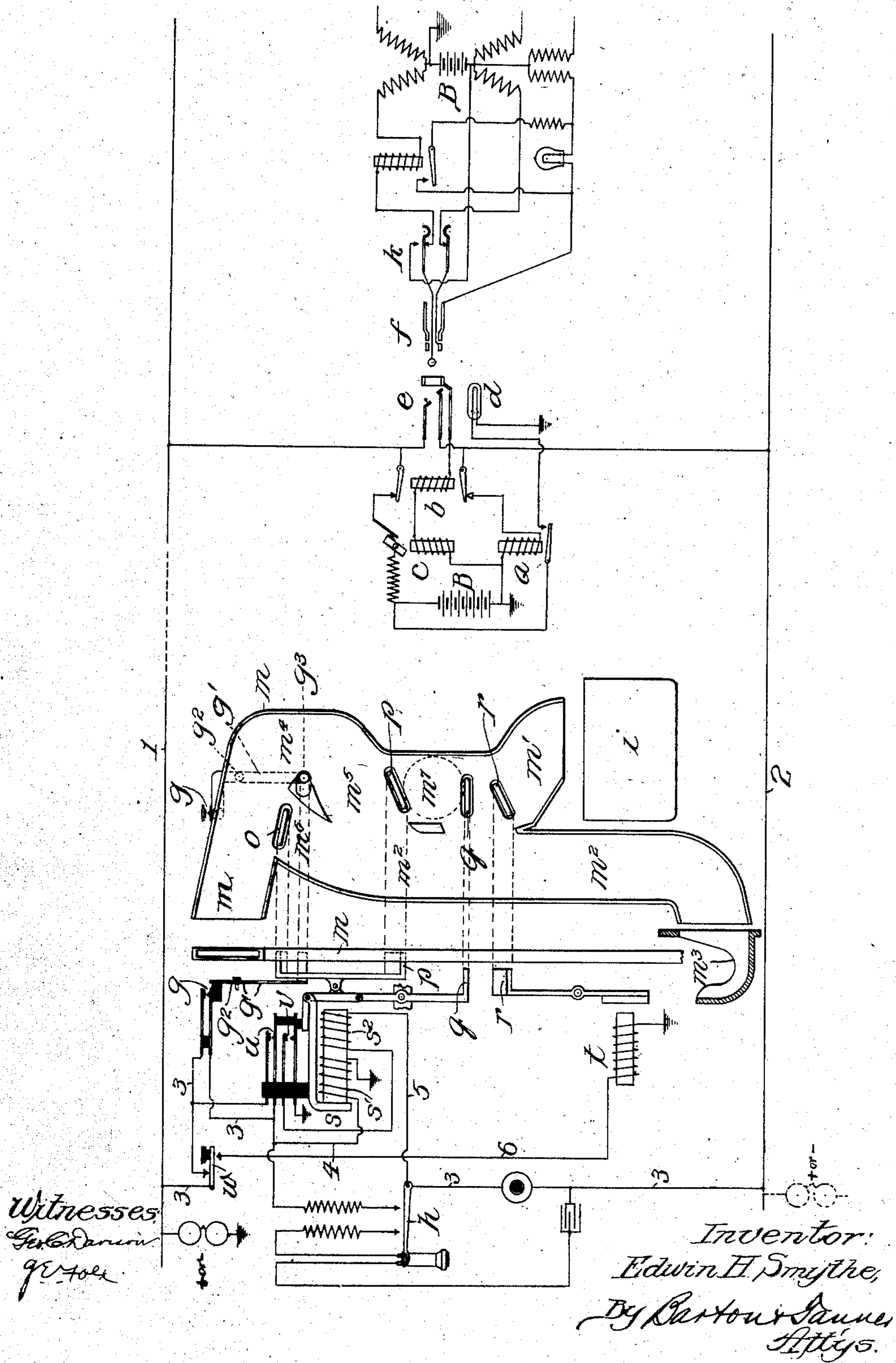


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E. H. SMYTHE.
TELEPHONE EXCHANGE APPARATUS.

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UNITED STATES PATENT OFFICE.

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TELEPHONE-EXCHANGE APPARATUS.

No. 846,628.

Specification of Letters Patent.

Patented March 12, 1907.

Application filed December 21, 1905. Serial No. 292,770.

To all whom it may concern:

Be it known that I, EDWIN H. SMYTHE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Telephone-Exchange Apparatus, of which the following is a full, clear, concise, and exact description.

This invention relates to telephone-exchange systems, and more particularly to systems of the class in which a coin-collector is provided at the subscriber's station to receive coins deposited in payment for telephone service. In a well-known system of this character the coin is deposited by the subscriber at the time a call for connection is transmitted to the central office. The coin is held temporarily in the collector under the control of the central-office operator and finally is either deposited in a permanent cash-box or is refunded to the subscriber, according as the desired service is or is not rendered.

The present invention contemplates further improvements in systems of this type and contemplates an organization of apparatus and circuits which will make possible an improved scheme of operation involving an automatic disposition of the deposited coin to accord with all the varied conditions which may arise in practice. Thus in the system of my invention the coin is deposited by the subscriber in calling the central office; but if the line is a party-line and is already in use at some other station the deposited coin will be automatically refunded. So if the line is out of order in such a way that a response from the central office is not obtained the coin may be recovered by the subscriber; but as soon as the central-office operator has responded to the call the coin is automatically brought under her complete control, so that it cannot be fraudulently recovered. If the connection called for cannot be established, (as when the called line is already busy,) the operator may permit the recovery of the coin by the subscriber; but if the desired service is rendered, as will usually be the case, the coin will, in the system of my invention, be automatically deposited in a permanent cash box or receptacle without the necessity of any special act on the part of the operator.

In the normal operation of telephone-exchange systems the connection called for is

usually established without difficulty, so that it is more often necessary to retain the coin than it is to refund it, and a great saving of the operator's time and thought is effected by having the permanent disposition of the coin brought about automatically as a mere incident to the ordinary actions of the operator, as by the mere taking down of the connection which has been established.

The accompanying drawing is a diagram of the circuits and apparatus preferably employed.

A telephone-line extends in two limbs 1 2 from the subscriber's apparatus shown at the left to the central-office switchboard apparatus shown at the right. It is understood that a number of subscribers' stations may be provided upon a party-line, all of which stations will be equipped in a manner identical to the one shown and will have the same circuit connections. For simplicity in the drawing, however, the apparatus of only one subscriber's station is illustrated.

At the central office a battery B is connected in a bridge across the two line conductors 1 2. One pole of said central battery, which is normally connected with the conductor 2 by way of the normally closed contact of a cut-off relay *b*, is grounded. The other pole of said battery is connected with conductor 1 through a normally closed contact of a slow-acting cut-off relay *c*. A line-relay *a*, controlling a local circuit through a line-signal lamp *d*, is included in the circuit between the battery B and the subscriber's line to respond to current when the circuit between conductors 1 and 2 is closed at any substation, whereby the lamp *d* may be lighted to indicate a call. A spring-jack or connection-terminal *e* is provided for the line. In the case of a multiple switchboard there will be of course a large number of such terminal spring-jacks, all connected in multiple. A portion of the operator's connecting cord-circuit and apparatus is illustrated, most of the apparatus shown being of a type well known to those skilled in the art. The connecting-plug *f* when inserted in the spring-jack establishes a local circuit from the central battery B, (which is also connected in a bridge of the cord-circuit between the windings of a repeating-coil in the usual manner,) said local circuit including the magnet-windings of the relays *b* and *c* of the line whose

spring-jack is plugged into. When connection is made with the line, therefore, the relays *b* and *c* will both be excited. When the connection is taken down by removing the plug from the spring-jack, the cut-off relay *b* will act quickly to reestablish the original connection of the battery with the line conductor 2; but the connection of the other pole of said battery with line conductor 1 will be reestablished by relay *c* only after an interval of delay due to the inertia of the relay-armature. Slow-acting relays suitable for the purpose are well known by those skilled in the art.

It will be noted that the operator's cord-circuit apparatus is so arranged that when the plug *f* is inserted in the spring-jack of a line the connection of the battery *B* with that line will be reversed—that is to say, the grounded pole of the battery will be applied by the plug to line conductor 1, which normally is connected with the free pole of said battery, and, similarly, the plug will connect the free pole of the battery to the line conductor 2, which is normally grounded. It will further be noted that a key *k* is provided in association with the operator's cord-circuit, said key being adapted when actuated to cut off the battery connection from the line conductor 2 and also to establish a connection from the free pole of said battery to the line conductor 1. This key is provided for the purpose of permitting the subscriber at the substation to recover a deposited coin, as will hereafter be described.

At the subscriber's station the usual telephone transmitting and receiving apparatus is connected in a bridge 3 between the line conductors 1 2, said bridge, however, being normally open at contacts *g* of the coin-collector and also normally open, as usual, at the contacts of the telephone-switch *h*. The contacts *g* are arranged to be closed together by the action of a coin deposited in the chute *m* of the coin-collector. In the apparatus shown a lever *g'*, pivoted at *g''*, is provided for actuating said contacts *g*, one end of said lever having a finger *g''*, which projects into the coin-chute to be engaged by a coin passing through the chute.

The specific mechanism of the coin-collector shown was designed especially to be employed in connection with the telephone-exchange system of the present invention; but said specific mechanism, although described herein in its relation to said system, is made the subject-matter of a separate application, Serial No. 283,621, filed October 20, 1905, in accordance with the rules of the Patent Office applicable to such cases.

In the diagram the coin-chute and the movable stops or guides therein are shown by both an edge view and a side view, corresponding parts being similarly lettered and connected by dotted lines.

The coin-chute *m* has a discharge-outlet *m'* into the cash-box *i* and a refund-passage *m''* leading to a refund-tray *m'''* outside the box. The receiving portion of the coin-chute leads from the top of the box diagonally downward toward the rear, where it turns at *m''* and continues in a passage *m'''*, leading diagonally downward and forward to the return-passage *m''*. A by-pass *m''''* leads from the receiving-chute directly into the return-passage *m''*; but the entrance to this by-pass is normally closed by a guide or stop *o*, which forms a removable portion of the floor of the receiving-chute. Similarly, a pocket or temporary coin-receiver *m''''* opens off the passage *m'''* of the coin-chute, the entrance to this pocket being normally blocked by a movable guide or stop *p*. When the guide *p* is removed, a coin passing through the chute will drop into the pocket *m''''*, where it will be held by a removable stop *q*, forming the floor of said pocket. From the pocket *m''''* two exits are provided, one into the return-passage *m''* and the other into the passage *m'*, leading to the permanent cash-box *i*. When the stop *q* is withdrawn, a coin in the pocket *m''''* will ordinarily be discharged through the passage *m'* into the cash-box; but a guide or stop *r* is provided, which may be interposed at the entrance of the passage *m'* to divert the released coin into the return-chute *m''*.

A coin passing down the chute *m* will be retarded at the turn *m''*, and the contact-actuating finger *g''* is located on the inner side of the chute at said turn. The engagement of the coin with said finger will therefore be prolonged, so that the mechanism controlled by said finger will be given time to act before the coin moves any appreciable distance beyond the turn.

A magnet *s* is arranged to operate the guides or stops *o*, *p*, and *q*, and a second magnet *t* is arranged to operate the guide or stop *r*, which controls the refund of a coin which has been released from the temporary receiver *m''''*.

In the particular form of apparatus shown the stops *o* and *p* are normally interposed in the coin-chute and the stops *q* and *r* are normally withdrawn. The magnet *s* is arranged when excited to withdraw the stops *o* and *p* and interpose the stop *q*. The magnet *t* is arranged when excited to interpose the stop *r*.

The magnet *s* is provided with two energizing-windings *s'* *s''*. The winding *s'* is connected in a ground branch 4, which is adapted to be connected with the line conductor 1 through the normally open contacts *g* of the coin-collector. As the central battery *B* is normally connected with the line conductor 1 at the central office, it will be seen that the closing of contacts *g* by a coin deposited in the chute will serve to complete the circuit through the branch 4, containing the energiz-

ing-winding s' of magnet s , whereby said magnet will be excited and will withdraw the stop p from the chute and interpose the stop q , so that the deposited coin will fall into the temporary receiver m^7 , where it will be held pending its final disposition. The magnet s when excited is arranged to close relay-contacts u and v . The contacts u are "hold-over-contacts," which establish the connection of the magnet-winding s' with line conductor 1 independent of the coin-actuated contacts g . The relay-contacts v , closed by the magnet when excited, serve to complete a branch energizing-circuit 3 5 from the line conductor 2 to earth. Normally the line conductor 2 is connected with the grounded pole of the central battery B; but when the operator has made connection with the line by means of her cord-circuit apparatus the battery connection, as before stated, is reversed and an independent locking-circuit is thus established from the free pole of the battery over line conductor 2, through branch 5, containing energizing-winding s^2 of the magnet s , to earth.

The magnet t , which controls the refund-stop r and which may therefore be termed the "refund-magnet," is connected in a normally open branch 6 from the line conductor 1, and the subscriber is provided with a key w , adapted for manual operation, which key is arranged when depressed to break the connection of the branch 4 with conductor 1 and establish an alternative connection from said conductor 1 to the branch 6, containing said magnet t . This key w is for the purpose of permitting the subscriber to recover the coin under certain circumstances, as where the line-lamp is burned out, so that the central-office operator does not respond to a call. At any time before connection has been made at the central office the subscriber by depressing key w can break the circuit of magnet s and establish a circuit through magnet t , whereby the stop q will be withdrawn and the stop r interposed, thus releasing the coin from the temporary receiver m^7 and deflecting it into the return-passage m^2 .

It should be noted that when the telephone is taken from the hook, as in transmitting a call, the branch 4 is brought into connection with the line conductor 2 by way of the bridge 3. The effect is that the removal of the telephone from the hook brings the magnet s into operative connection with the line conductor 2, so that said magnet will be excited if a potential exists upon said conductor 2. It will further be noted that such a potential will exist upon conductor 2 if the telephone bridge-circuit is closed at any substitution of a party-line or if a plug is inserted in a spring-jack of the line at the central office.

The operation of the system is as follows: In transmitting a call the subscriber first takes his telephone from the hook and then

deposits a coin in the chute m . If the line is busy, either because a connection has been established at the central office or because a subscriber at some other station of the line has taken his telephone from the hook to call, a potential will exist on the line conductor 2, and the magnet s will be excited as soon as the telephone is removed from the hook. The stop o will therefore be withdrawn from the coin-chute before the coin is deposited, and the coin will therefore fall through the by-pass m^6 into the return-passage m^2 and be refunded to the subscriber. If the line is out of order in such a way as to deprive it of its normal current-supply, so that no potential exists on either conductor 1 or conductor 2, the magnet s will not be excited, so that the coin upon reaching the stop p will not fall into the temporary coin-receiver m^7 , but will be deflected into the return-passage m^2 and be refunded. It has already been pointed out that if the operator does not respond the subscriber can regain his coin by pressing the special key w , which causes de-energization of magnet s and the excitement of magnet t , with the result that the coin is released from the pocket or temporary receiver m^7 and thrown into the return-passage. If the line is in order and not already busy, the coin in passing through the chute will operate contacts g to close the branch 4 and excite magnet s , which withdraws the stop p and interposes stop q , so that the coin is held in the pocket or temporary receiver m^7 pending its final disposition. Upon the response of the operator and the insertion of her answering-plug in the spring-jack of the line the connection of the battery with the line will be reversed and the circuit 2, 3, 5 established through the energizing-winding s^2 of the magnet s , so that said magnet will thereafter be excited by current in an energizing-circuit which is independent of the key w and independent of the telephone-hook, the coin being thus retained in the temporary receiver under the sole control of the operator.

Now upon the termination of the connection by the mere act of pulling out the plug f from the spring-jack e the coin held in receiver m^7 will be automatically deposited in the cash-box i , because owing to the delay of relay c in reestablishing the battery connection with line conductor 1 there will be an interval during which the line will be deprived of all current, so that the magnet s will be deenergized, withdrawing stop q and allowing the coin to fall through the passage m^7 into the cash-box. If, however, after the operator has made connection with the line she learns that the connection desired cannot be established, or if for any other reason the deposited coin should be returned to the calling subscriber, this may be accomplished by the operator pressing her key k , while the subscriber at the same time (by direction of

the operator) presses his key *w*. The result of this is that current is cut off from the line conductor 2 and applied to the line conductor 1. The magnet *t* is therefore excited, while the magnet *s* is deenergized, with the result that stop *q* is withdrawn to release the coin and stop *r* is inserted to deflect the coin into the refund-tray.

As the magnet *s* in its response serves to operate mechanism for temporarily retaining the coin, it will be convenient to refer to said magnet as the "retaining-magnet," while the other magnet *t*, which controls the stop *r*, may be referred to as the "refund-magnet."

It will be understood that the fundamental features of the system or organization herein set forth may be embodied in systems which may differ in many respects from the particular form shown in the drawings, and I do not, therefore, desire to be understood as limiting myself either to the precise mechanism of the coin-collector or to the precise arrangement of circuits shown in the drawings; but

I claim—

1. The combination with a metallic-circuit telephone-line, of a coin-collector at a subscriber's station having a retaining-magnet and a refunding-magnet and corresponding coin-distributing mechanisms operated by said magnets, a normal circuit for the retaining-magnet over one side of the line, a subscriber's key controlling said circuit, a circuit for said refunding-magnet also controlled by said key, and connecting apparatus at the central office adapted to establish an independent energizing-circuit for said retaining-magnet over the other side of the telephone-line.

2. The combination with a telephone-line, of a subscriber's coin-collector having a magnet, mechanism operated in the response of said magnet for retaining a deposited coin, said mechanism being adapted in its return to normal condition to release the coin within the collector, a second magnet, refund mechanism operated in the response of said second magnet, an operator's key, a circuit for said second magnet controlled by said key, an operator's connection-switch and a circuit for said first magnet controlled by said connection-switch.

3. The combination with a telephone-line, of a coin-collector at the substation having a magnet, mechanism controlled by the response of said magnet for retaining a deposited coin, said mechanism being adapted in its return to normal condition to release the coin within the coin-collector, a source of current, an energizing-circuit for said magnet, a second magnet, refund mechanism operated in the response thereof, a subscriber's key adapted to close a circuit through the second magnet, and switching mechanism under the control of the operator for disconnecting the current-supply from either the

first magnet alone or from both magnets, to control the disposition of the coin.

4. The combination with a telephone-line, of a coin-collector having a temporary coin-receiver, a retaining-magnet and mechanism operated in the response of said magnet for holding a coin in said receiver, said mechanism being adapted in returning to normal condition to discharge the coin within the collector, a normal circuit from the central office for said retaining-magnet, electromagnetic refunding mechanism adapted to return a discharged coin, a subscriber's refund-key, an operating-circuit for said refunding mechanism normally controlled by said key, operator's connecting apparatus at the central office, an independent energizing-circuit for said retaining-magnet, established by said connecting apparatus, an operator's key arranged to interrupt the energizing-circuit of said retaining-magnet while maintaining a battery connection with the circuit of said refunding mechanism to permit the recovery of the coin, and switching mechanism automatically operated in removing said connecting apparatus, adapted to interrupt the supply of current to both the retaining and refunding mechanism, to automatically discharge the coin within the collector.

5. The combination with a metallic-circuit telephone-line, of a coin-collector at the substation thereof having an operating-magnet in a branch from one side of the line, means operated by said magnet while excited for temporarily retaining a deposited coin, means at the central office for normally supplying current to said branch, a second magnet, mechanism operated in the response thereof for refunding a coin released by the first-mentioned magnet, a switch for operation by the subscriber, adapted to interrupt the branch circuit through the first-mentioned magnet and to close a circuit through the second-mentioned magnet, to refund the coin, and connecting apparatus at the central office adapted to establish an independent energizing-circuit for the first-mentioned magnet; whereby the subscriber may recover the deposited coin until the central-office operator has responded, the coin being thereafter under the control of the operator.

6. The combination with a telephone-line, of a subscriber's coin-collector having a magnet, coin-distributing mechanism operated in the response of said magnet for detaining a deposited coin, said mechanism being adapted in its return to normal condition to release the coin within the collector, a contact adapted to be actuated by a coin, means for supplying current to said magnet to excite the same, connecting apparatus at the central office and means controlled thereby for interrupting the excitation of said magnet in the removal of a connection.

7. The combination with a telephone-line

and a central battery, of a coin-collector at the substation thereof having a magnet and mechanism operated by the response of said magnet and its subsequent return to normal condition for disposing of a deposited coin, an energizing-circuit for said magnet from the central battery over one side of the line, controlled by contacts of the coin-collector, an independent energizing-circuit for said magnet over the other side of the line, a plug and spring-jack and switching apparatus controlled in making connection therewith adapted to establish said independent circuit and break said first-mentioned energizing-circuit, said apparatus being adapted to delay in restoring said first-mentioned circuit when the plug connection is taken down; whereby the coin is automatically disposed of without a special act of the operator.

8. The combination with a telephone-line having a battery normally connected with one side thereof at the central office, of a coin-collector at a substation having a coin-chute normally discharging into a return-passage, a branch of the coin-chute normally discharging into a cash-box, a magnet *s* having a winding in a branch circuit from the battery side of the telephone-line, a contact arranged to be closed by a coin in the chute, controlling the circuit through the magnet, mechanism operated in the response of the magnet for diverting a coin into said branch and detaining said coin therein, a second magnet *t*, means operated by said second magnet adapted to divert a released coin from said branch into the return-passage, and a manual-key adapted to shift the circuits to deenergize magnet *s* and energize magnet *t*, whereby a deposited coin may be recovered by the subscriber if the operator does not respond, and is automatically returned if the line-circuit is interrupted.

9. The combination with a telephone-line, of a coin-collector at the substation thereof having a coin-chute *m*, a refund-passage *m*² connected with said chute as a normal continuation thereof, a temporary coin-receiver *m*⁷, a cash-box adapted to receive a coin from said temporary receiver, a magnet, mechanism actuated in the response of said magnet adapted to divert a deposited coin into said temporary receiver, said mechanism being adapted to discharge the coin into the cash-box upon the return of said magnet to normal condition, a branch circuit for said magnet from one side of the telephone-line and a battery normally connected with the same side, a contact adapted to be closed by a coin in the chute to close said branch circuit, and means at the central office for interrupting the flow of current in said circuit.

10. The combination with a telephone-line, of a coin-collector at the substation thereof having a coin-chute adapted normally to return a deposited coin, of a magnet and mechanism

operated in the response of said magnet for detaining a deposited coin, said mechanism being adapted to discharge the coin into a permanent receptacle upon a mere return to normal condition, a circuit for said magnet over the telephone-line, controlled by the initial deposit of a coin, an operator's circuit at the central office and means for connecting the same with the line, means controlled independently of the coin for maintaining the excitation of said magnet before and during connection of said operator's circuit with the line, and means controlled in disconnecting said operator's circuit, for deenergizing said magnet; whereby the coin is automatically returned if the line-circuit is interrupted, but is brought under control of the operator by connection with the line and automatically discharged into the permanent receptacle by the mere act of taking down the connection.

11. The combination with a telephone-line, of a battery at the central office terminal thereof, a slow-acting relay having contacts normally connecting said battery to one side of the line, and operator's connection-switch and its circuits at the central office, means controlled in closing said connection-switch for exciting said relay to cut off the normal battery connection, and also for establishing a battery connection with the other side of the line, a coin-collector at the substation of the line having a coin-chute with a normal refund continuation, a contact adapted to be actuated by a coin in the chute, a magnet having an energizing-circuit from the normal battery side of the line, controlled by said contact, an independent energizing-circuit from the other side of the line, and coin-controlling mechanism actuated in the response of the magnet to detain a coin in its passage through the chute, said mechanism being adapted in its return to normal condition to discharge the coin into a permanent receptacle; whereby a coin is automatically detained if the line-circuit is in order, is brought under the control of the operator when connection is made with the line, and is automatically deposited in the act of taking down the connection, by the momentary interruption of current-supply during the delay of said slow-acting relay to reestablish the normal battery connection.

12. The combination with a double-wire telephone-line, of a coin-collector at a subscriber's station, having a retaining-magnet and a refunding-magnet and corresponding mechanism operated by said magnets, a central-office battery, a normal circuit from said battery over one side of the line to said retaining-magnet, a coin-actuated contact for closing said normal circuit, a subscriber's refund-key adapted to connect the refund-magnet to said normal battery side of the line while cutting said retaining-magnet out of said normal

circuit, operator's connecting apparatus adapted to open said normal circuit while establishing an independent locking-circuit for said retaining-magnet over the other side of the line, means controlled in the removal of
 5 the line, means controlled in the removal of the connecting apparatus for temporarily de-energizing said retaining-magnet to release the coin within the collector, and an operator's key associated with the connecting apparatus
 10 adapted to open the said locking-circuit while applying current to the first-mentioned side of the line to permit operation of said refunding-magnet.

13. The combination with a telephone-line,
 15 of a subscriber's coin-collector having a coin-passage, a magnet, mechanism operated in the response of said magnet for detaining a coin in the passage, said mechanism being adapted in its return to normal condition to
 20 release the coin within the collector, subscriber's refund mechanism for recovering a released coin, operator's connecting apparatus at the central office adapted to establish a locking-circuit for said magnet during con-
 25 nection, and an operator's key controlling said locking-circuit to permit the recovery of the coin by the subscriber.

14. The combination with a telephone-line, of a subscriber's coin-collector having a mag-
 30 net, coin-depositing mechanism operated in the return of said magnet to normal condition after response, operator's connecting apparatus at the central office, means controlled thereby for maintaining the excitation of said
 35 magnet during connection, subscriber's refunding mechanism, and means controlled by said connecting apparatus for blocking the operation of said refunding mechanism.

15. The combination with a telephone-line,
 40 of a substation coin-collector having a chute to receive coins, said chute normally discharging into a refund-passage, a magnet, mechanism operated in the response of said magnet for detaining a deposited coin, said
 45 mechanism being adapted in its return to normal condition to deposit the detained coin in a permanent receptacle, a contact adapted to be actuated by a coin passing through the chute for closing a circuit through
 50 said magnet, a source of current normally applied to such circuit at the central office, operator's connecting apparatus and an automatic switch actuated in the removal of said connecting apparatus after connection for in-
 55 terrupting the supply of current to said magnet-circuit; whereby the coin is automatically deposited as an incident to the removal of a connection.

16. The combination with a telephone-line, of a substation coin-collector having a chute 60 to receive coins, said chute normally discharging into a refund-passage, a magnet, mechanism operated in the response of said magnet for detaining a deposited coin, said mechanism being adapted in its return to nor- 65 mal condition to release the coin within the collector, a contact adapted to be actuated by a coin passing through the chute, for closing a circuit through said magnet, a subscriber's refund-key, means controlled thereby for 70 breaking said magnet-circuit and diverting the released coin into a refund-passage, operator's connecting apparatus at the central office, arranged to establish an independent energizing-circuit for said magnet during con- 75 nection, and a slow-acting automatic switch operated during connection, for interrupting the first-mentioned magnet-circuit, whereby the magnet returns to normal condition to deposit the coin during the delay of said au- 80 tomatic switch in reestablishing the magnet-circuit upon taking down a connection.

17. The combination with a metallic-circuit telephone-line, of a coin-collector at the substation thereof having a magnet and coin- 85 distributing mechanism operated thereby, a central battery, a slow-acting relay at the central office normally connecting said battery with one side of the line, a contact ar- 90 ranged to be actuated by a coin in the collector and adapted to connect said magnet with said side of the line having the normal battery connection, contacts operated by said magnet in its response to close an inde- 95 pendent connection of the magnet to said normal battery side of the line, and operator's connecting apparatus at the central office adapted to close an exciting-circuit for said slow-acting relay and also to establish a bat- 100 tery connection to the other side of the line, said magnet having a locking-winding connected with said last-mentioned side of the line; whereby the magnet is excited upon the initial deposit of a coin, is maintained excited during the connection, and is automatically 105 deenergized during the delay of the slow-acting relay in reestablishing the circuit when the connecting apparatus is removed.

In witness whereof I hereunto subscribe my name this 27th day of September, A. D. 110 1905.

EDWIN H. SMYTHE.

Witnesses:

IRVING MACDONALD,
 SYLVIA BLISS.