

No. 738,156.

PATENTED SEPT. 8, 1903.

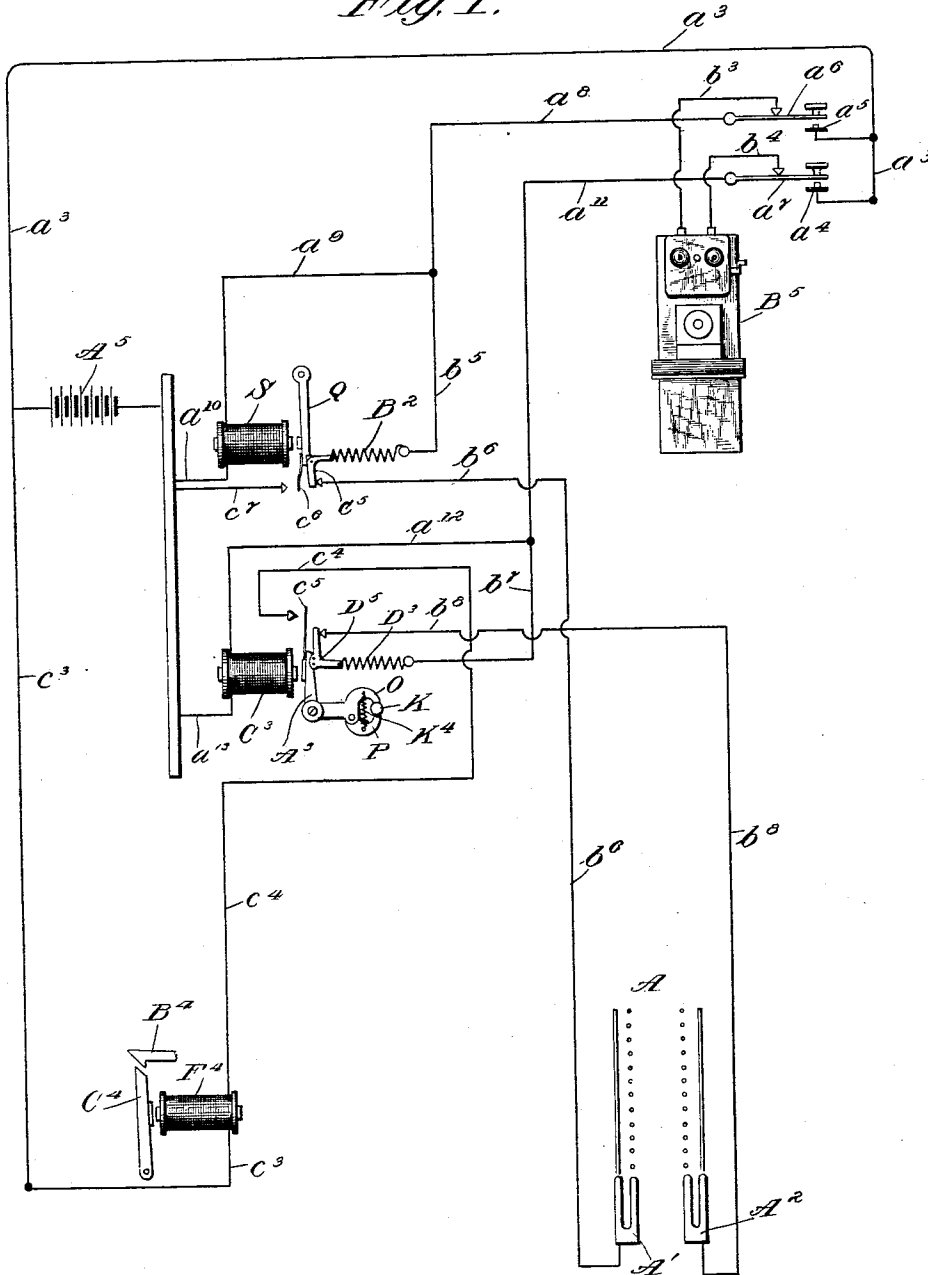
J. J. BROWNRIGG & J. K. NORSTROM.
AUTOMATIC TELEPHONE APPARATUS.

APPLICATION FILED NOV. 26, 1900.

NO MODEL.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

W. Weir
H. P. Gaither,

Inventors
John J. Brownrigg
John K. Norstrom
By Brown & O'Leary
Attys

J. J. BROWNRIGG & J. K. NORSTROM.
AUTOMATIC TELEPHONE APPARATUS.

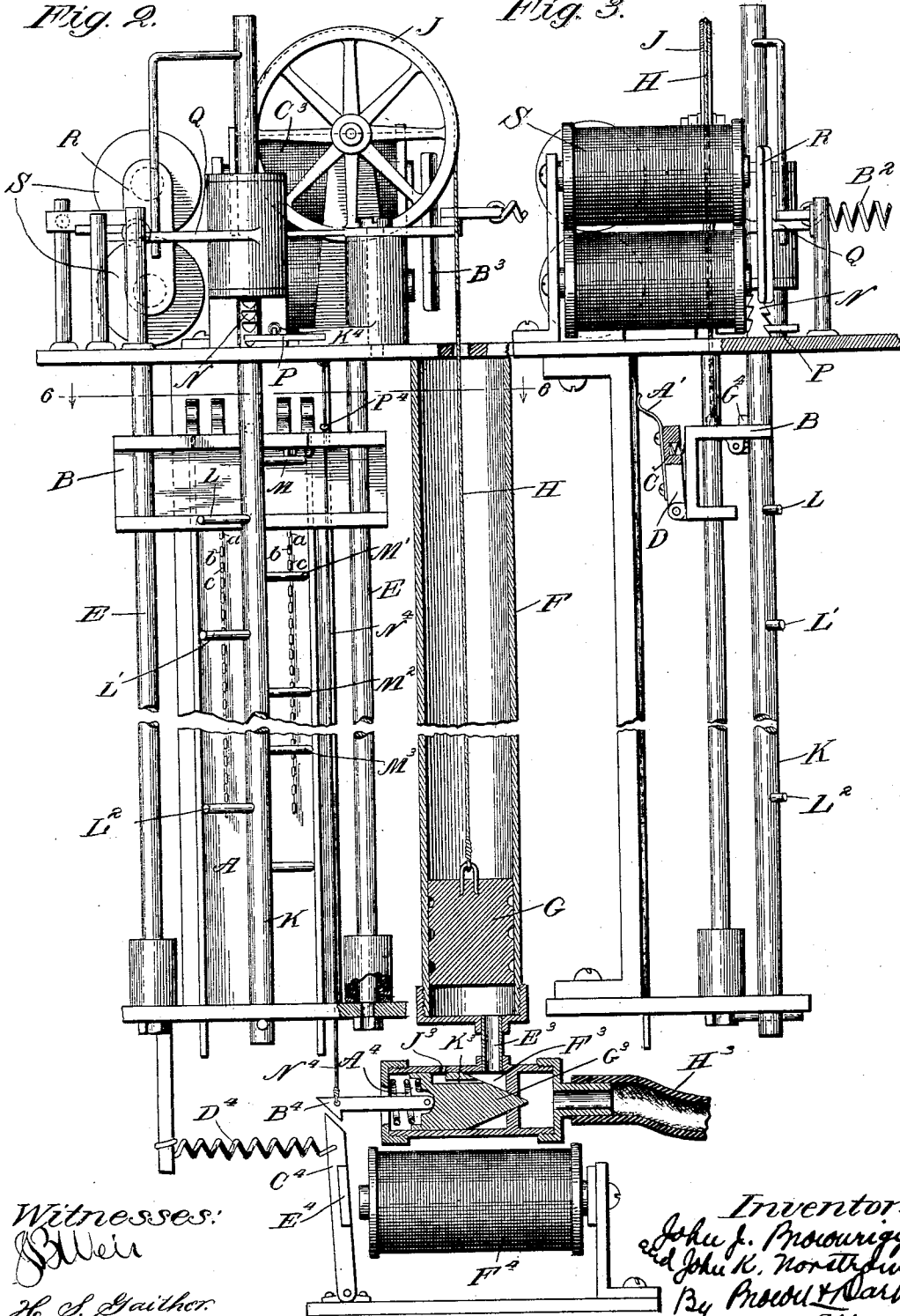
APPLICATION FILED NOV. 26, 1900.

NO MODEL.

3 SHEETS—SHEET 2.

Fig. 2.

Fig. 3.



J. J. BROWNRIGG & J. K. NORSTROM.
AUTOMATIC TELEPHONE APPARATUS.

APPLICATION FILED NOV. 26, 1900.

NO MODEL.

3 SHEETS—SHEET 3.

Fig. 4

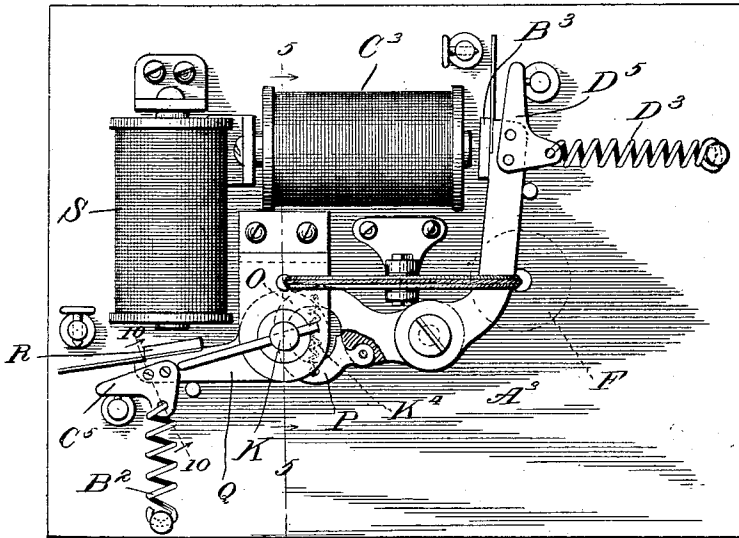


Fig. 5.

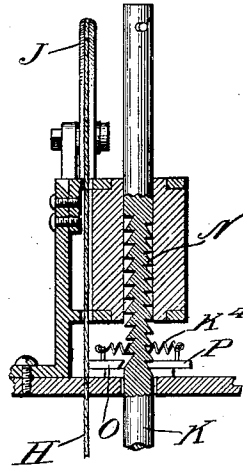


Fig. 6.

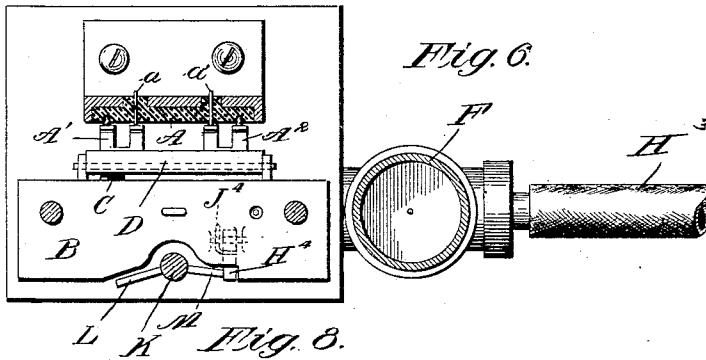


Fig. 8.

Fig. 7.

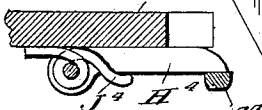


Fig. 9.

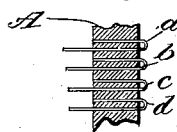
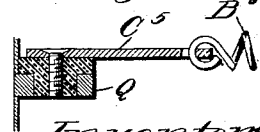


Fig. 10.



Witnesses:

J. J. Brownrigg

H. S. Gaither,

Inventors
John J. Brownrigg
& John K. Norstrom
By M. C. & S. B. Barby
Attys

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 COR-
PORATION OF ILLINOIS.

AUTOMATIC TELEPHONE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 738,156, dated September 8, 1903.

Application filed November 26, 1900. Serial No. 37,717. (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 Apparatus, of which the following is a specification.

This invention relates to automatic telephone apparatus.

The object of the invention is to provide a construction of automatic telephone apparatus which is simple in construction and efficient in operation.

A further object of the invention is to provide a construction of automatic telephone apparatus wherein each subscriber can control in a simple and expeditious manner telephonic connection between his line and the line of any other subscriber without the interposition of an operator at the central station.

A further object of the invention is to provide a construction of automatic telephone apparatus wherein the line connections of each subscriber are controllable from the subscriber's station and the parts are positively returned to normal position.

Other objects of the invention will appear more fully hereinafter.

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 diagram of the circuit connections controllable from a subscriber's station and illustrating the operation of the principles of the invention. Fig. 2 is a view in front elevation, parts in vertical section, of an illustrative form of mechanism controllable from a subscriber's station for effecting circuit connections with the wires or circuits of other subscribers of the system and embodying the principles of our invention. Fig. 3 is a side elevation of the same. Fig. 4 is a top plan view of the

same. Fig. 5 is a broken detail view in section on the line 5 5, Fig. 4, looking in the direction of the arrows. Fig. 6 is a broken view, in transverse section, on the line 6 6, Fig. 2, looking in the direction of the arrows. Fig. 7 is a broken detail sectional view of the contact-making carrier, showing the yielding stop supported upon an arm of the control-shaft. Fig. 8 is a broken detail view in perspective, showing a form of contact plate or board. Fig. 9 is a broken detail view in section, illustrating a manner of connecting the circuit-wires of the various subscribers to the contact plate or board. Fig. 10 is a detail sectional view on the line 10 10, Fig. 4, looking in the direction of the arrows.

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 communication 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 a movable contact in connection with the equipment for each subscriber and which movable contact is adapted to be moved 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 traveling contact to be moved by gravity in one direction and positively in the other direction as one arrangement embodying the principles of our invention, and we make pro-

vision for controlling the movements of said movable contact from the subscriber's station.

Referring particularly to the drawings, wherein is illustrated a construction and arrangement of parts associated with the equipment of one subscriber, reference-sign A designates a contact plate or board of suitable insulating material and which carries terminals $a a' b b' c c' d d' e e' f f'$, &c., of the circuits of each of the other subscribers in the exchange or system. Coöperating with the terminals $a a' b b'$, &c., are movable contacts $A' A^2$, adapted to be moved into any desired position with reference to the series of terminals $a a' b b' c c'$, &c., to complete the circuit connection from the subscriber's station to the station of any other subscriber of the system. A convenient arrangement of movable contacts is shown as illustrative of an operative embodiment of our invention, but to which, however, the invention is not limited, wherein said contacts are carried by a carrier B, and, if desired, efficient engagement of the contacts $A' A^2$ with the terminals $a a' b b'$, &c., may be secured by means of a spring C, the said contacts $A' A^2$ being carried upon a plate D, hinged to the carrier B, the spring C being interposed between said carrier and plate.

The carrier B may be guided in its movements in any suitable or convenient manner. In the form shown, to which, however, the invention is not limited, we have arranged said carrier to be guided by one or more posts or rods E. As above indicated, the movements of the carrier B may be effected in many different ways, either positively in both directions or positively in one direction and by gravity in the other direction. In the particular form illustrated as an operative embodiment of the principles of the invention we have shown said carrier as movable by gravity in one direction and positively in the other direction. To this end we employ a cylinder F, in which operates a plunger G, said plunger being connected to the carrier in any suitable or convenient manner—as, for instance, by means of the cord or rope H operating over a guide sheave or pulley J—and in the construction where the carrier is moved in one direction under the influence of gravity we so relatively proportion the weight of the carrier B and the parts carried thereby to the weight of the plunger G as to secure a movement of the carrier B in one direction or the other by gravity. In the arrangement shown the weight of the carrier B is somewhat in excess of the weight of the plunger G, so that the movement of the carrier under the influence of gravity is a falling or downward movement, the movement of said carrier in the opposite direction being effected positively by any suitable source of power or operating medium, as will be more fully explained hereinafter. The range of movement of carrier B is such as to traverse

the entire length of the contact plate or board A, so that the contacts $A' A^2$ may be brought into engaging relation with respect to any pair of contacts or terminals $a a' b b'$, &c., carried by the contact plate or board A.

In the proper operation of the apparatus it is desirable to provide means whereby the movements of the carrier B in effecting the circuit connection with the terminals of any desired subscriber's line-wire may be made quickly in the desired direction and to be arrested at the desired point to secure the engaging relation of the contacts $A' A^2$ with the desired pair of contacts or terminals on the terminal board or plate A. In order to accomplish this result, we provide a rock-shaft K, having two sets of arms or projections $L L' L^2$, &c., and $M M' M^2$, &c., adapted to be alternately brought into supporting relation with respect to carrier B. In the particular form shown embodying the idea the set of arms $L L' L^2$ project in an opposite direction to the set of arms $M M' M^2$, as clearly shown, the members of the two sets of arms or projections alternating with respect to each other with reference to the length of the rock-shaft K. From this description it will be readily seen that when the shaft K is rocked into one position the carrier B will rest on an arm in one of the sets of arms, and when said shaft is rocked in the other direction the arm thereon upon which the carrier has been supported will be moved out of supporting relation with respect to the carrier and an arm on the other side of the shaft will be brought into supporting relation with respect to the carrier, the carrier moving or dropping from the position in which it was previously supported until it encounters the arm or projection thus brought into engaging relation with respect thereto. The carrier will thus be supported in its new position until the shaft K is rocked in the opposite direction, when it will be again released and permitted to drop or move to a new position or until engaged by the next succeeding supporting arm or projection on the opposite side of the shaft. By spacing the arms or projections of shaft K a suitable distance apart it will be readily seen that the carrier B may be permitted to drop or move definite distances in traveling from one supporting-arm to the next succeeding one. This definite distance of movement of the contact-carrier in the practical operation of the apparatus and for the sake of convenience should bear a definite proportion to the number of pairs of terminal contacts $a a' b b'$, &c., and similarly the number of alternating supporting arms or projections upon shaft K may conveniently bear a definite proportion to the number of terminal contacts. For instance, and by way of illustration of the principles involved, suppose the terminal-contact board A should have one hundred pairs of terminals $a a' b b' c c'$, &c. Then a convenient arrangement would be to so space the supporting arms or projections on shaft K that the move-

ment of the contact-carrier from one supporting arm or projection on one side of the shaft to the next adjacent arm or projection on the other side of the shaft would cause said carrier to traverse, say, for instance, five pairs of the circuit-terminals $a a' b b'$, &c., the same proportion being carried out throughout the other supporting arms or projections of shaft K, and hence when shaft K is given a complete oscillation from the position shown in Fig. 2, for instance, to cause carrier B first to descend to engaging relation with stop or projection L and thence to M', the carrier B will have traveled a distance sufficient to cause the contacts A' A² to pass over ten pairs of the terminal contacts $a a' b b'$, &c. In other words, upon each complete oscillation of shaft K the carrier B moves a sufficient distance to pass over ten pairs of the terminal contacts. The movement of carrier B above described, however, is not sufficient for the practical purposes of an automatic telephone apparatus. For instance, suppose it is desired to make circuit connections between the subscriber's line and the line of some other subscriber the terminals of which occur in the terminal board A at a point intermediate the stopping-points of carrier B as regulated and determined by the oscillation of shaft K. In this case it is evident that provision must be made for an additional travel or movement of carrier B. Such additional travel or movement of said carrier may be effected in many different ways. A simple, convenient, and efficient arrangement is shown as illustrative of the principles involved wherein a step-by-step feed of shaft K endwise is effected, each step of the feed corresponding to the distance apart of adjacent terminal contacts $a a' b b'$, &c. This step-by-step feed of stop-shaft K permits also a corresponding travel of carrier B, which is supported by said shaft. The step-by-step feed of shaft K may be effected in many different ways. We have shown a construction of ratchet mechanism arranged to sustain or support shaft K and which when properly actuated releases said shaft and permits it to descend by gravity step by step at a time. To this end the shaft K may be provided or formed with ratchet-teeth (indicated at N) on opposite sides thereof, with which engage suitable pawls O P, the pawl P being pivotally connected to pawl O, said pawls operating as an escapement to permit the alternate release and support of shaft K, said pawls operating independently of the movements above described of carrier B from one to another of the stops or supporting-arms of shaft K.

We will now describe as illustrative of an operative embodiment of the principles involved a construction for rocking or oscillating shaft K and for actuating the pawls O P.

Suitably connected to shaft K is a lever Q, upon which is mounted an armature R of an electromagnet S. A retractile B² serves to normally hold lever Q and armature R sep-

arated from the electromagnet. When the electromagnet S is energized, the armature is attracted and lever Q rocked, thereby rocking shaft K. When the circuit of electromagnet S is broken and said magnet is de-energized, the retractile B² serves to restore or return the parts to the position shown in Fig. 4, thereby rocking shaft K in the opposite direction, and hence completing the oscillation of said shaft. Thus each time the circuit of electromagnet S is completed and then broken a complete oscillation is imparted to shaft K to permit carrier B to move from one supporting stop or arm on one side to the next adjacent stop or arm on the same side with an intermediate stop or rest upon the stop or arm on the other side, and by repeatedly making and breaking the circuit of electromagnet S it will be seen that shaft K will be repeatedly oscillated and that carrier B will thereby be permitted to move from stop to stop on said shaft K, and hence will be permitted to traverse all the terminal contacts on the terminal board A. Now in order to secure the step-by-step feed or movement of carrier B intermediate the supporting-stops on shaft K the ratchet or escapement pawls O P are actuated. This actuation may be effected by many specifically-different constructions. A simple and efficient arrangement for accomplishing this purpose and illustrative of the principles involved is shown, wherein the pawl O is connected to or forms part of a lever A³, pivotally mounted and carrying an armature B³, adapted to be attracted by an electromagnet C³ against the action of a retractile D³ whenever the circuit of said magnet C³ is completed. Thus by completing the circuit of electromagnet C³ the armature B³ is attracted and lever A³ rocked, thereby causing pawl or escapement tooth O to be moved into engaging relation with respect to a ratchet-tooth N, the same movement of said lever causing ratchet or escapement tooth or pawl P to clear said ratchet N in a well-understood manner. When the circuit of electromagnet C³ is broken, the retractile D³ rocks lever A³ in the opposite direction, thereby causing pawl P to be brought into engaging relation with the next succeeding tooth of ratchet N and freeing pawl O from engaging relation, and hence permitting the shaft K to move lengthwise one complete step. The distance thus moved by shaft K under the release of the escapement at each actuation thereof corresponds in extent to the distance between adjacent pairs of terminal contacts $a a' b b'$, &c., and a convenient arrangement is to provide the ratchet N with as many teeth as there are pairs of terminal contacts traversed by carrier B when traveling or moving from one stop—as M', for instance—to another stop on the same side of shaft K—as M², for instance. In other words, if when shaft K makes a complete oscillation carrier B moves a sufficient distance to traverse ten pairs of terminal contacts then the ratchet-

feed controlled by the escapement-pawls O P should provide ten steps of feeding movement of shaft K longitudinally, so that carrier B may be moved into engaging relation with respect to any particular pair of terminal contacts intermediate the stop-rests afforded said carrier by the stop-arms on shaft K.

From the foregoing description it will be seen that by oscillating shaft K carrier B will be dropped bodily from one supporting-arm to another, each drop or movement causing the carrier to traverse a definite number of pairs of terminal contacts, but without being arrested at any particular intermediate pair, and the operation of the escapement causes a step-by-step feed of the carrier to any intermediate or particular pair of terminal contacts. Thus suppose the terminal-contact board carries one hundred pairs of contacts and it is desired to make circuit connections between the subscriber's line and the sixty-fifth pair of terminal contacts on the terminal board A. Shaft K is oscillated so as to permit carrier B to drop to the sixth supporting-stop on said shaft. The escapement-feed is then actuated to permit the carrier B to move five additional steps, thus bringing the contact of carrier B into the desired contact relation with the fifth pair of terminals on terminal board A between the sixth and seventh stops on shaft K, thereby completing the desired circuit connection.

In the foregoing description we have set forth the operation whereby carrier B is moved from an initial position, so as to establish circuit connection with any desired pair of terminal contacts. We will now describe means for returning or restoring the parts to their normal or initial positions.

In the movements above described we have set forth not only a movement of carrier B relative to stop-shaft K, but we have also described a longitudinal feed of said shaft, and we have set forth that the movements described are effected by gravity, in that carrier B somewhat exceeds in weight the weight of plunger G and the friction of the parts. Therefore in order to restore the parts to normal position provision is made for moving plunger G in a direction to return carrier B to its initial position, as shown in Figs. 2 and 3. In the particular form shown, to which the invention is not limited, however, it will be observed that as carrier B descends plunger G travels through cylinder F. The return of plunger G to effect the restoration of the carrier B to initial position may be effected from any convenient or suitable source of power. In Fig. 2 we have shown as illustrative of the principles involved a construction and arrangement wherein cylinder G communicates through a passage E³ with a valve-chamber F³, in which is arranged a suitable valve G³, arranged to control an opening or port with which communicates a pipe H³, which may connect with an air or exhaust pump reservoir or other suitable means by means of

which a suction may be created in cylinder F to draw plunger G back to initial position. It is obvious that any other suitable or convenient arrangement of power mechanism for returning plunger G to initial position may be employed without departure from the spirit and scope of our invention. In the particular form shown as illustrative of an operative embodiment in which an exhaust or suction mechanism is employed the valve G³ is normally maintained in closed position, and when in closed position said valve opens a small port J³ in the valve-casing and establishes communication through said port and a passage K³ with cylinder F, so as to equalize the air-pressure upon both sides or ends of plunger G to permit of the gravity operation of the contact-carrier. A spring A⁴ may serve to normally hold valve G³ in position to cut off communication between pipe H³ and cylinder F and to open air-port J³ to said cylinder. Valve G³ may be actuated in many different ways to open the communication between cylinder F and pipe H³ and to close port J³. We have shown a convenient arrangement for accomplishing this result, but to which the invention is not limited, wherein said valve is provided with a latch B⁴, and a lever C⁴ when suitably rocked is adapted to engage the hook of said latch. The lever C⁴ is held in retracted position and out of engaging relation with respect to the hook of latch B⁴ by means of a spring D⁴. Said lever carries an armature E⁴, adapted to be attracted by the energization of an electromagnet F⁴. Thus when the circuit of magnet F⁴ is completed lever C⁴ is attracted or rocked into position to engage the hook on latch B⁴, and when the circuit of magnet F⁴ is broken lever C⁴ is rocked under the influence of retractile D⁴, thereby drawing on latch B⁴ and actuating valve G³ to open up communication between pipe H³ and cylinder F, the same movement closing port J³. This operation of the valve mechanism causes the plunger G to return to initial position, thereby effecting a return of carrier B (to which said plunger is connected through cord or other connection H) to its initial position. When carrier B has reached the initial position thereof with respect to its movement relative to shaft K, said carrier engages a pin or projection (indicated at G⁴) on shaft K, so that the continued movement of said carrier B toward initial or starting position will carry with it shaft K until the parts reach their final initial positions. In order to permit the return of carrier B past the stops L L' L² M M' M², &c., on shaft K, the following construction may be employed, it being understood that the operating-arm Q, through which oscillations are imparted to shaft K, is normally held in a retracted position by the retractile B², this position being such as to permit the series of arms L L' L² to clear the carrier B, as shown in Fig. 6: The engagement of the series of arms M M' M², &c., and carrier B is effected through a pivoted arm

H⁴, yieldingly held in one position upon carrier B by means of a spring J⁴, (see Figs. 6 and 7,) said spring holding arm H⁴ in position for said arm to rest on an arm, as M, of shaft II in one direction, but permitting said arm H⁴ to yield when the carrier B is moved in the opposite direction. In this manner carrier B may be moved past the arms M M' M², &c., in returning to initial position; but said arms form stops for supporting said carrier when the latter is moved in the opposite direction. To permit the return of shaft K to its initial position after being fed longitudinally by the ratchet and escapement mechanisms N O P, one of the pawls, as P, of said escapement is pivoted, as above indicated and as clearly shown, and the ratchet-teeth N are beveled or inclined in one direction, the escapement-pawls N and P being coöperatingly beveled or inclined, and by this construction the return of shaft K to initial position may be readily effected. A spring K⁴ may serve to yieldingly draw the pawls O P of the escapement toward each other.

When carrier B is restored to its final initial position, it is desirable to permit valve G³ to return to normal position to close the communication between pipe H³ and cylinder F. In order to accomplish this result, means are provided for releasing latch B⁴ from engagement with lever C⁴. This result is secured by means of a rod or cord N⁴, which is connected to latch B⁴ and is provided with a stop (indicated at P⁴, Fig. 2) adapted to be engaged by carrier B when said carrier reaches its initial position, thereby rocking latch B⁴ to effect a disengagement thereof from lever C⁴, and hence permitting spring A⁴ to return valve G³ to its closed position and opening port J³ to cylinder F.

Having described and set forth an illustrative embodiment of means whereby the desired circuit connections may be effected, we will now describe the arrangement whereby control of the movements of carrier B and of shaft K may be effected from the subscriber's station, particular reference being had to the diagram in Fig. 1, wherein A⁵ designates a battery or other suitable source of current-supply. From one terminal of this battery extends a circuit connection a³ to circuit-closing devices or terminals a⁴ a⁵ at the subscriber's station, through which circuit may be completed through keys or other convenient contacts a⁶ a⁷. When circuit is closed between contacts a⁶ and a⁵, then the battery-circuit is completed from battery A⁵ through wire a³, contacts a⁵ a⁶, wire a⁸, wire a⁹, magnet S, wire a¹⁰, to battery A⁵, and when circuit is closed between contacts a⁷ a⁴ the following circuit is established: from battery A⁵ through wire a³, contacts a⁴ a⁷, wires a¹¹ a¹², magnet C³, wire a¹³, back to battery A⁵. The completion of the circuit of magnet S causes arm Q to be rocked, thereby effecting a rocking movement of shaft K. The shaft

K will be held in its rocked position as long as the circuit of magnet S remains closed. When the circuit of said magnet is closed at the contacts a⁶ a⁵, the retractile B³ rocks said lever Q in the opposite direction, thereby completing the oscillation of shaft K, and hence permitting the carrier B (assuming it to be in its initial position at the start) to descend first to stop L by the rocking movement of shaft K, when arm Q is attracted by the magnet S, and thence to stop M' when the circuit of magnet S is broken, and arm Q is rocked under the influence of spring B² to complete the oscillatory movement of shaft K, and hence by repeatedly closing and opening the circuit of magnet S, through contacts a⁶ a⁵ or otherwise, carrier B may be caused to move quickly to any desired stop on shaft K. Similarly by completing the circuit of magnet C³ arm A³ is rocked by the attraction exerted by said magnet upon the armature B³, carried by said lever, and when said magnet-circuit is broken armature A³ is rocked in the opposite direction under the influence of retractile D³, thereby effecting an actuation of the escapement, and hence a feed of shaft K, one step longitudinally, and by repeatedly completing and breaking the circuit of said magnet C³ said shaft K may be fed longitudinally any desired number of steps through the actuation of the escapement. When the circuit of magnet S is broken at contacts a⁵ a⁶, connection is made through wire b³ from wire a³ to the subscriber's telephone, (indicated generally at B⁵, Fig. 1,) and when the circuit of magnet C³ is broken at contacts a⁷ a⁴ connection is made from wire a¹¹ through wire b⁴ to the subscriber's telephone B⁵. Carried by lever Q, but insulated therefrom, as clearly shown in Fig. 10, is a contact C⁵, which when said lever is in its retracted position completes circuit connections from wire a³ through wire b⁵ and wire b⁶ to one of the contacts, as A', of carrier B. Similarly a contact D⁵, carried by but insulated from lever A³, completes circuit connection when lever A³ is in its normal or retracted position, as shown in Fig. 1, from wire a¹¹ through wire b⁷ and wire b⁸ to the other contact A² of carrier B. When lever A³ is attracted by the energization of magnet C³, the circuit connection through wire b³ is broken, but another circuit is completed from battery A⁵, wire c³, electromagnet F⁴, wire c⁴, and contact c⁵, which is connected to lever A³, and said lever, being connected to or forming part of the escapement mechanism which is in constant engagement with shaft K, completes this circuit through said shaft to the mass or framework on which lever Q is also mounted. Said lever carries a contact c⁶, which completes circuit through wire c⁷, when lever Q is attracted by magnet S, back to battery A⁵. Thus when contacts a⁶ a⁵ are closed upon each other and also contacts a⁷ a⁴ are closed upon each other both magnets S and C³ are energized, the former attracting lever

Q and the latter attracting lever A³, and the circuit of magnet F⁴ is completed, thereby attracting lever C⁴ into engaging relation with respect to latch B⁴. This operation occurs when it is desired to restore carrier B and shaft K to their final initial positions, and after the engagement of lever C⁴ with latch B⁴ by breaking the connection between contacts a⁶ a⁵ or a⁷ a⁴ or at both points the circuit of magnet F⁴ is broken and lever C⁴ is free to be rocked under the influence of its retractile D⁴, thereby actuating valve G³ in the manner above described.

From the foregoing description the operation of effecting a circuit connection between a subscriber's station and the line of any other subscriber's station will be readily understood and is as follows: Suppose the subscriber desires to establish communication with another subscriber in the system whose terminals are the sixty-fifth pair (by way of illustration) on the terminal board A. Then the local subscriber first makes and breaks circuit connection at a⁶ a⁵ six times, thereby imparting six complete oscillations to shaft K through the repeated energization of magnet S, and hence permitting carrier B to descend to the sixth supporting-stop M M' M², &c. Then the subscriber makes and breaks circuit connection through contacts a⁷ a⁴ five times, thereby energizing and deenergizing electromagnet C³ five times, and hence effecting an actuation of the escapement O P five times and the consequent feed of shaft K longitudinally five distinct steps, and hence permitting carrier B to descend with said shaft K, so as to bring the contacts A' A² into circuit connection with the sixty-fifth pair of terminals on terminal board A. This operation completes circuit connection with the desired subscriber, and the call and answer or message may be transmitted in the usual or any convenient or well-known manner. When the communication has been completed, the local subscriber closes the circuit of both magnets S C³, thereby completing the circuit of magnet F⁴, and then the circuits of magnets S C³ are broken, thereby breaking the circuit of magnet F⁴ and effecting the actuation of valve G³ and, through the construction above described, restoring contact-carrier B and shaft K to their final positions.

From the foregoing description it will be seen that we provide a simple and efficient construction of automatic telephone apparatus whereby a subscriber is enabled to effect his own circuit connections with the line-wires of any other subscriber of the system without the interposition of an operator at the central station. It will also be seen that the current required for the various operations is not designed to effect the movements of the contact-carrier B or of shaft K, but merely control the mechanism which effects the movements of these parts, and hence comparatively weak currents may be employed, thereby materially reducing the battery-power re-

quired in the apparatus. In other words, the contact-carrier B is operated in one direction by gravity and restored to its normal position mechanically, the control of the mechanical mechanism and of the gravity release being effected electrically, and this we regard as a most important feature of the invention, and while we have described a specific construction for effecting the movements of carrier B it is to be understood that the movements of this carrier may be effected by many other specifically different constructions of apparatus 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 of construction and arrangement above described; but,

Having now set forth the object and nature of our invention and a construction embodying the principles thereof, 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 movable contact for completing circuit between a subscriber's line and the lines of the other subscribers in the system, devices for effecting the movements of said contact including a delivery-pipe arranged to communicate with a source of operating medium, and electrical connections for controlling said devices, as and for the purpose set forth.

2. In an automatic telephone apparatus, a movable contact for completing circuit between a subscriber's line and the lines of the other subscribers in the system, devices for effecting the movements of said contact and including a delivery-pipe arranged to communicate with a source of operating medium, a valve arranged in said pipe, and means under the control of the subscriber for operating said valve, as and for the purpose set forth.

3. 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, mechanical devices for effecting the movement of said contact and including a delivery-pipe arranged to communicate with a source of operating medium, a valve arranged in said pipe, and electrical connections for operating said valve, as and for the purpose set forth.

4. 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, a cylinder and piston for actuating said contact in the opposite direction, and connections between said piston and said contact, 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, a cylinder, a piston operating therein and connected to said contact, and means for controlling the operating

medium for actuating said piston, as and for the purpose set forth.

6. 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, a cylinder, a piston operating therein, connections between said piston and contact for moving the latter, means for controlling the operating medium for actuating said piston, said means being controllable from the subscriber's station, as and for the purpose set forth.

7. 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, a cylinder and piston, said piston being connected to said contact to move the same, a valve for controlling the piston-operating medium to said cylinder, and electrical devices under the control of the subscriber for actuating said valve, as and for the purpose set forth.

8. In an automatic telephone apparatus, a terminal board, a contact arranged to be moved by gravity into position to complete circuit between the subscriber's line and any desired terminal contact, a cylinder, a piston operating therein and connected to said contact for restoring the latter to initial position, and means for controlling a pressure-operating medium for operating said piston, as and for the purpose set forth.

9. In an automatic telephone apparatus, a contact gravity-actuated in one direction, a cylinder, a piston operating therein to restore or return said contact to initial position, a pipe communicating with a source of operating medium and with said cylinder, a valve-chest interposed in said pipe, a valve arranged therein, said valve being normally seated, a lever for unseating said valve, and means for actuating said lever, as and for the purpose set forth.

10. In an automatic telephone apparatus, a gravity-actuated contact, means for restoring said contact to initial position, including a cylinder and piston, a pipe communicating with said cylinder and a source of operating medium, a valve arranged to control said communication, a pivotally-mounted lever carrying an armature, an electromagnet for attracting said armature to rock said lever, means normally operating to return said lever, and means actuated by the return of said lever for operating said valve, as and for the purpose set forth.

11. In an automatic telephone apparatus, a gravity-actuated contact, means for restoring said contact to initial position, including a cylinder and piston, a pipe communicating with said cylinder, a valve arranged to control the piston-operating medium, a latch connected to said valve and provided with a hook, a pivoted lever, a spring for normally maintaining said lever retracted, electrical devices for rocking said lever against the action of said spring, said lever arranged to

engage said hook, when returned to initial position by said spring, for actuating said valve, as and for the purpose set forth.

12. In an automatic telephone apparatus, a gravity-actuated contact, a cylinder and piston for restoring said contact to initial position, a pipe communicating with said cylinder, a valve arranged in said pipe, a pivotal latch connected to said valve, electrically-operated devices arranged to engage said latch to unseat said valve, and means actuated by the return of said contact to initial position for automatically detaching said latch from said electrically-actuated devices, as and for the purpose set forth.

13. In an automatic telephone apparatus, a terminal board containing terminal connections of the line-wires of the subscribers in the system, a contact operating over said terminal connections, said contact being in the circuit of a subscriber's line and operated in one direction by gravity, power-actuated mechanical devices for effecting the return movement of said contact and including a pipe, a valve arranged therein, and electrical devices under the control of the subscriber for actuating said valve, as and for the purpose set forth.

14. 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, a movable fluid-actuated plunger, connections between said plunger and contact, and means for controlling the movements of said plunger, as and for the purpose set forth.

15. 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, a movable fluid-actuated plunger, connections between said plunger and contact, means for controlling the movements of said plunger, said means being controllable from the subscriber's station, as and for the purpose set forth.

16. 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, a movable fluid-actuated plunger, connections between said plunger and contact, mechanical devices for controlling the movements of said plunger, and electrical devices under the control of the subscriber for regulating said mechanical devices, as and for the purpose set forth.

17. In an automatic telephone apparatus, a terminal board, a contact arranged to be moved by gravity into position to complete circuit between the subscriber's line and any desired terminal contact, 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.

18. In an automatic telephone apparatus, a terminal board, a contact operating thereover, said contact being movable in one di-

rection by gravity, and a fluid-actuated plunger for returning said contact to initial position, as and for the purpose set forth.

19. In an automatic telephone apparatus, a terminal board, a contact operating there-
 5 over, said contact operating in one direction by gravity, a cylinder, a plunger operating therein, connections between said plunger and contact, said cylinder communicating
 10 with a source of power for operating said plunger, as and for the purpose set forth.

20. In an automatic telephone apparatus, a terminal board, a contact arranged to move
 15 thereover, a cylinder, a plunger operating therein and connected to said contact, said cylinder communicating with a source of power, a valve for controlling said communication, and means under the control of the
 20 subscriber for controlling said valve, as and for the purpose set forth.

21. In an automatic telephone apparatus, a terminal board, a contact operating there-
 25 over, a cylinder, a plunger operating therein and connected to said contact, said cylinder communicating with a source of power for actuating said plunger, a valve controlling said communication, and electrical devices
 30 under the control of the subscriber for actuating said valve, as and for the purpose set forth.

22. In an automatic telephone apparatus, a terminal board, a contact operating there-
 35 over, a cylinder, a plunger operating therein and connected to said contact, said cylinder communicating with a source of power, a valve controlling said communication, an
 40 electromagnet for controlling said valve, and means under the control of the subscriber for controlling the circuit of said electromagnet, as and for the purpose set forth.

23. In an automatic telephone apparatus, a terminal board, a contact operating there-
 45 over, a series of movable stops, and means for moving said stops into and out of supporting relation with respect to said contact, whereby said contact may be moved by grav-
 50 ity with reference to said terminal board, as and for the purpose set forth.

24. In an automatic telephone apparatus, a terminal board, a contact operating there-
 55 over, a series of movable stops arranged to be brought into or moved out of supporting relation with respect to said contact, whereby said contact is permitted to move by gravity
 60 with reference to said terminal board, and means for restoring said contact to initial position, as and for the purpose set forth.

25. In an automatic telephone apparatus, a terminal board, a contact operating there-
 65 over, a series of movable stop-supports for said contact, and means for moving said stop-supports into and out of supporting relation with respect to said contact, as and for the purpose set forth.

26. In an automatic telephone apparatus, a terminal board, a gravity-actuated contact
 operating thereover, a series of movable stop-

supports for said contact, and means under the control of the subscriber for moving said
 stop-supports into and out of supporting relation with respect to said contact and means
 70 for returning said contact to initial position, as and for the purpose set forth.

27. In an automatic telephone apparatus, a terminal board, a contact operating there-
 75 over, 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, as and
 80 for the purpose set forth.

28. In an automatic telephone apparatus, a terminal board, a contact arranged to oper-
 85 ate thereover, a shaft having suitably-spaced projecting arms, and means for rocking said shaft to move said arms into and out of sup-
 90 porting relation with respect to said contact, as and for the purpose set forth.

29. In an automatic telephone apparatus, a terminal board, a contact operating there-
 95 over, a shaft having oppositely-projecting arms, and means for oscillating said arms to alternately move said arms into and out of
 100 supporting relation with respect to said contact, as and for the purpose set forth.

30. In an automatic telephone apparatus, a terminal board, a contact-carrier operating
 105 thereover, a rock-shaft having oppositely-projecting and suitably-spaced arms, and means under the control of the subscriber for oscillating said shaft, as and for the purpose set
 110 forth.

31. In an automatic telephone apparatus, a terminal board, a gravity-actuated contact
 115 operating thereover, a stop-arm carried thereby and arranged to yield in one direction, supporting-stops, means for moving said stops
 120 into and out of supporting relation with respect to said stop-arm, and means for restoring said contact to initial position, as and for the purpose set forth.

32. In an automatic telephone apparatus, a terminal board, a contact-carrier operating
 125 thereover, a stop-shaft carrying supporting-stops, means for oscillating said shaft to move said stops into and out of supporting relation with respect to said carrier, to permit said
 130 carrier to move by gravity in one direction, means for restoring or returning said contact-carrier to initial position, and yielding stop-arms carried by said carrier, as and for the purpose set forth.

33. In an automatic telephone apparatus, a contact-carrier having a stop-arm arranged to
 135 yield in one direction, a stop-shaft having suitably-spaced supporting-arms, means for oscillating said shaft to move said supporting stops or arms into engaging and supporting
 140 relation with respect to the stop-arm on said carrier, whereby said carrier is permitted to move by gravity in one direction, and means for restoring said carrier to initial position,
 145 as and for the purpose set forth.

34. In an automatic telephone apparatus, a contact, a shaft carrying stops forming sup-

ports for said contact, a lever connected to said shaft for rocking the same, an electromagnet for rocking said lever, and means under the control of the subscriber for making and breaking the circuit of said electromagnet, as and for the purpose set forth.

35. In an automatic telephone apparatus, a contact gravity-actuated in one direction; a ratchet-escapement mechanism for releasing said contact step by step, means under the control of the subscriber for actuating said ratchet-escapement, a pressure-actuated mechanism for automatically returning said contact to initial position, means for controlling said pressure mechanism and means for automatically restoring said controlling means to normal position when said contact attains its initial position, as and for the purpose set forth.

36. In an automatic telephone apparatus, a gravity-actuated contact, a support for sustaining said contact, and a ratchet mechanism for releasing said support step by step to permit said contact to move by gravity in one direction, and means for returning said contact to initial position, as and for the purpose set forth.

37. In an automatic telephone apparatus, a gravity-actuated contact, a support therefor, a ratchet-escapement mechanism for releasing said support step by step, to permit said contact to move under the influence of gravity, and electrical devices under the control of the subscriber for actuating said ratchet-escapement, and mechanical devices for returning said contact to initial position, as and for the purpose set forth.

38. In an automatic telephone apparatus, a gravity-actuated contact, a support therefor, a ratchet-escapement mechanism for releasing said support step by step, to permit said contact to move under the influence of gravity, said ratchet-escapement mechanism including a pivoted pawl, and means for restoring said support to initial position, as and for the purpose set forth.

39. In an automatic telephone apparatus, a gravity-actuated contact, a support therefor, means for releasing said support from said contact to permit the same to move from one position to another by gravity, and a ratchet-escapement mechanism for releasing said support step by step, and means for restoring said parts to initial position, as and for the purpose set forth.

40. In an automatic telephone apparatus, a terminal board, a contact operating thereover, means for effecting the movement of said contact through definite distances of the length of said board, an auxiliary step-by-step feed mechanism for effecting the movements of said contact through intermediate steps, pressure mechanism for automatically restoring said contact to initial position, means for controlling said pressure mechanism and means for automatically restoring said controlling means to normal position

when said contact attains its initial position, as and for the purpose set forth.

41. In an automatic telephone apparatus, a gravity-actuated contact, a support therefor, said support provided with ratchet-teeth, in combination with escapement-pawls, for sustaining said support, and means under the control of the subscriber for actuating said escapement-pawls, whereby said support is given a step-by-step feed, as and for the purpose set forth.

42. In an automatic telephone apparatus, a contact, a support therefor, said support provided with ratchet-teeth, a lever having escapement-pawls coöperating with said ratchet-teeth, and a magnet for rocking said lever, the circuit of said magnet being under the control of the subscriber, as and for the purpose set forth.

43. In an automatic telephone apparatus, a gravity-actuated contact, a support therefor, means for releasing said support from said contact to permit said contact to move under the influence of gravity, and an auxiliary step-by-step release for said support, and means for returning said contact and support to initial position, as and for the purpose set forth.

44. In an automatic telephone apparatus, a gravity-actuated contact, a shaft having supporting-arms for said contact, means for rocking said shaft, and a ratchet-escapement support for said shaft, and means for restoring the parts to initial position, as and for the purpose set forth.

45. In an automatic telephone apparatus, a contact, a support therefor, an electromagnet for releasing said support from said contact to permit said contact to move under the influence of gravity, a second electromagnet for effecting a step-by-step release of said support, the circuits of both of said magnets being controllable from the subscriber's station, and means for returning said contact and support to initial position, as and for the purpose set forth.

46. In an automatic telephone apparatus, a gravity-actuated contact, a support therefor, means for normally maintaining said support in supporting relation with respect to said contact, and means under the control of the subscriber for releasing said support to permit said contact to move under the influence of gravity, and means for restoring said contact to initial position, as and for the purpose set forth.

47. In an automatic telephone apparatus, a gravity-actuated contact, a shaft having a series of supporting-arms for said contact, means normally operating to hold said shaft in position for one of the arms thereof to form a support for said contact, and means for rocking said shaft, as and for the purpose set forth.

48. In an automatic telephone apparatus, a contact, a supporting-shaft therefor, said shaft provided with sets of supporting-arms,

an operating-lever for oscillating said shaft, and an escapement mechanism for supporting said shaft, and electromagnets for actuating said lever and said escapement, the circuits of said magnets being controllable from the subscriber's station, as and for the purpose set forth.

49. In an automatic telephone apparatus, a carrier gravity-actuated in one direction, a plunger for returning said carrier to initial position, and means actuated by the movement of said contact as it approaches initial position for arresting the action of said plunger, as and for the purpose set forth.

50. In an automatic telephone apparatus, a contact gravity-actuated in one direction, means for restoring said contact to initial position, a valve for controlling said restoring means, and means actuated by the movement of said contact as it approaches initial position for actuating said valve to arrest said restoring means, as and for the purpose set forth.

51. In an automatic telephone apparatus, a movable contact, a cylinder and plunger, said plunger connected to said contact for moving the same to one limit of movement thereof, said cylinder communicating with a source of power, a valve for controlling said

communication, a latch connected to said valve, a rock-lever for engaging said latch, a spring for rocking said lever in one direction, an electromagnet for moving said lever in the opposite direction, means for making or breaking the circuit of said magnet, and auxilliary connections actuated by said carrier for releasing said latch from said lever, as and for the purpose set forth.

52. In an automatic telephone apparatus, a gravity-actuated contact-carrier, a shaft having supporting-arms, means for actuating said shaft to move said arms into and out of supporting relation with respect to said carrier, means for moving said supporting-shaft to effect additional movement of said carrier, means for returning said carrier to initial position, and a stop on said shaft arranged to be engaged by said carrier to restore said shaft to its initial position, as and for the purpose set forth.

In witness whereof we have hereunto set our hands, this 21st day of November, 1900, in the presence of the subscribing witnesses.

JOHN J. BROWNRIGG.
JOHN K. NORSTROM.

Witnesses:

FRANK A. LUNDQUIST,
S. E. DARBY.