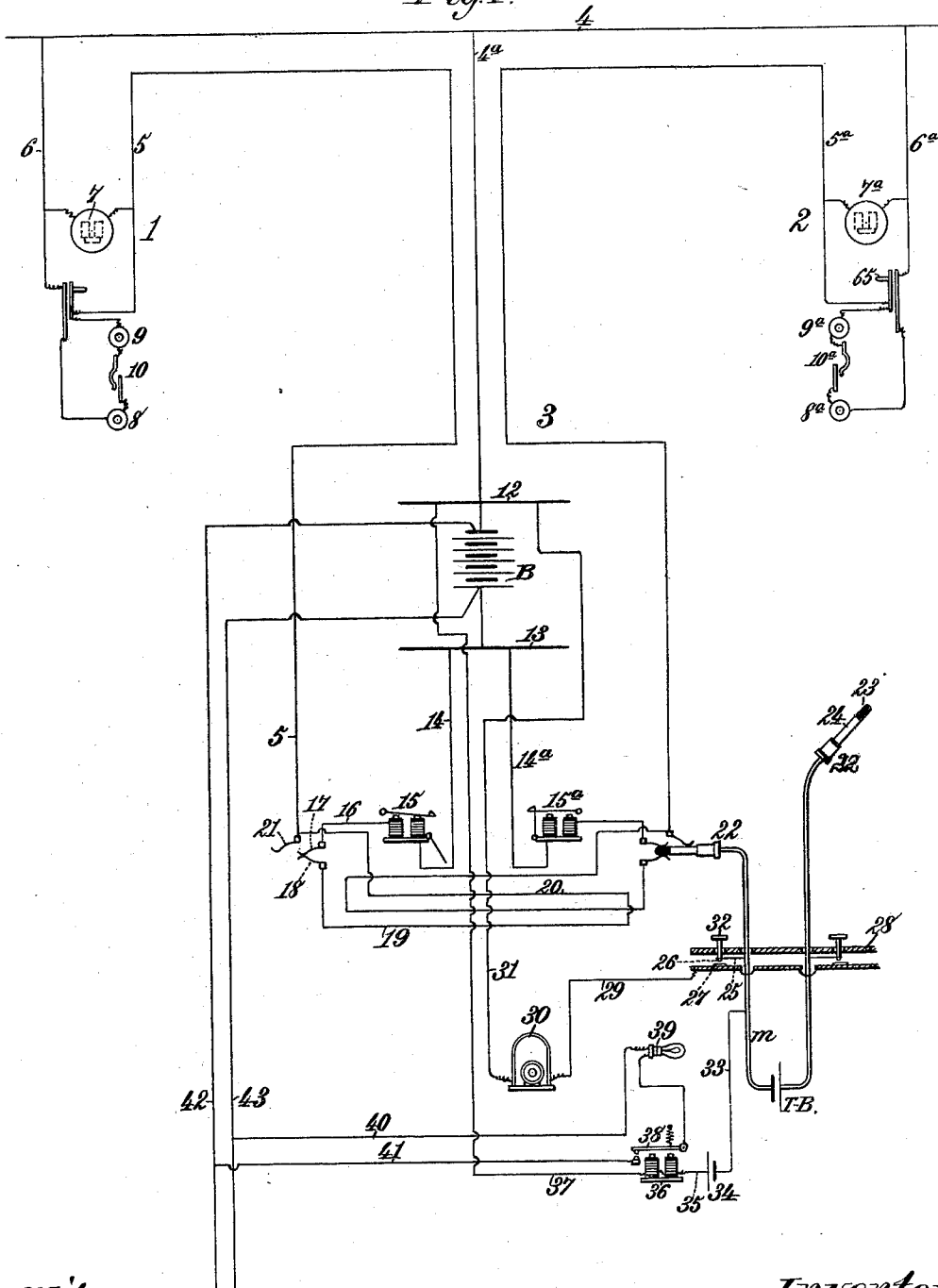


P. MINNIS.
TELEPHONE SYSTEM.

No. 561,417.

Patented June 2, 1896.

Fig. 1.



Witnesses:
Robert G. Swatt
Geo. W. Rea

Inventor:
Paul Minnis
By *James L. Norris*
Atty.

(No Model.)

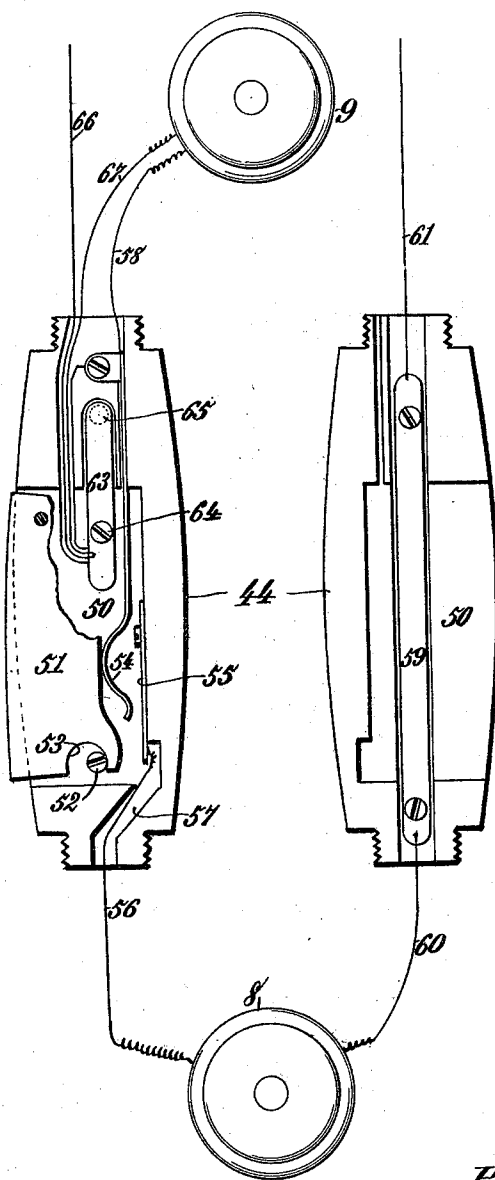
3 Sheets—Sheet 2.

P. MINNIS.
TELEPHONE SYSTEM.

No. 561,417.

Patented June 2, 1896.

Fig. 2.



Witnesses,
Robert Emmett
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Atty.

(No Model.)

3 Sheets—Sheet 3.

P. MINNIS.
TELEPHONE SYSTEM.

No. 561,417.

Patented June 2, 1896.

Fig. 3.

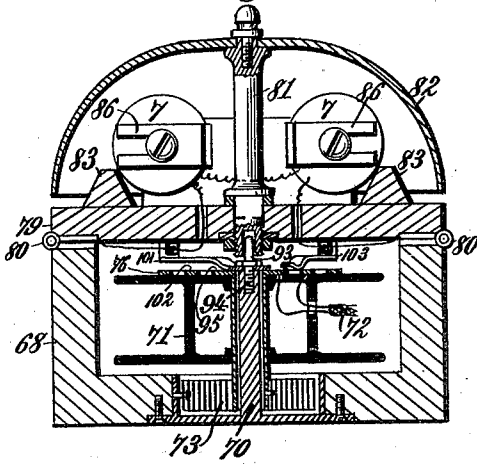


Fig. 4.

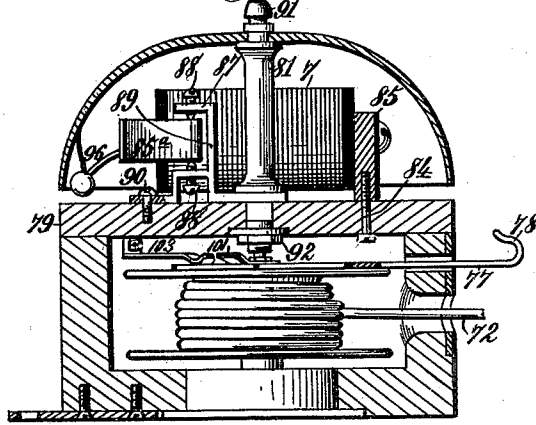


Fig. 5.

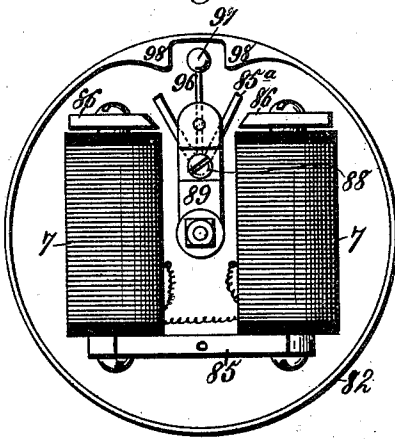
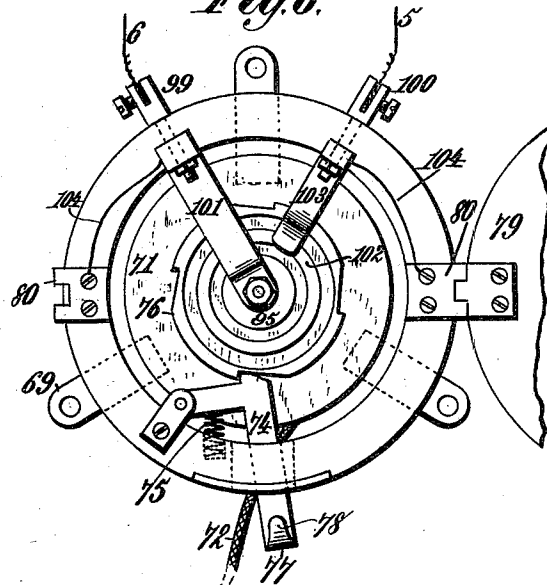


Fig. 6.



Witnesses:
Robert Everett,
Geo. M. Rea.

Inventor:
Paul Minnis.
By *James L. Norris,*
Atty.

UNITED STATES PATENT OFFICE.

PAUL MINNIS, OF MOBILE, ALABAMA, ASSIGNOR OF ONE-HALF TO THE HOME TELEPHONE COMPANY, OF SAME PLACE.

TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 561,417, dated June 2, 1896.

Application filed February 17, 1896. Serial No. 579,645. (No model.)

To all whom it may concern:

Be it known that I, PAUL MINNIS, a citizen of the United States, residing at Mobile, in the county of Mobile and State of Alabama, have invented new and useful Improvements in Telephone Systems, of which the following is a specification.

It is the purpose of my invention to provide a telephone system having the following characteristics: first, a series of line-stations in connection with a central station and with a switchboard and main battery at said central station by means of one independent service-wire to each of said line-stations and a common return-wire with which the service-wires are connected through the instruments in the line-stations, the metallic circuits thus provided being primary without induction-coils and without ground or connection with the earth at any point; second, a system comprising a series of independent service-wires connecting the line-stations with a switchboard at a central station, a single return-wire common to all the line-stations and to which the service-wires are connected, a single main battery in series connection with the line-stations and central station and adapted to charge the line with a direct primary current, and a series of relatively small batteries, one of which is directly connected with each pair of flexible cords at the central station, the undulations set up by the vocal vibrations being thrown upon the wires through said batteries; third, a system in which a signal of suitable character, such as a small incandescent lamp, is connected in multiple arc with wires from the poles of the main battery, the lamp-circuit being closed by devices operated by the current from small batteries, one of which is connected through one of the flexible cords with a circuit which is closed and opened at the line-station, its close being effected by the subscriber in using his telephone and the opening being automatic, whereby the signal, which is the equivalent of the "ring-off" now in use, is given to the central station the instant that conversation is at an end without requiring an action by the user of the telephone depending on his volition; fourth, my invention is also characterized by a novel arrangement of the talk-

ing-batteries and the ring-off batteries, whereby they are prevented from short-circuiting by opposing the similar poles in one series of batteries to the like poles in the other series; fifth, it is also characterized by the use of direct primary currents upon metallic circuits composed of one direct independent service-wire for each line-station and one return-wire common to all the line-stations in the system, said metallic circuits not being grounded or connected to earth at any point, and by the entire elimination of induction-coils and secondary circuits from the system; sixth, my invention comprises a novel arrangement for effecting telephonic communication, the same consisting in charging a return-conductor to which service-wires from the line-stations are connected with direct primary currents of a common voltage and quantity from talking-batteries connected for quantity or in multiple and drawing from the common fund of force present in the return-conductor for the service requirements of any individual line-station without respect to the individuality or identity of the respective sources from which the current used is derived. In other words, this feature of my invention may be said to consist in providing a series of small batteries equal in number to the flexible cords in the central station, each cord being connected to one of said batteries by dividing said cord and connecting the severed ends directly to the opposite poles, the batteries, which I term "talking-batteries," being thus upon a normally open circuit except at such times as the different service-wires are brought into use. In this manner I aim to charge the common return-wire with as many separate direct primary currents as there are complete lines of communication in use without the intervention of induction-coils, and to thus obtain a common charge in the return-wire having a quantity or amperage proportioned to the number of service-wires in use at any given moment, the charge in the common return-wire varying as the number of service-wires in use increases or diminishes, my object being finally to mass or combine the individual currents from the separate talking-batteries in one common fund of electromotive force at a point where it can be equally drawn upon for

the wants of each of the service-wires in use without regarding whether the current used in any particular line-station comes from the particular battery connected to the cord by which that station is brought into communication with another station or drawn from some other one of the series of talking-batteries, or, in other words, from the aggregate or common charge or fund of electromotive force present in the common return-wire, a single main battery being provided to operate the annunciators and to light the lamps which denote to the operators at the central station that the service-wires are in use.

My invention also comprises other novel features of construction and combination whereby I am enabled to greatly simplify and expedite the telephone service and improve the same, all of which will be fully explained hereinafter, and then particularly pointed out and defined in the claims which conclude this specification.

To enable those skilled in the art to which my invention pertains to fully understand and practice the same, I will now describe said invention in detail, reference being had for this purpose to the accompanying drawings, in which—

Figure 1 is a diagram showing an arrangement of circuits for a multiple-station system, two line-stations, a central station, and the necessary connections being included. Fig. 2 is a detail view showing in two parts the divided portions of the hand-telephone and the circuits, together with the switches to close the call-circuit and cut the telephone transmitter and receiver in and out of circuit. Fig. 3 is a detail section showing a call-box of the kind used at the line-station. Fig. 4 is a section taken in a plane at right angles with the section-plane in Fig. 3. Fig. 5 is a view of the interior face of the gong, also showing the arrangement of the electromagnets and striker. Fig. 6 is a view of the interior of the box, the gong or cover and top or front, together with the electromagnets, being removed, showing a front or top view of the reel with its line, ratchet, and pawl connections.

In said drawings the reference-numerals 1 and 2 indicate, respectively, two line-stations, and the numeral 3 denotes a central station.

Along the series of line-stations is led a single wire 4, which I will hereinafter term the "common return-wire." This wire is of a diameter sufficient to equalize the combined resistance of all the service-wires connecting the several line-stations in the system to the central station and the return-wire. The latter is not grounded or connected to earth at any point.

From the several line-stations service-wires lead to the return-wire 4 and to the central station, where they are connected to the line-jacks. These service-wires (shown by the numerals 5 and 6 in the diagram) are arranged at each line-station so as to form two

branches, which may be parallel in order to give convenient bridging connection to the terminals of the bell-coils 7, which are wound for a high degree of self-induction. Beyond these terminals the ends of the two branches of the service-wire are connected to one terminal of the transmitter 8 and one terminal of receiver 9, respectively. The circuit is normally open at each subscriber's station by means of a switch 10. (Shown conventionally in Fig. 1 and explained in detail hereinafter.) Said switch is opened automatically when the person using the telephone removes his hand from the handle supporting the transmitter and receiver.

From the return-wire 4 a tap-wire 4^a is carried to a single battery or generator B, usually placed in the central station. Opposite each pole of said battery is a spread terminal, to one of which (denoted by the numeral 12) the tap-wire 4^a is connected before passing to the adjacent pole of the battery. A continuation of the tap-wire 4^a connects the other pole to the second spread terminal 13, and from the latter a wire 14 is carried to an annunciator 15, which has a number denoting the line-station 1. A similar wire 14^a goes to a second annunciator 15^a, which is identified with line-station 2. These and other parts which are mere duplicates require no separate description, and I will denote the same by reference-numerals which are similar to those used on the parts actually described, but differentiated by adding the letter "a."

From the annunciator 15 a wire 16 is carried to annunciator spring-contact 17 of the corresponding line-jack on the switchboard, which is, until the plug is inserted, in electrical contact with a second annunciator spring-contact 18, from which annunciator multiple wire 19 is carried through the annunciator multiple spring-contacts of all the corresponding multiple jacks, beyond the last of which it is connected to line multiple wire 20, which line multiple wire 20 is carried back across the switchboard to the line multiple spring-contacts of all the corresponding multiple jacks, and finally to line spring-contact 21 of the corresponding line-jack, from which line spring-contact 21 the service-wire 5 is carried to the line-station 1.

At the central station each flexible cord is provided, as usual, with two plugs 22 at the ends of the cord. Each plug is provided with an insulating point or tip 23 and a conducting-body portion 24, and when inserted in the line-jacks or multiples the annunciator spring-contacts 17 and 18 will be separated, and resting on the insulating-point of the plug the circuit which includes the annunciator will be opened at this point, and line spring-contact 21 rests upon conducting-body 24, thus completing the connection between the service-wire 5 and the conducting-body 24. Each flexible cord is divided between its ends, and the two parts are connected to the opposite poles of a small battery TB, which I term

the "talking-battery." One of the parts of each flexible cord is connected by a conducting spring-strip 25 to a contact 26, arranged over a conducting-piece 27, which I usually place beneath the switchboard-apron 28. This strip or conducting-piece 27 is connected by a wire 29 to one pole of a magneto call-generator 30, its other pole being connected by a wire 31 to the first spread terminal 12, from which point the circuit is completed by the tap-wire 4^a, return-wire 4, one branch of service-wire 6, bell-coils 7, the other branch of the service-wire 5, to the spring-contact 21, and thence by the plug 24 and flexible cord to the contact 26, conducting-piece 27, and wire 29 to the magneto 30. The contact 26 is pressed against the piece 27 by a pusher 32. By pressing the pusher, therefore, when the plug is inserted in one of the line-jacks or one of its multiples the operator at the central station can ring the bell at the corresponding line-station.

Connected to one member of each flexible cord is a wire 33, which leads to one pole of a "ring-off" battery 34, so arranged that the pole to which said wire is connected is similar or of the same polarity as the pole of the battery TB with which the connected member of the flexible cord communicates. For example, if the part *m* of the flexible cord is connected to the negative pole of its battery TB, then the wire 33 is also connected to the negative pole of the battery 34, whereby said batteries are in opposition and cannot short-circuit. From the other pole of the battery 34 a wire 35 leads to one terminal of electromagnets 36, and from the second terminal a wire 37 leads to the first spread terminal 12, the circuit being completed by tap-wire 4^a, return-wire 4, one branch of service-wire 6, the connections and switch of the telephone, the other branch of the service-wire 5, spring-contact 21, plug 24, flexible cord, and wire 33. The electromagnets 36, thus energized, attract an armature-switch 38, which closes the circuit of a small incandescent lamp 39, which is in multiple-arc connection through wires 40 and 41 with open-circuit wires 42 and 43, leading from the opposite poles of the main battery B.

The circuit of the ring-off battery 34 is closed at the corresponding line-station by a switch, which the subscriber must close in order to cut his transmitter and receiver into circuit. This switch is automatically thrown open as soon as the telephone is released by the user's hand, and the circuit of the ring-off battery being thus opened the armature-switch, being no longer attracted, opens also, breaking the lamp-circuit and extinguishing the lamp 39. This is a signal to the operator that communication between any two line-stations is at an end. I thus avoid the constant neglect of those using the wires to ring-off when conversation ceases, as well as the annoyance and delay of compelling the central-station operators to make constant in-

quiries whether connected stations are still in communication. The questions are sometimes not answered, and then stations are cut out in the midst of a conversation. They are a source of continual annoyance to all concerned, and as they frequently provoke sharp replies the central-station attendants dislike to ask them, and when asked the attendant must either wait to make sure there is no reply or run the risk of cutting out stations which are actually transacting business. My invention avoids all these objections and leaves no act to be performed by the person using the telephone except to release the handle of the instrument, by which the central station is at once notified that the line is no longer in use between the stations. Each divided flexible cord has one of its members or parts connected in the manner described with a separate ring-off battery 34, the connected pole of which is opposed to the like pole of the battery TB, which is also connected to the same part of the flexible cords. These ring-off batteries are all independent, each operating its own electromagnet 36; but the local circuits, each embracing one of the armature-switches 38 and one of the lamps 39, are all in multiple-arc connection with the common pair of open-circuit feed-wires 42 and 43 by means of tap-wires 40 and 41, there being one of these local lamp-circuits to each ring-off circuit.

I will now explain the parts of the telephone at each line-station.

The receiver and transmitter at each line-station are both mounted upon a handle 44, having brackets 45 and 46 at its ends to support them. The receiver R is mounted upon the bracket 45, which is parallel, or nearly so, with the axis of the handle 44. The bracket 46, supporting the transmitter 8, is arranged, preferably, at somewhat less than a right angle with the axis of the handle, so that when the receiver is placed against either ear the transmitter is in position for use. An arm 48 projects from the base of the bracket 46 or is projected as a continuation of bracket 45, or two arms are provided, one on each bracket, said arm having an aperture 49 near its end to enable the parts to be suspended from a hook.

In the interior of the handle is a chamber 50, in which is a plate 51, pivotally mounted at one end and projected at the other end a little distance outside the handle, the degree of projection being controlled by a screw 52, lying in a notch 53 in the end of the plate. An elastic conducting-strip 54 bears against the interior edge of the plate and normally pushes it outward as far as permitted by the screw 52. When the handle is grasped, the pressure upon the projected edge of the plate 51 forces it inward and presses the end of the elastic strip 54 against and holds it in electrical contact with a contact-strip 55, which is secured by a screw to the bottom of the chamber 50. To the end of this contact-strip 55

which lies near one end of the handle is soldered a terminal 56, which enters through a channel 57. The fixed end of the elastic strip 54 lies near the other end of the handle, and to it is soldered a terminal 58. The connections of these terminals will be explained shortly. I also arrange upon one side of the chamber 50 a conducting-strip 59, extending nearly from end to end of the handle 44, and to the respective ends solder terminals 60 and 61. In a seat in the wall of the chamber, opposite the conducting-strip 59, is arranged an elastic strip 63, fixed at its inner end by a screw 64, but capable of being pushed at its free outer end against and into electrical contact with the contact-strip 59. This operation is effected by a pin 65, which lies in an aperture in the handle, near the end of the latter, projecting sufficiently so that it can readily be operated by one finger. To the elastic strip 63, at or near its fixed end, are soldered two terminals 66 and 67.

The terminal 66 forms part of one branch of the loop in the service-wire at the line-station. The terminal 67 is from the first electrode of the receiver, and 58 is the terminal of the second electrode of said receiver. The numeral 56 indicates the first terminal of the transmitter, and 60 is the second terminal of said transmitter. The circuit is completed by the terminal 61, which goes to the second branch of the loop in the service-wire. By pressing the pin 65 a circuit is completed through strip 59, terminal 61, branch of service-wire 6, return-wire 4, tap-wire 4^a, main battery B, spread terminal 13, and wire 14 to annunciator 15 of the central station identified with line-station 1, thence back through wire 16, annunciator spring-contacts 17 and 18 and their multiples, by annunciator multiple wire 19, and on through line multiple wire 20, service-wire 5, terminal 66, and strip 63 to original point of contact between strips 63 and 59, the current derived from main battery B over the circuit just described electrically operating annunciator 15, thus giving notice of a desire on the part of line-station 1 to communicate with the central station. The same result may also be produced by operating the palm-switch 44, the circuit being over terminals 66 and 67, through elastic strip 63 upon the receiver, thence by terminal 58, elastic strip 51, contact 55, wire 56, transmitter terminal 60, strip 59, terminal 61, service-wire, main wire, and so on over the path already described.

At each line-station I place a call-box, consisting of a cylindrical body portion 68, which is attached to the wall or to any support by screws passing through lugs 69, which project in the plane of the flat end of the box. Within the latter is a central spindle 70, upon which is sleeved a reel 71, and to this reel the flexible cord 72, containing the insulated terminal wires 61 and 66, is attached. The reel is rotated in one direction by a coiled spring 73, which is placed under the

tension required by drawing the flexible cord off the reel. When the cord is drawn out to the required extent, the reel is held by a pawl 74, thrown by a spring 75 into engagement with a ratchet 76. On the pawl 74, or formed in one piece with it, is a hanging arm 77, terminating in a hook 78. When the subscriber at a line-station has ceased talking, he hangs the transmitter and receiver, which are mounted on the handle 44, upon the hook 78. The weight at once overcomes the spring 75 and trips the pawl, and the reel thus set free rapidly draws the slack of the flexible cord into the box. It will be noted that the box being attached by its flat end the axis of the reel is horizontal and the arm 77 hangs vertically, so that the pull upon the hook 78 is due to the gravity of the telephone hung on it.

The outer end of the box is covered by a lid 79, attached by hinges 80. Projecting centrally from this lid is a post 81, upon which is a cup-shaped gong 82, within which are inclosed the call-bell magnets 7. These magnets lie in a cradle formed by two parallel projections 83, having the form of truncated elongated pyramids. They are formed of insulating material, and their downwardly-converging faces give firm support to the magnets and enable me to dispense with other fastenings, save only a single screw 84, which passes up through the lid 79 into the yoke 85, which connects the cores. Between the opposite ends of the magnets is mounted the armature 85^a, which is V-shaped, the pole-pieces 86 being beveled upon their adjacent ends to correspond. The armature is pivoted at its apex upon an axis 87, supported by two conical bearings 88, which are adjustable in the parallel parts of a bracket 89. This bracket is mounted on the lid 79, one of its foot-pieces having a square aperture to receive the square shank of the post 81. The other foot-piece receives a screw 90, which enters the lid 79. To the outer end of the post 81 the gong 82 is fastened by a screw 91, and its squared end terminates in a threaded extremity, which receives a nut 92, that is turned up against a washer on the inner face of the lid. An opening is also formed in this shank, which receives a point 93 on the head of a screw 94, which is tapped into the end of the spindle 70 to confine a collar 95, by which the reel 71 is held on the spindle.

Between the diverging parts of the armature 85 the hammer or striker 96 projects, its ball 97 lying between two shoulders 98, which project from the inner face of the gong.

The wires 5 and 6 are connected to binding-posts 99 and 100, the former being electrically connected by a strip 101 to the central spindle 70, with which one wire of the flexible cord is in circuit by being soldered to the collar 95. The other wire of the cord is soldered to a ring 102, mounted on the head of the reel, which is non-conducting material. This ring has contact with a strip 103, leading to binding-post 100.

The terminals of the bell-coils are led to the opposite hinges of the box, which are connected to the strips 101 and 103 by wires 104.

The call-box and hand-telephone comprise all the apparatus at any line-station, and they are shown in Figs. 2 to 6, inclusive, in actual size. These parts, as well as the ring-off apparatus, form the subject-matter of separate applications for Letters Patent, which are filed of even date herewith, and I make no claim in this application to any one of said parts separately.

What I claim is—

1. A telephone system, comprising a series of line-stations, a series of independent service-wires connecting said line-stations with a switchboard at a central station, a single wire common to and in connection with each of the service-wires, a tap-wire from the single wire to one pole of a main battery and from the other pole to a spread terminal, connections from said terminal to annunciators at the central station, a series of small talking-batteries one of which is interposed in each of the flexible cords at the central station, and normally open switches at each line-station to close the annunciator-circuit and the talking-circuit, the arrangement being such that the polarity of the talking-batteries in the return-wire is always the same, substantially as described.

2. A telephone system comprising a central station and a series of line-stations, a series of separate service-wires connecting the line-stations to the switchboard at the central station, a single wire common to and in connection with the several service-wires, a single tap-wire connecting the common wire through a single main battery to annunciators at the central office, a normally open switch at each line-station to close the annunciator-circuit, a series of small talking-batteries, a corresponding series of flexible cords each of which is severed and the severed ends directly connected to the opposite poles of one of the talking-batteries, and a normally open switch at each line-station to close the circuit of the talking-battery interposed in the flexible cord which connects one line-station with another, the arrangement being such that the polarity of the talking-batteries in the return-wire is always the same, substantially as described.

3. A telephone system comprising a central station, a series of line-stations, a series of independent service-wires one of which connects each line-station to a switchboard at the central station, a single wire common to and in connection with the other ends of the service-wires, a tap-wire connecting the single wire to one pole of a main battery, connections from the second pole of said battery to annunciators at the central station, a receiver and transmitter mounted on a single handle at each line-station, a switch in said handle to close the annunciator-circuit, a series of small talking-batteries one of which is

interposed in each of the flexible cords at the central station, a switch in the telephone-handle at each line-station to close the circuit of the talking-battery through which each line-station is brought in connection with some other station, call-bells in bridging-circuit between two branches of each service-wire at each line-station, and a magneto call-generator at the central station connected through the tap-wire to the single common wire and through a normally open switch to one wire of each flexible cord, substantially as described.

4. In a telephone system, the combination with a single return-wire and a series of independent service-wires connecting the line-stations with the central station and the return-wire, of a single main battery in series with the return-wire and switchboard-annunciators, a series of talking-batteries supplied with current from the independent service-wires through the connections at the switchboards, and a series of independent automatic ring-off circuits, one for each pair of plugs and flexible cords of the switchboard, each of said ring-off circuits comprising a small independent battery and an electromagnet, controlling an armature-switch by which a local circuit is opened and closed, each of said local circuits being provided with an independent visual signal, such as a lamp, and all of such local lamp-circuits being supplied with current from a common pair of feed-wires from the two poles of the single main battery; each of said ring-off circuits including when in use, one of the ring-off batteries, one of the electromagnets, the return-wire, one of the service-wires, one of the plugs and flexible cords of the switchboard by which connection is made with the service-wire through the spring-jacks of the switchboard or their multiples, the line spring-contact of one of the spring-jacks, the loop and telephone at one of the line-stations and a switch in the handle of the telephone normally opened when the telephone is not in use and closed by the grasp on the handle of the telephone by the person using it, substantially as described.

5. In a telephone system, a series of automatic ring-off circuits comprising a plurality of visual signals, such as lamps, a series of ring-off batteries, each of which comprises in its circuit one of the flexible cords of the switchboard, a series of circuits for the lamps deriving current from a common pair of open-circuit feed-wires from the main battery B, a series of electromagnets, each controlling an armature-switch to open and close one of the lamp-circuits, each of said ring-off circuits including one of the ring-off batteries and the line-wire, and a normally open switch at each line-station by which the circuit of the ring-off battery and the transmitting and receiving circuits are closed, whereby upon ceasing communication the said switch opens automatically thereby cutting out the telephone and extinguishing the lamp, thus notifying

the central station that the wires are not in use, substantially as described.

6. In a telephone system, the combination with a central station and a series of line-stations of a single wire common to all the line-stations, a series of service-wires each connected to said single wire and through the transmitter and receiver at a line-station to the switchboard at the central station, a series of small talking-batteries, and a corresponding series of flexible cords each of which is severed and its severed ends directly connected to the opposite poles of one of said talking-batteries, the arrangement being such that the polarity of the talking-batteries in the return-wire is always the same, substantially as described.

7. In a telephone system, the combination with a central station of a series of line-stations, a single wire common to all the line-stations, a series of service-wires each connected to said single wire and through a transmitter and receiver at a line-station to the switchboard at the central station, a single tap-wire connected to the single wire and to one pole of a main battery, a series of annunciators connected to the other pole of said main battery, a normally open switch in the hand-telephone at each line-station to close an annunciator-circuit, a series of small talk-

ing-batteries one of which is interposed in each flexible cord at the central station, and a normally open palm-switch in the hand-telephone at each line-station to close the circuit of one of said batteries, substantially as described.

8. In a telephone system, the combination with a central station and a series of line-stations of a single wire common to all the latter, a series of service-wires connected to the single wire and through the talking-outfits at the line-stations to the switchboard at the central station, a single main battery, a tap-wire connecting the single common wire to one pole of said battery, a series of annunciators connected to the other pole, a series of independent ring-off batteries, circuits for the same which include normally open switches in the hand-telephones at the line-stations, a series of visual signals such as lamps, and circuits for said lamps which include switches operated by the ring-off batteries, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

PAUL MINNIS.

Witnesses:

CLAYTON B. CLARK,
WILLIAM H. SULLIVAN.