No. 738,158. PATENTED SEPT. 8, 1903.

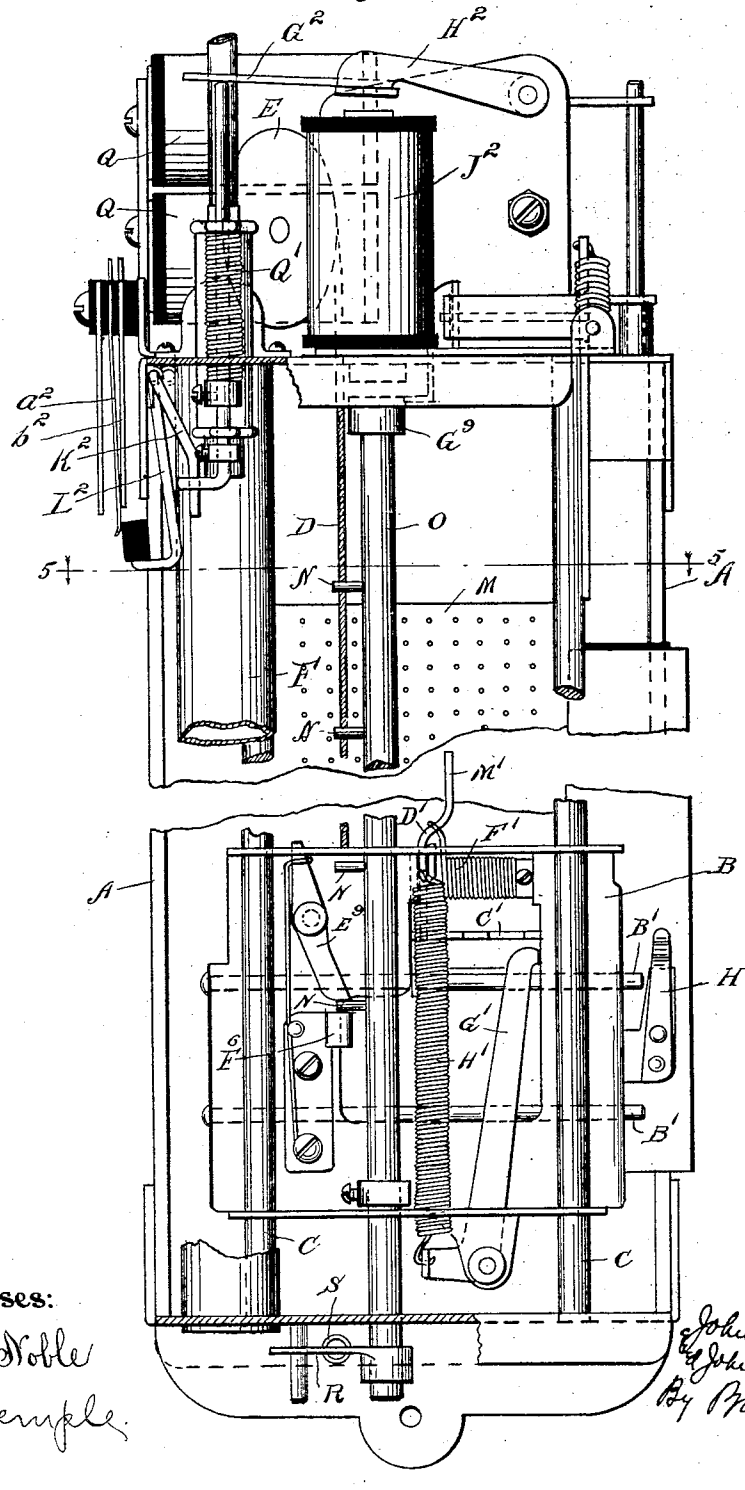
J. J. BROWNRIGG & J. K. NORSTROM.

AUTOMATIC TELEPHONE SYSTEM.

APPLICATION FILED JUNE 3, 1901.

NO MODEL. 6 SHEETS—SHEET 1.

Fig. 1



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NO MODEL. 6 SHEETS—SHEET 2.

Fig. 2

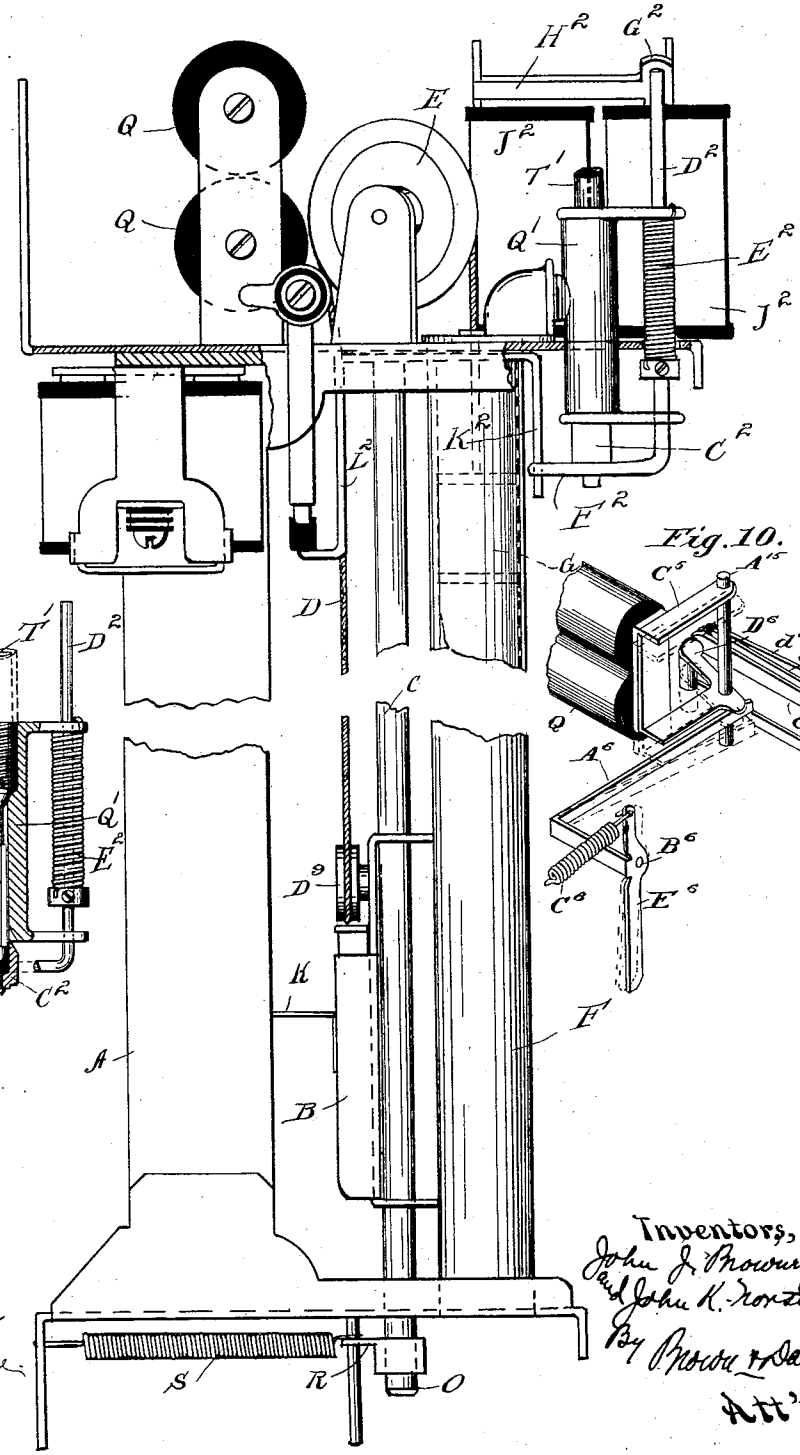

Fig. 6

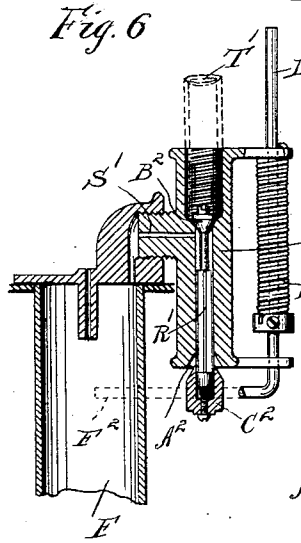

Fig. 10.

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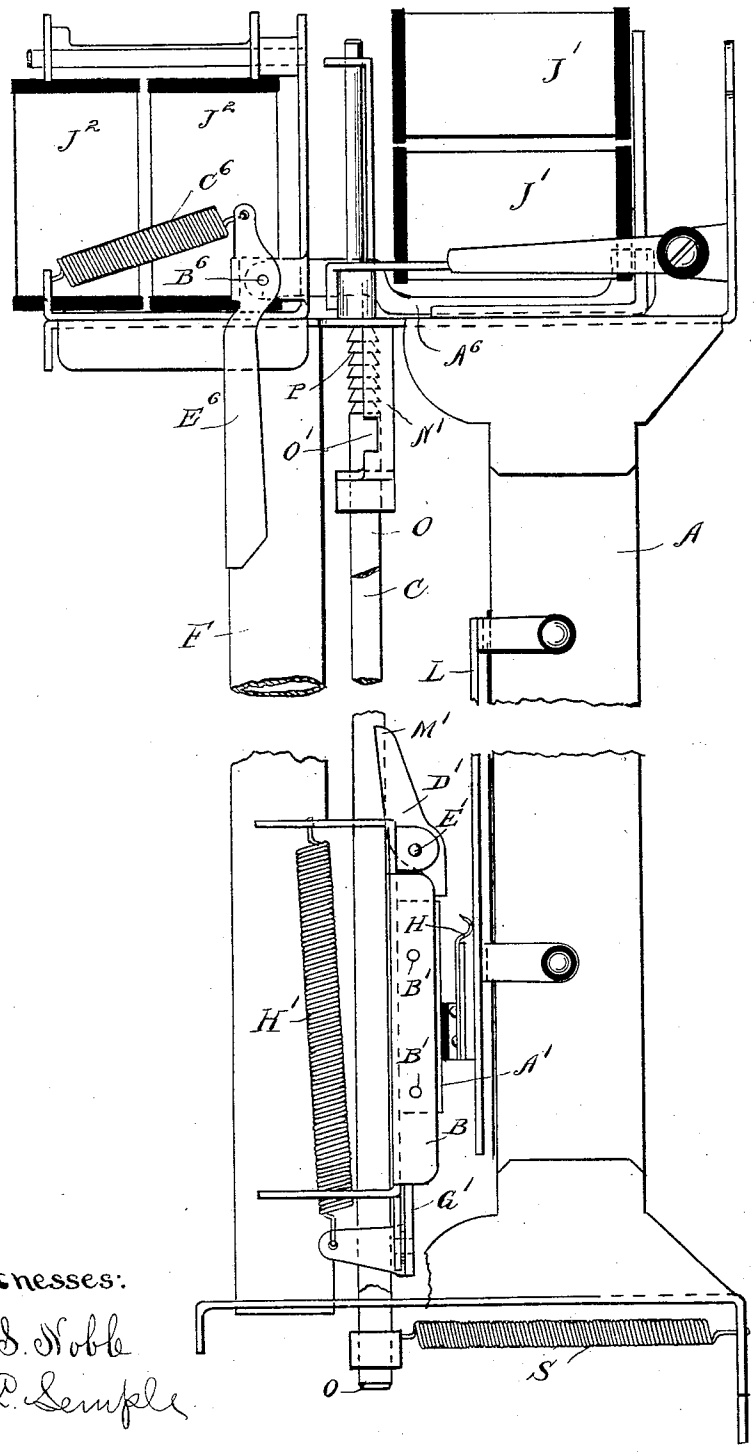
NO MODEL. 6 SHEETS—SHEET 3.

Fig. 3



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NO MODEL. 6 SHEETS—SHEET 4.

Fig. 4

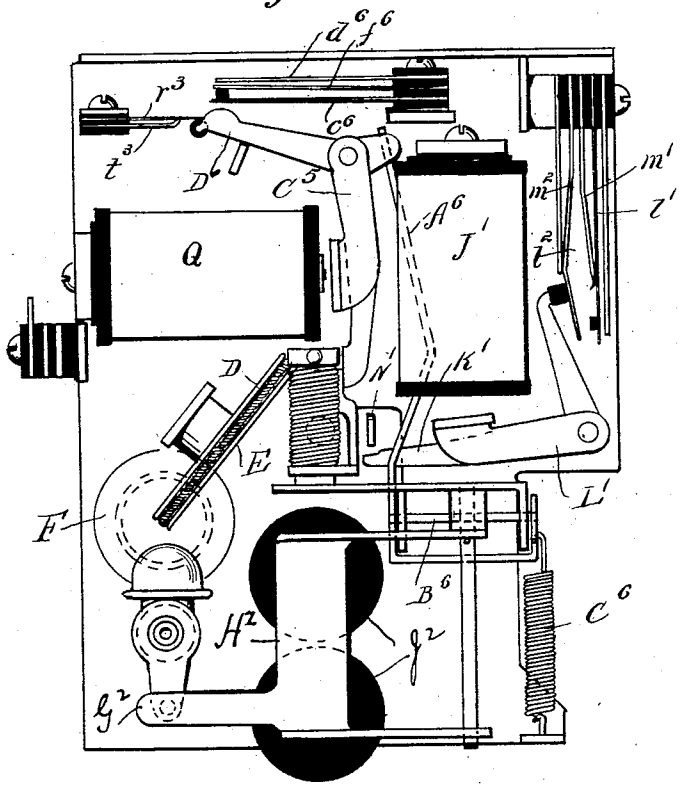
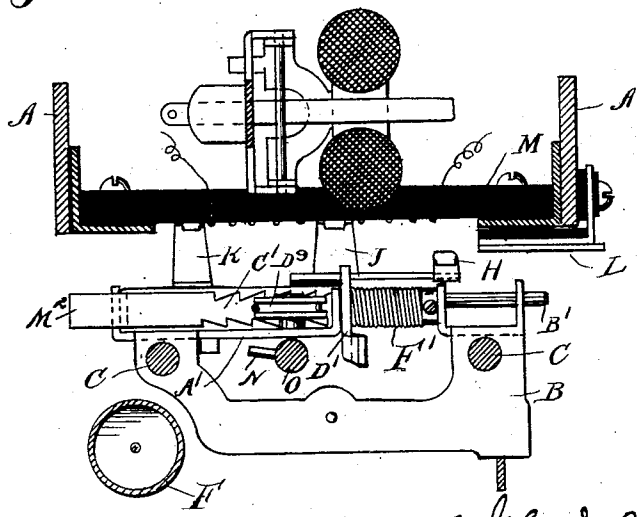


Fig. 5



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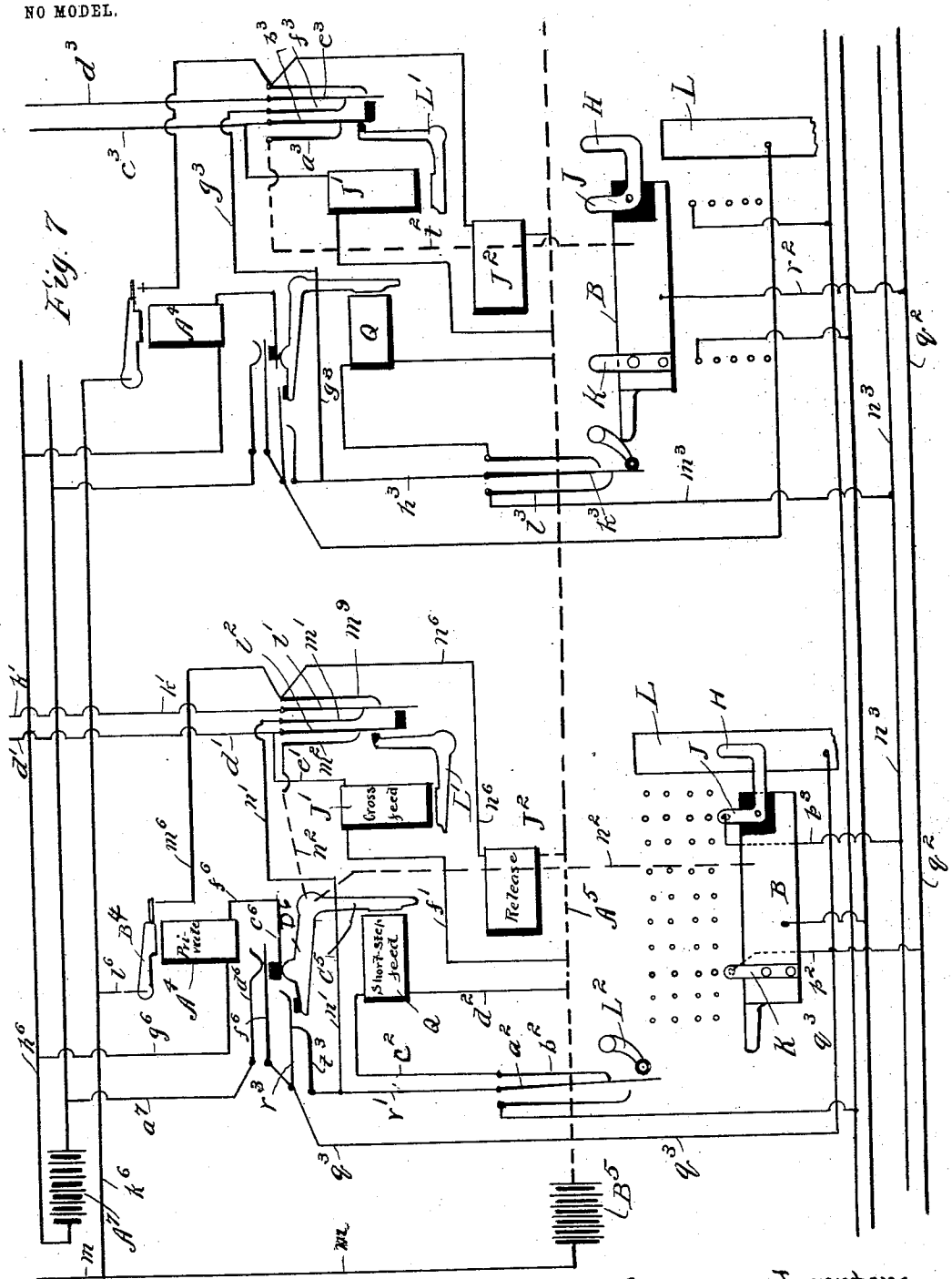
AUTOMATIC TELEPHONE SYSTEM.

APPLICATION FILED JUNE 3, 1901.

NO MODEL. 6 SHEETS—SHEET 5.

Fig. 7



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AUTOMATIC TELEPHONE SYSTEM.

APPLICATION FILED JUNE 3, 1901.

NO MODEL. 6 SHEETS—SHEET 6.

Fig. 8

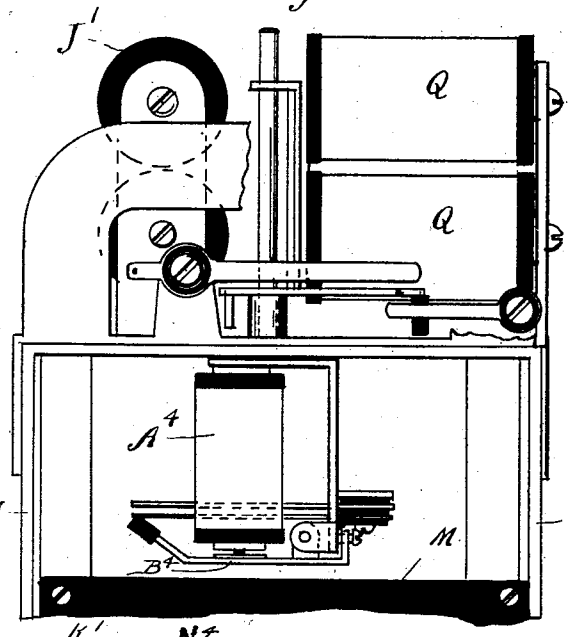
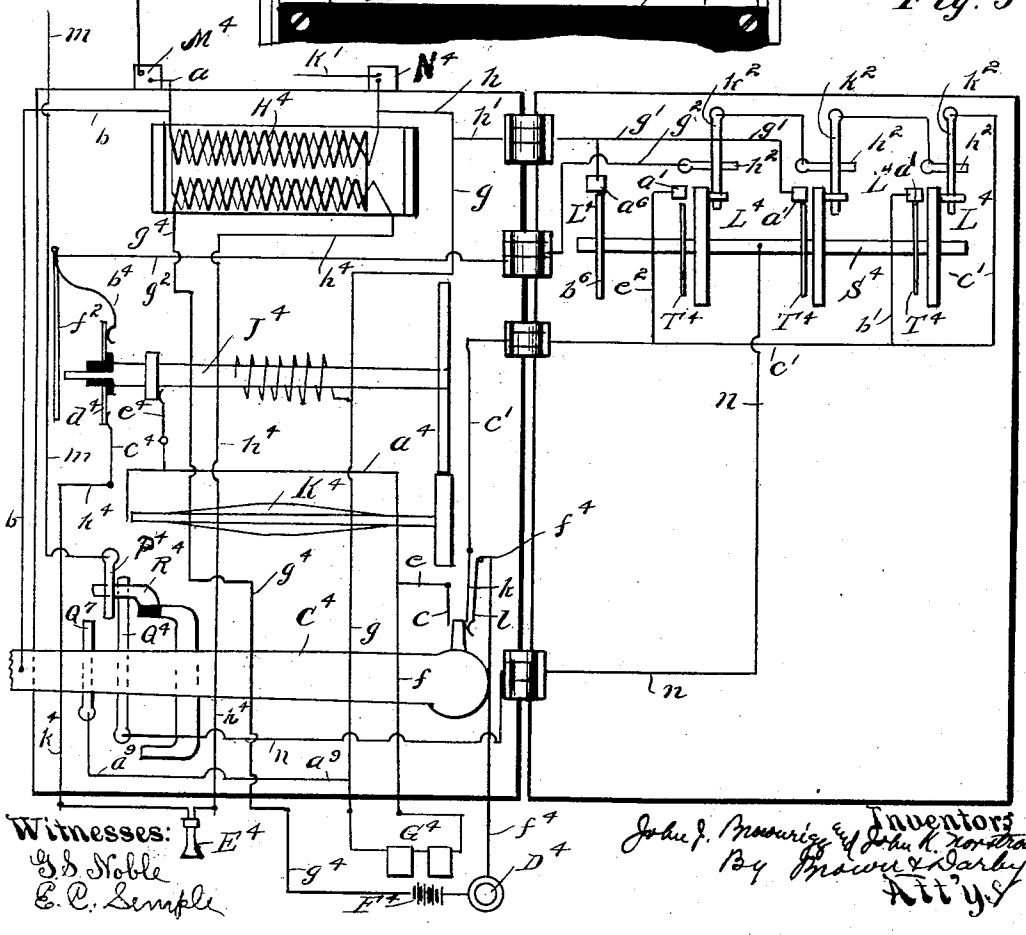


Fig. 9



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No. 738,158. Patented September 8, 1903.

UNITED STATES PATENT OFFICE.

JOHN J. BROWNRIGG AND JOHN K. NORSTROM, OF CHICAGO, ILLINOIS, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO THE GLOBE AUTOMATIC TELEPHONE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

AUTOMATIC TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 738,158, dated September 8, 1903.

Application filed June 3, 1901. Serial No. 62,876. (No model.)

To all whom it may concern:

Be it known that we, JOHN J. BROWNRIGG and JOHN K. NORSTROM, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Automatic Telephone System, of which the following is a specification.

This invention relates to automatic telephone systems.

The object of the invention is to provide an apparatus which is simple in construction and efficient in operation for automatically effecting the desired circuit connections from a subscriber's line to the line of any other subscriber in the system without the intervention of an operator at the central station.

The invention consists, substantially, in the construction, combination, location, and arrangement, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings and to the various views and reference-signs appearing thereon, Figure 1 is a view in front elevation of an apparatus embodying the principles of our invention, parts being broken out and parts in section. Fig. 2 is a view in side elevation of the construction shown in Fig. 1. Fig. 3 is a view similar to Fig. 2, taken from the opposite side of the machine. Fig. 4 is a top plan view. Fig. 5 is a view in transverse section on the line 5 5, Fig. 1, looking in the direction of the arrows. Fig. 6 is a detached detail view in section, showing a construction of control-valve for admitting the medium to the cylinder for returning or restoring the parts to initial position after a circuit connection has been made. Fig. 7 is a diagram showing electric circuits. Fig. 8 is a broken view in rear elevation. Fig. 9 is a diagram showing the circuits of the calling apparatus employed in connection with the automatic system. Fig. 10 is a detached detail view in perspective, parts being omitted, illustrating the operation of a part of the apparatus, a displaced position being indicated in dotted lines.

The same part is designated by the same reference-sign wherever it occurs throughout the several views.

Our invention contemplates the provision of means which are simple in construction and controllable from the subscriber's station, whereby each subscriber in a telephone-exchange may effect direct connection with any other subscriber without the interposition of an operator at the central station. In an automatic telephone system of this character it is desirable to provide means which are simple and efficient and accurate in operation for making the necessary circuit connections. It is also desirable to provide means whereby the circuit connections may be effected expeditiously and the parts returned or restored to normal position positively and accurately. Our invention, therefore, includes combinations and arrangements of parts whereby these results may be secured, and in carrying out our invention we provide movable contacts in connection with the equipment for each subscriber and which movable contacts are adapted to be moved into position to complete the circuit of the particular subscriber in connection with which said contact is employed with the line of any other subscriber of the system, and we arrange said movable contacts to be moved by gravity in one direction and positively or by power-actuated means in the other direction, and we make provision for controlling the movements of said movable contacts from the subscriber's station.

In our pending application, Serial No. 37,717, filed November 26, 1900, we have set forth, described, and claimed an automatic telephone apparatus wherein a movable contact is employed for the purpose of making the necessary circuit connections. The present application relates to an apparatus of this nature, and in carrying out our invention we provide means whereby the movements of a contact by which the desired circuit connections are made are effected by gravity in one direction and positively in the other direction, said movements being controllable from the subscriber's station, and we employ mechan-

ism by which long-step and short-step feed movements are imparted to the movable contact, each long-step feed or movement of said contact carrying said contact over a definite group of circuit-terminals and each short-step feed movement of said contact permitting the contact to be arrested in circuit-connection relation with any particular circuit-terminal of any particular group. In the present application we contemplate the employment of means for the purpose of multiplying the number of circuit connections which is possible to be made from any subscriber's station, and to this end we provide means whereby the movable contacts are permitted short and long step feed movements and in addition lateral feed movements as will be more fully hereinafter described, thereby greatly multiplying or increasing the range of the apparatus. We also provide means whereby the movable contacts are returned or restored to initial or normal position. We also include suitable mechanism whereby when a subscriber attempts to make circuit connection with the line of another subscriber in the system, which other line is already "busy," the parts are all automatically returned or restored to initial position without disturbing the circuit connection of the busy line, thus avoiding the objection of one subscriber breaking the circuit or busy connection of the line-wire of another subscriber, while at the same time the apparatus is free to be operated to make circuit connection with the line-wire of any subscriber which is not busy.

Certain other special features of construction are also embraced within our present invention, which will be more fully explained hereinafter.

Referring to the accompanying drawings, reference-sign A designates a suitable frame of suitable construction and arrangement for supporting the various parts of the apparatus. Suitably mounted to travel vertically on said frame is a carriage B, said carriage being guided in the vertical movements thereof in any suitable manner—as, for instance, by means of guide-rods C, suitably fixed in the framework. A cord or other suitable flexible connection D is connected at one end to the carriage B, as will presently be more fully explained, said cord or flexible connection passing up to a guide pulley or sheave E, suitably journaled upon the framework, and thence leads down through a cylinder F and is connected to a plunger G. (Indicated by dotted lines in Fig. 2.) Mounted upon carriage B are contact-strips H J, suitably connected together and insulated from the carriage B, as most clearly shown in Fig. 7. Also mounted upon carriage B is another contact strip or wiper K, which is in electrical connection with the mass—that is, is not insulated from the carriage. Suitably mounted upon the frame A, but insulated therefrom, is a contact-strip L, in connection with which the wiper H operates. Said contact-strip L is in electrical connection, as will be more fully explained hereinafter, with the line wire or circuit of the particular subscriber in connection with which the apparatus is employed—that is, at the central station. A complete set of apparatus such as is now being described is employed for each subscriber to the system, each set including a carriage and the contact strips or wipers H, J, and K, as above explained, and each set of the apparatus is provided with a contact-strip L, which is in electrical connection with the line-wire of the particular subscriber corresponding to such set or apparatus. Also mounted in the frame is an insulating strip or board M, (see Fig. 5,) through which, but insulated from each other, is led a circuit-terminal for each subscriber to the entire system. These circuit-terminals are preferably arranged in groups, as indicated most clearly in the diagram Fig. 7, each group containing a number of vertical rows of said terminals. Contact strips or wipers J K are designed to operate over vertical rows of said circuit-terminals. The circuit-terminals over which the strips or wipers J K operate are in coöperating pairs—that is to say, when wiper or strip J is brought into proper relation with any particular terminal in any particular row the contact strip or wiper K will be brought into connection with the terminal which forms the other member of the pair of terminals for the particular subscriber being called, as will be more fully explained hereinafter.

We have referred above to the fact that long-step and short-step gravity-feed movements are imparted to the contact-carriage. Such movements are governed and controlled by ratchet mechanism in the manner set forth in our application above referred to and as shown in the accompanying drawings, wherein the carriage is releasably supported upon pins N, carried by a rock-shaft O, said rock-shaft being suitably mounted for longitudinal movements and also for rotative movement or oscillation. The longitudinal movements of said shaft are imparted step by step by a ratchet mechanism, (indicated at P, Fig. 3.) The particular construction of said ratchet mechanism is more fully explained and set forth in our pending application, Serial No. 41,133, filed December 26, 1900, said ratchet mechanism being actuated by an electromagnet Q. The carrier being supported upon the shaft O, it will be apparent that a step-by-step feed imparted to the shaft will also effect a corresponding step-by-step feed to the carrier. The long step-by-step feed movements of the carrier are permitted by rocking shaft O to cause the pins N thereon to be carried alternately out of and into engaging relation or position with respect to the carrier, thereby permitting the carrier to drop from one pin to another. The rock-shaft O may be held in initial or normal position in any suitable or convenient manner.

In the form shown a crank-arm R is mounted upon said shaft, and a spring or retractile S is connected to said arm, the tension of said spring operating to normally hold said shaft in one limit of its rocking movement.

In order to enable the contact strips or wipers J K to be brought into proper relation with respect to any particular or desired pair of vertical rows of circuit-terminals and also in order to desirably increase the range of the apparatus—that is, to increase the number of circuit connections which the apparatus may accommodate—we provide a lateral movement of the contacts. To accomplish this result, instead of mounting the contact strips or wipers H J K directly upon carrier B said contact strips or wipers are mounted upon a secondary carriage A′. This carriage is mounted to move laterally with respect to the line of travel of main carriage B and may be guided in such lateral movement in any suitable manner—as, for instance, by means of guide-rods B′, mounted in said main carriage B. The lateral movement of said secondary carriage when operated to effect a desired circuit connection may be imparted in any suitable or convenient manner. We have shown a simple arrangement for effecting the desired operation, including a rack C′, mounted on or forming part of the secondary carriage. With the teeth of this rack-bar is arranged to engage a ratchet-pawl D′, pivotally mounted upon a stud E′, mounted in the main carriage B. A spring F′ is arranged to impose a tension on said pawl D′ to maintain the same in a normal or retracted position. A lever G′, pivotally mounted upon main carrier B, is arranged to engage the secondary carriage A′, and a spring H′, connected to said lever G′, exerts the tension thereof in a direction to cause said lever G′ to bear upon the secondary carriage, normally tending to force it from its normal position and in a transverse or lateral direction. The pawl D′ serves to prevent the lateral movement of the carriage under the influence of spring H′ until said pawl D′ is rocked. Rocking movement is imparted to the pawl D′ from magnet J′ by means of an arm K′, connected to the armature-lever L′ of said magnet. The end of said arm K′ is arranged to project into engaging relation with respect to the end M′ of pivoted pawl D′ when the carriage B is in its extreme or retracted position. The arm K′ of said armature-lever L′ also effects the rocking movements of stop-shaft O by engaging the end N′ of a crank-arm mounted on said shaft O. The end of said crank-arm is provided with a notched or cut-away portion, as shown at O′, Fig. 3, and the projecting end M′ of pawl D′ is brought into register or alongside of the notched or cut-out portion O′ when the carrier B is in its normal or retracted position, so that the operating-arm K′ of armature-lever L′ when actuated with the parts in their normal or retracted position will effect a rocking of pawl D′ without effecting a rocking of stop-shaft O. The transverse or lateral feed-rack C′ is provided with teeth in sufficient number to enable or permit the desired transverse or lateral feed of the secondary carrier, so as to bring the contact strips or wipers J K into proper relation with any desired pair of vertical rows of circuit-terminals.

After a subscriber has operated or controlled the apparatus so as to effect a circuit connection with the line-wire of another subscriber it is desirable to restore the parts to normal or initial retracted position, and as a means for accomplishing the return of the parts we have referred to a plunger G, operating in a cylinder F and suitably connected by a cord or other connection D, operating over a pulley or sheave E. Therefore we provide suitable means for controlling the admission and exhaust of an operating medium to the cylinder F. Many specifically different constructions and arrangements of apparatus and devices for accomplishing this result may be employed. We have shown an arrangement (see particularly Fig. 6) of a valve mechanism comprising a plug Q′, having passages R′ and S′ therethrough. The passage S′ delivers into cylinder F at the top end thereof. The passage R′ connects at one end through a pipe T′ or otherwise with a suitable source of air-pressure or other operating medium, and at the other end said passage delivers, as at A^2, to the outer air. A valve B^2 controls the admission of the operating medium to the plug Q′. A valve C^2 controls the exhaust-opening A^2. The valves B^2 C^2 are suitably connected together, so that when the one is seated the other is unseated, and the passage S′, which delivers into the cylinder, is arranged intermediate the seats of valves B^2 C^2. Thus it will be seen that when valve B^2 is raised valve C^2 is closed, thereby opening the cylinder F to a source of operating medium, and when B^2 is seated valve C^2 is opened to permit exhaust from said cylinder F. The valve B^2 is normally held closed by gravity, the valve C^2 being open at the same time. A rod D^2 is suitably mounted in the main frame for rocking as well as longitudinal movement. A spring E^2 is arranged to oppose both the longitudinal and rocking movement of said rod. An arm F^2 of said rod is normally held and pressed toward or into engaging relation with respect to valve C^2. From this construction it will be seen that when rod D^2 is projected endwise a distance sufficient for arm F^2 to clear valve C^2 the rotative tension of spring E^2 will cause said arm F^2 to engage underneath said valve C^2, and when said rod D^2 is relieved of endwise projection the spring E^2 operates to return or restore said rod D^2, thereby raising valve C^2 and seating the same, at the same time opening valve B^2 to admit operating medium to the cylinder F. The endwise projection of rod D^2 is effected through the engagement therewith of an arm G^2 of the pivoted armature-lever H^2 of an electromagnet J^2, the circuit of which is con-

trollable from the subscriber's station in any suitable or convenient manner, as will be more fully explained hereinafter.

It is desirable that when the contact-carrier and its associated parts are restored to initial or normal position that the control-valve B^2 be again seated. This result may be accomplished in many different ways, and we have shown a simple arrangement wherein a rod or shaft having crank-arms K^2 L^2 is suitably journaled in a fixed part of the framework. The arm K^2 is arranged in the path of the end of arm F^2, as clearly shown in Fig. 2, and the arm L^2 is arranged in the path of a movable part of the carrier, so that when the carrier is in extreme or retracted position the arm L^2 is engaged to rock arm K^2 in a direction to engage the arm F^2 to release the same from supporting relation with respect to valve C^2. We employ as the engaging part of said carrier with the arm L^2 the projecting end M^2 of rack-bar C', carried by the secondary carriage, and consequently the supply of operating medium to the cylinder is not cut off until all the parts, including the laterally-movable secondary carriage, are restored to initial or primary position.

Reference-sign A^4 designates an electromagnet having a pivoted armature B^4, the movements of which control a switch included in the circuit of the magnet J^2, which magnet actuates the valve mechanism for controlling the supply and exhaust of operating medium to the cylinder F, as will be more fully explained hereinafter. We have shown in Fig. 9 a diagram of the circuits of a telephone at a subscriber's station and showing the coöperative arrangement of the parts and circuits thereof in connection with the operation and control of the mechanism above described, and we will now describe such arrangement and coöperative relation.

Reference-sign C^4 designates the receiver-hook; D^4, the transmitter; E^4, the receiver; F^4, a local battery; G^4, the call-bell or ringer; H^4, an induction-coil; J^4, the generator-shaft; K^4, the armature of the generator, and L^4 the calling-switches. Suppose the parts are in their normal position, with the weight of the receiver imposed upon hook C^4. Thereupon a circuit will be completed as follows: from binding-post M^4, through wire *a*, wire *b*, receiver-hook C^4, spring-contact *c*, wire *e*, wire *f*, call-bell G^4, wire *g*, wire *h* to terminal N^4. This completes the ringer-circuit, the two line-wires being respectively connected to the terminals M^4 and N^4, and hence the apparatus is in condition to receive a signal from a distant station. Now suppose the subscriber at the local station desired to effect an automatic circuit connection with the line-wire of another subscriber to the system. The calling-switches L^4 are manipulated to correspond with the desired number to be called. The manipulation of switches L^4 may be accomplished in any desired manner, so as to make and break successively contacts between the members T^4 and the contacts *a'*. This make and break may be accomplished by hand, if desired, or by causing each one of the parts T^4 of the switches to be displaced from normal position, so that in returning it will be brought into contact with its coöperating contact *a'* the desired number of times corresponding to the number to be called, as more fully explained in our pending application, Serial No. 41,134, filed December 26, 1900, and also in a companion application executed of even date herewith, filed June 3, 1901, and bearing Serial No. 62,877. When, as explained in said applications, the calling-switches L^4 are set in proper position for calling a particular number or subscriber, the receiver is raised from the hook C^4, thereby closing circuit between the contacts *k l* and hook C^4 and breaking contact between hook C^4 and contact *c*. The raising of the hook C^4 by the removal of the receiver therefrom also closes a circuit between contact-strips P^4 and Q^4 by means of an insulated bridging-strip R^4. This insulated bridging-strip R^4, as indicated diagrammatically in Fig. 9, may be arranged to be moved coincidently with the hook C^4 only when said hook approaches the limits of its up and down movements, the conducting-strips P^4 Q^4 being arranged adjacent thereto, as more fully explained in the pending application above referred to, Serial No. 62,877. Thereupon circuit is completed as follows: from a line-wire *m*, which is in the circuit of the battery at the central station, to contact-strip P^4, bridging-strip R^4, contact-strip Q^4, wire *n* to contact-bar S^4, which is in electrical connection with the mass of the calling-switches L^4. Each of the calling-switches L^4 comprises a make-and-break device, one of the parts of which, as indicated at T^4, is in electrical connection with the mass and the conductor-bar S^4 and the other of which includes a contact *a'*. The calling-switch L^4 on the right side will be the first one to actuate thereupon, making and breaking circuit between the part T^4 and the part *a'* a number of times corresponding to the number to which the calling-switch has been set, thereby sending electrical impulses corresponding in number to the number of makes and breaks over the following circuit: from the conductor-bar S^4 or mass of the calling mechanism through part T^4, contact *a'*, wire *b'*, wire *c'*, contact *k*, hook C^4, wire *b*, wire *a*, to binding-post M^4, thence over the line-wire to the central station. Referring now to the diagram of Fig. 7, the electrical impulses arrive at the central-station apparatus over line-wire *d'*, wire *e'*, magnet J', wire *f'*, to battery strip or conductor A^5, thence to the main battery B^5 at the central station, the wire *m* being connected to the other pole of said battery, thus completing the circuit. The successive energizations of magnet J' effect an actuation of the armature-lever L' of said magnet and the consequent actuation of pawl D', thereby permitting the lateral feed of the secondary car-

riageA′ upon main carriage B, as above explained, said secondary carriage being advanced or fed laterally as many steps as breaks have occurred in the call-switch L^4, and the number of breaks occurring in said call-switch will depend upon the position to which said switch is moved or actuated by the subscriber making the call.

We will now describe the circuit and operation controlled by the second or intermediate calling-switch L^4, which, as will be understood, operates in the same manner as above described to make and break a circuit, the number of makes and breaks corresponding to the position to which said calling-switch is actuated by the subscriber in making a call. Circuit is completed from the main central-station battery B^5 through line-wire m and the same circuit as above traced to the contact-bar S^4 or mass, by which is meant and included the framework of the apparatus, thence through device T^4 and contact a' of the second call-switch, wire g', wire h', wire h, terminal N^4, wire k', to the central station, contact-spring l', contact-spring m', wire n', wire r', contact-spring a^2, contact-spring b^2, wire c^3, the windings of electromagnet Q, wire d^2, to battery return-strip A^5, to battery B^5. The resulting successive energizations of magnet Q effect actuations of the pivoted armature-lever C^5, through which is controlled the ratchet mechanism P for imparting the short-step feed movements to supporting rock-shaft O. This short-step feed-ratchet mechanism consists of a rack or ratchet-teeth P, (see Fig. 3,) formed on or carried by the supporting-shaft O and with which coöperates a pivoted pawl, said pivoted pawl being actuated by the electromagnet Q, as above explained, and when this ratchet mechanism is operated a longitudinal gravity-feed movement is imparted or permitted to shaft O. This ratchet mechanism, however, is more fully shown, described, and explained in our applications, Serial No. 37,717, filed November 26, 1900, and Serial No. 41,133, filed December 26, 1900, and is therefore only indicated in the present case. The number of short-step feed movements thus imparted to the contact-supporting rock-shaft O is determined by the number of energizations of magnet Q, and consequently by the number of makes and breaks effected by the intermediate call-switch L^4 at the station of the subscriber making the call, and consequently is controlled by the position to which said calling-switch is actuated, as will be clearly understood. The actuation of the next intermediate switch L^4, which has been displaced by the subscriber making the call, completes a circuit from battery B^5 to conductor-bar S^4, the same as before, and the mass, through the corresponding part T^4 and contact a', through wire e^2 to wire c', and thence on through the same course as above described to binding-post M^4, line-wire d', magnet J′, wire f', and return conductor or strip A^5 to battery B^5, the same as before, thereby again successively energizing magnet J′ as many times as there were makes and breaks of the corresponding controlling call-switch L^4. The second set or series of energizations of said magnet J′ through the lever-armature L′ thereof effects the axial rocking of supporting stop-shaft O through the engagement of said armature-lever with arm N′, as above explained.

From the above description it will be seen that the magnet J′ is successively energized to impart the lateral feed-steps to the secondary carriage, and also said magnet is again successively energized to impart rocking movement to stop-shaft O; but intermediate these steps or operations or successive energizations of magnet J′ the magnet Q has been energized to impart the short-step longitudinal feed to stop-shaft O, and the initial short-step feed movement of said shaft permits said shaft to descend a distance sufficient for the carriage B, mounted thereon, to be lowered, so as to permit the arm K′ of armature-lever L′ to clear the end of pawl D′ and also to carry the notch O′ of arm N′ of stop-shaft O beyond the path of the arm K′ of said magnet armature-lever L′. Consequently the second series of energizations of magnet J′, and consequently actuations of armature-lever L′, effects the axial displacements of stop-shaft O through the engagement of arm K′ with the arm N′ on said stop-shaft, and the axial or rotative displacements of said stop-shaft O are against the action of spring S and serve to move the stops N into and out of engaging or supporting relation with respect to the carrier B, thereby permitting said carrier to drop or move by gravity to effect the long-step feed movements thereof, thus completing the desired circuit connection of the line-wire of the subscriber making the call with the circuit-terminals of the desired subscriber being called through the contact-strips H, J, and K, said contact-strips being brought into the desired relation with respect to the circuit-terminals of the particular subscriber being called by the lateral short-step and long-step feed movements imparted thereto in the manner above set forth. The next step is to effect a call or a signal from the calling-station to the station of the subscriber being called. This is effected through the following circuit: The subscriber making the call then operates the calling-generator by rotating shaft J^4 and moving said shaft into electrical contact with a contact strip or plate f^2. Thereupon the generating-current traverses the following circuit: from armature K^4 or mass to shaft J^4, contact f^2, wire g^2, contact-strips h^2, and coöperating contact-strips k^2, wire c', contacts k, hook C^4, wire b, wire a, terminal M^4, and line-wire d'. Arriving at the central station over line-wire d', the circuit proceeds through contact-strip l^2 and contact m^2 and to the mass, and then to contact-strip K, which is also connected to the mass, as indicated by

dotted line n^2, thence to the circuit-terminal of the desired subscriber into contact with which said contact-strip K has been brought by the feed movements above described of carrier B, thence through wire p^2 to wire q^2, thence through wire r^2 to the mass of the apparatus at the central station corresponding to the number called or to the subscriber being called, thence through the mass of the apparatus, as indicated by dotted lines t^2, to contact-strip a^3, contact-strip b^3, the line-wire c^3 of the subscriber being called. The current then proceeds over the line-wire of the called subscriber to the station of the called subscriber. Suppose now the diagram in Fig. 9 to represent the arrangement of apparatus at the called station, the line-wire c^3, above mentioned, will correspond to the wire d'. Thence the current proceeds through binding-post M^4, wire a, wire b, hook C^4, contact c, wire e, wire f, the call-bell G^4, wire g, wire h, terminal N^4, wire k'. Now referring back to Fig. 7, wherein reference-sign d^3 designates the second line-wire of the called station corresponding to the line-wire k', above mentioned, the circuit proceeds from line-wire d^3, contact e^3, contact f^3, wire g^3, wire h^3, contact k^3, contact 13, wire m^3, to wire n^3, thence through wire p^3 to circuit-terminal, over which contact wiper or strip J has been brought by the subscriber making the call, thence through contact-strip H, contact-strip L, wire q^3, contact r^3, contact t^3, wire n', contact m', contact l', wire k', thence over the calling-subscriber's line-wire to binding-post N^4, wire h, wire g, ringer G^4 of the calling-station, wire f, wire a^4, back to the armature K^4, thus completing the calling-circuit. The actuation of the generator J^4 in making a call or signal breaks circuit between contact-strips b^4 and c^4, the circuit between said contacts being completed by the conductor-strip d^4, insulated on the generator-shaft J^4. At the same time a circuit is also broken between generator-shaft J^4 and a contact-strip e^4. The breaking of circuit in making a call between contact-strips b^4 and c^4 cuts out the local receiver, and the breaking of the circuit between the generator-shaft J^4 and contact-strip e^4 breaks the shunt-circuit of the generator.

We have now described the connections and operations for making and completing a call from one subscriber to another subscriber to the system, and the apparatus is now in condition for talking. We will therefore now describe the talking-circuit. From the local battery F^4 circuit is completed through transmitter D^4, wire f^4, contact l, hook C^4, wire b, through the primary windings of induction-coil H^4, wire g^4, back to local battery F^4. The derived circuit may be traced as follows: from one terminal of the secondary of the induction-coil through wire h^4, receiver E^4, wire k^4, contact-strip c^4, insulated plate d^4, contact-strip b^4, wire g^2, contact-strips h^2 k^2, wire c', strip k, hook C^4, wire b, wire a, terminal M^4, line-wire d', arriving at the central station over line-wire d', contact-strip l^2, contact m^2, the mass, as indicated by dotted line n^2, to contact K, the circuit-terminal contacting therewith, wire p^2, wire q^2, to the automatic apparatus at the central station of the called subscriber through wire r^2, the mass, as indicated by the dotted line t^2, contact a^3, contact b^3, the line-wire c^3 of the called subscriber. Now, supposing the diagram in Fig. 9 to represent the circuit arrangement of the subscriber being called, the talking-circuit, above described as continuing from the central station over the line-wire c^3 of the called subscriber, arrives at the instrument of the called subscriber over line d', terminal M^4, wire a, wire b, hook C^4. By this time the called subscriber has removed his receiver from the hook C^4. Therefore the talking-circuit proceeds from hook C^4, contact k, wire c', contact-strips k^2 h^2, wire g^2, contact b^4, insulated conductor-strip d^4, contact-strip c^4, wire k^4, the receiver E^4 of the called subscriber, wire h^4, through the secondary winding of the induction-coil H^4 to terminal N^4, line-wire k', thence back through the central station through line d^3, Fig. 7, contact e^3, contact f^3, wire g^3, wire h^3, contact k^3, contact l^3, wire m^3, wire n^3, wire p^3 to the circuit-terminal controlled by contact-strip J, to said contact-strip, to contact-strip H, strip L, wire q^3, contact r^3, contact t^3, wire n', contact m', contact l', wire k', thence (referring to Fig. 9) back to the calling subscriber's station over wire k', terminal N^4 to the other terminal of the secondary winding, thus completing the talking-circuit.

Now suppose a subscriber attempts to make a circuit connection with the line-wire of another subscriber which is already "busy." Our invention, as above indicated, contemplates and includes means for automatically restoring the parts of the apparatus controlled by the subscriber attempting to make the call to their initial position without disturbing the circuit connections of the busy line and without breaking in on such line. This result is controlled by the electromagnet A^4, above referred to, in the following manner: The extreme left-hand call-switch L^4 comprises a single contact which completes a circuit when all of the other calling-switches after being displaced are restored to their initial positions. This single contact we have designated by reference-sign a^6 and a coöperating part b^6, and through said contacts or parts a^6 b^6 is completed a circuit as follows: from the main battery B^5 at central station through line m, contact-strips P^4 R^4 Q^4, wire n, to contact-bar S^4, or mass b^6 a^6, wire h', wire h, binding-post N^4, wire k'. Now referring to Fig. 7, the circuit enters the central-station apparatus by wire k', to contact-strip l', contact-strip m', wire n', wire r', contact a^2, wire b^2, wire c^2, magnet Q, wire d^2, back to battery B^5, thereby effecting an energization of magnet Q and a consequent actuation of its armature-lever C^5. The circuit

thus traced is opened automatically when the carrier is restored to its initial position by the engagement of the carriage with arm K², thereby rocking the arm L², and hence opening the circuit between contact-strips a^2 b^2, as most clearly shown in Fig. 1. The armature-lever C^5 is hinged or pivoted upon a rod A^{15}, upon which rod said armature-lever may slide vertically. The armature-lever is arranged to rest upon the free end of arm A^6, said arm A^6 being pivoted, as at B^6. A spring C^6 is connected to arm A^6 and exerts a tension upon said rod A^6 in a direction to hold the free end of said rod A^6 normally elevated or raised, thereby normally holding the armature-lever C^5 in raised position upon its pivot-rod A^{15} and to bring an arm D^6, connected to said armature-lever, into position when magnet Q is energized to close circuit between said arm D^6, which is in electrical connection with the mass, as indicated by the dotted line n^2 in Fig. 7, and a contact-strip c^6 and also to close circuit between two contact-strips d^6 and f^6. Connected to or forming part of arm A^6 is a depending portion E^6, arranged in the path of the carrier B, so that when said carrier is in its extreme retracted or initial position, said carriage will engage the extension E^6 and rock or swing arm A^6 down about its pivot B^6. This movement lowers the end of said lever A^6, upon which rests armature C^5 and its connected arm D^6, and hence permits said arm D^6 to be dropped down or lowered, so as to be permitted to rock or swing whenever magnet Q is energized without effecting contact between the strips f^6 and d^6 and between said arm D^6 and contact c^6. As soon, however, as the carrier has been dropped or actuated into the desired position to effect the circuit-connection said carrier clears the end of extension E^6 and permits spring C^6 to rock arm A^6 about its pivot and to raise arm D^6 into position, so that when actuated it will close the circuits between said arm and contact c^6 and also between contacts f^6 and d^6. The closing of circuit between these contacts completes the following circuit: from local battery at the central station A^7 through wire a^7, contact-strip d^6, contact-strip f^6, wire q^3, strip L, wiper H, wiper J, the contact with which wiper J is in contact, wire p^3, wire n^3, wire m^3, contact l^3, contact k^3, wire h^3 g^3 f^3 e^3 d^3. Now referring to Fig. 9 and assuming said Fig. 9 to illustrate the apparatus at the station of the called subscriber, the circuit enters over line k to binding-post N^4, through the secondary winding of the induction-coil H^4, wire h^4, the receiver E^4, wire k^4, contact c^4, plate d^4, contact b^4, wire g^2, contacts h^2 k^2, wire c', contact k, hook C^4, wire b, wire a, terminal M^4, wire d'. Now, again referring to Fig. 7, said circuit enters the apparatus at the central station through wire c^3, contact b^3, contact a^3, the mass as indicated by dotted line t^2, thence through wire r^2, wire q^2, wire p^2, the circuit-terminal, contact-wiper K, the mass as indicated by dotted line n^2, to lever C^5, contact c^6, wire f^6, the windings of electromagnet A^4, wire g^6, wire h^6, back to local battery A^7. The actuation of this magnet A^4 attracts the armature-lever B^4 thereof and completes the following circuit: from main battery B^5, wire m, wire k^6, wire l^6, armature B^4, wire m^6, wire n^6, the release-magnet J^2, to wire or return conductor A^5, to battery B^5. The actuation of this release-magnet J^2 operates the valve mechanism which controls the supply and exhaust from cylinder F, as above explained. Thus it will be seen that the circuit above traced of magnet A^4 is the same as the talking or ringing circuit of the instrument being called—that is, if the line being called is a busy line this circuit will be a talking-circuit, and if such line is not busy it will be the ringing-circuit. In the ringing-circuit, however, the resistance of the bell very largely exceeds the resistance of the talking-circuit. Consequently although the circuit of the magnet A^4 is completed in both cases the resistance is so much larger in the one case than the other that the magnet in the one case is not energized sufficiently to actuate the armature thereof, whereas in the other case—that is, when circuit connection is made with a talking-circuit—the resistance in the circuit of magnet A^4 is reduced sufficiently to effect an actuation of the armature thereof and the consequent closing of the circuit of the release-magnet J^2, thereby effecting a restoration of the parts to their normal or initial position automatically. It will be seen that this automatic restoration of the parts occurs whenever the receiver of the called subscriber has been removed from its hook and said hook has been raised to its upper limit of movement and whether the receiver has been removed from its hook as a result of a call from a third party or the result of calling a third party, because when the receiver is upon its hook circuit between the hook and contact k is broken and when the receiver is removed from the hook and the hook is raised circuit between contact k and the hook is completed.

We have now described the operation in making a call and in completing the talking-circuit. We have also described how the parts are returned or restored in case the called line is found to be busy. We will now suppose that the line is not busy and the desired circuit connection is completed and the message or communication is effected. It remains to be described how the parts in such circumstances are returned to initial or normal position after the parties have completed their communication. The receiver at the calling-station is replaced upon its hook C^4, thereby rocking said hook under the weight of the receiver, thereby breaking contact between contacts k and l with the receiver-hook C^4, and again completing circuit between contact-strip c and hook C^4. The rocking movement of receiver-hook C^4 into downward position does not break circuit between strips

Q^4 and P^4 until the hook C^4 approaches the extreme downward limit of its movement, the hook being permitted a considerable range of movement toward its downward limit before the bridging contact-strip R^4 is moved, as above explained and as is explained more fully in our companion application executed of even date herewith, Serial No. 62,877, and during such downward movement said hook remains in contact with contact-strip Q^4 and an auxiliary or additional contact-strip Q^7. Thus the circuit of the two line-wires d' and k' from the main battery B^5 is as follows: through wire m, contact P^4, contact R^4, contact-strip Q^4, hook C^4, wire b, wire a, binding-post M^4, and line d', and also from hook C^4 through contact-strip Q^7, wire a^9, wire g, wire h, binding-post N^4, and line-wire k'. We will now follow the circuit of line-wire d' from Fig. 9 to Fig. 7. The current enters the central station over line-wire d', wire e', magnet J', wire f', battery-strip A^5, to battery B^5. The other circuit from binding-post N^4, Fig. 9, continues through link k' to the central station, arriving over line k', continues through strip 1', contact m^9, wire n^6, and release-magnet J^2, battery-strip A^5, to battery B^5. It will be observed that both these lines or circuits are closed coincidently, or at the same time, and the resulting energization of magnet J' by the rocking movement of armature L' effects the closing of contact-strip l' upon contact-strip m^9 and the breaking of circuit between strip m^2 and contact l^2, thus completing the circuit of the release-magnet J^2, the energization of which attracts the armature H^2 thereof, and consequently depresses rod D^2 against the action of spring E^2 to permit the arm F^2 to be carried into position to engage underneath valve C^2. Now when the receiver-hook is completely down circuit between strip P^4 and Q^4 is broken by the strip R^4, which bridges the space between said strips P^4 Q^4, being withdrawn from coincident contacting relation with respect to said strips, thereby breaking the circuit of the release-magnet J^2, whereupon the spring E^2 will raise rod D^2, and the arm F^2, engaging underneath valve C^2, raises said valve into closed or seated position and at the same time raises valve B^2 and opening the cylinder F to the source of fluid or power supply, and hence returning the carrier B through the actuation of the piston in cylinder F. Instead of connecting the cord or flexible connection D directly to carriage B said cord operates over a pulley or wheel D^9 (see Fig. 2) and is thence led transversely of said carriage and connected to the secondary carriage A'. As the main carrier B proceeds upon its return movement the pivoted pawl E^9 upon said carrrier permits the pins N on stop-shaft O to run therepast, said pawl coöperating with a fixed stop F^6 to form alternating stops or supports for the carrier in effecting the long-step feed movements thereof. When the carrier B approaches its extreme or initial position, said carrier engages a shoulder G^9 upon stop-shaft O in case said shaft has been longitudinally displaced under the influence of the short-step release-feed and raises said shaft longitudinally, thereby restoring the same to its initial position. The added weight of the shaft O and its associated parts introduces friction which will permit the operating-cord to return the secondary carriage, in case said carriage has been operated, to its initial position, or in case the added weight of shaft O is not sufficient then the continued pull on the carrier operating-cord when said shaft and carrier finally reach their initial positions and are stopped will effect positively and certainly the return of the secondary carriage. Thus the parts are returned to normal or initial position ready for the next cycle of operations. The return of the secondary carriage to its initial position causes the part M^2 thereof to engage the arm L^2, thereby rocking arm K^2 in a direction to carry arm F^2 out of engaging relation with respect to valve C^2, and hence permitting said valve to drop into open position, as shown in Fig. 6, thereby seating or closing valve B^2 and opening cylinder F to exhaust.

It is obvious that many variations and changes in the details of construction and arrangement would readily occur to persons skilled in the art and still fall within the spirit and scope of our invention. We do not desire, therefore, to be limited or restricted to the exact details shown and described; but,

Having now set forth the object and nature of our invention and a construction embodying the principles thereof and having explained such construction, its purpose, function, and mode of operation, what we claim as new and useful and of our own invention, and desire to secure by Letters Patent of the United States, is—

1. In an automatic telephone apparatus, a contact for completing circuit between a subscriber's line and the lines of the other subscribers in the system, said contact arranged to be moved by gravity in one direction vertically, a ratchet mechanism for moving said contact laterally with respect to the line of gravity movement thereof, and automatic means for restoring all of the parts to initial position, as and for the purpose set forth.

2. In an automatic telephone apparatus, a contact for completing circuit between a subscriber's line and the lines of the other subscribers in the system, said contact arranged to be moved by gravity in one direction vertically, ratchet mechanism for moving said contact laterally with respect to the line of gravity movement thereof, and automatic power-actuated means for returning said contact to initial position, as and for the purpose set forth.

3. In an automatic telephone apparatus, a main carriage, a secondary carriage mounted thereon, a contact for completing circuit be-

tween a subscriber's line and the lines of the other subscribers in the system, said contact being mounted on said secondary carriage, said main carriage being actuated by gravity in one direction vertically, means for moving said contact secondary carriage laterally with respect to the line of gravity movement of said main carriage, power-actuated devices for positively restoring said contact to initial position, and means for automatically controlling said power-actuated devices, as and for the purpose set forth.

4. In an automatic telephone apparatus, a gravity-actuated main carriage, a secondary carriage mounted thereon and carrying a contact for completing circuit between a subscriber's line and the lines of the other subscribers in the system, in combination with means for feeding said secondary carriage laterally with respect to the line of gravity movement of said main carriage, power-actuated devices for returning said secondary carriage and said main carriage after being displaced, to initial position, and means for controlling the gravity and lateral feed movements and said power-actuated devices from the subscriber's station, as and for the purpose set forth.

5. In an automatic telephone apparatus, a contact for completing circuit between a subscriber's line and the lines of the other subscribers in the system, said contact being gravity-actuated in one direction vertically, a ratchet mechanism for moving said contact laterally with respect to the line of its gravity movement, electrical devices for controlling the gravity and lateral feed movements of said contact, and means for controlling the circuits of said electrical devices, as and for the purpose set forth.

6. In an automatic telephone apparatus, a contact gravity-actuated in one direction vertically for completing circuit between a subscriber's line and the lines of the other subscribers in the system, a ratchet mechanism for moving said contact laterally with respect to the line of gravity movement thereof, electrical devices for controlling the gravity-feed, and electrical devices for imparting the lateral feed movements of said contact, and power-actuated devices for restoring said contact to initial position, as and for the purpose set forth.

7. In an automatic telephone apparatus, a movable main carriage, and a secondary carriage mounted thereon and carrying a contact for completing circuit between a subscriber's line and the lines of the other subscribers in the system, means for imparting to said main carriage long-step feed movements to carry the same through definite distances, means for imparting to said main carriage short-step feed movements, and means for imparting to said secondary carriage lateral feed movements, and means for controlling said several means, as and for the purpose set forth.

8. In an automatic telephone apparatus, a terminal board containing the circuit-terminals of the line-wires of the subscribers to the system, a contact operating over said terminal board, a main carriage, a secondary carriage mounted thereon, and upon which said contact is mounted, means for moving said main carriage through long-step movements to carry said contact over definite groups of said terminals, means for moving said main carriage through short-step movements to bring the same into circuit connection with any particular terminal of a group, and means for moving said secondary carriage laterally with respect to the line of long and short feed movements thereof, as and for the purpose set forth.

9. In an automatic telephone apparatus, a terminal board containing circuit-terminals of the line-wires of the subscribers in the system, a gravity-actuated main carriage, a secondary carriage mounted thereon and carrying a contact adapted to operate over said terminal board, means for controlling the gravity movements of said main carriage, and means for moving said secondary carriage laterally step by step with respect to the gravity movements of said main carriage, and means for restoring the parts to initial position, as and for the purpose set forth.

10. In an automatic telephone apparatus, a terminal board containing the circuit-terminals of the line-wires of the subscribers to the system, a contact operating over said terminal board, a carrier having transverse guides, a secondary carriage mounted on said carrier and arranged for movement along said transverse guides, said carriage carrying said contact, a gravity-feed for said carrier, and means for moving said secondary carriage upon and transverse to the line of gravity-feed of said carrier and along said guides, as and for the purpose set forth.

11. In an automatic telephone apparatus, a terminal board containing the terminals of the line-wires of the subscribers to the system, a contact operating over said board, said contact arranged to be moved by gravity over said board, means for moving said contact laterally with respect to the gravity movement of said contact to complete circuit between the subscriber's line and any desired circuit-terminal, a movable fluid-actuated plunger, and connections between said plunger and contact for restoring the same to initial position, as and for the purpose set forth.

12. In an automatic telephone apparatus, a terminal board, a contact arranged to be moved by gravity over said board, means for moving said contact laterally with respect to the gravity movement of said contact to complete circuit between the subscriber's line and any desired circuit-terminal, a movable fluid-actuated plunger connected to said contact for restoring the same to initial position, and means for controlling the action of said plunger, as and for the purpose set forth.

13. In an automatic telephone apparatus, a

terminal board, a contact operating thereover, a series of movable stops, means for moving said stops into and out of supporting relation with respect to said contact, whereby said contact may be moved by gravity with reference to said terminal board, and means for moving said contact laterally with respect to said gravity movement, as and for the purpose set forth.

14. In an apparatus of the class described, a carrier having transverse guides, a secondary carriage movably mounted on said carrier for movement along said guides and carrying a contact, means for actuating said secondary carriage to move the same along the guides upon said carrier, and a gravity-feed for said carrier, as and for the purpose set forth.

15. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier, a support for said carrier, means for moving said support to feed said carrier, a secondary carriage mounted on said carrier for movement thereon, means for imparting a step-by-step feed movement to said secondary carriage upon and with respect to said carrier, said contact being mounted on said secondary carriage, as and for the purpose set forth.

16. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier, a support for said carrier, means for releasing said support to permit of gravity movement thereof, a secondary carriage mounted upon said carrier and carrying said contact, and means for moving said secondary carriage laterally with respect to the line of gravity movement of said support, as and for the purpose set forth.

17. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier, a support for said carrier, means for detaching said support from said carrier to permit of a gravity-feed of said carrier, a secondary carriage mounted on said carrier, and means for moving said secondary carriage laterally with respect to the gravity movement of said carrier, as and for the purpose set forth.

18. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier, a series of movable stops, means for moving said stops into and out of supporting relation with respect to said carrier, whereby said carrier may be moved by gravity with reference to said terminal board, a secondary carriage mounted upon said carrier and carrying said contact, and means for moving said secondary carriage laterally with respect to the line of gravity-feed of said carrier, as and for the purpose set forth.

19. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier, a series of movable stops arranged to be brought into or moved out of supporting relation with respect to said carrier, whereby said carrier is permitted to move by gravity with reference to said terminal board, a secondary carriage mounted upon said carrier and carrying said contact, means for moving said secondary carriage laterally with respect to the gravity-feed of said carrier, and means for restoring said parts to initial position, as and for the purpose set forth.

20. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a shaft having arms projecting therefrom, and means for rocking said shaft to move said arms into and out of supporting relation with respect to said contact, and means for moving said contact laterally, all combined and arranged as and for the purpose set forth.

21. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier, a secondary carriage mounted upon said carrier and carrying said contact, means for moving said secondary carriage relatively to said carrier, a shaft having arms projecting therefrom arranged to form a support for said carrier, and means for rocking said shaft to move said arms into and out of supporting relation with respect to said carrier, as and for the purpose set forth.

22. In an automatic telephone apparatus, a terminal board, a contact arranged to operate thereover, a carrier, a secondary carriage mounted thereon for lateral movement relatively thereto, a shaft having suitably-spaced projecting arms arranged to form supports for said carrier, and means for rocking said shaft to move said arms into and out of supporting relation with respect to said contact, as and for the purpose set forth.

23. In an automatic telephone apparatus, a terminal board, a contact operating thereover, means for effecting long-step feed movements of said contact through definite distances of the length of said board, and including a support for said contact, said support having suitably-spaced stops, and means for displacing said supporting-stops to permit of gravity-feed movements through long steps of said contact, an auxiliary step-by-step feed mechanism for effecting the movement of said contact through intermediate short distances, and means for moving said contact laterally with respect to said board, as and for the purpose set forth.

24. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier, a secondary carriage mounted thereon and carrying said contact, a support for said carrier, means for moving said support, means for releasing said carrier from said support, and means for moving said secondary carriage independently of said carrier, as and for the purpose set forth.

25. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier, a secondary carriage mounted thereon for movement relatively thereto and carrying said contact, means for moving said carrier through definite distances of the

length of said board, and an auxiliary step-by-step feed mechanism for effecting the movement of said carrier through intermediate steps, as and for the purpose set forth.

26. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier, a secondary carriage mounted upon said carrier, means for moving said secondary carriage relatively to said carrier, a support for said carrier, means for releasing said support to permit of gravity movement thereof, and means for releasing said carrier from said support to permit of additional gravity movements of said carrier independently of said support, as and for the purpose set forth.

27. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a gravity-actuated carrier, a secondary carriage mounted thereon and carrying said contact, means for moving said secondary carriage laterally with respect to said carrier, a support for said carrier, means for releasing said support from said carrier to permit said carrier to move under the influence of gravity, and a step-by-step release for said support, and means for returning said parts to initial position, as and for the purpose set forth.

28. In an automatic telephone apparatus, a gravity-actuated contact, a shaft having supporting-arms for said contact, means for rocking said shaft, means for releasing said shaft for step-by-step feed movements, means for moving said contact laterally with respect to said shaft, and means for restoring the parts to initial position, as and for the purpose set forth.

29. In an automatic telephone apparatus, a contact gravity-actuated in one direction, a plunger for returning said carrier to initial position, a cylinder in which said plunger operates, a valve for controlling the admission of operating medium to said cylinder, and means actuated by the return of said contact to initial position for closing said valve and opening said cylinder to exhaust, as and for the purpose set forth.

30. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier having lateral supporting-rods, a secondary carriage mounted on said rods for movement laterally with respect to said carrier, a supporting-shaft for said carrier having suitably-spaced supporting-pins, means for rocking said shaft to alternately move said pins into and out of supporting relation with respect to said carrier, and means for restoring the parts to initial position, as and for the purpose set forth.

31. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier, gravity-actuated in one direction of its feed movement, a support for said carrier, means for displacing said support to release said carrier, a carriage mounted on said carrier and carrying said contact, means for imparting lateral feed movement to said carriage with reference to the line of gravity-feed of said carrier, and means for restoring said parts to initial position, including a plunger, a cord connected at one end to said plunger and at the other end to said secondary carriage, as and for the purpose set forth.

32. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier having a guide, said carrier being gravity-actuated in one direction, a support therefor, means for displacing said support to release said carrier, a secondary carriage mounted on said carrier for lateral movement with respect to the line of gravity-feed thereof, and means for restoring said parts to initial position, including a plunger, connections between said plunger operating over said guide and connected to said secondary carriage, as and for the purpose set forth.

33. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier having a guide, a support for said carrier, means for displacing said support to release said carrier, a secondary carriage mounted on said carrier, means for imparting a feed movement to said secondary carriage upon and with reference to said carrier, said carrier being gravity-actuated in one direction, and means for returning said parts to initial position, including a plunger, and a cord connected at one end to said plunger and passing over the guide on said carrier and connected at the other end to said secondary carriage, as and for the purpose set forth.

34. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carriage upon which said contact is mounted, a carrier carrying said carriage, a rock-shaft supporting said carrier, a ratchet mechanism for moving said carriage relatively to said carrier and including a pivoted pawl, an arm connected to said rock-shaft for rocking the same, and a magnet for actuating said arm and pawl, as and for the purpose set forth.

35. In an automatic telephone apparatus, a terminal board, a contact operating thereover, a carrier, a secondary carriage mounted thereon and carrying said contact, means normally operating to move said secondary carriage laterally upon and with reference to said carrier, a ratchet mechanism for opposing said operating means, means for releasing said ratchet mechanism step by step, and means for moving said carrier, as and for the purpose set forth.

36. In an automatic telephone apparatus, a terminal board, a contact operating thereover, said contact being gravity-actuated in one direction, means for moving said contact laterally with respect to the gravity-feed thereof, means for restoring said parts to initial position, including a cylinder, a plug communicating with said cylinder, with the outer air, and with a source of operating medium,

valves respectively arranged to alternately close and open said connections to the source of power and the outer air, a spring-actuated arm for moving said valves, and a magnet for controlling said spring-actuated arm, as and for the purpose set forth.

37. In an automatic telephone apparatus, a terminal board, a contact operating thereover, means for moving said contact into position to effect the desired circuit connection, means operating when released to restore said contact to initial position, and means for automatically releasing said restoring means so as to effect the return of said contact to initial position in case the circuit to be called is already closed, as and for the purpose set forth.

38. In an automatic telephone apparatus, a terminal board containing the circuit-terminals of the line-wires of the subscribers to the system, a contact operating over said board, means for automatically moving said contact into the desired position to effect circuit connections with the line-wire terminals of any subscriber to the system, means for automatically restoring said contact to initial position and means for bringing said automatic restoring means into operation automatically in case the line-wire of the subscriber being called is busy, as and for the purpose set forth.

39. In an automatic telephone apparatus, a terminal board containing the circuit-terminals of the line-wires of the subscribers to the system, a contact operating thereover, means for moving said contact into position to make circuit connections with the line-wire of any desired subscriber, power-actuated mechanism for returning said contact to initial position, and means for automatically actuating said power mechanism in case the line-wire of the particular subscriber being called is busy, as and for the purpose set forth.

40. In an automatic telephone apparatus, a terminal board, a contact operating thereover, means for moving said contact into position to make circuit connections with any desired subscriber to the system, power-actuated devices for restoring said contact to initial position, a magnet for controlling said power-actuated devices, and means, operated automatically when the line-wire of the subscriber being called is busy, for closing the circuit of said magnet, as and for the purpose set forth.

41. In an apparatus of the class described, a terminal board, a contact operating thereover, means for moving said contact into position to complete the circuit of the line-wire of any subscriber to the system, said circuit being a calling or ringing and a talking circuit, switches arranged at the station of the subscriber being called for changing said circuit from a ringing to a calling circuit, power mechanism for restoring said contact to initial position, a magnet for controlling said power mechanism, said magnet being also included in the circuit closed by said contact, whereby when said circuit is a talking-circuit said magnet is energized to actuate said power mechanism to restore the parts to normal or initial position, as and for the purpose set forth.

42. In an automatic telephone apparatus, a terminal board, a contact operating thereover, means for moving said contact into position to make circuit connections with the line-wire of any subscriber to the system, power mechanism for restoring said contact to initial position, switches arranged at the station being called for controlling said circuit, said switches operating when the called station is not in use to close a ringing-circuit, and when said apparatus is in use, to close a talking-circuit, electrical devices also arranged in said circuit to operate only when said circuit is a talking-circuit, said electrical devices operating to automatically control said power mechanism to restore said contact to initial position, as and for the purpose set forth.

In witness whereof we have hereunto set our hands, this 24th day of May, 1901, in the presence of the subscribing witnesses.

JOHN J. BROWNRIGG.
JOHN K. NORSTROM.

Witnesses:
E. C. SEMPLE,
S. E. DARBY.