

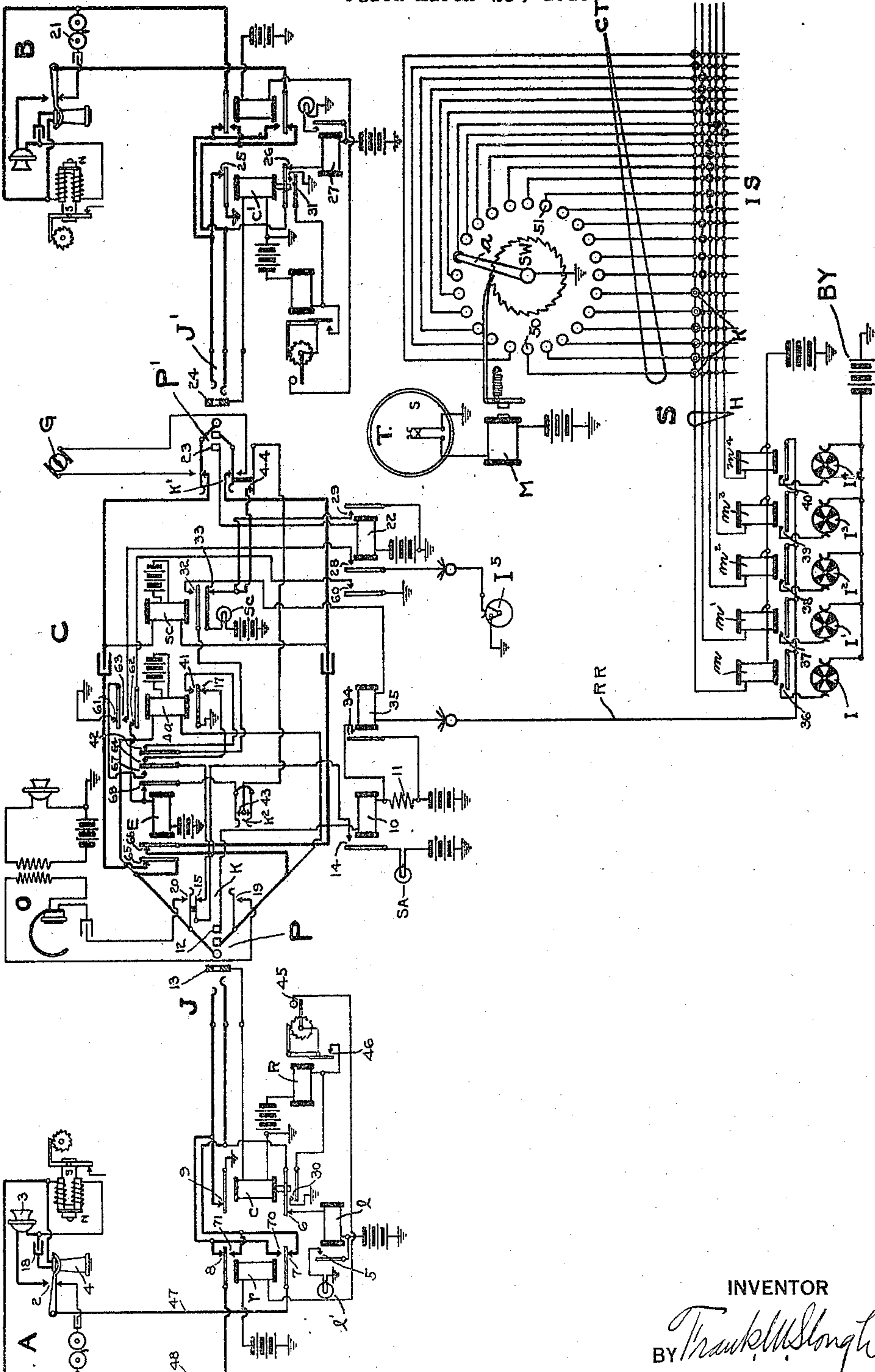
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F. M. SLOUGH

MEASURED SERVICE TELEPHONE SYSTEM

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INVENTOR

BY *Frank M. Longh*

UNITED STATES PATENT OFFICE.

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MEASURED-SERVICE TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that I, FRANK M. SLOUGH, a citizen of the United States, and residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Measured-Service Telephone Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to telephone exchange systems, and more particularly to measured service telephone systems in which a record is kept of the service secured by the subscriber through the exchange, and relates furthermore to facilities provided for the purpose of giving improved service to the subscriber.

It is an object of this invention to provide means to charge subscribers for calls in accordance with the time of day when such calls are made, and in accordance with the time the subscriber's telephone is in use.

It is another object of this invention to provide an improved registration apparatus at the exchange and associated with the line apparatus of the subscriber thereat, for registering the units proportional to the charge to be made to the subscriber, and it is still another object of this invention to provide registration means at the subscriber's station, so that the subscriber may be kept informed at all times as to the charges being made against him.

Other objects of this invention and the invention itself will be apparent as the description thereof progresses.

It has been found in the operation of telephone exchanges that the load during busy hours of the day is far in excess of that during the remaining hours of the day. For instance, in certain exchanges it is found that at about 9 o'clock in the morning and again at 5 o'clock in the evening, there is an abnormal load placed upon the system by the increased number of calls being put through at these times, this on account of the business and social habits of telephone users. During these short periods which vary in different locations in duration and occurring at different times of the day according to the location and habits of the people living therein, it is necessary to call

into use at the telephone exchange an increased amount of telephone line interconnecting apparatus over what is ordinarily required during other times of the day, and the provision of this extra apparatus not only increases the cost of the telephone exchange apparatus, but cuts down the efficiency of operation of the same. This is true whether the exchange is a subscriber operated or a centrally operated exchange.

It is an object of this invention to so apportion a charge made to the subscriber, that it will be to the subscriber's monetary interest to make his calls, if possible, occurring at some other than the busy time of day for the telephone exchange, and to limit the conversational period length.

In registering charges against calling subscribers and telephone exchanges, it is the usual practice to charge the subscriber so much a call, but this is objectional for the reason that in such a method of charging an injustice is done to the subscribers who use the telephone for only short periods of time, so that in my improved system I so arrange a register at the main office and a subsidiary register at the telephone substation, which register units of the charge at certain rates of registration, the rates depending upon the time of day, and the number of registrations depending therefore upon the time of day and the length of the conversational period.

In my improved system, I positively control the subsidiary subscriber's register by the main office subscriber's register, so that there will be uniformity of registrations between the two registers.

The objects of this invention and the invention itself will be more clearly understood from a description of the drawing illustrating the embodiment of my invention in a manual or centrally operated telephone system, although many of the objects of my invention may be capable of embodiment in a subscriber operated or so-called automatic telephone system.

Referring to the drawing, at A, I show a calling subscriber's substation apparatus, and at B, I show a called subscriber's substation apparatus. At C, I show an operator's connection link circuit illustrated here-

in as a cord circuit. For the line of the subscriber A, I show a line relay *l*, controlling a signal lamp *l'*, a cutoff relay *c* and a substation registration relay *r*. The contacts of the relay *r* are of the make-before-break type to insure the energization of the supervisory relay *sa* during the transmission of impulses controlling registration. I also show a central office register at R and a switchboard jack in which the calling subscriber's line terminates at J. The cord circuit C terminates at the call answering end in a switchboard plug P, and at the called subscriber's end in a switchboard plug P'. An operator's set is shown at O, and adapted by means of a switchboard key *k* to be connected to the talking strands of the cord circuit. At S, I show registration apparatus common to a plurality of cord circuits C, and capable of controlling the operation of registers on whatever line such cord circuits may be connected. For instance, the apparatus S may serve the lines of an entire exchange. The apparatus S consists of a clock or other timing apparatus T, which operates contacts *s* at certain intervals, for instance, once an hour. Under the control of these contacts and operated at such periods as the contacts are operated, is a motor magnet M for a rotary switch SW which is propelled from switch contact to switch contact under the control of the timing apparatus T and the control magnet M, thereby changing the connection between the switch-arm *a* of the switch SW from one contact of the switch to another according to the time of day.

As illustrated there are 24 contacts for this switch, one for each hour of the day, and there are furthermore 24 conductors CT, leading from these contacts to an interconnecting switch mechanism IS. This interconnecting switch mechanism is herein illustrated as the well-known plug switchboard, in which it is possible to interconnect any of the vertical circuit conductors CT extending through this switchboard to any of the horizontal conductors H. Any number of the conductors CT may be connected to the same conductor of the group H, as may be desired. Each of the conductors of the group H leads to a magnet, such as m^1 , m^2 , m^3 or m^4 . Each of these magnets control the connection to a common rate of registration circuit conductor RR, leading to the cord circuits of the exchange. One of the registration interrupters I, I¹, I², I³, and I⁴, is included in circuit with the rate of registration conductor RR at a time, depending upon the position of the switch SW at the time and the condition of interconnection of the switchboard IS, as may be predetermined by the insertion of the interconnecting plug, such for instance as is shown in the drawing by the positions occupied by the plugs K, and the other like plugs.

The interrupters I, I¹, I², I³ and I⁴, have different rates of actuation, revolving for instance, at different rates of speed, so that the connection between the central office source of current BY and the rate of registration conductor RR is made and broken at different rates depending upon the particular interrupter interconnecting the said source of current and the said conductor.

The called line apparatus for the called subscriber B, is arranged in like manner to that of the subscriber whose substation is shown at A and will not be specifically described. It may be said in passing, that excepting when the subscriber B is a calling subscriber that the apparatus which has to do with the registration functions alone will not be operated, since it is customary to only charge the originating or calling subscriber for connections put through the switchboard.

For the supervision of the connection put through the switchboard by means of the interconnecting link circuit C, two signal lamps are provided, SA and SC for the answering and the calling end of the cord circuit respectively. At *sa* and at *sc* are the respective supervisory and controlling relays under the control of the answered and called subscribers, respectively.

At E, is shown a relay performing a function of conditioning the signal lamp SA to make a recall for the calling subscriber, and in addition performs the function of separating the talking strands of the cord circuit, so that the called subscriber may not hear an ensuing conversation between the recalling subscriber and the operator.

The other apparatus shown in the drawing and the operative relation between the different apparatus therein shown will be more clearly understood from a description of a connection which will be assumed to be made between a calling subscriber at the substation A, and a called substation at B, as follows:

The subscriber at A removing his receiver from the hook, will close a talking circuit by the closure of the contacts 2 for the substation transmitter 3 and receiver 4 of the substation A, and will close a circuit including the winding of the line relay *l* to operate the line lamp *l'* upon the closure of the contacts 5 of the line relay *l*. The circuit of the line relay *l* can be traced from the negative pole of battery through the winding of the said line relay *l*, the normal contacts 6 of the cutoff relay *c*, the normal contacts 7 of the registration relay *r*, the contacts 2 of the substation hookswitch, the transmitter 3, the winding of the registration magnet N which acts as the substation instrument circuit, the normal contacts 8 of the registration relay *r*, and the normal contacts 9 of the cutoff relay *c* to the ground pole of the source of current. Current from the said

source operating the line relay and closing its contacts 5, will operate the line lamp L' , attracting the attention of the operator to the call. The operator will answer the call by inserting the answering plug P of the cord circuit C into the jack J of the line making connection between the talking conductors thereof to the tip and sleeve springs of the jack by the corresponding talking conductors of the cord circuit. The insertion of the plug into the jack will complete a circuit, including the windings of the cutoff relay c of the line, of the local controlling relay 10 of the cord circuit and of a resistance coil 11, together with the central office source of current, this circuit being completed by the joining of the contact 12 of the plug to the thimble contact 13 of the jack. Current from the said source will flow over this circuit operating the relays 10 and c , which will thereupon attract relay armatures, the closing of the contacts 14 of the relay 10 preparing a circuit for the answering supervisory lamp SA , and the opening of the contacts 9 and 6 of the line cutoff relay c opening the circuit of the line relay L to extinguish the line lamp L' . The answering supervisory lamp SA will not be operated at this time however, because of the presence of the subscriber substation instrument across the limbs of the line operating the supervisory relay sa , the circuit for this relay including the central office source of current, the tandem windings of the relay sa , the tip and ring contacts of the answering switchboard plug P , the contacting tip and ring springs of the jack J of the line, the talking strands of the line leading to the substation instrument A , the circuit being completed thereat through the substation transmitter 3 and the substation register-impedance coil N , across which is connected in multiple the substation receiver 4 in series with the substation condenser 18. Current from the source of current operating the supervisory relay sa , will open the contacts 17 in the circuit of the supervisory lamp SA to prevent its operation.

The operator will now operate the listening key k , closing the contacts 19 and 20 to connect the operator's telephone set at O to the talking strands of the cord circuit which are, as has been stated, at the time connected to the talking strands of the line circuit. The operator and subscriber being now in conversational circuit will converse, and the operator will learn the number of the called-for line, which we will assume in this description is the line containing the substation B . The operator will make connection with the called-for line after making the usual busy test, and the plug P' is therefore inserted into the jack J' to extend the connection between the calling and called lines by the operation of a ringing key k' . A

ringing generator G , may be connected to the called line to ring the bell 21 at the called subscriber's substation instrument.

At the time the connection was made by the plug P' with the called line jack J' , a circuit was closed for the local controlling relay 22 for the called subscriber's end of the cord circuit, the said circuit including the contact 23 of the plug P' and the thimble contact 24 of the jack of the called line, the circuit furthermore including the central office source of current and the winding of the called line cutoff relay c' . Current from the said source will operate the relays 22 and c' , the relay c' opening its contacts 25 and 26 to disconnect the called line relay 27 from the line conductors, and the relay 22 closing its contacts 28, 29 and 60.

At this point it may be stated, that the cutoff relays c and c' for the lines have two armatures, the one armature having a sensitive adjustment and the other armature an insensitive adjustment, the last-named armature being for the relay c , that armature which operates the contacts 30, and for the relay c' that armature operating the contacts 31. These contacts for the two relays will not, at this point in the operation of the circuit, be operated. The operator having restored her listening key k to normal, the contacts 15 will again be closed to condition a circuit for the answering supervisory signal SA . The ringing key k' having been operated, will again be restored, closing its normal contacts and connecting the windings of the called supervisory relay sc , together with the central office source of current in circuit with the called subscriber's line to be operated at the moment of response of the called subscriber upon taking his receiver from the hook to close the line circuit of the called line, whereupon the called supervisory relay sc will be operated, attracting its armatures, closing its contacts 32, and opening its contacts 33.

Prior to the response of the called-for subscriber, the called supervisory lamp SC was operated over a circuit traced from the negative pole of the source of current, through the lamp SC , through normal contacts 33 of the relay sc , and now closed contacts 29 of the relay 22 to ground pole of the source of current. Upon the breaking of the contacts 33, this signal is extinguished denoting to the operator that the called-for subscriber has responded. At this time the two subscribers are in conversational circuit, the one with the other, and it is at this time that it is desired by the improved construction herein set forth, to begin to register units of charge against the calling subscriber.

These units of charge may be for convenience in the register R at the central office .1¢ units and may be for the substation reg-

ister N a multiple of these .1¢ units, for instance, it may register 1¢ units. The adjustment of the contacts 30 of the cutoff relay *c* is preferably such that the contacts 30 will be closed when the circuit including the winding of the cutoff relay *c* is decreased in resistance by an amount equal to the shunting of the resistance coil 11 in its circuit. Upon such a shunting, for instance, by the operation of the contacts 34 of the register relay 35 the contacts 30 will be closed, and the adjustment is so made that they will be again opened upon the opening of the contacts 34, the operation of these contacts 30 of the relay *c* being adapted to be opened and closed under the control of the contacts 34 the while the contacts 6 and 9 remain opened.

At I, I¹, I², I³ and I⁴, are shown interrupters revolving to produce interruptions of circuit conductors associated with them, each interrupter revolving at a different rate of speed so that each will produce a characteristic rate of circuit interruption. Means are provided by the provision of contacts 36, 37, 38, 39 and 40 for the relays *m*, *m*¹, *m*², *m*³ and *m*⁴ respectively, for including in circuit with the controlling registration conductor RR any one of the circuit interrupters described having a definite characteristic rate of interruption. Assume for the moment, that the relay *m* alone is operated at the time the circuits involved are operating as described. Such being the case, the circuit interrupter I will be included in circuit with the conductor RR, imparting to this circuit interrupter its definite characteristic rate of circuit interruption, whereby the circuit conductor RR will have its circuit interrupted at a definite characteristic rate. Also included in circuit with the conductor RR are the central office source of current BY, the relay 35 of the cord circuit, the now closed contacts 32 of the relay *sc*, the now closed contacts 41 of the relay *sa*, and the normally closed contacts 42 of the relay E. Current from the source BY will operate the relay 35 momentarily at the end of definite intervals predetermined by the characteristic rate of interruption of the interrupter I, and each time that the relay 35 is operated, the contacts thereof will be closed to short circuit the resistance coil 11 in the circuit of the line cutoff relay *c*, to operate its insensitive armature to close the contacts 30 of the relay *c*. The contacts 30 are included in circuit with the central office source of current and the register R. The register will be operated at each closure of the contacts 30, and the counting mechanism not shown in the drawing but, well understood, will be advanced from one counting position to another at each actuation.

Periodically, and at the end of periods during which the register R has been opened

at a definite predetermined number of times, for instance ten times, the contacts 45 are momentarily closed upon the next succeeding actuation of the register, a circuit thereby being completed during such actuation for the substation register controlling relay *r*, including the central office source of current, the circuit being traced from the negative pole of the said source, the winding of the relay *r*, through contacts 45 of the register mechanism, through contacts 46 attached to the armature of the register and closed when the register armature is in its full attracted position, the circuit however, traced through now closed contacts 30 of the cutoff relay *c* to the ground pole of the source of current. The relay *r* will be energized over this circuit attracting its armature, interrupting the flow of current from the central office source, through the windings of the cord supervisory relay *sa*, to the conductors 47 and 48 of the line leading to the substation register N, and then again closing the circuit but reversing the line conductors 47 and 48 with respect to the positive and negative poles of the source of current connected to the windings of the supervisory relay *sa*. In other words, the central office battery is momentarily reversed with respect to the substation register N, and this register is adjusted to only operate when current from the central office battery is reversed in direction. Therefore, upon such a reversal the register N at the substation which is magnetically polarized, will operate to indicate to the subscriber that so many charge units, for instance ten .1¢ charge units have been registered by the master controlling register R at the central office. It can be seen that since the number of registrations depend upon the rate of interruptions of the interrupter I, that by operating the relay *m*¹ instead of the relay *m*, that a different interrupter, for instance the interrupter I' included in circuit with the relay 35, and therefore causing this relay to be actuated at a different rate, for instance, a more rapid rate will cause the registrations of the two registers to be accomplished at a different or correspondingly more rapid rate. Other rates of registration actuations may be accomplished by including the other registers in circuit with the relay 35. The circuit conductor RR in circuit with which the registrations are adapted to be included, is common to a plurality of cord circuits and may be common to all of the cord circuits of an exchange. The relays 35 are individual to their respective cord circuits.

Now, at T, M, SW, and IS, are shown switching means to provide for the association of the different interrupters in circuit with the conductor RR at different times of the day as may be desired. This apparatus consists of a switchboard IS, by means of

which any of the vertical conductors CT may be connected to any of the horizontal conductors H leading to the relays m^1 , m^2 etc., to control their operation, and may be of any suitable form, being illustrated as a plug cross-bar switchboard of a well-known form.

The clock mechanism T, is adapted by means of the intervening driving magnet M and a central office source of current to step the rotary switch SW from its position of contact with one of the vertical circuit conductors CT to another from hour to hour, so that in twenty-four hours the rotary switch will have completed a circuit with each one of the vertical conductors CT, each one for an hour. The position of the plug in the switchboard IS obviously determines which relay of the group m to m^4 is to be included during a given hour in circuit with the central source of current, the connection to the ground pole of which is applied to the rotary switch-arm a . For instance, when the rotary switch-arm a makes contact with the contact 50, the relay m is operated and the circuit interrupter I is for an hour associated with the circuit conductor RR. Again during that hour in which the switch-arm a rests upon the contact 51, the relay m^2 is operated to include the circuit conductor I^2 in circuit with the conductor RR to control the operation of cord circuit relays, such as 35. Thus, the clock mechanism T shifts the rate of registrations as may be predetermined by the switch plugs on the switchboard IS. The registrations go on during the conversational period as long as the two subscribers have their receivers from the hook without replacement.

When the subscribers finish their conversation and either hangs up his receiver, the registration automatically ceases by the opening of the contacts 32 or 41 in the circuit of the controlling relay 35 of the cord circuit. The called-for subscriber hanging up will give a disconnect signal by the closing of the contacts 33 in the circuit of the signal lamp SC. The calling subscriber retiring, will give a disconnect signal by the deenergization of the supervisory relay sa which will retract its armatures, closing the contacts 61, 62 and 17 and opening the contacts 63 and 41. The closing of the contacts 62 completes a circuit for the locking relay E, the circuit being traced as follows: from the ground pole of the source of current, now closed contacts 60 of the relay 22, normally closed contacts 62 of the relay sa , the winding of the locking relay E to the negative pole of the source of current. Current from the said source flowing over this circuit will operate the locking relay E which will attract its armatures, opening its contacts 42, 64, 65 and 66, and closing its contacts 67 and 68. The closure of the

last-named contact 68, completes a locking circuit for the relay E, this circuit extending to the winding of the relay E independent of the contact 62 of the relay sa ; this locking circuit extending from the negative pole of the source of current, through the winding of the relay E, through now closed contact 68 thereof, through normally closed contacts 43 of the restoring key k^2 , through normally closed contact 44 located on the ringing key k' , through now closed contacts 29 of the relay 22, to the ground pole of the source of current. The closure of the contacts 67 of the relay E and of the contact 61 of the supervisory relay sa completes a circuit for the signal lamp SA, to cause this signal lamp to give a disconnect signal, this circuit being traced as follows: from the negative pole of the source of current, through the said signal lamp, through now closed contact 14 of the relay 10, through normally closed contacts 15 located on the listening key k , through now closed contacts 67 of the relay E and the normal contacts 61, now closed, to the ground pole of the source of current. Current from the said source will operate the said disconnect lamp to give a disconnect signal to the operator.

The duty of the operator upon observing this signal, is to perform the act of disconnection by withdrawing the two plugs of the cord circuit of the jacks of the calling and called subscribers. However, it often happens in practice, that the operator being engaged in the work of performing supervisory acts for other connected subscribers and in putting up other connections, may overlook this disconnect signal for the time being. The system of my invention is so arranged that during this interval and prior to the time the operator performs the act of disconnection, the originating connected subscriber may cause the disconnect signal to operate in a characteristic manner so as to give a special signal to the operator, this ordinarily denoting to the operator that the calling subscriber desires another connection, or perhaps may want the called subscriber recalled.

Assuming now that the subscriber A makes such a recall by again taking his receiver from the hook, the supervisory relay sa will be again operated, breaking its normal contacts, and again causing its normally opened contacts to be made. The opening of the normal contacts 61 by the supervisory relay sa will interrupt the connection to the ground pole of battery which has maintained the supervisory signal SA operative, and instead will substitute an alternate connection to ground through the flash interrupter I^5 , the circuit including the said interrupter being traced from the ground pole of battery, through the said interrupter,

which is common to a plurality of cord circuits, through contacts 28 of the relay 22, through the now closed contacts 63 of the relay *sa*, through the contacts 67 of the relay *E*, through normal contacts 15 on the listening key, through contacts 14 of the relay 10, through the signal lamp SA, to the negative pole of the source of current. Current from the said source will intermittently flow over the said circuit as the interrupter I^5 revolves, causing a characteristic flash of the lamp SA to attract the attention of the operator to the recall. The operator will attend to the recall by operating her listening key *k*, which will open the circuit of the signal lamp SA, by the breaking of the contacts 15 located on the listening key extinguishing the lamp. The closure of the contacts 19 and 20 will again connect the operator's telephone to the telephone of the calling subscriber at A in conversational circuit. The subscriber at B, that is, the first called subscriber, even though he may have his receiver off the hook, will not be connected in conversational circuit with the operator or the calling subscriber at this time due to the continued opening of contacts 65 and 66, causing the talking strands in the direction of the called subscriber to be severed. The operator may therefore converse with the subscriber at A to the exclusion of the subscriber at B, absolute secrecy being maintained as to the subscriber at B.

If the calling subscriber desires a new connection to some other subscriber's line than the subscriber's line having the substation B, he will make known his desire to the operator who will perform the next necessary connection, by withdrawing the plug *P'* of the cord circuit from the jack *J'* of the former called line and insert it into a jack of the now called line, and perform the ringing function in the manner which has been described for the line having the substation B. If this is done, the locked-up relay *E* will be restored to normal by the withdrawal of the plug *P'* from the jack *J'*, since such withdrawal causes a deenergization of the relay 22 and an opening of the contacts 29 serially included in the locking circuit of the relay *E*, as has been described, the locking circuit being opened the relay *E* will be restored to normal position.

If the calling subscriber merely desires the operator to again ring the called subscriber, this may be done without withdrawing the plug *P'* from the jack *J'*, and by merely operating the ringing key *k'* the restoration of the locked relay *E* will take place, since the contacts 44 serially included in the locking circuit of the locked relay *E* will be opened upon every operation of the ringing key *k'*. If the calling subscriber desires to be reconnected to the called subscriber whom the operator knows to have the telephone off

the hook by the effaced condition of the signal lamp SA, the relay *E* may be restored to normal by throwing the un-locking key *k*² momentarily to open contacts 43 serially included in the locking circuit of the relay *E*, as has been described.

It will be observed that the restoration of the relay *E* restores the contacts 65 and 66 to operative condition, whereby the talking strands of the cord circuit will be extended from the calling to the called ends of the cord circuit, and as the case may be, from calling to called subscribers' substations. The restoration of the relay *E* also dissociates the flash interrupter I^5 from the signal lamp SA by the opening of the contacts 67 of the relay *E*. The restoration of the relay *E* also again conditions the subscriber's charge mechanism of the calling line to operate by the closing of the contacts 42 of the relay *E* in the circuit of the relay 35, which relay may be called the registration relay, and it is only necessary thereafter that each subscriber has his receiver off the hook, closing contacts 41 and 32 of the calling and called supervisory relays to cause the registration to recommence.

Now, if it is assumed that the time of day has arrived when the clock mechanism at *T* through the intermediate driving magnet *M* has advanced the switch-wiper *a* to a position where the relay *m* is retired and one of the other relays determined by the position of the plugs on the switchboard IS is operated, it can be seen that the rate of registration will change depending upon which relay as m^1, m^2, m^3, m^4 is operated, and which interrupter therefore as I^1, I^2, I^3, I^4 , is included in circuit with the relay 35, to control its operation. Both subscribers may converse, the registration going on automatically, the number of registrations being a function of the length of the time they converse and of the time of day when they converse.

The conversation being completed, the subscribers retiring will operate their disconnect signals in the well-known manner and the connection may be taken down by the operator, in which case all of the apparatus involved in the connection is restored to normal position.

What I claim and desire to cover by United States Letters Patent is defined in the following claims in which I claim:—

1. In a telephone system, the combination with a subscriber's telephone line, of a register mechanism for the said line located at a main station, of a second register mechanism for the said line located at a substation on the line, and means operative under the control of the main station registration mechanism to operate the substation mechanism a fractional number of times the main station mechanism is operated.
2. In a telephone system, the combination

with a telephone line, of register mechanism associated with the said line, of an operator's link circuit for connecting the said line to other telephone lines, timing means, progressively movable switch mechanism operable under the control of said timing means, of a plurality of circuit controllers under the control of the said timing and switch mechanism, whereby the said timing and switch mechanism may select a given one of the said circuit controllers, and means to cause a selected circuit controller to operate the said line register under the control of apparatus in the said link circuit.

3. In a telephone system, the combination with a telephone line, of register mechanism associated with the said line and located at a main exchange terminal thereof, an operator's link circuit for connecting the said line with other telephone lines, register operating mechanism associated with the said link circuit and adapted to be associated with the said line mechanism when connection is made between the said link circuit and the said line circuit, of a plurality of registration controlling means for the said registration means, and timing means including a progressively movable non-numerical switch to select a given one of the said controlling means to control the said registration means.

4. In a telephone system, the combination with a telephone line, of register mechanism associated with a main exchange terminal of the said line, of subsidiary register mechanism located at a substation of the line, a central exchange mechanism operating at a definite predetermined rate to operate at the said rate the main exchange line register mechanism of the said line, and means associated with the said last-named register mechanism to operate the said subsidiary register mechanism once, when the main exchange line register mechanism has been operated a predetermined number of times.

5. In a telephone system, the combination with a telephone line, of register mechanism associated with a main exchange terminal of the said line, of subsidiary register mechanism located at a substation of the line, a central exchange mechanism operating at a definite predetermined rate to operate at the said rate the main exchange line register mechanism of the said line, means associated with the said last-named register mechanism to operate the said subsidiary register mechanism once, when the main exchange line register mechanism has been operated a predetermined number of times, and a main exchange switch for varying the rates of registration.

6. In a telephone system, the combination with a telephone line, of register mechanism associated with a main exchange terminal

of the said line, of subsidiary register mechanism located at a substation of the line, a central exchange mechanism operating at a definite predetermined rate to operate at the said rate the main exchange line register mechanism of the said line, means associated with the said last-named register mechanism to operate the said subsidiary register mechanism once, when the main exchange line register mechanism has been operated a predetermined number of times, a main exchange switch for varying the rates of registration, and a clock mechanism controlling the said rate of varying means.

7. In a telephone system, the combination with a plurality of telephone lines, of a plurality of link circuits at a main exchange for interconnecting the said lines, substation telephones for the said lines, substation control relays in each of the said link circuits for calling and called interconnected subscribers' lines, a register individual to a calling one of said lines, commutators associated with the said link circuits adapted to operate the said register under the control of the said relays, timing means for associating a commutator with said register and means under the control of the calling substation instrument to destroy the control of the said commutator over the said register.

8. In a telephone system, the combination with a telephone line, of main exchange register mechanism for the said line, of subsidiary mechanism at a substation of the said line, a central exchange commutator operating at a definite predetermined rate to operate at the said rate the main exchange line register of the said line, and means associated with the said last-named register to operate the said subsidiary register, the said means causing the registration by the subsidiary register of a fractional part of the number of main exchange register registrations.

9. In a telephone system, telephone lines, a register mechanism for each line located at the main station, an operator's link circuit for connecting the said line to other telephone lines, a plurality of interrupters for variably operating the register mechanism of the calling line and a progressively movable non-numerical switch for selecting a desired interrupter to control said register mechanism.

10. In a telephone system, a plurality of telephone lines, two register mechanisms associated with each telephone line, an operator's link circuit for connecting one telephone line to any of the other telephone lines and an interrupter for operating one of said registers in response to each operation of said interrupter, said second register being operated in response to a plurality of operations of said first register.

11. In a telephone system, a plurality of
telephone lines, a polarized register mech-
anism associated with each telephone line
an operators link circuit for connecting one
5 telephone line to any of the other telephone
lines and means including a relay individual
to the calling line and operated responsive

to the interconnection of the calling and
called telephone lines for reversing current
in the calling line to operate said register. 10

In witness whereof, I hereunto subscribe
my name this 23rd day of March, A. D.
1918.

FRANK M. SLOUGH.