

Sept. 22, 1925.

1,554,349

H. H. IDE

SUBSTATION CIRCUIT

Filed May 2, 1923

3 Sheets-Sheet 1

Fig. 2.

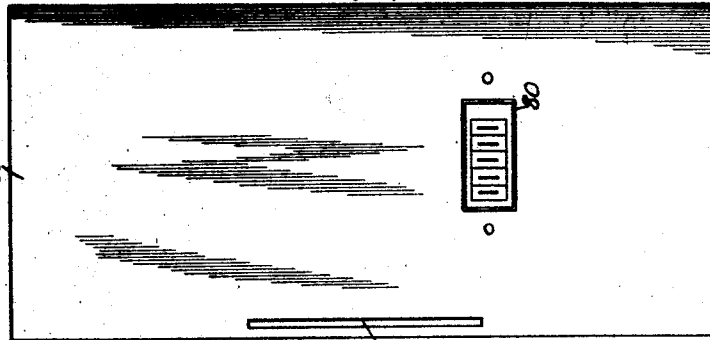
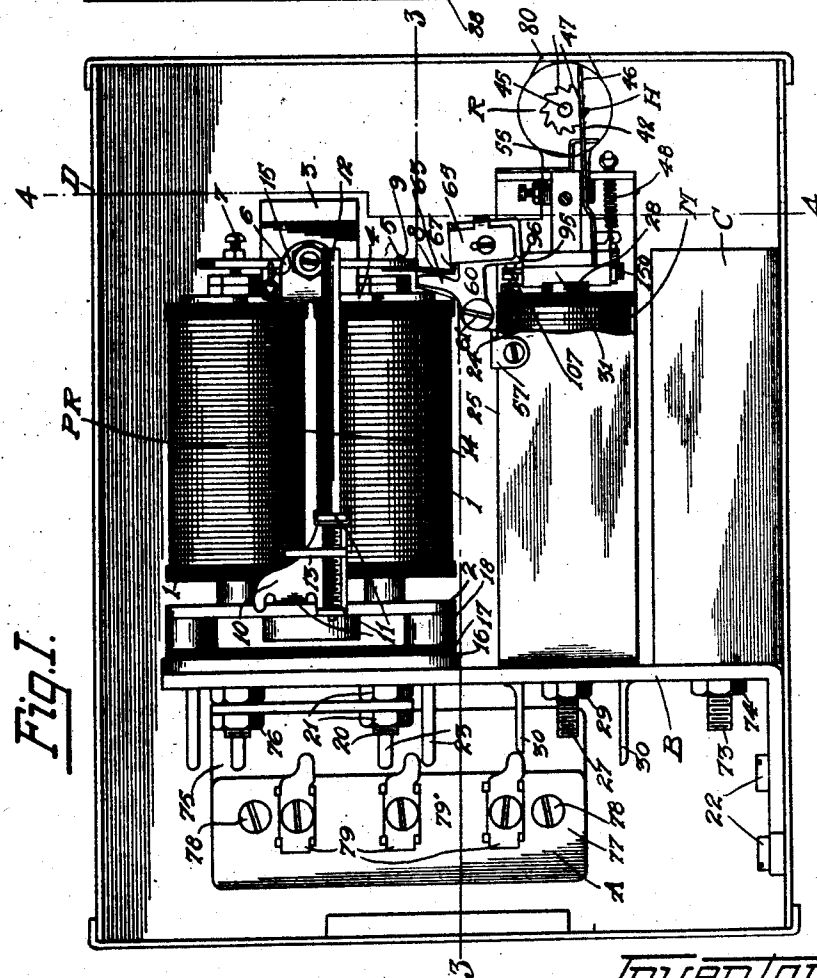


Fig. 1.



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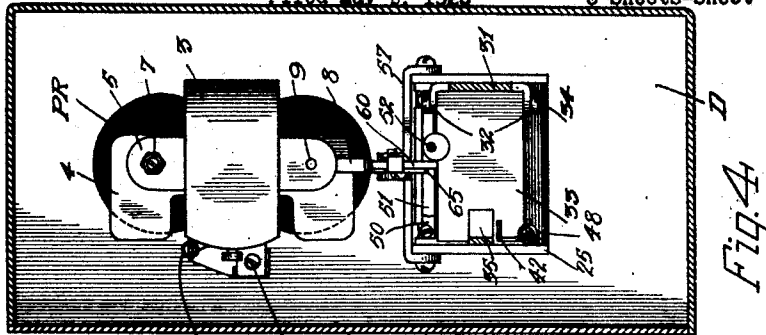


Fig. 4

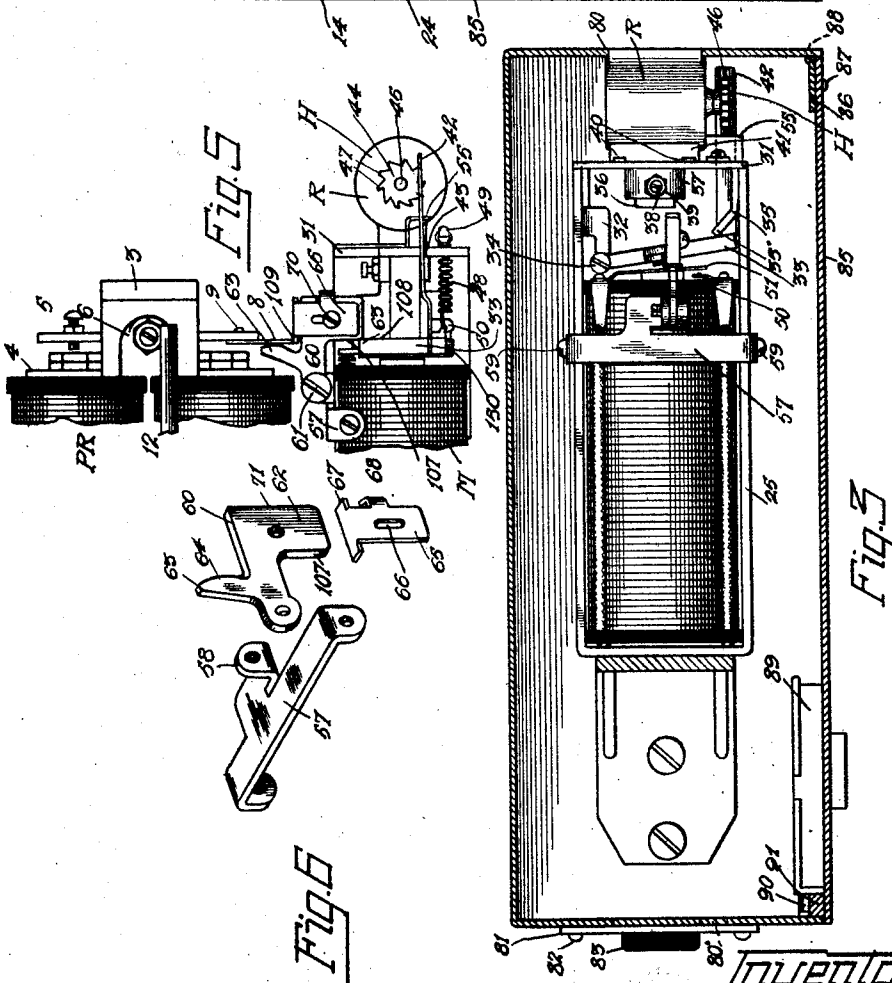


Fig. 5

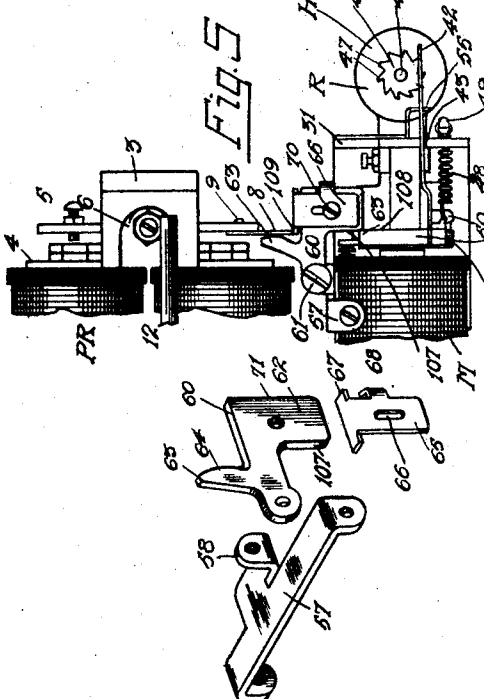


Fig. 6

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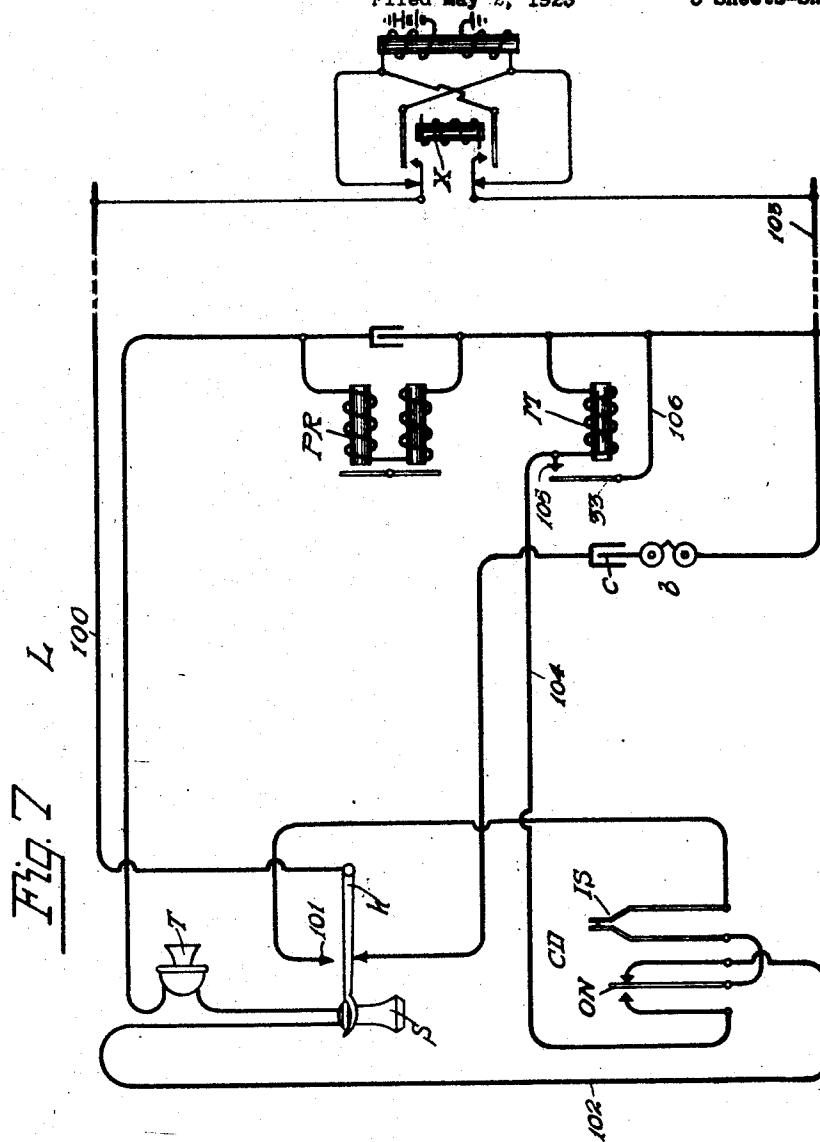
1,554,349

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SUBSTATION CIRCUIT

Filed May 2, 1923

3 Sheets-Sheet 3



Inventor:
Harry Hilde.
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UNITED STATES PATENT OFFICE.

HARRY H. IDE, OF LAGRANGE, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

SUBSTATION CIRCUIT.

Application filed May 2, 1923. Serial No. 636,141.

To all whom it may concern:

Be it known that I, HARRY H. IDE, a citizen of the United States of America, residing in LaGrange, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Substation Circuits, of which the following is a specification.

My invention relates to service or call register meters, such as is used for registering the number of calls completed by a calling subscriber in an automatic telephone system.

One of the features of my invention is the provision of means for registering each call extended and completed by a calling subscriber to a called for subscriber in an automatic telephone system. A service meter or registering device of my invention is provided at each subscriber's substation and is so arranged that when the subscriber initiates a call, the meter device will operate to register the call and will lock up and remain in its locked position until the called subscriber removes his receiver whereupon my meter device is released from its locked position and restored to normal where it remains in readiness to register the next call initiated by this calling subscriber. In case the called for subscriber does not answer or for some reason the calling subscriber replaces his receiver before the called for subscriber answers, the meter device of my invention will not be released to permit it to restore to normal but will remain in its locked position, so that when the said subscriber again removes his receiver, the register meter will not operate to register another call but will only be released and restored when the calling subscriber's line has been connected to a called subscriber's line and the called subscriber has removed his receiver from its switch-hook.

Another feature of my invention lies in the simple and economical manner in which my meter or registering device is constructed, and operated, and also the manner in which the various parts are assembled, so as to permit the same to be mounted as a single unit.

The foregoing features as well as others will be more clearly pointed out in the ensuing specification, reference being had to the accompanying drawings, in which like

reference characters in the several views denote like parts, and in which

Fig. 1 is a side elevation of the register mechanism of my invention with the cover of the enclosing casing removed.

Fig. 2, is a right end view of Fig. 1;

Fig. 3, is a sectional view along the line 3—3 of Fig. 1 and showing the apparatus in its normal unlocked position;

Fig. 4, is a sectional view along the line 4—4 of Fig. 1.

Fig. 5, is a view showing the registering mechanism of my invention in its locked position, and the means for controlling and locking the same;

Fig. 6, is a view showing certain parts of the locking means for locking the registering mechanism in its operated position; and

Fig. 7, is a schematic view of the circuit arrangement of the substation with which my invention may be used.

Referring now in general to my invention, PR is a polarized relay, which may be of any well known type, and is adapted to operate when the called subscriber removes his receiver from its switch-hook. A relay α is provided and is controlled by the called subscriber to reverse the flow of current through the talking conductors of an automatic or manual system, to operate relay PR as is well known in the art. R is a service or register meter for registering the number of calls or connections completed by the calling subscriber, and which meter R may be of the well known Veeder type.

A magnet, M is operatively associated with the meter R by means of a ratchet and pawl mechanism H. C is a condenser, which may be of any well known type, and is provided for the usual and well known purposes. A is a terminal rack to which are secured terminals for connecting external conductors with conductors extending to the polarized relay PR, magnet M, and condenser C of my invention; B is a mounting rack, to which are secured, the relay PR, magnet M, condenser C and terminal rack A, to form a single unit, said mounting rack B being secured to the enclosing casing D.

Having described my invention in general, I will now give a detail description of the same.

The polarized relay PR comprises a pair of magnet coils 1, which are suitably secured to a member 2. A permanent U shaped magnet 3 is provided and has one of its legs suitably secured to the member 2, and its other leg extending at right angles to and in close proximity to the ends of the cores of the magnet coils 1. A yoke 4 is provided which is suitably secured to the cores of the magnet coils 1. An armature 5 is pivotally supported between a pair of ears 6 integrally formed with and intermediate the ends of the yoke 4, said armature being provided at its one end with an adjustable screw 7 for micrometrically adjusting the armature relative to the ends of the cores of the magnet coils 1. The other end of the armature 5 has a flexible member 8 secured thereto by means of a rivet 9 and whose purpose will be pointed out later. A bracket 10 having a pair of ears 11, is provided and suitably secured to the member 2, said ears 11 having suitable openings through which one end of a rod 12 extends and is suitably secured therein, said one end of rod 12 being threaded. A member 13 having a suitable tapped orifice is provided and has screw-threaded engagement with the threaded end of rod 12. The rod 12 is permitted to be rotated in the orifices in the ears 11 of bracket 10 but so arranged that it will not move in a longitudinal direction, and when the rod 12 is rotated, member 13 will move in a longitudinal direction, to increase or decrease the tension of the coil spring 14, which has its one end secured to a hook 15, which hook 15 is suitably secured to the armature 5, the other end of said spring 14 being arranged to engage an opening in the free end of the member 13. The spring 14 retains the armature 5 in its normal position. The member 2 of relay PR is suitably secured to a member 16, but insulated and separated therefrom by a suitable insulation 17 and spacer washers 18, said member 16 being in turn secured to the mounting rack B by means of screws 20 and nuts 21. The rack B is secured to the enclosing casing D by means of screws 22 which pass through suitable openings in said rack B and have screw-threaded engagement with suitable tapped orifices in the said cover casing D. Members 23 are provided which are connected to the winding of the magnet coils 1 and extend through members 17 and 16 and rack B.

The electro-magnet M of my invention for operating the meter or register device R comprises a magnet coil 24 secured between the legs of a U-shaped heel iron 25 by means of a screw-threaded extension 27 of the core 28 of said electromagnet 24, which extension extends through suitable openings in the heel iron 25 and rack B where it has screw-threaded engagement with a nut 29,

whereby said magnet coil 24 and heel iron 25 are secured to the mounting rack B against displacement. Suitable terminals 30 are provided for the energizing winding of magnet coil 24 which extend through the heel iron 25 and rack B and are adapted to permit the winding of the magnet coil 24 to be connected to the external circuit with which it may be associated. A front plate 31 is provided which is secured to the free ends of the heel iron 25, in a suitable manner, and which front plate 31 is provided with a pair of integrally formed ears 32 between which is pivotally mounted an armature 33 by means of suitable pivot screws 34, whereby the armature 33, is supported in operative position relative to the end of the core of the magnet coil 24. An angular member 35 is provided which is integrally formed with the front plate 31 and has its end 35' positioned in the path of travel of the armature 33, to limit the extent of the stroke of the said armature 33. The service or register meter R may be of the well known Veeder type and comprises the usual counting train which is actuated by means of a suitable ratchet and pawl mechanism H. The meter R is mounted on the plate 31, and to accomplish this, the casing which encloses the counter train is provided with a lug 36, integrally formed with the casing and which lug 36 extends through a suitable opening in the plate 31. A sleeve 37, having an opening for receiving the lug 36, is provided and is secured to the plate 31 in any suitable manner as by means of a staking operation. A set screw 38 having screw-threaded engagement with a suitable tapped orifice in the sleeve 37 holds the meter R upon the plate 31, and a lock nut 39 holds the screw 38 in its position after it has been tightened. To prevent rotation of the meter R in the sleeve 37 after it is in place, the plate 31 is provided with lugs 40 integrally formed with the plate 31 by a shearing operation and which are so arranged so as to engage the extension 41 of the meter R in such a manner to prevent rotation of said meter R. A pawl 42 is provided which is pivotally secured to the free end of the armature 33 by means of a suitable pivot screw 150 shown on the drawing and extends forward through a slot 43 in the plate 31 and cooperates with a ratchet 44 secured to the shaft 45 of the counter train of the meter R. The forward end of the pawl 42 is provided with a rectangular orifice in which a portion of the ratchet 44 rests so that the edge 46 of said orifice engages a tooth 47 of the ratchet 44. An angular member 55 is provided and secured to the plate 31, said member 55 having a suitable slot through which said pawl 42 extends and serves as a guiding means for said pawl 42. A coil spring 48 is provided for holding the armature 33 in its normally

retracted position, its one end being secured to a clip 49 fastened to the plate 31 in a suitable manner, and the other end of spring 48 is attached to an angular extension 50 integrally formed with the pawl 42. The tension of the spring 48 is such as to exert an upward pull upon the pawl 42, and this upward pull holds the pawl 42 in engagement with the ratchet 44. The rearwardly extending member 35 of the plate 10 serves as an adjustable stop for the armature 33 when in its retracted position, and permits the proper adjustment of the stroke of the armature 33, that is the member 35, may be bent inwardly to permit a longer stroke or bent outwardly to shorten the stroke of the armature 33. A set of contact springs 50 and 51 is provided and secured to the end of the coil 24 by means of suitable screws. A buffer 52 of suitable insulation material is secured to the armature 33, the said buffer engaging the spring 51 to move it into engagement with the spring 50 upon the attraction of the armature 33, and the engagement of contact springs 50 and 51, a shunting circuit is closed for the winding of magnet coil 24. A member 57 is provided which has its ends turned over at right angles to its main body portion, and also has an ear 58 for a purpose to be presently pointed out, said member being of a size to span the coil 24 and to have its turned over ends engage the legs of the heel iron 25 and is secured in position by means of suitable screws 59 which extend through suitable openings in said ends and then have screwthreaded engagement with suitable tapped orifices in the legs of the heel iron 25. An angular member 60 is provided and is pivotally mounted on the member 57 at the ear 58 by means of a suitable pivot pin 61, which extends through an opening in the said angular member 60 and then has screwthreaded engagement with a suitable tapped orifice in the ear 58 of member 57. The downwardly extending portion 62 of member 60 is adapted to engage the upper edge portion 63 of the armature 33 when the said armature is in its attracted position and to hold or lock said armature 33 in its attracted position to prevent further actuation of the service or register meter R, as will be more clearly pointed out later. The upwardly extending portion 63 of angular member 60 is arranged so that its curved edge 64 engages the member 8 secured to the end of armature 5. An adjustable member 65 is provided which is secured to the portion 62 of member 60 by means of a screw 70 which passes through a slot 66 in said member 65 and then has screw-threaded engagement with a tapped orifice 67 in member 60. The member 65 has its enlarged end 67 turned over so that it is in alignment with the upwardly extending por-

tion 63 of member 60, so that said turned over end 67 of member 65 will be in operative engagement with the end of the member 8 secured to armature 5 for purposes to be more clearly hereinafter described. An ear 68 integrally formed with member 65 engages the face 71 of member 60 to prevent rotation of the adjustable member 65, and to co-operate with the screw 70 in maintaining said member 65 in its adjusted position on the member 60. The member 65 may be adjusted relative to the member 8, by loosening the screw 70 which will permit the member 65 to be moved in a vertical direction due to the slot 66, and when the proper adjustment is made, screw 70 is again tightened.

A condenser C for overcoming sparking as is well known, is provided and secured to the rack B by means of the screw-threaded member 73 and nut 74.

The terminal rack A comprises an angular member 75 which is secured on the screws 20 and held thereon by nuts 76 which have screw-threaded engagement with the said screws 20. To the member 75 is secured a strip of insulation 77 by means of screws 78 which pass through openings in said strip of insulation 77 and have screw-threaded engagement with suitable tapped orifices in said member 75. Suitable terminals 79 are provided for receiving and connecting external conductors with the terminals of the polarized relay PR, electromagnet M and condenser C, and are secured thereto by means of screws 79.

The enclosing casing D is provided with a rectangular opening 80 at one end and is of a size and so arranged that a portion of the casing of the service meter R will engage this opening 80 and is for the purpose of permitting the reading of said service meter R. Another rectangular opening 80' is provided in the opposite end of the casing D which is closed by means of a plate 81 which spans said opening 80' and is secured to the casing D by screws 82 which extend through openings in said plate 81 and then have screw-threaded engagement with suitable tapped orifices in the casing D. The plate 81 is provided with an opening in which is suitably secured a cylindrical member 83, through which said cylindrical member 83 external conductors are led to the terminal rack A. The side 85 of the casing D is removably secured to the rest of the casing D at its one end by means of a tongue member 86 which is secured to one end of the side 85 by a rivet 87, the said tongue member 86 adapted to engage a slot 88 in the casing D, and said side 85 secured, at its other end by means of a locking member 89 which is secured to the side 85 and so arranged that the bolt 90, when in its locked position as shown in Fig. 3, will engage the member 91 which is suitably

secured to the casing D. To remove the side 85, all that is necessary is to insert a suitable key into the lock 89 and operate the same to cause the bolt 90 to disengage the member 91 and then pull out and downwardly on the said side 85 whereupon the member 86 will disengage the slot 88.

For mounting purposes, I have so arranged the openings 80 and 80' that the apparatus of my invention secured to the rack B may be secured in the casing D as shown in Figs. 1 and 3, or reversed so that the service meter R will engage opening 80', instead of opening 80, and when mounted in this position, the screws 22 will engage openings provided in the opposite end of the casing D, and the plate 81 will span and close the opening 80 instead of opening 80'.

Having described the construction of my invention and the manner in which it is assembled, I will now describe the circuit arrangement wherein my invention is connected as illustrated in Fig. 7 and also the operation of my invention in registering a call or connection completely established by the calling subscriber.

In Fig. 7, I show a substation L which comprises a transmitter T, receiver S, receiver switch-hook *h*, calling device CD, call bell *b* and condenser *c*, and the polarized relay PR and electro-magnet M of my invention, the polarized relay PR of my invention is adapted to work in connection with a system wherein the battery flow is reversed upon the removal of the receiver from its switch-hook at the called for subscriber's substation. When the receiver S is on its switch-hook *h* and the armature 33 of electromagnet M is in its unlocked or normal position, the corner portion 95 of member 60, will rest upon the top edge 96 of the armature 33 of electro-magnet M, and the member 8, secured to the armature 5 of relay PR will rest between the extension 63 of member 60 and the enlarged turned over end 67 of the adjustable member 65 as is clearly shown in Fig. 1. When the receiver S at substation L is removed from its switch-hook, preparatory to establishing a call, a circuit is closed for the polarized relay PR traced from battery at the main exchange, conductor 100, alternate contact 101 of switch hook *h*, closed impulse contact springs IS and normally closed off-normal contact springs ON of the calling device CD, conductor 102, through the receiver S and transmitter T, winding of the polarized relay PR, conductor 103 and back to the other side of battery at the main exchange. Polarized relay PR does not operate over this circuit to attract its armature against the tension of spring 14, due to the fact that current is flowing through the winding of relay PR in such a way as to cause the relay to attract its armature in the same di-

rection as the tension of spring 14 is exerting upon said armature. Nothing more happens at this time. Now when the subscriber at L operates the calling device or impulse sending mechanism CD to transmit impulses of current to the main exchange, and upon the movement of said calling device off-normal, the off-normal contacts ON assume their alternate position, whereby an energizing circuit is closed for the electro-magnet M, which may be traced from battery at the main exchange, over conductor 100, alternate switch-hook contact 101, closed impulse springs IS, alternate contact of off-normal contacts ON, conductor 104, winding of said electro-magnet M, and conductor 103 to the other side of battery at the main exchange. Electromagnet M energizes over this circuit and attracts its armature 33 against the tension of spring 48 whereby contact spring 51 is caused to engage contact spring 50 to close a shunting circuit about the winding of said electro-magnet M, and which is represented in Fig. 7 by front contact 105, this shunting circuit for the winding of electro-magnet M, is the same up to and including conductor 104 as just traced above and then through front contact 105 and armature 33 of said electro-magnet, conductors 106 and 103 to battery. The attraction of armature 33 operates the pawl and ratchet mechanism H to operate the service or register meter R to register the call.

When the armature 33 is attracted, its top edge 96 will disengage the corner portion 95 of member 60, and said member 60 will, by gravity, move about its pivot pin 61 in a downward direction whereby the face 107 of member 60 will engage the face 108 of armature 33, and the end of member 8 secured to the armature 5 of relay PR will engage the top face 109 of the member 65. Thus the armature 33 of electro-magnet M will be locked in this position until the flow of battery is reversed through the polarized relay PR which will only be when the calling substation L is connected to another subscriber's line and the subscriber thereon has removed his receiver from its switch-hook. The subscriber at substation L having completed operating the calling device CD to transmit the required number of impulses and assuming that the called for subscriber responds by removing his receiver from its switch-hook, a relay X will be operated at the main exchange to change the flow of battery through polarized relay PR in the well known manner. The reversal of the flow of battery through relay PR will cause said relay PR to attract its armature in a direction opposite to the tension of spring 14, whereby member 60 will move about its pivot 61 in an upward direction to free armature 33 of electro-magnet M,

due to the engagement of member 8, secured to armature 5, and the face 64 of the extension 63 of member 60. The armature 33 being disengaged by member 60; said armature 33 will be restored to normal by the spring 48 whereupon the pawl 42 will engage another tooth of the ratchet 44 to register the next call initiated by the subscriber at substation L. When conversation has terminated and the subscribers replace their receivers upon their respective switch-hooks, current will no longer flow through the relay PR, and said relay will de-energize whereupon its armature will be restored to its normal position by the coil spring 14; and the corner portion 95 of member 60 will again engage the top edge 96 of the armature 33, while the free end of member 8 will rest between the end of the turned over end 67 of member 65 and the extension 63 of member 60.

Assuming now that the called for subscriber did not respond or that his line tested busy and the calling subscriber replaced his receiver S upon its switch-hooks, *h*, in this case, the flow of battery will not be reversed through the winding of relay PR, due to the failure of the current reversing relay X at the main exchange control by the called for subscriber to operate, whereupon relay PR will not operate to move the member 60 upward to cause the same to disengage armature 33 of electro-magnet M. Thus it is at once obvious that the armature 33 of electro-magnet M will remain in its locked position. Now should the subscriber at substation L initiate another call by removing his receiver from its switch-hook and operating the calling device CD, this will have no effect upon the electro-magnet M due to the fact that armature 33 of electro-magnet M is in its locked up position and the shunt circuit remains established about the electro-magnet M, and since the said armature 33 is in its locked position the ratchet and pawl mechanism H will not operate to advance the service meter R another number. Now when the called for subscriber responds, the current flow of battery will be reversed to effect the operation of the polarized relay PR whereby the armature 33 is released and permitted to restore to normal as is clearly described in detail above and further explanation is deemed unnecessary for a clear understanding of my invention.

From the foregoing it will be readily seen that I have provided means for registering a call when first initiated and will not register another call until a complete connection has been made with a called subscriber's line and the called for subscriber has removed his receiver from its switch-hook.

While I have illustrated and described a particular embodiment of my invention, I do not wish to be limited to the exact struc-

ture as shown, but aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

Having described my invention what I claim as new and desire to secure by United States Letters Patent, is:

1. In a device of the character described a register meter and a meter magnet therefor; actuating means controlled by said meter magnet for actuating said register meter, means associated with said actuating means and controlled by said meter magnet for locking said actuating means against actuation, and a polarized relay operatively associated with said second means for actuating said second means to free said actuating means.

2. In a device of the class described, a register meter, actuating means for actuating said register meter, a meter magnet for said register meter for controlling and operating said actuating means, locking means pivotally supported on said meter magnet and controlled by said meter magnet for locking said actuating means against actuation, and a polarized relay operatively associated with said locking means and adapted to actuate said locking means to free said actuating means to permit the same to restore to normal.

3. A device of the character described including a register mechanism, actuating means for actuating said register mechanism, a meter magnet for said register mechanism for controlling said actuating means, locking means supported on said meter magnet and controlled by said meter magnet for locking said actuation means against actuation, when said register mechanism has been advanced one step, to prevent further actuation of said register mechanism, and a relay operatively associated with said locking means for operating the same to release said actuating means to permit further actuation of said register mechanism.

4. In a telephone system, a calling substation, a call registering device for registering the number of calls completed by said calling substation, an electro-magnet for advancing said registering device, locking means and controlled by said electro-magnet for preventing further actuation of said registering device, and a polarized relay controlled by a called subscriber for actuating said locking means to permit further actuation of said call registering device.

5. In a telephone system, a calling substation, a call registering meter for registering the number of calls completed by said substation, electromagnetic means controlled by said substation for advancing said registering meter a single step, locking means under the control of said electro-magnet for locking said registering device against further advancement, and electromagnetic

means controlled from a called substation for actuating said locking means to permit further advancement of said registering meter.

5 6. In a telephone system, a calling and called substation, a call registering device for registering the number of calls completed from said calling substation, electro-
10 magnetic means controlled by said calling substation for actuating said registering device to register a single call, means under the control of said electromagnet means for preventing further actuation of said registering device, and a polarized relay controlled from the called substation for releasing
15 said last means to permit said registering device to register another call when initiated from said calling substation.

7. In a telephone system, a calling substation, a service meter for registering the number of calls completed from said calling substation, actuating means for advancing
20 said service meter a single step upon the initiation of a call from said substation, and locking means under the control of said electromagnet for preventing further advancement of said service meter until said calling substation has been connected to another subscriber's line and the subscriber
25 thereon responds by removing his receiver from its switchhook.

8. In a telephone system, a subscriber's substation, a service meter for registering the number of calls completed from said subscriber's substation, electromagnetic means
35 for actuating said service meter when a call is initiated at said subscriber's substation to register a single call, means for preventing further registration of said service meter regardless of the number of calls initiated at said subscriber's substation prior to the connection of said subscriber's substation with another subscriber's line and the subscriber
40 thereon responds, and electromagnetic means controlled by the first subscriber to respond to a connection extended from said subscriber's substation for operating said second means to permit said service meter to register another call when another call is initiated at said subscriber's substation.
50

9. In a telephone system, a calling substation and a called substation, a call registering device for registering the number of calls completed between said calling and called
55 substations, a magnet controlled at said calling substation for actuating said device to register a single call at a time, means for preventing further actuation of said device by said magnet, and a relay controlled at said called substation for permitting further actuation of said call registering device.
60

10. In a telephone system, a subscriber's substation, a service meter for registering the number of calls completed from said sub-

scriber's substation with other subscribers' substations, an impulse sending device, a magnet for actuating said service meter to register a single call at a time, and controlled by said impulse sending device, means for removing said magnet and the actuation of
65 said service device from the control of said impulse sending device, a relay controlled from another subscriber's substation for actuating said means to restore said magnet and service meter to the control of said impulse sending device.
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11. In a device of the character described, a register mechanism and an electromagnet for operating the same, said registering mechanism being secured to said electromagnet, locking means primarily controlled by said electromagnet for preventing the operation of said service meter, a polarized relay for actuating said locking means to permit the operation of said service meter, a condenser associated with said electromagnet and polarized relay, a terminal rack for connecting external conductors with said electromagnet, said polarized relay, and said condenser, and a mounting rack to which is secured said electromagnet, polarized relay, terminal rack and condenser to form a single unit for mounting purposes.
80 85 90 95

12. In a device of the character described, a register mechanism, an electromagnet for operating the same, said registering mechanism secured to said electro-magnet, locking means primarily controlled by said electromagnet for preventing the operation of said register mechanism, a polarized relay for actuating said locking means to permit the operation of said register mechanism, a condenser associated with said electro-magnet and polarized relay, a terminal rack for connecting external conductors with said electromagnet, said polarized relay and said condenser, and a mounting rack to which is secured said electro-magnet, polarized relay, terminal rack and condenser to form a single unit, an enclosing case in which said unit is mounted, said enclosing case having an opening in each end of a size to receive a portion of said register mechanism to permit the reading of said register mechanism, said mounting rack adapted to be secured in said enclosing case so that the register mechanism will engage the said opening in one end or to engage the said opening in the other end of said enclosing case, and a member provided with means through which external
100 105 110 115 120 conductors extend to said terminal rack, said member adapted to be secured to said enclosing case and to span the opening not engaged by said register mechanism.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 27th day of April, 1923.
125

HARRY H. IDE.