

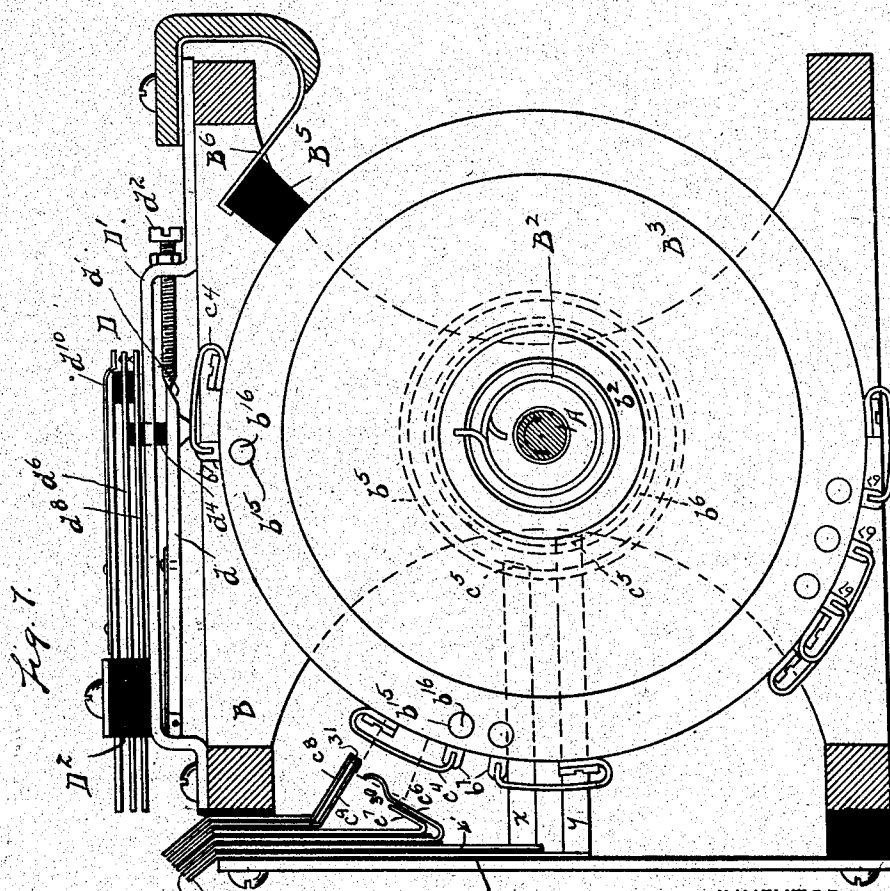
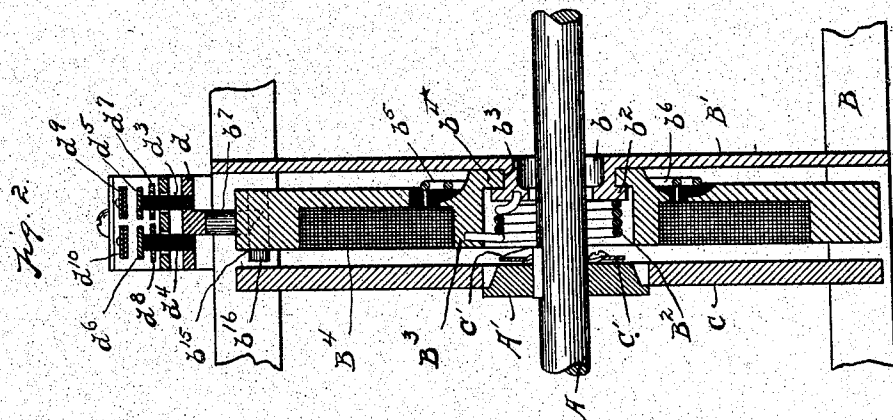
No. 815,380.

PATENTED MAR. 20, 1906.

J. G. ROBERTS.
TELEPHONIC APPARATUS.

APPLICATION FILED JUNE 26, 1900. RENEWED SEPT. 19, 1902.

4 SHEETS—SHEET 1.



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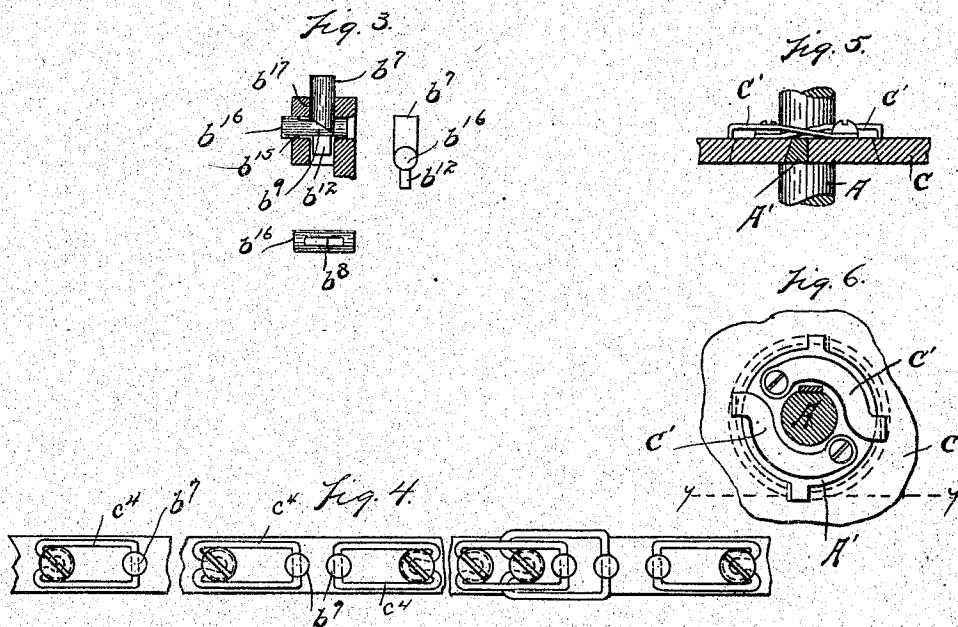
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4 SHEETS—SHEET 2.



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4 SHEETS—SHEET 3.

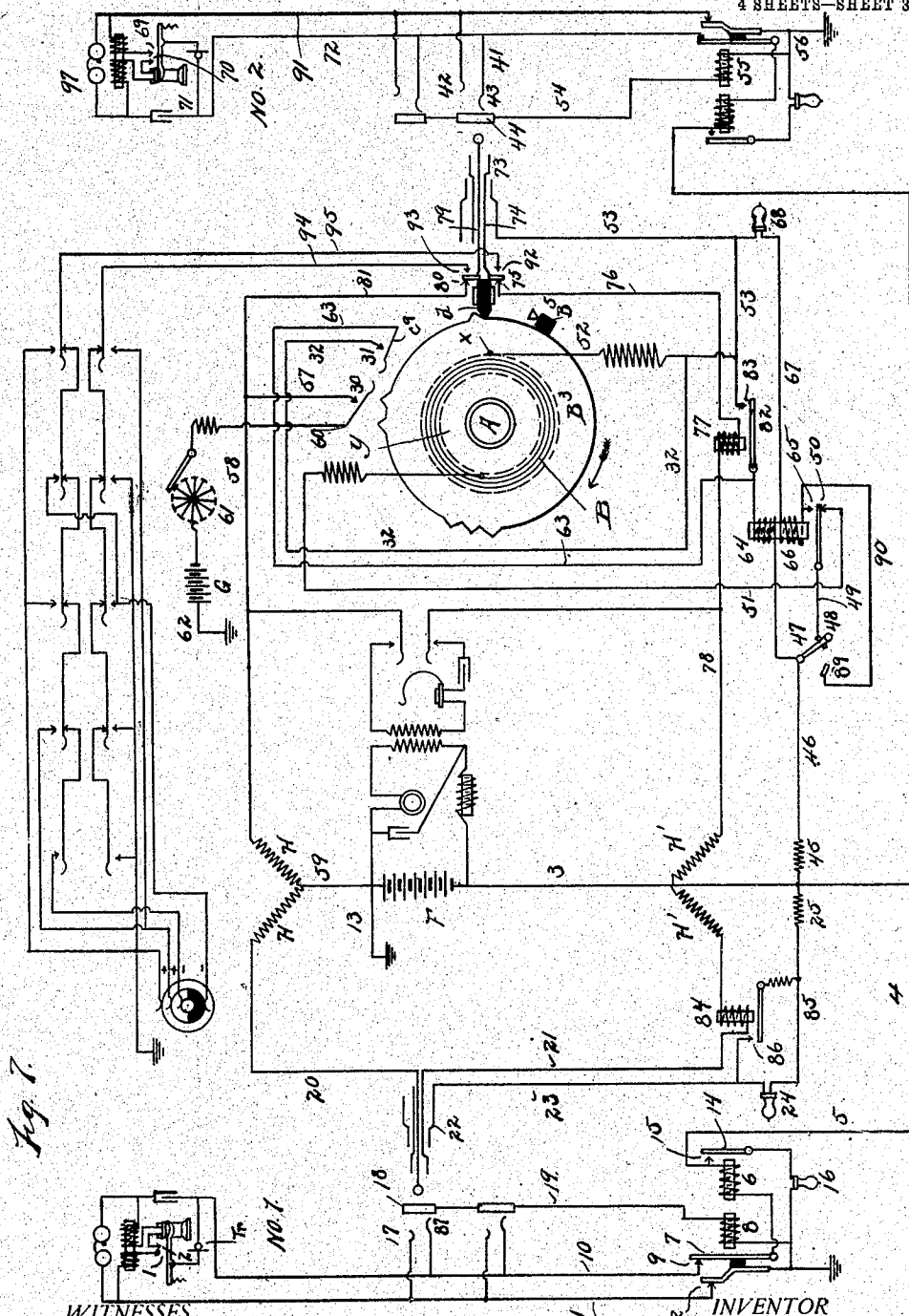


Fig. 1.

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4 SHEETS—SHEET 4.

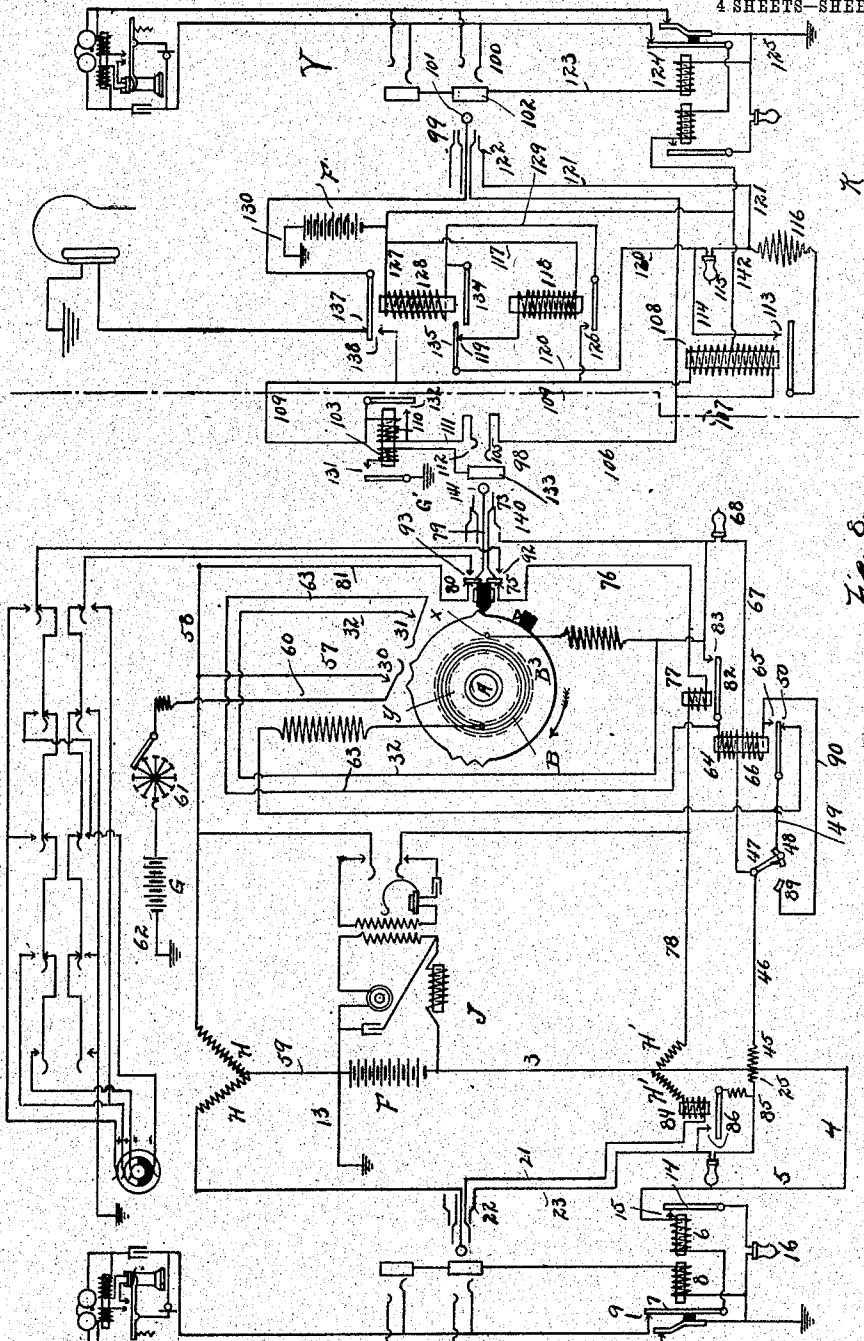


Fig. 8.

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UNITED STATES PATENT OFFICE.

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TELEPHONIC APPARATUS.

No. 815,380.

Specification of Letters Patent.

Patented March 20, 1906.

Application filed June 26, 1900. Renewed September 19, 1902. Serial No. 124,083.

To all whom it may concern:

Be it known that I, JOHN G. ROBERTS, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Telephonic Apparatus; and I declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to telephone-circuits, and has for its object the construction of a telephonic apparatus which shall accomplish the following objects: First, to effect the automatic switching of a signaling-current on the line of a called subscriber by the insertion of the calling-plug into the called-subscriber's jack; second, to have this signaling-current switched automatically on the called line at specified intervals of time, not continuously, and for a specified number of times and no more, provided the party does not answer; third, to provide for automatically signaling back to the calling party, indicating that the called party does not answer by a "don't-answer" signal, which shall be signaled back after a certain fixed time from the beginning of the call; fourth, to provide a visible signal in the apparatus indicating that the called party did not answer or that, having answered, he was through with the connection and had hung up his receiver, and also providing that in either case the signal is a part of the complete disconnect-signal for the other party, the said disconnect-signal being now under the control of the calling party; fifth, to provide means for automatically discontinuing the action of the ringing apparatus when the called party answers the call and to then lock the circuit, so that when he is through and hangs up his receiver the calling apparatus will not begin to operate again, which locking apparatus for locking the circuit is only released by the removal of the plug from the line-jack.

My invention consists of the apparatus hereinafter described and claimed.

In the drawings, Figure 1 is an end view of the ringing-machine which I have devised with the armature removed. Fig. 2 is a vertical section of the ringing-machine through

the center. Figs. 3 and 4 illustrate details of the spring-mechanism projections for actuating the ringing-contacts. Figs. 5 and 6 show details of the spring-mountings for the armature. Fig. 7 illustrates the circuit in a multiple board employing my invention, and Fig. 8 illustrates it as applied to a trunking-board.

In the drawings, A is a shaft common to a series of machines, which shaft is appropriately journaled and driven with a constant motion. Mounted on this shaft A are a series of these machines, one for each operator's set. One only is shown and described. It can thus be taken as a type of all the others. A hub A' is keyed to the shaft A and rotates with it.

B is a frame coextensive with the length of the shaft, having at appropriate intervals cross-bars, of which one only is shown at B'. Through this cross-bar B' is a central perforation b , in which the shaft A passes. Around the opening through which the shaft passes is a raised ledge b^2 , and which carries fixed thereto a coiled spring B², the opposite end of the spring being attached to a circular electromagnet B³, adapted to rotate and wind up the spring B², and which when the rotating force is released compels the circular electromagnet to return to its normal position by the resiliency of the spring. The raised circumferential ledge is undercut at b^3 , and the rotating armature has at and fashioned on its hub an inwardly-projecting circumferential flange b^4 , whereby the electromagnet has a bearing upon which it turns. A circumferential recess is milled out of the electromagnet B³, in which is inserted a magnet-coil B⁴, the terminals of which are the two collecting-rings b^5 b^6 , carried by the electromagnet, but insulated, as shown.

x and y are brushes in contact with the collecting-rings and lead through insulated sockets x' y' in the frame to the corresponding lines, as hereinafter described. Through these current is conveyed to the coil B⁴, which is thus energized, and the hub and periphery of the electromagnet are thus polarized, whereby the annular armature C is attracted thereto.

C is a circular armature fitted to the hub A', and thus rotating with it. It is held up to the hub, by two curved springs C' C', one

end of each being attached to the hub A' and the other end to the armature, as shown in Figs. 5 and 6. The armature is a disk of soft iron, and when the circular electromagnet is energized, as hereinafter stated, it draws the rotating armature up to its face and is compelled by the contact to rotate in unison with it so long as the contact is maintained. This rotation also increases the tension of the spring B², which when the armature C is released by cutting off the magnetizing-current reverses the rotation and restores the electromagnet to its original position.

At appropriate intervals near the periphery of the circular electromagnet B³ are transverse perforations b¹⁵ b¹⁵, in which are inserted pins b¹⁶. In Fig. 3 I have shown the details of one of these plungers. In the periphery of the circular electromagnet B³ are a corresponding number of radial perforations b¹⁷, in which are inserted a corresponding number of plungers b⁷. The plungers b¹⁶ b¹⁶ extend a short distance beyond the face of the electromagnet B³; as shown in Fig. 3, and opposite the plunger b⁷ there is a mortise or rectangular perforation, as shown at b⁸, also opposite the plunger b⁷ there is a triangular notch b⁹. The plunger b⁷ has a tenon b¹², which loosely fits in the mortise b⁸, so that the two plungers are interlocked together. The plunger b⁷ has adjacent to the tenon its enlarged portion cut at an angle to fit in the notch b⁹. The perforation b⁵ in the plunger b¹⁶ is somewhat longer than the width of the plunger b⁷ or of the tenon which engages the perforation. This allows a longitudinal motion of the plunger b¹⁶, bringing its outer end down near the face of the circular electromagnet. This motion by virtue of the angular portion or notch engaging the angular portion of the plunger b⁷ raises the latter for the purpose hereinafter specified, the raising being against a spring c⁴, Fig. 1, (also Fig. 4,) which is attached to the periphery of the electromagnet and engages the top of the plunger b⁷. This throws the spring outwardly for the purpose of making an electrical contact for the purpose hereinafter described. When the forcing-plunger b¹⁶ is withdrawn, the spring forces the plunger b⁷ downward into the notch on b¹⁶ and forces b¹⁶ back to its normal position with its end projecting beyond the face of the electromagnet. As already stated, there are a number of these plungers near the periphery of the electromagnet B³, as shown in Fig. 1, and they are arranged in any manner to carry out a predetermined result, as shown. I have arranged them one in one place, a pair in another place, and a set of three in another place, with corresponding mechanisms of spring-contacts for each, all as shown in Fig. 1.

Fixed to the electromagnet is an insulated block B⁵, and attached to the frame is an abutment E⁶. This is shown in the drawings in the form of a spring hook, and therefore it

may be termed a "spring-stop." It is obvious, however, that as it performs the office merely of an abutment any convenient form might be adopted. When the parts are normally in place, the rotating electromagnet is normally held by the insulating-stop B⁵ coming in contact with this abutment by virtue of the coiled spring B². When the circular armature C is drawn toward the face of the electromagnet by its being energized, as hereinbefore stated, it forces in all of the projecting plungers b¹⁶ b¹⁶, and therefore forces out the corresponding radial plungers b⁷ b⁷ and also the springs c⁴ c⁴, connected with the radial plungers, and when the energy is withdrawn from the electromagnet the circular springs controlling the armature throw the armature away, and thus restore all of these parts referred to their normal position. The contact made by the armature with the plugs to the face of the electromagnet is sufficiently strong, so that the electromagnet is compelled to revolve in unison with the armature in the direction of the arrow, thus contrary to the tension of the spiral spring B², and on the withdrawal of that energy and the consequent withdrawal of the armature C the electromagnet is released and is returned to its normal position by the resiliency of the coiled spring B² with the insulated stop B⁵ against the abutment B⁶.

Mounted upon the frame is a compound switch D, which consists of various parts, and fixed sustaining portion or frame D' is fixed to the frame B, and a spring-anvil contact d, which is adapted to come in contact with the springs c⁴ c⁴ when they are thrown out by the action upon the plugs b⁷. In Fig. 1 the anvil d is shown in contact with one of these springs. The anvil-frame at d' is beveled, and the beveled set-screw d², passing through the frame, is brought in contact with it in such manner that the turning of a set-screw will adjust the position of the anvil d toward or from the circular electromagnet B³. The spring upon which the anvil d is mounted tends to force the anvil toward the electromagnet, this action being prevented or stopped by the set-screw d². Mounted upon the anvil-arm are two insulated blocks d³ d⁴, one of which is shown in Fig. 1 and both being shown in Fig. 2. Each of these blocks carries upon its upper end a spring-contact d⁵ d⁶, which is mounted in an insulated block D². Mounted also in the insulating-block D² is a pair of springs below d⁵ d⁶, which are marked d⁷ d⁸. This pair of springs is not in contact. Each of them is perforated to allow the insulating-blocks d³ d⁴ to pass through them, respectively. Upon the extremities of the springs d⁵ d⁶ d⁷ d⁸ are contact-points, so that when the parts are in a normal position, as shown in Fig. 1, the springs d⁵ d⁷ are in electrical contact, as are also the springs d⁶ d⁸. Located above the springs d⁵ d⁶ is a pair of

rigid bars $d^9 d^{10}$. The ends of each of these are so fashioned with contact-points underneath them so that they are adapted to come in contact with the extremities of the upper surfaces of the springs $d^5 d^6$, respectively—that is, that d^5 will form a contact with d^9 and d^6 with d^{10} . These parts are so adjusted that the elevation of the anvil d carries with it the insulated blocks $d^3 d^4$ and will elevate the metal springs $d^5 d^6$, thus breaking the electrical contact normally existing between d^5 , d^7 , d^8 , and d^9 and make an electrical contact between $d^5 d^9$ and $d^6 d^{10}$. Thus the rotation of the electromagnet B^3 , caused as hereinbefore stated, will intermittently make and break contacts through the switch D in the manner specified, once for the first spring, twice for the pair of springs, three times for the triad of springs, for the reason that they are thrown out, as already stated, by the attraction of the armature C toward the face of the circular electromagnet B^3 .

Attached to the frame B , in proximity to the rotating armature C , is a series of insulated electrical line-terminals, two of which, $c^3 c^4$, are in the form of straps. Their inner extremities at $c^5 c^6$ (shown in dotted lines in Fig. 1) are in contact with the two collecting-rings respectively connected to the extremities of the coil inclosed in the depression in the electromagnet. Two others, $c^6 c^7$, terminate in proximity to the periphery of the electromagnet B^3 , but without a normal contact. Other arms $c^8 c^9$ terminate in proximity to the electromagnet, but are not normally in contact therewith. One of the terminals c^8 is so fashioned that as the insulated block B^5 , carried by the electromagnet, is brought into contact with it it is pushed thereby outwardly and makes contact electrically with the terminal c^7 for the purpose hereinafter described. The further and slightly-continued rotation of the electromagnet brings this insulated block B^5 against the terminal c^9 and forces it into electrical contact with terminal c^8 . This is for a purpose hereinafter specified.

The shaft A , rotating in the direction of the arrow, (see Fig. 1,) is timed to rotate so that the block B^5 is brought from its normal position to the position shown in dotted lines in Fig. 1 in about eighty-four seconds. Of course this may be varied to any assignable degree that may be desired.

In Figs. 7 and 8 I have shown this ringing mechanism combined with a multiple and a trunking system, with circuits so arranged as to effect by the combination the results already specified, the line and circuits with the accompanying apparatus being shown diagrammatically, the apparatus, other than the ringing mechanism, being that which is well known and hence is only indicated. "No. 1" is supposed to be the calling-subscriber's station and set. "No. 2" is sup-

posed to be the called-subscriber's station and set. The circuits of the multiple system are shown diagrammatically in Fig. 7. When No. 1 lifts his receiver from the hook, the metallic arm makes two contacts, Nos. 1 and 2 thus bridging between the two contacts. Circuits may now be traced from the main battery F by beginning at one side through line 3, line 4, and line 5, through the coil of the relay 6, thence to armature 7 of relay 8, contact 9 being normally closed on line 10, whence it branches on line 11, through the transmitter Tr to the arm of the receiver-hook, thence through line 11 to normally closed contact 12, and thence to the ground. The opposite pole of the battery also goes through line 13 to ground. This completes the circuit. The current through this circuit energizes the relay 6, closes armature 14, closes contact 15, and thus shunts the current from the battery from line 5, through contact 15 on armature 14, passing through a lamp 16, thence to the ground-line, thus energizing and lighting lamp 16, which is a signal to the operator that No. 1 has made a call. The operator then inserts an answering-plug in the answering-jack 17, which has three points, one for the tip, one for the collar or sleeve of the plug, and a third for the collar of the plug. The tip and the collar or sleeve are connected with lines 11 and 10, respectively, or the circuit connecting the subscriber. The collar 18 is connected by line 19 to relay 8 and thence to the line connecting the lamp and ground. Line 11 is connected through the tip of the plug to line 20. Line 10 is connected through the collar or sleeve of the plug to line 21, both in the operator's set. These answer the purpose of talking-lines when the connection is complete. Line 19 through the collar of the jack 18 is connected with the collar of the plug 22 and line 23 of the operator's set, so that the plugs are three-point plugs corresponding with the three-point jacks. By tracing line 23 it will be found to pass through the lamp 24, thence through a resistance 25 to the battery-line 3, through the battery to ground over line 13. Commencing at the plug it connects with the collar of the jack, thence over line 19, through relay 8, to ground. A part of the energy of the battery F therefore passes over this line and would light lamp 24 but for the fact that supervisory relay 84 is energized over the metallic line and the answering half of the cord-circuit and closes a short circuit at 86 about the lamp, which causes it to remain dark. In energizing relay 8 it attracts the armature 7 and breaks contact 9, also contact 12, thus cutting out relay 6 and lamp 16. On inserting the calling-plug into any jack, we will say, belonging to the called subscriber, which is assumed to be No. 2 and represented on the board by jack 41, it makes a contact 42 with the tip of

the plug, contacting 43 with the sleeve of a plug and contact 44 with the collar of the jack and collar of the plug. The connections 42 and 43 are the line connections. When these connections are made, a circuit is established from the battery F, through resistance 45, line 46, to the three-point switch 47, which is normally in condition shown in the drawings, making contact 48, line 49, to normally closed contact 50, thence through line 51 to the magnet-coil B⁴ of the ringing mechanism, thence over line 52, thence over line 53 to the collar of the calling-plug, which may make contact 44 with the collar of the jack, continuing the circuit over line 54, through relay 55, through line 56 to ground, the opposite pole of the battery being also connected to the ground through line 13.

As hereinbefore explained, the energization of the coil in the ringing mechanism produces a magnetic condition of the rotating electromagnet and instantly draws the armature to its face, and by virtue of the continuously-rotating shaft A it commences to rotate, and being in the position shown in Fig. 1 it makes the contacts specified and, as will be hereinafter described, actuates a circuit which rings the called-subscriber's bell first once, then twice, then three times, if he does not answer before the completion of the ringing. Should the party not answer, the electromagnet continues to revolve until the block B³ closes, as hereinbefore described, contact 30, which actuates a don't-answer signal and brings up against the switch abutment c², closing contact 31 between the two springs and actuates a circuit which breaks the circuit in which the electromagnet is included, and thereupon the rotary electromagnet B³ is compelled to return to its original position by the tension of the spring B². The don't-answer signal is located in a circuit energized by the battery G and may be traced as follows: Commencing at contact 30 it passes over line 57, line 58, and lines 59 and 13 to ground. Upon the opposite side of the contact it passes over line 60, through the don't-answer interrupter 61, to battery G, line 62, to ground. By means of the induction-coil windings II H the buzz of the interrupter is heard by the calling subscriber, whereupon he hangs up his telephone.

As already stated, the insulated block B⁵ coming in contact with c² closes contact 31, and this establishes a circuit as follows: Over contact 31, over line 32 to line 52, to line 53, to the collar of the calling-plug, thence to the collar of jack 41, thence over line 54 to relay-coil 55, thence over line 56 to ground. Beginning again at contact 31, passing over line 63 to first coil of relay 64, thence to three-point switch 47, over line 46, through resistance 45, over line 3, to battery, then over line 13 on the opposite side of the battery F to ground. This energizes the locking-relay,

64, opens contact 50, and closes contact 65. This interrupts the circuit over line 51, connected with the energized coil of the rotating electromagnet B³, releasing its armature C from contact with it by the action of the spring C', whereupon the rotating electromagnet is restored by its reverse motion to its original position, the restoration being effected, as hereinbefore stated, by the coiled spring B². The closing of contact 65 allows current to flow from battery F over line 3, resistance 45, line 46, line 49, to contact 65, thence through locking-coil 66, thence over line 67, through the supervisory lamp 68, then line 53, to collar of the calling-plug, thence over line 54, coil 55, and line 56 to ground. The opposite side of the battery is connected to ground by line 13. This is a substitute circuit for the one just established by the closing of contact 31, and as the reverse rotation of the rotating electromagnet opens contact 31, and would thereby restore contact 50, the circuit just described is introduced as a substitute therefor to energize the relay 64 and maintain contact 65, which keeps contact 50 open and at the same time lights lamp 68, indicating to the operator that the called-for subscriber did not answer, or, as will hereinafter be seen, that the calling subscriber had finished and he had hung up his receiver. Under either circumstance the operator would withdraw the calling-plug from the jack 41. If, on the other hand, as the rotating electromagnet actuates the calling-signal for the called subscriber, if he answers by taking down his receiver he closes contacts 69 and 70 with and through the arm of the receiver switch-hook. Under these circumstances the talking-line then would be closed between the two subscribers, as subscriber No. 1 has effected a corresponding contact by having previously withdrawn his receiver from its switch-hook. It also establishes the following circuits: from contact 70, through the receiver hook-arm, over line 71, line 72, contact 43, to sleeve of plug 73, line 74, contact 75, line 76, to supervisory relay 77, line 78, repeating-coil winding II', line 3, to battery, on the opposite side commencing with contact 69, line 91, to contact 42, with the tip of the plug, then line 79, contact 80, line 81, line 58, through repeating-coil winding II, to line 59, to the opposite side of the battery. This circuit operates relay 77 and its armature 82 to close contact 83, whereupon a further circuit is established very similar to that established by the closing of contact 31 instead of going over line 63. From the locking-coil 64 it passes over the armature 82, through contact 83, closing over line 53, to the collar of the calling-plug, thence to the collar of the jack, thence over line 54, to relay 55, and over line 56 to ground. The other side of the circuit is made over line 13 to ground. The action of this circuit there-

upon closes contact 65, breaking contact 50, and establishes the circuit already described. Opening contact 50 resets the rotating electromagnet B³ by destroying its magnetism and the releasing of its armature, whereupon it returns to its original position, as stated, the same as though it had advanced in its rotation until the insulated block B⁵ thereon had closed contact 31. It will be noticed that this latter circuit passing over line 53, through contact 83, shunts out the lamp 68, so that it gives no indication by lighting, as already stated in a former instance.

After the termination of the conversation between the two subscribers they proceed to hang up their receivers upon the receiver-hooks, thereby breaking contacts 1 and 2 in the calling subscriber's set. This interrupts a circuit heretofore established on the calling-circuit through relay 84 and opens the short circuit about the supervisory signal 24, which is lighted over a circuit from battery F, as follows: over line 3, line 85, through the supervisory lamp 24, line 23 to collar 22, sleeve 18 of jack 17, line 19, relay 8 to ground, from the opposite side of the battery over line 13 to ground. A parallel circuit is established during conversation over line 3, then over the winding repeating-coil H' through relay 84, closing contact 86, thence to line 21 to the sleeve of the jack, thence to contact 87, thence over line 10 to contact 1, over line 11 to tip of the plug in jack 17, thence over line 20 to winding repeating-coil H, line 59 to battery. This cuts out lamp 42 during the time of the conversation between the subscribers. It thereby becomes a clearing-out signal by its being relighted when the receiver is hung on the hook, and contacts 1 and 2 are broken. The breaking of contacts 1 and 2 destroys the power of the relay 84 and opens contact 86. When the called subscriber hangs up his receiver and breaks contacts 69 and 70, the same action takes place by the breaking of contact 83, shunting the circuit over line 67, lamp 68, and line 53, as already explained, thereby lighting lamp 68, serving as a clearing-out signal for the called subscriber.

The three-point switch 47 may be used for detaining the action of the ringing-electromagnet B³ in case the operator wishes not to ring the subscriber at once. Upon the inserting of the plug she will throw the lever to the left, breaking contact 48 and making contact 89. The breaking of the contact 48 opens the circuit to line 49 and to contact 50 of the electromagnet. The making of contact 89 introduces a circuit, as follows: from 47 over line 90, through coil 66 of the locking-relay, line 67, through lamp 68, over line 53, collar of the calling-plug and sleeve of the jack, thence over line 54, thence through coil 55 and line 56 to ground; so that it lights the lamp 68 and cuts out the ringing-electromagnet. The lamp 68 then serves as

busy signal. Its use in this case would be as follows: Suppose the line to the called and subscriber was busy. An operator could thus insert the plug in the jack of this line, and during the time this line was busy the circuit just described through the lamp 68 would be shunted by the closing of contact 83, as before described, and whereupon when the subscriber hung up his receiver and was through talking the shunt maintained by the contact 83 would be open, the signal 68 would light, and the operator employing that signal would be given a visible indication that she was at liberty then to go ahead and call that subscriber. Of course this would be used only in case of a specially urgent call, at which time the answering-plug would necessarily be withdrawn to prevent the calling party from overhearing the conversation. By closing contact 48 the operator can start the ringing-machine as it restores the circuits, as already described. It is unnecessary to describe the circuits of the operator's set, as they are common and in every day use and form no part of this invention.

The interrupted current caused by the interrupter 61 produces an induced current through the windings H, and thereby is heard in the ear of the calling subscriber. The manner of producing the induced current is old and well understood, and therefore is not described in detail.

The raising of anvil *d* breaks contacts 75 and establishes contacts 92 and 93 over lines 94 and 95, leading to the selective ringing-keys, the construction and operation of which are old and well known, and as they form no part of this invention in themselves it is not necessary for me to describe them. I preferably employ, however, a bank of keys in which any one depressed will so remain until another is depressed, when the former releases. The depression of any key that is selected throws the generator-current from this mechanism over lines 94 and 95, through contacts 92 and 93, through the calling-plug to lines 72 and 91 and calls the called subscriber by ringing the bell 97. I have shown but one called subscriber on the line; but by the arrangement of this bank of ringing-keys, all of which is old and well known, it is obvious to those skilled in the art that I may put four subscribers on the line and by old and well-known means ring such one of these subscribers as may be desired. All I desire to illustrate is the connection of this bank of ringing-keys with the system as showing the manner of introducing the ringing-up mechanism in order to call the called subscriber. Other systems might be used, as a single ringing-key for single subscribers on that line, without departing from this invention.

In Fig. 8 I have shown this system as applied to a trunking-board, and especially the

arrangement of circuits for facilitating the connecting of a subscriber's line terminating in one switchboard with a subscriber's line terminating in the other switchboard through a trunking-line between these two boards; also, especially the arrangement for calling subscribers and automatic means for introducing the calling-current, discontinuing the same, and giving disconnect-signals to the operators. J is an operator located at X switchboard, who receives a call from the calling subscriber, as before stated and described. Upon ascertaining that the party called for has his line terminating in Y switchboard she immediately instructs an operator at the Y switchboard, by means of a special circuit, (not shown and to which she can have connection by a key at her disposal,) the number of the subscriber called for. The K operator located at Y switchboard assigns to the J operator the number of the trunk which she, the K operator, desires to use, whereupon the J operator inserts the calling-plug 140 into the trunking-jack 98, which is X switchboard-terminal of the trunk assigned, as before stated. At the same time the K operator proceeds as follows: Picking up the trunking-plug 99, which is the opposite terminal of the selected trunking-line, she tests the line of the called subscriber by touching the tip 101 of the plug to the sleeve 102 of the jack and assuming she finds it not busy will insert the plug into the jack. Both operations in making a trunking connection are the same as have been followed in previous trunking systems and well-known to the art. At this point, however, I provide means for starting and stopping the ringing-machine automatically, and it is necessary that both connections just described—namely, the insertion of the calling-plug into the trunking-jack and the insertion of the trunking-plug into the jack of the called subscriber—be made to start the operation of the ringing-machine. From this point the ringing-current is applied through the trunk and through the connection at the Y switchboard to the called-subscriber's line in exactly the same manner as had been described when the connection is entirely upon the one switchboard by the insertion of a calling-plug in the multiple jack. The machine stops automatically at the end of this motion or upon the called subscriber taking his receiver from the hook as before, and the disconnect-signal at the X switchboard operates in the same manner as under the previous circumstances. We will say, for instance, that the called subscriber had hung up his receiver and a disconnect-signal had been indicated to the J operator at the X switchboard. The J operator will then withdraw the calling-plug from the trunking-jack, the withdrawal of which automatically signals the K operator at the Y switchboard by the lighting of a signal associated with

that trunking, whereupon she, the K operator at the Y switchboard, withdraws the trunking-plug from the called-subscriber's line-jack, and the disconnect is complete. This operation is carried out by the following circuits: It will be noticed that the circuit from the sleeve of the trunking-jack through the coil 103 to contact 131 to earth is normally open at the contact 131. Hence when the J operator inserts the calling-plug into the trunking-jack the circuit as previously described through the coil of the rotating electromagnet is not completed, but will be open at this contact 131. A circuit, however, is made from the battery F to line 3, coil H', line 78 to the coil 77, line 76, contact 75, and sleeve 73 of the calling-plug to contact 105, line 106, line 107, coil 108, line 109, coil 110, line 111, contact 112, tip 141 of the calling-plug, line 79, contact 80, line 81, line 58, coil H, line 59 to battery F. The relay-coil 108 is of a very high resistance, in practice about twelve thousand ohms, to prevent the operation of supervisory signal 77 at this time from the battery F. The current flowing through this coil closes contact 113, which establishes a shunt around lamp 115 by the line 114 and the resistance-coil 116. It is assumed that the operator has or will at this moment insert the trunk-plug 99 into the jack 100, whereby circuits are established as follows: from the battery F' through line 117, coil 118, contact 119, line 120 to lamp 115, a shunt about the lamp through the line 114 and resistance 116 having been already completed, thence continuing through line 121 to the collar 122 of the plug, thence to sleeve 102, line 123, coil 124 of the cut-off relay, thence over line 125 to ground. This does not light the lamp, owing to the shunt through contact 113 around it; but it is in position to be lighted as soon as contact 113 is broken, and it thus serves, as hereinafter shown, as a disconnect-signal by the breaking of the circuit through coil 108. The establishing of a circuit through coil 118 actuates its armature and closes contact 126. This establishes another circuit from battery F' over line 127, relay 128, line 129, contact 126, line 109 to coil 110, line 111 to contact 112 of jack, thence to tip 141 of the plug, thence to contact 80, over line 81, line 58 to coil H, line 13 to ground. The opposite side of the circuit is over line 130 to ground. The current now passing through coil of the relay 110 is sufficient to operate it, whereupon it closes contacts 131 and 132, contact 131 establishes a ground connection at G' through the sleeve 133 of the trunking-jack 98, and the closing of contact 132 puts a shunt around the coil 110 of the relay. The relay, however, remains closed, because of the current passing from the battery F, through contact 131, through the circuit already traced to contact 131 to ground. The circuit through

relay 128 closes its armature 134 and mechanically breaks contact 119 and makes contact between the armature 134 and the spring-arm 135, and thereby passing the circuit from the coil 128, through these two arms 134 and 135 and over line 120 to the lamp 115 and from thence through line 121 and over the circuit already described to line 125 and ground. The lamp, however, is not actuated, as it still remains shunted by contact 113, as already stated. The circuit heretofore mentioned as passing through relay 118 and contact 119 is broken by the breaking of contact 119. The actuation of the relay 118 closes contact 126, and as soon as contact 119 is broken current ceasing to flow through relay 118 breaks contact 126; but relay 128 remains operative by virtue of the switching of a current through arms 134 and 135, as already stated. The operation of relay 128 also breaks contact 137, which leads to the operator's telephone in the usual manner for obtaining the busy test, and contact 138 is established, which closes the talking-circuit between the boards over line 109, through coil 110, over line 111 to the tip 141 of the plug. By virtue of the closing of this contact 138 the called subscriber is enabled to be rung up, as already stated, and by the same circuits as shown in Fig. 7, whereupon if he does not answer the same action takes place with regard to the ringing mechanism, as heretofore described, and if he does answer the ringing mechanism is stopped by taking the telephone off the hook, and the talking is completed through the same circuits and the circuits as traced through the trunking-line. On hanging up his receiver and breaking the contacts heretofore described in his telephone set the current through line 76 and relay 77 is broken, as hereinbefore described in connection with Fig. 1, whereupon the disconnect-lamp 68 is lighted, thus operating as a clearing-out signal, as hereinbefore stated, whereupon the operator at the X board withdraws the plug from the trunking-line jack, breaking the contacts therewith, taking current off from relay 108, thereupon breaking contact 113 and shunting around lamp 115, which then becomes lighted by virtue of the circuit from battery F' passing directly through it, as already stated, whereupon the operator upon the Y board withdraws the trunking-plug from the called subscriber's jack, thus restoring all of the parts of all of the circuits to their normal position and condition. The relay-coil 108 is bridged, through the medium of lines 107 109, directly across the talking-line, but is of sufficient impedance to prevent short-circuiting the voice-currents. From the center of coil 108 runs the connecting-line 142 directly to battery F'. The purpose of this is to keep relay 108 energized through all the conditions of sending selective signals over this trunking-line to a called

subscriber. The different circuits established by depressing selective ringing-keys are such that a ground connection is made either on one side or the other of the line during the moment of the passage of the calling-current. Hence the battery F' will have a complete circuit through either one half or the other of the coil 108 to the ground at the one side or the other of the selective ringing-key keeping its armature and contact 113 closed. Otherwise we would have a vibratory effect, due to the alternations of the alternating current of the signal.

By "intermittent periodic" ringing device used herein I mean such a ringing device that comparatively long intervals of rest or of no current occur throughout the sending of the signaling or ringing current, which is otherwise of the periodic type or that broken by regular short intervals. The arrangement preferred is that described, whereby the call-bell is first given one ring followed by a period of rest, then two rings followed by a second rest, then three rings, and so on. Of course other arrangements could be employed. It will also be seen that the ringing-current always starts immediately upon the insertion of the connecting-plug, which differs from the ordinary scheme of employing a divided ring-contact upon a revolving shaft, which may or may not send out ringing-currents immediately, according to the position of the parts.

What I claim is—

1. In combination with the ringing apparatus of a telephone-substation, a ringing device located at the central station, consisting of a continuously-revolving shaft, an armature revolving therewith capable of movement longitudinally in the line of the shaft, a circular electromagnet concentrically embracing the shaft, but elastically attached to a fixed portion of the sustaining-frame, electrical means for energizing said electromagnet for the purpose of bringing the armature in contact therewith, whereby said armature compels a partial rotation of the electromagnet, means attached to the periphery of the electromagnet whereby a series of ringing contacts are made to actuate the ringing mechanism at the substation, an electromagnetic means for automatically discontinuing the circuit energizing the electromagnet whereby the armature is released therefrom and the electromagnet returns automatically to its original position by virtue of the resiliency of its elastic connections, substantially as described.

2. In combination with the ringing apparatus of a telephone-substation, a ringing device located at the central station, consisting of a continuously-revolving shaft, an armature revolving therewith capable of movement longitudinally in the line of the shaft, a circular electromagnet concentrically em-

bracing the shaft, elastic connections between the electromagnet and a fixed portion of the sustaining-frame, electrical means for energizing said electromagnet for the purpose of bringing the armature in contact therewith, whereby said armature compels a partial rotation of the electromagnet, means attached to the periphery of the electromagnet whereby a series of ringing contacts are made to actuate the ringing mechanism at the substation, an electromagnet for automatically discontinuing the circuit energizing the electromagnet whereby the armature is released therefrom and the electromagnet returns automatically to its original position by virtue of the resiliency of its elastic connections; and means whereby said electromagnet is energized by the closing of a circuit when the calling-plug is inserted in the calling-jack, substantially as described.

3. In combination with the ringing apparatus of a telephone-substation, a ringing device having a sustaining-frame located at the central station, consisting of a continuously-revolving shaft, an armature revolving therewith capable of movement longitudinally in the line of the shaft, a circular electromagnet concentrically embracing the shaft, elastic connections between the electromagnet and a fixed portion of the sustaining-frame, electrical means for energizing said electromagnet for the purpose of bringing the armature in contact therewith, whereby said armature compels a partial rotation of the electromagnet, means attached to the periphery of the electromagnet for making a series of ringing contacts to actuate the ringing mechanism at the substation, an electromagnet for automatically discontinuing the circuit energizing the electromagnet whereby the armature is released therefrom and the electromagnet returns automatically to its original position by virtue of the resiliency of its elastic connections, and means for energizing said electromagnet when the calling-plug is inserted in the calling-jack, and a "don't-answer" signal whereby, after a specified interval, the calling subscriber is notified that the called subscriber has not answered, substantially as described.

4. In an electrosignaling apparatus for a central station of a telephone system, the combination of a continuously-revolving shaft, a series of electromagnets one for each operator's set arranged concentrically upon said shaft, a framework with sustaining-brackets each having appropriate bearings for said electromagnets, a spring connection between each of said magnets and each of said brackets, means for holding said electromagnets in a normal or reposing position against the tension of the spring, a series of rotating armatures corresponding to said electromagnets, each of which is in close proximity to each of said magnets, said ar-

matures being concentrically attached to said shaft and rotating therewith, but capable of longitudinal movement thereon, elastic means to resist such movement, a source of electricity, means for completing a circuit from said source through the coils of each of said electromagnets respectively, by the completion of a conversational circuit, whereby the said electromagnet is caused to revolve due to the contact of said armature, ringing mechanism and circuits actuated by said revolving electromagnet, and means for automatically restoring each of said electromagnets respectively to their original position, substantially as described.

5. In combination with a continuously-revolving shaft, a fixed framework, an electromagnet a coil-spring to rotatably attach said magnet to said fixed framework, means for retaining the magnet in a normal position, electrical circuits adapted to energize the coil of said electromagnet and a disk armature connected to rotate with said shaft, spring mechanism thereon for normally holding it away from the electromagnet, and adapted to be overcome by the attraction of the magnet for the armature, whereby the armature would compel the electromagnet to rotate so long as the two were in contact, a stop fixed to said rotating magnet to limit its rotation and a series of contacts actuated by said stop, whereby the circuit by which said electromagnet is locked to the armature is broken, thereby automatically releasing the armature from the electromagnet, substantially as described.

6. In combination with the ringing apparatus of a telephone-station, a ringing device consisting of a continuously-revolving shaft and a stationary frame, an annular relay concentric therewith consisting of two parts one part rotating normally with the shaft and a spring to normally attach the other part to the stationary framework to permit rotary motion, means for energizing the electromagnet of said relay whereby the two parts are magnetically attracted and rotate in unison while said electromagnet is energized, substantially as described.

7. In a telephone system, subscribers' lines, an operator's connective device, a ringing-generator, and means to connect said generator to said device comprising in part a rotatable shaft, a circular magnet or relay comprising two parts, one a disk armature and the other a core or shell having a coil wound thereon, one of said parts being mounted to rotate with the shaft, and the other mounted to rotate independently of the shaft, and a coil-spring having one end connected with said latter part.

8. In a telephone system, subscribers' lines, an operator's cord-circuit, a ringing-generator, and means to connect said generator to said cord-circuit comprising in part a

rotatable shaft, a circular magnet comprising a disk armature mounted to rotate therewith, and a circular shell or core having a magnet-coil wound thereon, a support on which said core is rotatably mounted, and a spring yieldingly connecting said core with said support.

9. In a telephone system, subscribers' lines, an operator's cord-circuit, a ringing-generator, and means to connect said generator to said cord-circuit comprising in part a rotatable shaft, an armature and a magnet core or shell through which said shaft passes, the said armature being mounted to rotate with said shaft and being longitudinally movable thereon, and the said shell being supported independent of said shaft, a coil-spring surrounding the shaft and within the shell and having an end connected with the shell and another with the support.

10. In a telephone central-office ringing apparatus, the combination with framework, of a cylindrical rotatable part therein, contacts on said framework near the said cylinder, means to effect its rotation in both directions, projections on said cylinder to operate said contacts as it rotates in one direction, and means for preventing such operation when the cylinder rotates in the reverse direction.

11. In a telephone central-office ringing apparatus the combination, of a cylinder mounted to rotate forward and backward therein, pins, lugs or projections extending from said cylinder, contacts mounted on the frame in the path of said pins, lugs or projections, and means for drawing in said pins, lugs or projections in the backward rotation of the cylinder so that the contacts are not then operated.

12. In a telephone central-office ringing apparatus, a rotatable element having a pin or plunger in its periphery, a longitudinal plunger coacting with said peripheral plunger to project the same beyond its normal position, a spring to force said plunger back into the cylinder, means to press on said longitudinal plunger to project the other, and contacts located within operating distance of said projected plunger.

13. In a telephone central-office ringing apparatus, a rotatable element having a series of plungers radially movable in its periphery, longitudinal plungers adapted to project beyond the face of said cylinder and coacting with the other plungers to force the same outward, springs to hold the latter plungers inward, contacts mounted in the path of said projected peripheral plungers, and means to simultaneously press upon and release all the longitudinal plungers.

14. In a telephone central-office ringing apparatus, a rotatable shaft, a cylindrical element adapted to rotate independently of said shaft, a circular disk rotatably secured

to said shaft but longitudinally movable, contacts located near the periphery of said cylinder, plungers radially movable in the periphery of said cylinder, longitudinal plungers projecting from the end or face of said cylinder and coöperating with the other plungers to force them outward, and means to force said disk against said cylinder to rotate the same and operate the plungers.

15. In a telephone central-office ringing apparatus, a rotatable shaft, a circular relay or magnet comprising a disk armature rotatably secured to said shaft and longitudinally movable, a concentric magnet core or shell rotatable independent of said shaft and having a coil wound thereon, a spring connecting said shell with the framework, plungers movable in the periphery of said shell, longitudinal plungers coacting with the other plungers to force the same outward, means to force them inward and the longitudinal plungers back, contacts mounted in the path of the projected peripheral plungers, and means to close a circuit through said coil to draw up the armature, project the plungers and rotate the cylinder against the tension of the said spring and when said circuit is broken to release the armature and draw in the plungers so as not to operate the contacts on the backward rotation of the magnet-cylinder.

16. In a telephone-exchange, the combination with line-circuits, of operator's connective means to interconnect said circuits in pairs, a periodic calling device introduced into one of said circuits by the act of connecting said means thereto, a time-limit apparatus, and a "don't-answer" signal automatically operated by said time-limit apparatus after a predetermined time.

17. In a telephone-exchange, the combination with line-circuits, of operator's connective means to interconnect said circuits in pairs, a periodic calling device introduced into one of said circuits by the act of connecting said means thereto, an automatic time-limit apparatus for cutting off said calling device after a predetermined time, and a "don't-answer" signal automatically operated by said time-limit apparatus after a predetermined time.

18. In a telephone-exchange the combination with line-circuits, of operator's connective means to interconnect said circuits in pairs, and a periodic calling device introduced into one of said circuits by the act of connecting said means thereto, an automatic time-limit apparatus for cutting off said calling device after a predetermined time, and an operator's disconnecting-signal automatically operated by said time-limit apparatus after a predetermined time.

19. In a telephone-exchange, the combination with line-circuits, of operator's connective means to interconnect said circuits in pairs, a periodic calling device introduced

into one of said circuits by the act of connecting said means thereto, an automatic time-limit apparatus for cutting off said calling device after a predetermined time, and a
 5 "don't-answer" and operator's disconnecting-signal automatically operated by said time-limit apparatus after a predetermined time.

20. In a telephone-exchange, the combination with line-circuits, operator's connective means to interconnect said circuits in pairs, a periodic calling device introduced into one of said circuits by the act of connecting said means thereto, a time-limit apparatus, a
 15 "don't-answer" signal automatically operated by said time-limit apparatus after a predetermined time, and an automatic cut-off device operative after a predetermined time to cut off said calling device and said time-limit apparatus.

21. In a telephone-exchange, the combination with line-circuits, operator's connective means to interconnect said circuits in pairs, a periodic calling device introduced into one of said circuits by the act of connecting said means thereto, an automatic time-limit apparatus for cutting off said calling device after a predetermined time, a "don't-answer" signal automatically operated by said time-limit apparatus after a predetermined time, and an automatic cut-off device also operative after a predetermined time to cut off said calling device and said time-limit apparatus.

22. In a telephone-exchange, the combination with line-circuits, operator's connective means to interconnect said circuits in pairs, a periodic calling device introduced into one of said circuits by the act of connecting said means thereto, an automatic time-limit apparatus for cutting off said calling device after a predetermined time, an operator's disconnecting-signal automatically operated by said time-limit apparatus after a predetermined time, and an automatic cut-off device also operative after a predetermined time to cut off said calling device and said time-limit apparatus.

23. In a telephone-exchange, the combination of line-circuits, operator's connective means to interconnect said circuits in pairs, a periodic calling device introduced into one of said circuits by the act of connecting said means thereto, an automatic time-limit apparatus for cutting off said calling device after a predetermined time, a "don't-answer" and an operator's disconnecting signal automatically operated by said time-limit apparatus after a predetermined time, and an automatic cut-off device operative during said predetermined time to cut off said calling device and said time-limit apparatus.

24. In a telephone system, the combination with a telephone-line, of a periodic calling device connected with the line in the act of es-

establishing a connection therewith, a time-limit apparatus, a "don't-answer" signal automatically operated by said time-limit apparatus after a predetermined time, and an automatic cut-off device adapted to be operated by the response of the subscriber to cut off the calling device.

25. The combination with telephone-lines, of a periodic calling device connected with one of the lines in the act of establishing a connection therewith, an automatic time-limit apparatus for cutting off said calling device after a predetermined time, a "don't-answer" signal automatically operated by said time-limit apparatus after a predetermined time, and an automatic cut-off device adapted to be operated by the response of the called subscriber to cut off said calling device and time-limit apparatus.

26. The combination with telephone-lines united for conversational purposes, of a periodic calling device connected with one of said lines in the act of making the connection, an automatic time-limit apparatus for cutting off said calling device after a predetermined time, an operator's disconnecting-signal automatically operated by said time-limit apparatus after a predetermined time, and an automatic cut-off device operated by the response of the called subscriber to cut off said calling device and said time-limit apparatus.

27. The combination with subscribers' lines, of a periodic calling device introduced into one of said lines in the act of making a connection therewith, an automatic time-limit apparatus for cutting off said calling device after a predetermined time, a "don't-answer" signal and an operator's disconnecting-signal automatically operated by said time-limit apparatus after a predetermined time, and an automatic cut-off device operative by the response of the subscriber to cut off said calling device and said time-limit apparatus.

28. The combination with a telephone-line, of an operator's cord-circuit having a connecting-plug attached thereto, an intermittent periodic ringing device adapted to be connected with the line upon the establishment of a connection and to always send out ringing-current immediately upon the insertion of the plug, and means to disconnect the said device upon the response of the called subscriber.

29. The combination with a telephone-line, of an operator's connecting-plug, an intermittent periodic ringing device adapted to be connected with the line by the act of inserting the plug, each intermission in the ringing being followed by a greater number of short rings than in the previous period, means to cause the device to immediately send out ringing-current upon the insertion of the plug, and means operated by the re-

sponse of the called subscriber to disconnect and restore the device to normal position.

30. The combination with an operator's cord-circuit, a trunk-line and a subscriber's line, of a ringing device associated with the cord-circuit, and means for automatically connecting the device with the cord-circuit to signal the subscriber upon the connection of the cord-circuit with the trunk and the trunk with the line, substantially as described.

31. The combination with a cord-circuit, of a trunk-line with which said circuit is connected, a subscriber's line, a ringing device associated with the cord-circuit, and means to automatically connect the same with the cord-circuit upon the connection of the trunk with the subscriber's line and to automatically render the same inoperative upon the response of the subscriber.

32. The combination with a cord-circuit, a trunk-line with which the cord-circuit is connected, and a subscriber's line, of a ringing device and a disconnecting-signal associated with said cord-circuit, and means for automatically operating said device upon the connection of the trunk-line with the subscriber's line and to automatically disconnect the same upon the response of the subscriber, said disconnecting-signal being thereafter under the control of the subscriber.

33. The combination with subscribers' lines terminating at different offices, a cord connector at one office, and a trunk-line extending between the offices, of supervisory signals and a ringing device associated with the cord connector, means for automatically connecting said device with the cord connector upon connecting said connector with the trunk-line and the latter with the called-subscriber's line, and further means for thereafter controlling the said supervisory signals from the substations, whereby the operator at the cord connector has complete supervision of the connection.

34. The combination with a calling and called telephone-line and a cord-circuit at a central office for uniting them, of an automatic ringing device at the central office for sending signaling-current over the called line, a "don't-answer" signal, a switch for connecting the same with the calling line, an automatic time-limit apparatus set in operation simultaneously with the automatic ringing device, and means controlled by said time-limit apparatus for actuating said switch, whereby the calling party is automatically notified when the called station has been signaled a given time, substantially as described.

35. The combination with a calling and a called telephone-line, of an automatic ringing device at the central office for sending signaling-current over the called line, a "don't-answer" signal, a switch for connecting the same with the calling line, an automatic time-limit device set in operation simultaneously

with the automatic ringing device, and means controlled by said time-limit device for actuating said switch, whereby the calling party is automatically notified when the called station has been signaled a given time, substantially as described.

36. The combination with a calling and a called telephone-line and means at a central office for uniting them, of an automatic ringing device at the central office for signaling the called station, a "don't-answer" signal, a switch for disconnecting the ringing-current from the called line and applying the said signal to the calling line, and an automatic time-limit device for bringing about the operation of said switch, whereby ringing-current is automatically applied to the called line for a given time and then stopped and a signal transmitted to the calling station, substantially as set forth.

37. The combination with a calling and a called line, and a cord-circuit at a central office for uniting them, of a source of ringing-current and a ringing device at the central office for connecting the same with the called line, means controlled through the agency of a switch at the called station for automatically disconnecting the ringing-current, an automatic time-limit device set in operation when ringing-current is applied to the called line, a "don't-answer" signal, and a switch for connecting the same with the calling line controlled by said time-limit device, whereby the called party is automatically signaled for a definite time, and upon his failure to respond, a report to that effect is automatically made to the calling party, substantially as described.

38. The combination with a calling and a called line, of a source of ringing-current and an automatic ringing device at the central office for connecting the same with the called line, means controlled through the agency of a switch at the called station for disconnecting the ringing-current, an automatic time-limit device set in operation when the ringing-current is applied to the called line, a "don't-answer" signal, and a switch for connecting the same with the calling line controlled by said time-limit device, whereby the called party is automatically signaled for a definite time and, upon his failure to respond, a report to that effect is automatically made to the calling party, substantially as described.

39. The combination with a telephone-line extending to a central office and means for there connecting it with a second or called line, of an automatic ringing device and means for connecting the same with the called line to signal the called party, means at the central office under the electrical control of the called party for disconnecting the ringing device from the line, a "don't-answer" signal and a switch for applying the same to

the first-mentioned or called line, and an automatic time-limit device for operating said switch and for disconnecting the ringing device, substantially as described.

40. The combination with a calling and a called telephone-line and means at a central office for uniting them, of a source of ringing-current and means for automatically applying the same to the called line, means at the central office under the electrical control of a switch at the called station for disconnecting the source of ringing-current, a "don't-answer" signal and an automatic switch for applying the same to the calling line, an automatic interrupter for intermittently disconnecting the ringing-current from the called line, and an automatic time-limit device to disconnect said source of ringing-current and for controlling said automatic switch, whereby the called party is automatically signaled for a given time, and a signal then transmitted to the calling party indicating that there has been no response, substantially as set forth.
41. The combination with a calling and a called telephone-line and means at a central office for uniting them, of a source of ringing-current and an automatic ringing device for applying the same to the called line, means controlled through the agency of a switch at the called station for disconnecting the source of ringing-current, a source of current connected with the calling line, means at the substation of the calling line for determining the flow of current therein, and a "don't-answer" signal, and an automatic time-limit apparatus for disconnecting said ringing-current from the called line and applying the "don't-answer" signal to the calling line, substantially as described.
42. The combination with a calling and a called telephone-line and means at a central office for uniting them, of a source of ringing-current and means for automatically applying the same to the called line, means at the central office under the electrical control of a switch at the called station for stopping the flow of ringing-current, a "don't-answer" signal, a switch for applying the same to the calling line and disconnecting the ringing-current from the called line, an instrument in the calling line responsive to the "don't-answer" signal, a rotatable cam for actuating the switch last mentioned, a device for intermittently interrupting the flow of ringing-current in the called line, and an electromagnetic device for controlling the rotation of the aforesaid cam, substantially as described.
43. In a telephone system, the combina-

tion with a calling line and a called line, of means at a central office to interconnect them for conversational purposes, a periodic calling device adapted to be connected with the called line, a time-limit apparatus to cut off said ringing device after a predetermined time, and a "don't-answer" signal also controlled by said time-limit apparatus to notify the calling party of the failure of the called party to respond after said predetermined time, substantially as described.

44. In a telephone system, the combination with a calling line and a called line, of means at a central office to interconnect them for conversational purposes, an automatic ringing device for the called line, a time-limit apparatus, and a "don't-answer" signal, said time-limit apparatus being adapted to cut off said ringing device after a predetermined time and to connect the "don't-answer" signal to the calling line to notify the calling party of the failure of the called party to respond.

45. The combination with a calling and a called telephone-line and a cord-circuit to unite them, of a central battery connected with the cord-circuit and supervisory signals associated with each end of the said circuit, an automatic ringing device connected with the cord-circuit, by the act of connecting the said circuit with the called line, a relay to disconnect said device controlled by current from said battery flowing in the called line, said current-flow being determined by the position of the telephone switch-hook at the called substation, an automatic time-limit apparatus to cut off said ringing device in case the called party does not respond within a given time, and an "answer-back" mechanism adapted to be connected with said cord-circuit by said time device to notify the calling subscriber of the failure of the called party to respond, substantially as described.

46. In a telephone system, the combination with a cord-circuit and a trunk-circuit adapted to connect subscribers' lines for conversation, of an automatic ringing outfit associated with the cord-circuit and operative when a connection is made with the line to send ringing-current through the trunk to the called-subscribers' stations, and means for automatically cutting off said outfit, substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

JOHN G. ROBERTS.

Witnesses:

NETTIE V. BELLES,
ELLIOTT J. STODDARD.