply 99, through the contacts of key 5, through the winding of relay 35 and to the other side of power supply 99, thus causing relay 35 to operate. Relay 35, when operated, locks up through its lower contacts, key 6, the control key 4 of the printer, lead 36, power supply 99 and through the winding of the relay. The operation of relay 35 closes a circuit, through its upper contacts to start the printer motor 3 and also closes a circuit from alternating current supply 98 through the rectifier 37. Direct current supplied by rectifier 37 now operates relay 32 which removes the ground from the tip, opens the ringer circuit and closes the subscriber's loop through the sending circuit of the printer. The closing of the loop results in the operation of relay 40 at the central office, the circuit being traced from battery 41, upper break contact of relay 42, winding 43 of relay 40, jacks 10, 11 and 45, break contacts of key 97, make contact of relay 32, contact 77 of key 7, winding of relay 31, contacts 2 of printer, winding of relay 30, contact 79 of key 7, break contacts of jacks 11 and 45, lower outer break contact of

relay 42 to ground 44. The operation of relay 40 causes the operation of relay 46 through a circuit from battery 47, winding of relay 46, make contact of relay 40 to ground 48. The operation of relay 46 in turn results in the operation of relay 51 through a circuit from battery 49, winding of relay 51, lower inner break contact of relay 42 to ground 50 on make contact of relay 46. The operation of relay 51 completes a circuit to energize line lamp 12 which serves to notify the central office operator that the subscriber is calling. The operation of relay 49 also connects battery 52 through lower make contact of relay 51, one winding of relay 42 to sleeve of jack 9 thus placing a busy indication on this jack. (The voltage of battery 52 is 24 and therefore does not energize the winding of message register 13 sufficiently to attract the armature.) Relay 42 does not operate at this time, as its windings are connected in opposition.

The operator upon noticing that lamp 12 has been lighted, answers the call by plugging her answering plug 14 into jack 9. Battery is present on the sleeve of the plug and relay 42 therefore operates at this time. The operation of relay 42 removes battery 49 from the tip of the loop and connects it through winding 54 of relay 40 and also removes battery 41 from the ring of the loop and connects it through the cord circuit. Both windings of relay 40 now being energized in opposition, this relay releases which in turn causes the release of relay 46. The operation of relay 42 also opened the energizing circuit of relay 51, releasing it and extinguishing line lamp 12. Communication may now take place between the operator and the calling subscriber.

When the answering plug 14 has been inserted into jack 9, a circuit is completed from ground 61 through the winding of relay 42, sleeve of the jack and plug, winding 63 of relay 62, winding of relay 65 to a potentiometer made up of resistances 66 and 67. It being assumed that this cord is the first to complete the sleeve circuit, the midpoint of the potentiometer will be negative with respect to the sleeve and relays 62 and 65 will operate. The operation of relay 62 will close a circuit from ground 70, make contact of relay 62, winding of relay 71 to battery 72 and relay 71 will operate. The operation of relay 71 closes a path from battery 73, upper break contact of relay 74, winding of relay 75, upper inner make contact of relay 71, winding 64 of relay 62, sleeve of jack and plug, winding of relay 42, to ground 61. This constitutes the operating circuit of relay 75, and the holding circuit for relay 62. It will be noted that a circuit has also now been completed from battery 73, upper break contact of relay 74, winding of relay 75, upper inner make con-

tact of relay 71, winding 64 of relay 62, sleeve of plug and jack through the winding of message register 13 to ground 76. The register will not be operated at this time, however, as the resistance of its winding is so high that it will not operate on 24 volts, the voltage of battery 73. (Unless otherwise stated, all batteries are 24 volts.) The operation of relay 62 also causes the operation of relay 96 which applies ground to the balancing networks of the cord circuit repeater.

After the operator has inserted her answering plug 14 into jack 9, she operates her key 26 in order to connect her printer in series with the answering side of the cord circuit repeater. As the calling side of the repeater is closed, the operator can transmit into and receive from the line to which the answering cord is connected.

The operator now, in order to acknowledge the subscriber's call, operates her printer set to send the word "operator", "opr." or the like, which is typed on the receiving unit of the calling subscriber's printer. The subscriber then answers by operating his sending unit, to transmit to the operator's printer set information regarding the called subscriber's line. Let it be assumed that the connection desired is a "local" connection, that is, a connection between subscribers whose lines terminate at the same central office. The operator now inserts her calling plug 15 in the called subscriber's line jack. It will be understood that the called subscriber's line and station equipment is exactly the same as that of the calling subscriber shown in Fig. 1 and it will not therefore be separately illustrated, but reference will again be had to Fig. 1 when describing operations at the called subscriber's station.

The insertion of calling plug 15 in jack 9 closes a circuit from battery through the winding of relay 101, sleeves of plug and jack, winding of relay 42 to ground 61 operating relays 101 and 42. The operation of relay 101 closes a circuit from ground through its upper make contact, through the winding of relay 102 to battery, operating relay 102. The operation of relay 42 transfers the tip side of the line from ground 44 to a circuit through winding 54 of relay 40 to battery 90. Relay 40 will now operate on a circuit from battery 90, jack 10, break contact of relay 103, winding 54 of relay 40, lower outer make contact of relay 42, jacks 11 and 45, through contact 79 of key 7, winding of relay 30, printer contacts 2, winding of relay 31, contact 77 of key 7, break contact of relay 32 to ground 33. The operation of relay 40 in turn operates relay 46 on a circuit from battery 47 through winding of relay 46 to ground 48. The operation of relay 46 places ground 50 on the tip of the cord circuit and completes a circuit from ground 50, winding of relay

103, tip of jack 9 and plug 15, lower middle make contact of relay 102, lower inner break contact of relay 104, upper break contact of relay 105, lower inner break contact of relay 106, upper outer break contact of relay 107, winding of relay 108 to battery, operating relay 108. It will be noted that at this time a circuit is also closed from the same ground (50) on the tip through the circuit previously traced as far as lead 109, then branching through lead 110 and through the winding of polarized relay 111 to battery 112 which operates the armature of the polarized relay 111 to ground 113. The operation of relay 108 will close a circuit to operate relay 107, traced from battery through winding of relay 107, lower inner make contact of relay 108 to ground on tip previously traced in connection with describing operation of relay 108. The operation of relays 107 and 108 causes calling cord lamp 114 to be lighted through a circuit from battery 115, lamp 114, lower outer make contact of relay 108 to ground 116 and also closes the calling side of the repeater to keep the printing circuit closed.

The operator now signals the called subscriber by operating ringing key 117 to E which applies ground to the winding of relay 118 operating it. The operation of relay 118 closes a circuit through its lower make contact (now connected to ground 50 through circuits previously traced) through the winding of relay 106 to battery operating it. Relay 106 by its operation opens the holding circuits of relays 108 and 107 causing their release. When the two last mentioned relays are released, the energizing circuit for calling lamp 114 is broken and the lamp is extinguished. The operation of relay 106 also closes the calling side of the repeater and connects battery 119 to ringing guard lamp 120 and also to the winding of relay 121. Lamp 120 will light and the winding of relay 121 being closed from battery through an interrupter 122 to ground, this relay will be repeatedly operated for 2.0 seconds and released for 4.0 seconds. At each operated position of relay 121 ringing current from source 123 is applied to the subscriber's line while for each released position battery 124 is applied thereto (these circuits being from the upper contacts of the relay) and this alternate battery and ringing current, which it will be understood operates the signal bell at the subscriber's station, will continue to be applied to the line until the subscriber answers.

It will be noted, at this point, that for each released position of relay 121 battery 126 is applied to lead 125 through the lower break contact of the relay. This lead is associated with the winding of relay 74 which is one of the relays controlling the operation of message register 13 at the calling subscriber's station, it will be remembered that ground

is present on the other side of the winding of relay 74 due to the prior operation of polarized relay 111 to ground 113. It is not desirable that the message register should operate at this stage of the connection, however, as the called subscriber has not yet responded and in order to prevent the operation of relay 74 at this time (which in turn would operate the message register) a short-circuiting path for battery 126 is temporarily provided through lead 127 to the tip ground 50 of the station line.

Assuming that the called subscriber is present at his station, he will answer the call by pressing his answering key 128 which starts his printer set in the manner described above in connection with the operation of calling key 5 by the calling subscriber. As above described, relays 40 and 46 at the called subscriber's station now release. Ground 50 is removed from the tip circuit and relay 106 releases extinguishing ringing guard lamp 120. The release of relay 106 opens the operating circuit of relay 121 which now therefore remains released. The ring circuit has now been restored to normal and communication may take place.

As the called subscriber has now responded and the connection requested by the calling subscriber has been completed, it is desirable that the message register 13 of the calling subscriber's line should now be operated to register the call. The register does, in fact, operate at this time in the following manner:

As stated above, when the called subscriber answered, the ground 50 was removed from the tip which means that the short-circuiting path to ground through lead 127 for battery 126 is no longer present. We have, therefore, a circuit from battery 126, lower break contact of relay 121 through winding of relay 74 to ground 113 on relay 111 and relay 74 will operate. The operation of relay 74 the replacement of the normal 24 volt battery 73, of 48 volt battery 129 and we now have a circuit from battery 129, upper make contact of relay 74, winding of relay 75, upper inner make contact of relay 71, winding 64 of relay 62, sleeves of plug 14 and jack 9, winding of message register 13 to ground 76. As the message register is designed to operate on 48 volts, it will operate over the above circuit and the completed connection will be registered. The 48 volt battery is only present on the above circuit momentarily for as relay 74 operates, it completes a second circuit from battery 112, winding of polarized relay 111 to ground 130 on the lower make contact of relay 74. This circuit operates relay 111 to its open contact 131, thus opening the circuit through the winding of relay 74, causing its release and the replacement of the normal 24 volt battery on the operating circuit of relay 75. In or-

der to preclude any possibility of the message register operating more than once during the same connection, a holding path through the first winding and contact 132 has been provided which, once the register has been operated on the 48 volt battery, will hold it operated on the 24 volt battery. The message register is therefore held in an operated position until, at the completion of the call, plug 14 is withdrawn from jack 9, opening the circuit through its winding and returning it to normal position until the next connection.

As the operation of the message register has been described, it is not thought necessary to describe progress of the call any further. It is sufficient to say that after the called subscriber has answered the call by operating his key 128, he sends some acknowledgment on his printer set which is received on the printer sets of both the operator and the calling subscriber. The operator monitors on the connection until the subscribers are in satisfactory communication when she disconnects her set by restoring her key 26 to its normal position. When the call has been completed, the subscribers restore their circuits to normal by pressing their stop keys 6. In the course of restoring the subscribers' circuits to normal, the supervisory lamps 114 and 133 are lighted notifying the operator that the connection has been completed. She will then remove the answering and calling plugs from their associated jacks and the cord circuit will be restored to normal.

It will be apparent from the above that this invention provides a message registering device that is operated automatically without attention on the part of the operator. The device does not operate until the connection has been actually completed and then remains operated until the connection has been broken down, which avoids the possibility of more than one registration during the same call. The introduction of this device has not added to the duties of the operator and yet provides a means of assuring the registering of each connection completed.

As mentioned above it is an important feature of this invention that calls completed for a subscriber to an "unattended station" are recorded on the calling subscriber's register. To illustrate how such a connection is recorded let us assume that, in case of the connection traced above, after the operator has plugged her calling cord 15 into the called subscriber's jack and, after applying ringing current to his line for a reasonable time, has found that he did not answer the call. The operator would then operate her printer set to send a message to the calling subscriber informing him that the called subscriber was absent from his station and asking him if he desired her (the operator) to, by remote control, start the printer set at the

called station in order that the calling party might transmit a message thereto. Assuming that the calling party desired such a service, the operator would operate her "unattended" key 134 which completes a circuit to operate relay 105. The operation of this relay momentarily applies positive battery 135 to the tip of the cord circuit (relay 102 is at present operated). This positive battery passes through the winding of relay 103 at the unattended station (which is a polarized relay, the normal direction of current through it being such as to hold it unoperated) and operates it which connects positive battery 41 to the tip of the subscriber's loop (relay 42 is at present operated). This positive battery operates relay 31 (circuit traced through tip contact 79 of key 7, relay 30, contacts 2, winding of relay 31, contact 77 of key 7, make contact of relay 32 to ground 33), which like relay 103 is a polarized relay held unoperated by the direction of the current normally flowing through it. The operation of relay 31 completes a circuit through its make contact which is the same as that completed when either key 5 or 128 is operated by the subscriber. The subscriber's printer set is put into operation in the manner described above in connection with the called subscriber answering the call, ringing guard lamp 120 is extinguished, and the operator releases her unattended key 134 and notifies the calling party that the printer set at the called station has been started and that a message may be transmitted thereto. In accordance with my invention the message register 13 at the calling station is caused to operate in order to register the call at the time the printer set at the called station is put into operation by the operator. The circuit by which this registration is obtained is the same as that used when a call is completed to an attended station. Relays 40 and 46 are released after the operation of relay 31 just as they released after key 128 had been operated as described above in the instance where the called party was present at his station to answer the call. As also described above, ground 50 is removed from the tip and and relays 106 and 121 are released. The removal of ground from the tip as above described opens the short-circuiting path through lead 127 and completes an operating circuit for relay 74. The operation of relay 74 momentarily places 48 volts on the winding of message register 13 operating it to register the connection. It will be understood, therefore, that this invention provides a means for registering such calls completed to "unattended stations", and, further, that exactly the same apparatus and circuits are used for registering each type of call, i. e., those answered by the called subscriber and those completed to "unattended stations." The latter feature is especially valuable as it aids in minimizing

the amount of apparatus necessary at the central office.

While it is believed that the automatic system of registration described above will be preferred in most instances, as it does not add to the duties of the operator and lessens the chance of incorrect registration, it is recognized that in certain instances it may be desirable that registration be under the manual control of the operator. Accordingly there is illustrated in Fig. 5 an embodiment of the invention in which the operator has control of the registration. This modification is shown in a more or less schematic form as the method of operation is in general similar to the automatic system already described in detail. For example, the wiring of plug 14, relay 62 and relay 71 is exactly the same as before and only that portion of their circuits having a part in the operation of the message register has been completely shown. It will be noted, however, that additional contacts have been provided on the operator's key 26, controlled by swinging contacts 136 and 137 thereof, which when the latter is operated, connect into the circuit associated "message register" keys, the operation of which, in turn, substitutes 48 volt battery for the 24 volt battery normally connected through the winding of relay 75. It will be remembered that in the instance of the automatic system previously described, this substitution was brought about by the operation of relay 74.

To illustrate the operation of the manually controlled system, let us assume, referring to Fig. 5, that the operator answers the calling subscriber's signal by inserting her answering plug 14 in subscriber's jack 9 and operates her listening key 26 to connect her printer set with the line. The operation of key 26 transfers the 24 volt battery on the winding of relay 75 from break contact 138 of key 26 to break contact 139 of message register key 140. It is assumed that the left section of key 26 has been operated. Had the right section been operated, the battery of relay 75 would, of course, be found on break contact 141 of message register key 142. Relay 71 having operated through the circuit described in connection with the automatic system, a circuit may now be traced from battery 143, break contact 139 of key 140, make contact 144 and break contact 145 of key 26, winding of relay 75, make contact of relay 71, winding 64 of relay 62, sleeve of jack and plug, winding of message register 13 to ground 76. The message register does not operate at this time, however, for as stated above, its winding is of such a value that it will not operate on 24 volts but on the other hand will operate on 48 volts. After the called subscriber has answered or at any other period of the connection, when the operator may wish to record the call on mes-

sage register 13, she has but to operate message register key 140 which substitutes 48 volt battery 146 for the normal 24 volt battery 143. Message register 13 will operate and will then be locked up by the 24 volt battery through the first winding and contact 132 to ground 76 until the connection has been broken down by withdrawal of plug 14 from the subscriber's jack.

While arrangements are frequently included in printing telegraph exchange systems whereby toll connections, i. e., connections between subscribers of different exchange areas may be completed (by means, for example, of circuits of the type described in the copending application of Locke and Kinkead previously referred to) such circuits have not been described in connection with the present invention as the register contemplated thereby is designed to operate to record the completion of local connections only.

What is claimed is:

1. A telegraph exchange system comprising a central office and a plurality of subscribers' telegraph printer stations any two of which stations may be connected through said central office as desired, and including means, under control of the central office attendant, whereby apparatus at an unattended subscriber's station may be set into operation in order to record a message transmitted through said central office by a second subscriber, characterized in this, that means individual to said second subscriber's station are provided for registering each connection completed from his station to an unattended station.

2. In a telegraph exchange system, comprising a central office and a plurality of subscribers' telegraph printer stations any two of which stations may be connected through said central office as desired and including means, under control of the central office attendant, whereby apparatus at an unattended station may be set into operation to record a message transmitted through the central office by a second subscriber, registering means, individual to the second subscriber's station line, operating upon the starting of the apparatus at the unattended station and additional means for retaining said registering means in an operated condition until the apparatus at the unattended station has been stopped.

3. In a telegraph exchange system comprising a central office, a subscriber's telegraph printer station, a line for the subscriber's station terminating at the central office, a plurality of other subscribers' stations, lines for the other stations also terminating at the central office and an interconnecting circuit for interchangeably connecting the subscriber's station line with certain of the other lines, a meter associated with the sub-

subscriber's line, operating means and retarding means both effective after the subscriber's station line has been connected to another line, the operating means tending to
 5 cause the operation of the meter and the retarding means preventing such operation and means effective upon apparatus at the station of the other line being set into operation for rendering the retarding means ine-
 10 fective.

4. In a telegraph exchange system comprising a central office, a subscriber's telegraph printer station, a line for the subscriber's station terminating at the central office,
 15 a plurality of other subscribers' stations, lines for the other stations also terminating at the central office and an interconnecting circuit for interchangeably connecting the subscriber's station line with certain of the
 20 other lines, a meter associated with the subscriber's station line, a relay associated with the interconnecting circuit which by its operation causes the operation of the meter, means operable after the subscriber's station
 25 line has been connected to another station line for providing an operating path for the relay, and means for preventing the operation of the relay until apparatus at the station of the other line has been set into opera-
 30 tion.

5. In a telegraph exchange system, comprising a central office, a subscriber's telegraph printer station, a line for the subscriber's station terminating at the central office,
 35 a plurality of other subscribers' stations, lines for the other stations also terminating at the central office and an interconnecting circuit for interchangeably connecting the subscriber's station line with certain of
 40 the other lines, a meter associated with the subscriber's station line, and means, effective after the subscriber's station line has been connected to another station line and apparatus at the station of said other line has
 45 been set into operation, for completing an operating circuit for the meter.

6. In a telegraph exchange system comprising a central office, a subscriber's telegraph printer station, a line for the subscriber's station terminating at the central office,
 50 a plurality of other subscribers' stations, lines for the other stations also terminating at the central office and an interconnecting circuit for interchangeably connecting the subscriber's station line with certain of the
 55 other lines, a meter associated with the subscriber's station line, a relay associated with the interconnecting circuit which by its operation causes the operation of the meter, an
 60 operating path for the relay established after the subscriber's station line has been connected to another station line, and means for preventing the operation of the relay until apparatus at the station of the other line has
 65 been set into operation, said last mentioned

means comprising a path to ground in parallel to the operating path.

7. In a telegraph exchange system, comprising a central office, a subscriber's telegraph printer station, a line for the sub-
 70 subscriber's station terminating at the central office, a plurality of other subscribers' stations, lines for the other stations also terminating at the central office and an inter-
 75 connecting circuit for interchangeably connecting the subscriber's station line with certain of the other lines, a meter associated with the subscriber's station line, a relay associated with the interconnecting circuit which by its
 80 operation causes the operation of the meter, an operating path for the relay established after the subscriber's station line has been connected to another station line, means for preventing the operation of the relay, and
 85 means for rendering said preventing means ineffective upon apparatus at the station of the other line being set into operation.

8. In a telegraph exchange system comprising a central office, a subscriber's telegraph printer station, a line for the subscriber's station terminating at the central office, a plu-
 90 rality of other subscribers' stations, lines for the other stations also terminating at the central office and an interconnecting circuit for interchangeably connecting the sub-
 95 scribe's station line with certain of the other lines, a meter associated with the subscriber's station line, a printer set at the central office, two batteries associated with the interconnect-
 100 ing circuit one being of higher voltage than the other, a key also associated with the interconnecting circuit for connecting the printer set thereto and for connecting the battery of lower voltage to the winding of the
 105 meter and a second key operable to substitute for said battery the second battery of higher voltage thereby causing the meter to operate.

9. In a telegraph exchange system comprising a central office, a subscriber's tele-
 110 graph printer station, a line for the subscriber's station terminating at the central office, a plurality of other subscribers' stations, lines for the other stations also termin-
 115 ating at the central office and an interconnecting circuit for interchangeably connecting the subscriber's station line with certain of the other lines, a meter associated with the subscriber's station line, a printer set at the
 120 central office, two batteries associated with the interconnecting circuit one being of higher voltage than the other, a key also associated with the interconnecting circuit for connecting the printer set thereto and for connect-
 125 ing the battery of lower voltage to the winding of the meter and a second key operable to substitute for said bat-
 130 tery the second battery of higher voltage thereby causing the meter to operate, and means effective upon operation of the

meter for holding it in operated condition until the connection between the lines has been discontinued.

10. In a telegraph exchange system, comprising a central office, a subscriber's telegraph printer station, a line for the subscriber's station terminating at the central office, a plurality of other subscribers' stations, lines for the other subscribers' stations also terminating at the central office, and an interconnecting circuit at the central office for interchangeably connecting the subscriber's station line with certain of the other lines, a meter associated with the subscriber's station line, a relay associated with the interconnecting circuit which by its operation causes the operation of the meter, a battery also associated with the interconnecting circuit, means operable after the subscriber's station line has been connected to another station line for establishing two paths to ground for the battery, one path leading through the winding of the relay and the other path diverting such a portion of the current from the first path that the relay does not operate and means operable when apparatus at the subscriber's station of the other line is set into operation, for removing the second path whereupon, due to the increased flow of current in the first path, the relay operates causing the operation of the meter.

11. In a telegraph exchange system, comprising a central office, a subscriber's telegraph printer station, a line for the subscriber's station terminating at the central office, a plurality of other subscribers' stations, lines for the other subscribers' stations also terminating at the central office, and an interconnecting circuit at the central office for interchangeably connecting the subscriber's station line with certain of the other lines, a meter associated with the subscriber's station line, a relay associated with the interconnecting circuit which by its operation causes the operation of the meter, a battery also associated with the interconnecting circuit, means operable after the subscriber's station line has been connected to another station line for establishing two paths to ground for the battery, one path leading through the winding of the relay and the other path diverting such a portion of the current from the first path that the relay does not operate, means operable when apparatus at the subscriber's station of the other line is set into operation, for removing the second path whereupon, due to the increased flow of current in the first path, the relay operates causing the operation of the meter, and means effective upon operation of the meter for holding it in operated condition until the connection between the lines has been discontinued.

12. In a telegraph exchange system com-

prising a central office, a subscriber's telegraph printer station, a line for the subscriber's station terminating at the central office, a plurality of other subscribers' stations, lines for the other stations also terminating at the central office and an interconnecting circuit at the central office for interchangeably connecting the subscriber's station line with certain of the other lines, a meter associated with the subscriber's station line, a relay associated with the interconnecting circuit which by its operation causes the operation of the meter, a battery associated with the interconnecting circuit, means operable after the subscriber's station line has been connected to another station line for establishing two paths to ground for the battery, one path leading through the winding of the relay and the other path diverting such a portion of the current that the relay does not operate and means at the central office for setting apparatus at the subscriber's station of the other line into operation and for removing the second path whereupon, due to the increased flow of current in the first path, the relay operates and causes the meter to operate.

13. In a telegraph exchange system comprising a central office, a subscriber's telegraph printer station, a line for the subscriber's station terminating at the central office, a plurality of other subscribers' stations, lines for the other stations also terminating at the central office and an interconnecting circuit at the central office for interchangeably connecting the subscriber's station line with certain of the other lines, a meter associated with the subscriber's station line, a relay associated with the interconnecting circuit which by its operation causes the operation of the meter, a battery associated with the interconnecting circuit, means operable after the subscriber's station line has been connected to another station line for establishing two paths to ground for the battery, one path leading through the winding of the relay and the other path diverting such a portion of the current that the relay does not operate and means at the central office for setting apparatus at the subscriber's station of the other line into operation and for removing the second path whereupon, due to the increased flow of current in the first path, the relay operates and causes the meter to operate, and means effective upon the operation of the meter for holding it in operated condition until the connection between the lines has been discontinued.

14. In a telegraph exchange system comprising a central office, a subscriber's telegraph printer station, a line for the subscriber's station terminating at the central office, a plurality of other subscribers' stations, lines for the other stations also terminating at the central office and an intercon-

necting circuit for interchangeably connect-
ing the subscriber's station line with certain
of the other lines, a meter associated with the
subscriber's station line, a relay associated
5 with the interconnecting circuit which by its
operation causes the operation of the meter,
means operable after the subscriber's station
line has been connected to another station
line for transmitting calling signals over
10 the other line and for providing an operating
path for the relay and means for preventing
the operation of the relay until the sub-
scriber at the station of the other line re-
sponds to the calling signals.

15 15. In a telegraph exchange system com-
prising a central office, a subscriber's tele-
graph printer station, a line for the sub-
scriber's station terminating at the central
office, a plurality of other subscribers' sta-
20 tions, lines for the other stations also ter-
minating at the central office and an inter-
connecting circuit for interchangeably con-
necting the subscriber's station line with cer-
tain of the other lines, a meter associated
25 with the subscriber's line, a relay associated
with the interconnecting circuit which by
its operation causes the operation of the
meter, operating means and retarding means
both effective after the subscriber's station
30 has been connected to another line, the op-
erating means tending to operate the relay
and the retarding means preventing such op-
eration, and means effective upon apparatus
at the station of the other line being set into
35 operation for rendering the retarding means
ineffective.

16. A system comprising a subscriber's
printing telegraph apparatus, a subscriber's
line, a central exchange at which said sub-
40 scriber's line terminates along with other sub-
scribers' lines, an interconnecting circuit for
interchangeably connecting said subscriber's
line with other subscribers' lines for inter-
communication therebetween, a key in said
45 interconnecting circuit and devices at said
subscriber's station operable under the in-
fluence of said key to set the motor of the
subscriber's printing telegraph apparatus
into operation characterized in this, that a
50 meter is provided at the central exchange
for recording each time the motor is started
by means of said devices.

In witness whereof, I hereunto subscribe
my name this 25th day of January, 1932.

55 ALLAN B. DICKINSON.