No. 732,131. PATENTED JUNE 30, 1903.

A. J. SPRINGBORN.

SELECTIVE PARTY LINE TELEPHONE SYSTEM.

APPLICATION FILED JUNE 12, 1901.

NO MODEL. 5 SHEETS—SHEET 1.

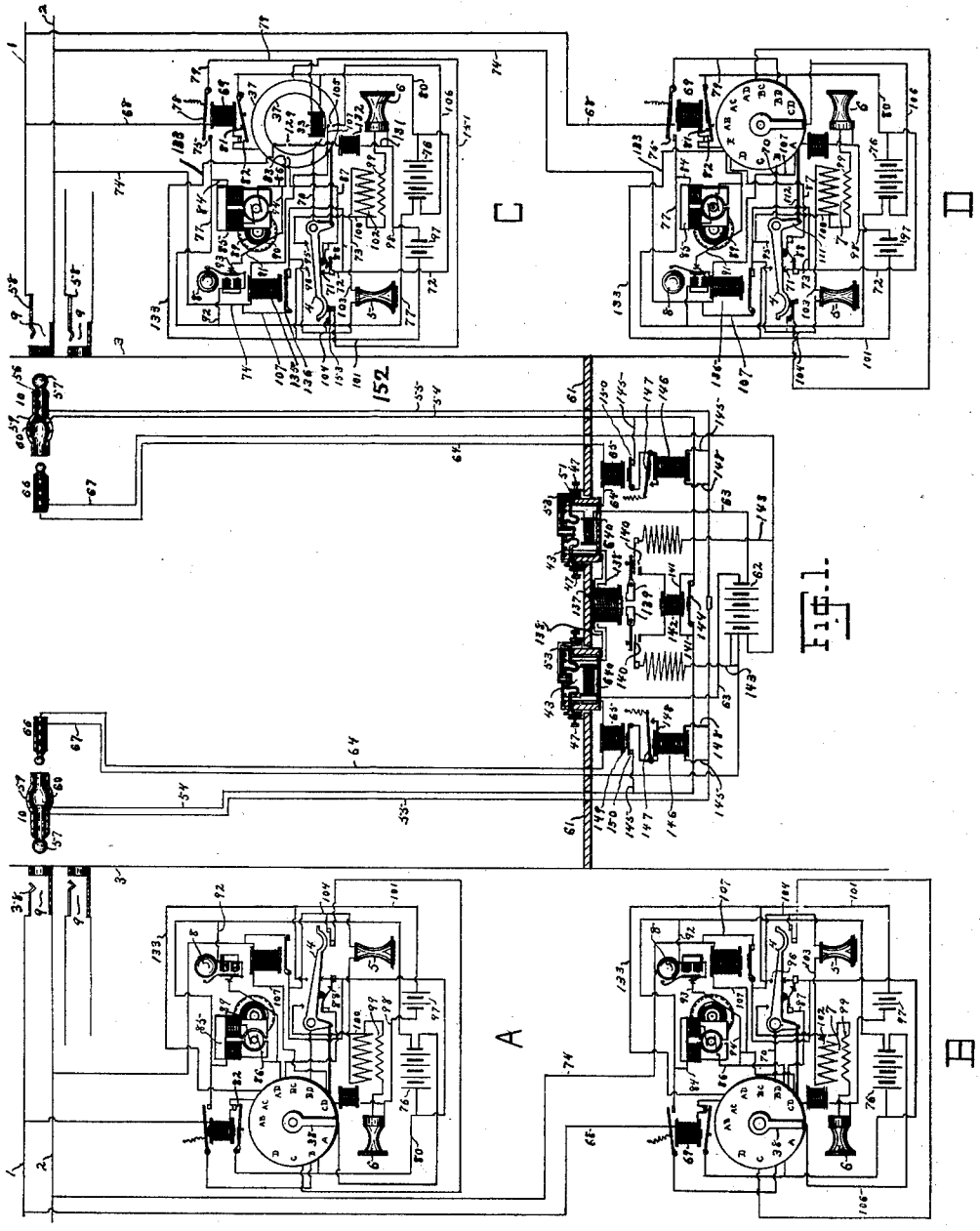

Fig. 1.

Witnesses
H. W. Woodward.
Adolf Krauss.

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By his Attorney
S. E. Foulds

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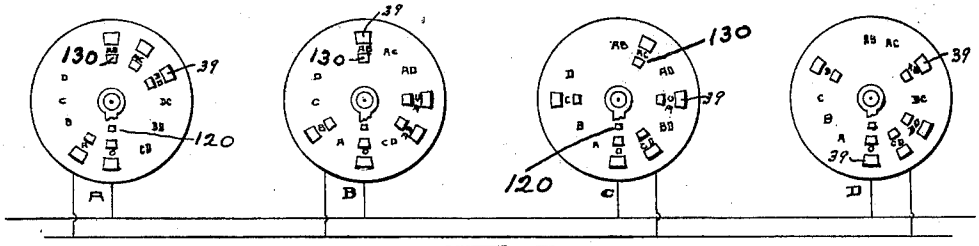

Fig. 2.

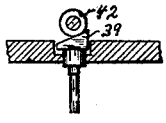

Fig. 9.

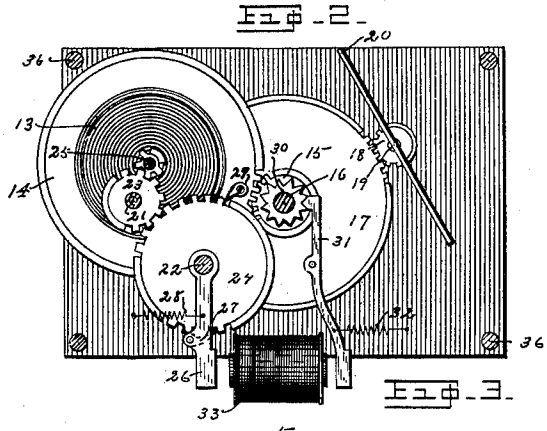

Fig. 3.

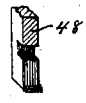

Fig. 10.

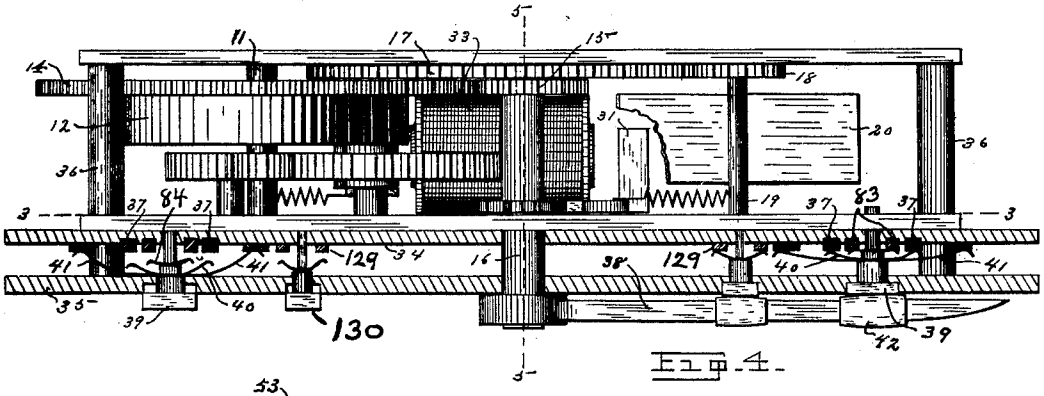

Fig. 4.

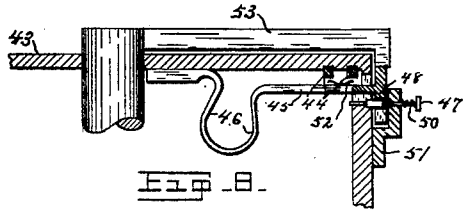

Fig. 8.

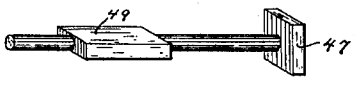

Fig. 11.

WITNESSES:

Brennan West.

M. C. Barnaby

Albert J. Springborn INVENTOR.

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D. E. Foulds ATTORNEY.

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NO MODEL. 5 SHEETS—SHEET 3.

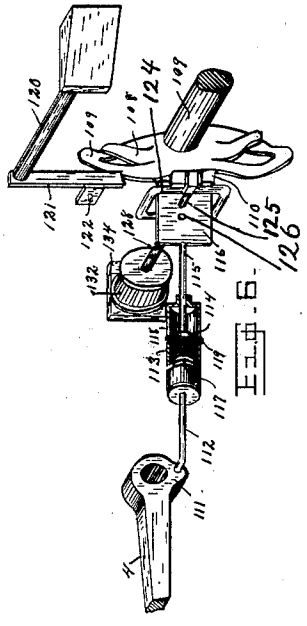

FIG. 6.

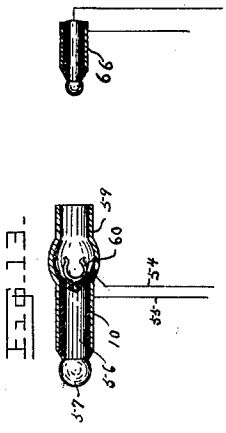

FIG. 13.

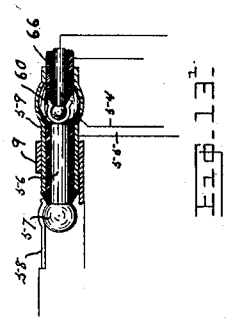

FIG. 13.

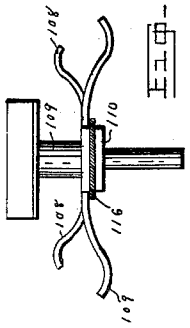

FIG. 7.

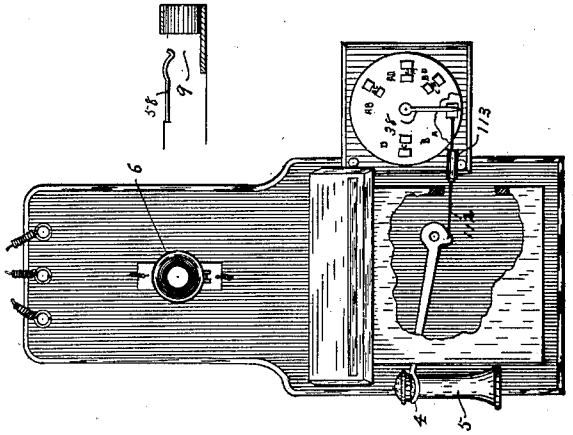

FIG. 12.

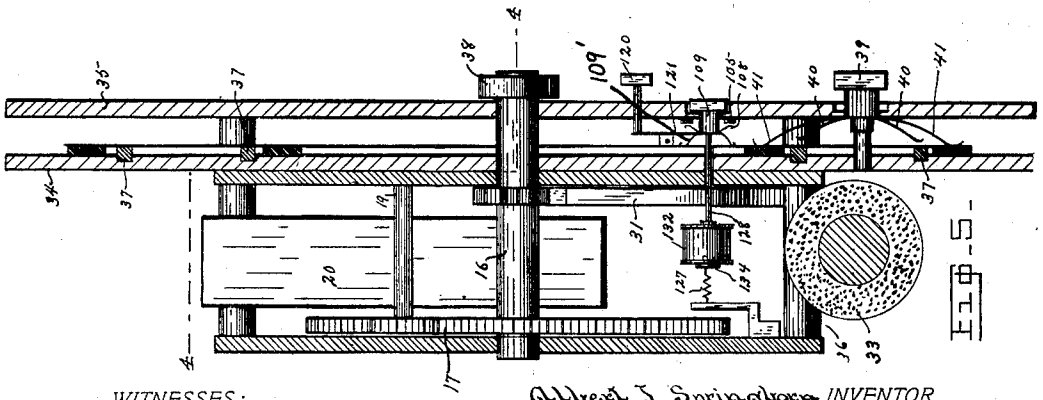

FIG. 5.

WITNESSES:

Brennan West.

W. C. Bromley.

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A. E. Foulds ATTORNEY.

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A. J. SPRINGBORN.

SELECTIVE PARTY LINE TELEPHONE SYSTEM.

APPLICATION FILED JUNE 12, 1901.

NO MODEL. 5 SHEETS—SHEET 4.

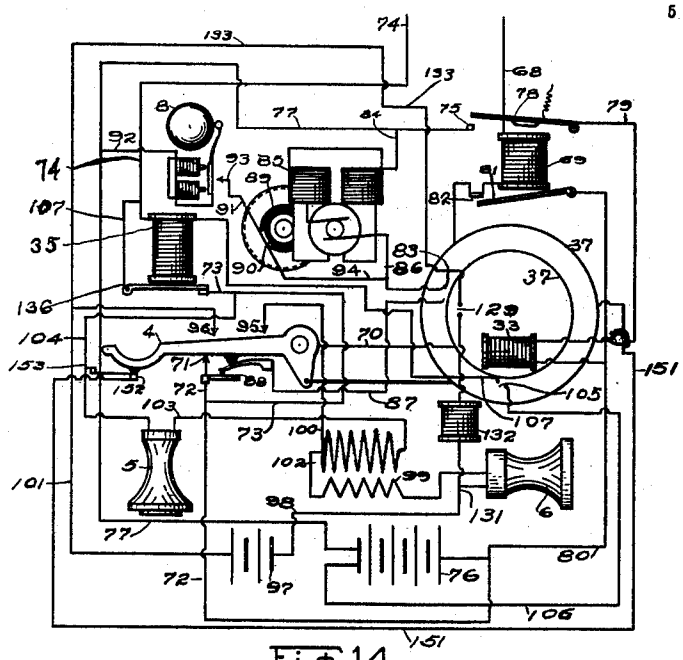

Fig. 14.

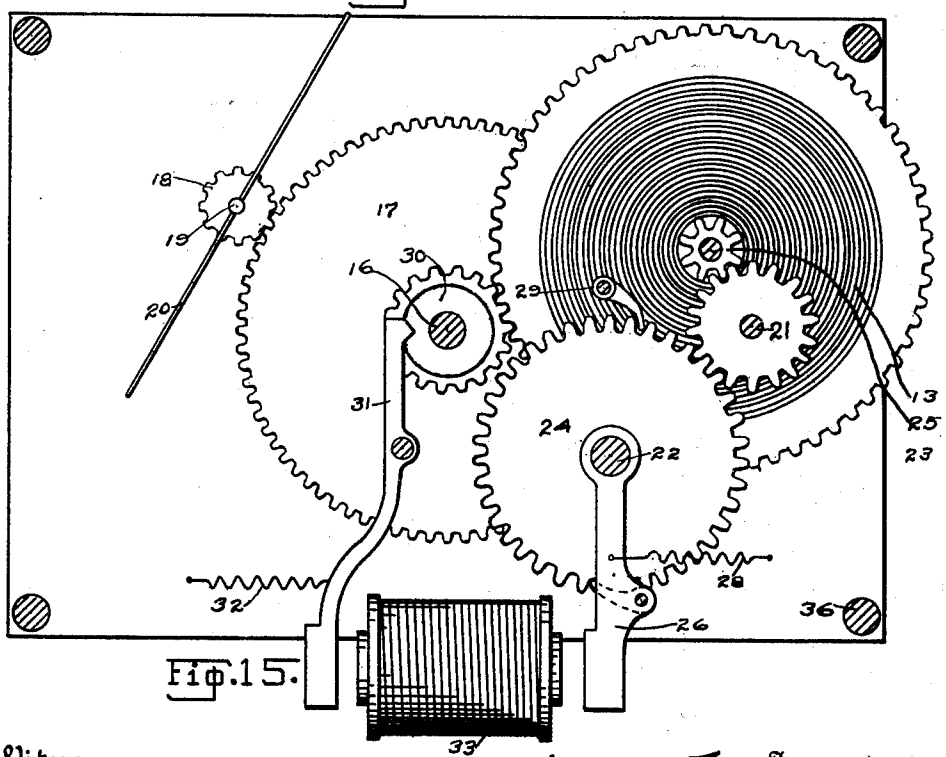

Fig. 15.

Witnesses
W. D. Browning.
T. L. Mead, Jr.

Albert J. Springborn Inventor
By his Attorney
D. E. Foulois.

No. 732,131. PATENTED JUNE 30, 1903.

A. J. SPRINGBORN.

SELECTIVE PARTY LINE TELEPHONE SYSTEM.

APPLICATION FILED JUNE 12, 1901.

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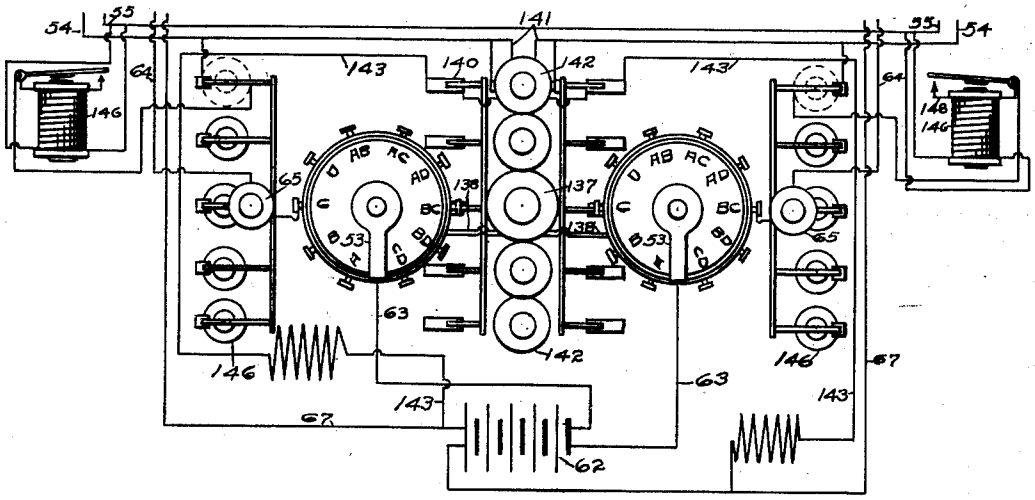

Fig. 16.

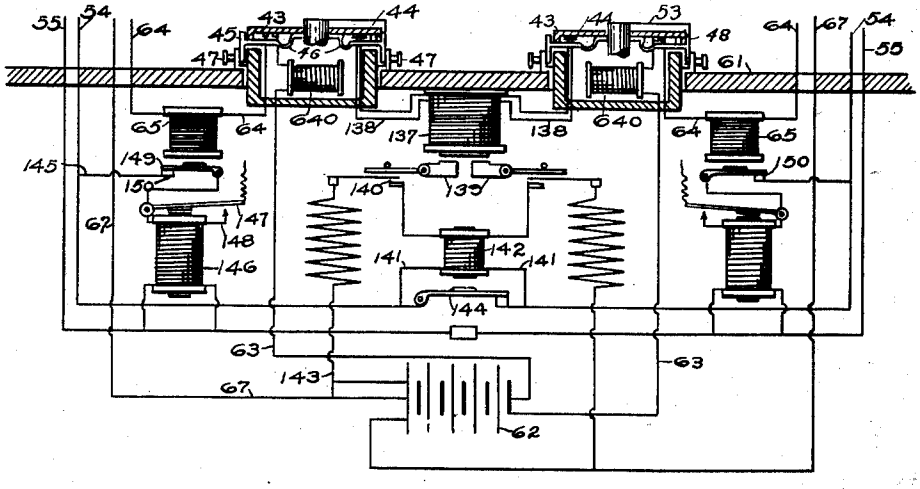

Fig. 17.

Witnesses
W. D. Browning.
T. L. Mead Jr.

Albert J. Springborn Inventor
By his Attorneys D. C. Foulds

No. 732,131. Patented June 30, 1903.

UNITED STATES PATENT OFFICE.

ALBERT J. SPRINGBORN, OF CLEVELAND, OHIO.

SELECTIVE PARTY-LINE TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 732,131, dated June 30, 1903.

Application filed June 12, 1901. Serial No. 64,302. (No model.)

To all whom it may concern:

Be it known that I, ALBERT J. SPRINGBORN, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and useful Improvement in Selective Party-Line Telephone Systems, of which the following is a specification.

This invention relates to what are known as "party-line" telephones, and has reference to the means employed whereby the particular telephone on the line with which communication is desired is signaled to the exclusion of all the other telephones and whereby all the telephones not so signaled are left without connection, so that it is impossible to use them. These means are illustrated in the accompanying drawings, in which—

Figure 1 shows a diagrammatic view of two party-lines, each being provided with two telephones in parallel and each extending to the central office, the connections and apparatus in which are also shown. Fig. 2 shows a diagrammatic view of a party-line which is provided with four telephones in parallel, showing the dials for the selecting apparatuses and the means for making the proper connection for each. Fig. 3 shows a view of the clockwork and the mechanism for controlling the same, said view being taken on the line 3 3 of Fig. 4. Fig. 4 is a view of the clockwork and the dial, the same being taken on line 4 4 of Fig. 5. Fig. 5 is a view through the clockwork and dial, the same being taken on the line 5 5 of Fig. 4. Fig. 6 is a perspective view of the mechanism for controlling the circuit-closer for returning the dial-hands to "0." This figure also shows a detail view of the means employed for preventing a party who is not in the talking-circuit from returning the telephones on the line to "0" while another party is talking. Fig. 7 is a view of a detail shown in Fig. 6, the key being shown in full. Fig. 8 shows an enlarged view of a portion of the selecting devices employed at the central station. Fig. 9 is a section taken through the outer dial in the plane of a depressible key, showing the beveled head of said key and the roller on the dial-hand for depressing the same. Fig. 10 is a section through the outer end of the spring-pieces for connecting the conducting-rings in the central selecting device and showing the T-slots in the same. Fig. 11 is a perspective view of one of the keys of the selecting device for the central station. Fig. 12 is a view, partly in elevation and partly in section, of a telephone having my selecting device attached thereto. Fig. 13 shows at the left the switchboard-jack, at the center the plug for the same, and at the right the selecting-plug. Fig. 13′ shows these parts with both plugs in position. Fig. 14 is a diagrammatic view, on an enlarged scale, of the telephone connections shown in Fig. 1. Fig. 15 is an enlarged view of the clockwork mechanism for operating the selecting device at central. Fig. 16 is a diagrammatic view showing in plan the arrangement of the dials and connections at central, and Fig. 17 is an enlarged view taken vertically through the center of the dials and also showing the electrical connections at the central station.

Similar reference characters designate corresponding parts throughout the several views of the drawings.

In party-line telephone systems in use at present the subscriber is subjected to the annoyance of having all of the signals sounded on his telephone whether he is the particular subscriber desired or not. Furthermore, after the proper connections are made the users of these telephones are liable to be interrupted by other persons on the line, who may listen to or take part in the conversation, thus destroying all secrecy in the service. In order to overcome these serious defects and at the same time to make my inproved system entirely automatic and quick in action, I have devised the means of which the drawings show my preferred form, in which—

1 and 2 represent the main wires of a party-line, the same leading from the various party-telephones (shown at A, B, C, and D) to the switchboard, (indicated at 3.) In order to more clearly disclose the means for connecting two party-lines at the central station, I have shown the telephones A and B on one line and C and D on another, each of the lines leading to the switchboard, which for the sake of clearness is shown divided, one line passing in at one side and the other line at the other side.

In each of the telephones shown, 4 designates

the hook, upon which the receiver 5 is adapted to hang in the usual manner.

6 is the transmitter, the circuit from which leads through the primary of the induction-coil 7.

8 designates the call-bell, which in the party-line telephones used in connection with this system is preferably of the ordinary make-and-break-circuit form.

At the central station 9 represents the ordinary jacks of the switchboard, and 10 the plugs for the same. These plugs are of the peculiar construction shown, the purpose of such construction being hereinafter made to appear.

This system depends for its operation upon a series of selecting devices, one for each telephone, and also upon one or more of a somewhat different form of selector at the central station. In order for these devices to always select the particular party with whom connection is desired to the exclusion of all other parties on the line, it is necessary for all of the selecting devices to move synchronously. To accomplish this result, I provide each selecting device with clockwork mechanism, which is shown in Figs. 3, 4, and 5, these figures being intended to illustrate selecting devices at the telephones, although the clockwork mechanism for the device at central is practically the same, as appears from Fig. 15. In this mechanism, 11 represents the drum-arbor, and 12 the drum, within which is coiled the spring 13. As will be understood, one end of this spring is fastened to the drum, while the other end is attached to the drum-arbor. Secured to the drum is a large pinion 14, which meshes with and drives a small pinion 15, which is secured to the central shaft 16. Also secured to the central shaft is a large pinion 17, which meshes with a small pinion 18 on the shaft 19, which carries the governing-fan 20. Instead of a fan a suitable form of escapement mechanism may be employed, if desired. Projecting from the frame of the clockwork mechanism are studs 21 and 22, upon which are journaled gear-wheels 23 and 24, which are geared to a small pinion 25 upon the drum-arbor. Also journaled upon the stud 22 is a lever 26, which carries a pawl 27 for engaging with the teeth of the gear-wheel 24 to drive the same when the lever is moved forward against the tension of its spring 28. For preventing the backward rotation of the gear-wheel 24 I provide a detent-pawl 29, which is secured to a stationary part of the framework and engages with the top teeth of the gear-wheel. From this description it will be understood that when the lever 26 is moved forwardly it will turn the gear-wheel 24 and through the train of gearing will turn the drum-arbor to wind the spring. Furthermore, when the central shaft is permitted to turn by releasing mechanism, presently described, the train of gearing extending from the drum-arbor to the governing-fan will be rotated. This releasing mechanism is shown most clearly in Fig. 3 and Fig. 15 and consists of a notched disk 30, which is secured to the central shaft, in the notches of which the beveled end of a lever 31 is normally pressed by means of a spring 32. When this lever is moved so as to disengage its beveled end from the notches, the clockwork mechanism is free to operate. It will be seen that it is necessary to release all of the mechanisms on the various party-telephones on a line at the same instant, and for this purpose I provide each of the selecting devices with an electromagnet 33, which is preferably mounted between the ends of the levers 26 and 31, so that when a current is passed about the same these levers will be drawn toward each other to release the clockwork and also to wind up the spring. The gears for winding the spring and those for driving the central shaft are so proportioned that the spring is always kept under driving tension. The frame for the clockwork mechanism is secured to the rear side of an inner dial-plate 34, and the central shaft projects through the same and also through the center of the outer dial 35, the framework and the dials being secured together by the posts 36. Secured to the front face of the inner dial are two conducting-rings 37, which are mounted concentrically with each other and with the central shaft. Under conditions which will hereinafter be fully explained these conducting-rings form a part of the talking-circuit. Normally they are insulated from each other, so that no current can pass between them, but are connected together at certain points by means which is controlled by the clockwork mechanism. This means consists of the dial-hand 38, which is secured to the outer end of the central shaft and which moves over the face of the outer dial, and also of the keys 39, which are mounted in the dials, so as to project between the conducting-rings 37. These keys carry spring metallic connecting-pieces 40, which extend over the conducting-rings and are adapted to be pressed into contact therewith. Preferably these connecting-pieces are formed of spring material, so that proper connection will be more certain. As shown, they are in the form of tongues, which are stamped from a blank, the outer portions 41 of which extend beyond the ends of the tongues and press upon the surface of the inner dial to hold the key 39 in its outward position. Although the blank shown in Fig. 6 is intended for a special purpose, hereinafter stated, this figure shows the way in which these blanks with their tongues are formed from the single piece of metal. The head of the keys 39 are beveled on their outer surfaces, (shown in Fig. 9,) and the dial-hand 38 is preferably provided with a roller 42, which is adapted to roll upon the beveled face of the heads, and thus depress the same to force the connecting-pieces 40 into contact with the conducting-rings 37. As illustrated more clearly in Fig. 2, which shows a party-line

with four telephones connected therewith, the keys 39 are arranged in different positions on the different telephones. Thus in telephone 4 the keys are placed at A, AB, AC, and AD. By having the keys so placed when the dial-hand passes the same the talking-circuit through telephone A will be bridged between the conducting-rings 37. In telephone B the keys are placed at B, AB, BC, and BD. In telephone C the keys are placed at C, AC, BC, and CD. In telephone D the keys are placed at D, AD, BD, and CD. Normally all of the dial-hands rest at the lower part of the dial, which I designate as "0."

From the above description it will be understood that inasmuch as the dial-hands are started from the same point and travel with the same speed whenever the circuit is made at one telephone it will be open at all of the other telephones except when it rests upon the keys having a double letter, in which case both of the telephones having those particular letters will be in the circuit, so that communication can be had between them.

The current which sets the various selecting devices in operation is controlled in the first instance at the central station by the selecting device or devices there. These devices are shown in Fig. 1 at 43, in Figs. 15, 16, and 17, and also in part in Fig. 8. As has been stated, these selecting devices are provided with practically the same kind of driving means as those in the party-telephone. In these selecting devices the dial-hand instead of making the circuit as in the party-telephones breaks the same, so as to stop the current which is flowing through the magnets 33 in the various telephones. The instant this occurs the springs 32 will throw the beveled ends of the levers 31 into a notch of the disks 30, which will instantly bring the hands on all of the dials to rest. The selecting devices 43 carry on the inside of their covers conducting-rings 44, which are made and arranged similarly to those in the other devices. Normally the conducting-rings have no metallic connection, so that no current can flow from one to the other. When desired, however, they are bridged by the spring-levers 45, which are arranged within the selecting device and radiate from the center thereof. These levers are formed, preferably, of spring material, and in order to secure better results as a spring I form the same with a downwardly-turned bend, as shown at 46. With this construction it is evident that the levers tend to spring upwardly into contact with the conducting-rings 44. Normally they are prevented from doing so, however, by keys 47, which are arranged about the dial, there being one key for each lever. As is shown more clearly in Fig. 10, the depending portions 48 on the outer ends of the levers are provided with T-shaped holes or slots, through which the keys 47 pass, and the keys are also provided with enlarged portions, (shown at 49,) which normally rest in the wider portion of the T-slot to hold the lever 45 depressed, the keys being held in this position by means of a spring 50, which is placed between the heads of the keys, and a plate 51, which is secured to and extends around the selecting devices. As long as the large portion 49 of the key remains in the large part of the T-slot the lever will be depressed. When, however, the key 47 is pushed inwardly, the part 49 is removed from the slot and the lever 45 springs up, the small portion of the key passing through the small portion of the T-slot. In order to secure a more certain contact, I preferably provide the levers 45 with spring-pieces 52, which are pressed tightly against the conducting-rings when the levers are up. When the contact is made in the central-station selecting devices as described, all of the devices, including the one at central, are thrown into operation and are kept running until the circuit is broken. This is done by the dial-hand 53 on the selector at the central station. For accomplishing this result I project the end of the dial-hand beyond the top of the dial and turn the same downwardly into the plane of the extension 48 on the end of the levers 45. When the dial-hand is turned so as to bring the same into engagement with the lever 45, the latter is depressed out of contact with the conducting-rings 44, and the large portion of the T-slot is brought into line with the large part 49 of the key 47, so that the latter may snap into the hole in the lever and hold the same depressed. When the lever 45 is pressed downwardly in this manner, the circuit through the dials in the central station and also on the party-line is broken, so that the various magnets 33 are de-energized. This permits the various levers 31 to engage with the notches in their disks 30 to stop the clockwork mechanisms. For reasons hereinafter stated it is not desired to stop the dial-hand on the central-station circuit until it has made a complete rotation and returned to "0". For this reason the disks 30 for these selecting devices are formed with a single notch for the lever 31. With this construction when the circuit is broken, as above described, the levers 31 merely press against the smooth surfaces of the periphery of the disk 30 until the notch is brought opposite thereto, when they snap into engagement and stop the mechanism with the dial-hands at "0." This construction is best seen in Fig. 15.

Having thus described the structure of the dial mechanisms, I shall now proceed to trace the various circuits and will invite attention to the diagrams shown in Figs. 1, 14, 16, and 17. 54 and 55 represent the wires within the cables, to which are connected the plugs 10, heretofore referred to, said plugs being adapted for insertion into the jacks 9 of the switchboard in the usual manner. Each of these plugs is composed of a central piece 56, which is provided with a head 57 for en-

gagement with the springs 58 of its jack. Surrounding the piece 56 and insulated therefrom is a sleeve 59, which has a bulge near its center just opposite the rear end of the piece 56. Within this bulge and connected with the said piece are springs 60, the function of which will be hereinafter stated. The wires 54 and 55 extend through the operator's table 61 and passing across below the same extend outwardly through the table again and are connected at their opposite ends to another plug 10, like the one just described. When these plugs are inserted into their respective jacks, complete metallic connection is made between the leading-wires which are connected with said jacks, and any telephones on these lines will under certain conditions be connected for talking. In order to send the current through all of the party-telephones, it becomes necessary to provide a battery at central and also the necessary connection between the same and the main lines 1 and 2. This battery is shown at 62, where it is conveniently arranged below the operator's table 61, on top of or within which are placed the operator's selecting devices 43. From this battery I lead wires 63 into the selecting devices at central and carry them around the electromagnets 640, which correspond to the magnets 33 in the telephone heretofore described, and from thence to one of the conducting-rings 44. From the other one of these rings I lead a wire 64 downwardly through the selecting device to an electromagnet 65 and from thence outwardly through the table to the inner part of what I term my "selecting-plug" 66. This plug, like that heretofore described, is composed of an inner part and an outer sleeve, which are insulated from each other. This plug is adapted to be inserted into the rear end of the plug 10, when the springs 60 will engage with the head of the inner part of the plug 66, thus forming an electric circuit from one of these inner parts to the other and thence to the main wire 1. The sleeves on the selecting-plugs form electric contact with the sleeves 59 on the plugs 10, which afford an electric connection between the sleeves on the plugs 66 and the main wires 2. From the sleeves on the selecting-plugs wires 67 lead back to the opposite side of the battery 62, the wires 64 and 67 forming a cable. Assuming that a complete circuit is established through the party-telephones, it will be seen that when the plugs 10 and 66 are inserted in their respective positions and the circuit in the selector is closed by the depression of a key 47 a current will flow from the positive side of the battery 62 through the selecting mechanism, thence around the magnet 65, thence through the inner portions of the two plugs, thence through wire 1, through the various telephones, back through the wire 2 and the sleeves of the jack and the plugs, and back through the wire 67 to the opposite side of the battery. As soon as the current begins to flow the magnet 640 is energized, which releases the clockwork mechanism for that selecting device, so that the dial-hand 53 is rotated. The current will continue to flow until the dial-hand reaches the lever 45, which has been released, when it will press said lever downwardly until it is caught by its key 47, thus breaking the circuit. Similarly the current has released all the various selecting mechanisms on the line with which the selecting-plug 66 is connected, and the dial-hands of these various mechanisms have turned with the hand on the central dial until the current was broken, when the hands on the telephone's dials were arrested. As has been stated the dial-hand 53 tends to move until a complete rotation has been made, when it is also arrested.

In Fig. 1 the telephone, which I have named "C," has its dial and the driving mechanism removed to show in diagram the arrangement of the various wires in the selecting mechanism and their connections with the other parts of the telephone. This telephone, with its connections, is also shown in Fig. 14. In these figures the contacting rings 37 appear, and it will be remembered that these rings are bridged wherever any of the keys 39 are depressed. It should be stated that each of the various telephone-dials has a key at "0," so that when all of the dial-hands have been returned to this point a complete circuit will be formed between the conducting-rings. When the current comes in from central over wire 1, it will be conducted over the wires 68 to the relay 69 and thence to the outer ring 37. From here it will pass through the contact-plate 40 to the inner ring 37 and thence by the wire 70 to the hook 4. From here it will pass out at the contact 71 and will follow the wires 72, 73, and 74 to the lead-wire 2, from which it returns to the battery 62, as has been described. Inasmuch as this current is divided between the telephones, it may not have sufficient strength to actuate the magnets 33 for releasing and winding the clock mechanism on the selecting devices. For this reason it is conducted about the relay 69, which closes a local circuit at 75. In this circuit is placed a battery 76, which sends a current through wires 77, contacts 75, armature 78, wires 79, electromagnet 33, and wires 80 to the battery. This gives a short local circuit with slight resistance, so that a current strong enough to operate the clockwork mechanism is secured, which current continues to flow as long as the relay is energized. It will of course be understood that this same result is effected in all the various telephones on the line. Inasmuch as these telephones are all alike, I shall confine my description to one of the same and shall refer to the others only when some difference in their structures makes it necessary to do so. Now no sooner does the hand of the dial for the telephone begin to rotate than it passes off of the key 39 at "0," which

key moves outwardly and breaks the circuit between the conducting-rings 37. The current would then cease to pass around the relay 69, and the dial-hand would stop if some means were not provided for switching the current around the selecting mechanism. For this purpose I cause the relay 69 to operate a second armature 81, which makes contact with the wire 68 beyond the relay 69, so that the current will pass from said relay through the contact-point at 82, the armature 81, and the wires 80, 72, 73, and 74 back to the wire 2, as before. By this connection the relay will be kept energized and the contact-points 76 kept closed, so that the clockwork mechanism will be permitted to operate until the circuit is broken at the central station, as described. A wire 151 is also led off at some point beyond the relay, as from the outer conducting-ring 37, to a pair of contact-points 152, which are pressed together by the hook 4. These points are also connected to wire 104, presently described, by wire 153, and as long as the hook is down part of the current may pass along this circuit. When the dial-hand gets to the proper point, it is necessary to sound the call-bell to signal the user of the particular telephone desired. For this purpose I place preferably between the conducting-rings 37 contact-points 83, which are shown in Figs. 4, 1, and 14, Fig. 4 being a view taken through the telephone C of Fig. 2, this particular telephone having keys 39 diametrically opposite on the horizontal line. All of the keys on the dials except those at the "0" point are provided with metallic circuit-closers 84, which press upon the contacts 83 when their respective keys are depressed and held down by the dial-hand 38, there being contact-points 83 at each of the keys. As soon therefore as the dial-hand reaches the desired point it stops with the key depressed, forming contact between the conducting-rings 37 and the contact-points 83. It will be remembered, however, that no other telephone on the line, except when a double-letter key is pressed, has a key in this particular location, so that no other bell is sounded, as no other telephone is in connection. When the contacts 83 are closed as described, a current flows from the battery 76 through wires 77 84, motor 85, wire 86 to the contact-points 83, through the contact-piece 84, wire 87, contact-points 88, and wires 72 to the opposite side of the battery 76. This current will drive the armature on the motor as long as it flows. This armature is geared so as to rotate a disk 89, which is formed of insulated material except at one part 90 on its periphery, which is formed of conducting material. Brushes 91 bear upon the periphery of this disk, but are out of contact and insulated from each other except when the metallic portion 90 passes under them. This contact lasts for an instant only, and during this time a current is permitted to flow from the wire 77 into the wire 92, bell 8, wire 93, brushes 91, and wire 94 to wire 86, so that for this short time the circuit is divided between the bell and the motor. By this arrangement the bell is rung intermittently as long as the current is permitted to flow in the circuit described. It will be noticed that the contact-points 88 are pressed together by means of the hook 4 as long as the receiver is hanging thereon; but whenever the subscriber who is called removes his receiver the hook will fly up and will break the circuit at the points 88, which will stop the motor and the bell. When the hook rises, it forms contact at 95 and 96 with the lines to the talking-circuit, so that a current flows from the battery 97 through wires 98, transmitter 6, primary coil 99, wire 100 to the hook, and thence back by wire 101 to the battery again, this circuit differing in no particular degree from those in use at the present time. The impulses which are set up in the secondary 102 of course alternate in the circuit, but may be traced through the wire 103, receiver 5, wires 104, 73, and 74 to the main wire 2, thence to the jack 9 and to the cable at the central into the opposite jack, from whence it passes around the other telephone in the circuit, back through central to the line 1, down wires 68, conducting-rings 37, which are now connected, contact-pieces 40, through wire 70 to the hook 4, and thence back through wire 100 to the secondary 102, from whence it started.

In order to save time and to avoid labor and annoyance at the central station and also to make certain that the lines will not be left in an inoperative position, it is desirable that the various telephones be automatically returned to "0" when the persons who have been using the lines hang up their receivers. For this purpose I place contact-points 105 on the dial and provide the latter with mechanism for opening these contact-points when the dial-hand is on "0". When said hand moves from "0," these points will under certain conditions, presently stated, come together. Assuming that these contacts are together while the hook 4 is depressed, a current will flow from the battery 76 through the wire 106, contact-points 105, wires 107 and 74 to the main line 2, thence through all of the various telephones on the line, as well as the line with which connection may have been established, through central to the opposite wire 1, and thence back through the wire 68, conducting-rings 37 with their connecting-pieces, wire 70, hook 4, and wire 72 to the battery again. It will be noticed that this current flows about the relay 69, which becomes energized and closes the local circuit at 75, which throws a strong current around the magnet 33, which controls the clockwork mechanism, for it will be remembered that this magnet when energized attracts the armatures of both of the levers 26 and 31, thus starting and winding the said mechanism. This local current will

continue to flow until the dial-hand reaches "0," when the contacts at 105 will be broken and all of the dial-hands will stop.

It will be evident that the contacts at 105 must not be permitted to come together unless that particular telephone to which they belong is in use. Otherwise as soon as the dial-hand moved away from "0," the telephone-receiver being on the hook, a complete circuit would be established through all of the telephones, which would cause the dial-hands of the same to move entirely around to "0" again, when the hand would break the circuit. Consequently it becomes necessary to form a connection, either mechanical or electrical, between the receiver-hook and the contact-pieces at 105, so that these pieces may not come together except when the hook is raised. My preferred form of this connection is shown in Figs. 5, 6, and 7, particular reference being directed to Fig. 6, in which 4 represents the hook, and 108 the contact-piece, which bridges the contacts 105. This piece is secured to a key 109, which projects outwardly through the dial and has its head beveled on its upper face, so as to be depressed by the dial-hand when at "0." It will be noticed from Fig. 5 that the contacts 105 are formed on the inner face of the outer dial rather than upon the inner dial, as are the other contacts. The depression of the key 109 therefore separates the contacts and the contact-piece 108. This contact-piece has inwardly-projecting spring portions 109, which bear against the inner dial, so as to press the key outwardly, and it also has an inwardly-extending lug or tongue 110. The hook 4 is of a bell-crank form, having the downward extension 111, to which is jointedly secured a rod 112, which is secured to a cylinder 113. Mounted for movement within this cylinder is a piston 114, the rod 115 for which projects out through the cylinder-head and is secured to a plate 116. Figs. 6 and 7 show this plate bearing against the face of the lug or tongue 110, and Fig. 6 also shows the spring 117, which is in the cylinder at the rear of the piston, in a compressed condition. This is the position of these parts when the telephone has been in use and the receiver has been hung up again. In other words, this is the position of these parts when the last circuit described is completed by closing the contacts at 105 and at 71. When the dial-hand comes to "0," the key 109 is depressed until the upper part of the lug or tongue is brought below the plate 116, which will then snap forward over the contact-piece 108 and will prevent the same from moving against the contact-points 105. When, however, the dial-hand has moved from over the key 109 and the receiver is removed from the hook, the plate 116 will unless prevented be pulled back to release the contact-piece 108 and permit it to engage with the contacts 105. To limit the movement of the piston in its cylinder, so as to draw back the plate when the hook is raised and also to prevent the plate from turning, so that it will not engage properly with the contact-plate, I provide the cylinder with grooves 118, into which extend projections 119 on the piston, the projections sliding in the grooves.

In order to prevent any person on the party-line from returning the telephones to "0," and thus destroying connection between two parties while they are using the line, which he could do by simply removing his receiver from the hook, which would close the contact at 105, and then hanging up the receiver again, which also closes the circuit at 71, I provide the plate 116 with suitable locking means, the same being shown more clearly in Figs. 5 and 6, the connections for the same appearing in Fig. 1. By this means the plate 116 is locked in position over the contact-plate 108 except when the dial-hand for that telephone is resting upon a key 39. When the hand is in this position, it is necessary for the plate to be unlocked, so that the hook can rise; but at all other times it should be locked down. Inasmuch as it should always be possible to raise the hook when the dial-hand is on "0," I provide the dial at that point with a special key 120, which, like the others, is formed with an inclined face, so as to be depressed by the dial-hand. This key bears with its inner end against the end of a lever 121, which is pivoted at 122 and has its opposite end passing below a hook 123, connected with the catch. For clearness this lever is shown partly broken away in Fig. 6. This catch preferably consists of an open rectangle 124, which surrounds the plate 116 and has above the plate a projection 125, which is adapted to enter a hole 126 in the plate. While the key 120 is depressed, the projection 125 is held out of the hole, so that the plate may move. As soon as the dial-hand turns from over the key 120 the projection is pulled into the hole by means of a spring 127, which is connected to the rear end of the stem 128 of the catch, which locks the plate and also the hook until the hand reaches the key 39 of that particular dial. At this point the plate 116 must be again released, and for this purpose I place at the various keys (indicated on telephone C in Fig. 2) contact-points 129, which are adapted to be closed by keys 130 when the dial-hand is resting upon the adjacent key 39, or, if preferred, the contact-closers may be carried by the latter keys. When contact is made in this manner, a current is permitted to flow from battery 97 through wires 98, 131, magnet 132, (see Fig. 6,) contact 129, wire 133, and wire 101 back to the battery. When the magnet 132 is energized in this way, it will attract its armature 134, which is connected with the stem 128 of the catch, and by so doing will release the plate 116. From this description it will be seen that it is impossible to lift the hook to return the line to "0" unless the dial-hand for that particular telephone is resting upon one of the keys 39. In order that the current

passing through the magnet 132 may not rob the circuit through the transmitter of its current, I make the magnet 132 with a high resistance.

It has been shown that when the contacts are closed at 105 and at 71 the current flows through the first-named contact through the wire 74 to the main line 2. When it reaches the wire 107, however, if it is not prevented it passes down through said wire and through wires 73 and 72 to the battery again. It therefore becomes necessary to open this latter branch of this circuit when the telephones are to be returned to "0." For accomplishing this result I place an electromagnet 135 in the wire 74, so that as soon as the current starts through this magnet it will break this circuit through the other branch by lifting the armature 136, thus compelling the current to pass out on the main line.

In the description of the circuits first given it was assumed that the receiver was hanging on the hook of the telephone, so that the same was depressed, as shown in the diagram in Figs. 1 and 14. When, however, a party—say at telephone C in Fig. 1—desires connection, he must signal central, which he does by removing his receiver, thus operating a signal at central in the usual way. The operator then inserts the plug 10 into the jack of the line which has signaled and ascertains by the usual plugging-in and listening device with which the central station is furnished in the usual way who it is that is talking and with whom connection is desired. Let us suppose that a party at telephone C wishes to talk with a party at telephone A, which is on another party-line. It is necessary for central to place both of these party-lines in condition, so that these two telephones and no others will be in the talking-circuit. This is done by inserting the selecting-plug 66 into the plug 10, which is already in circuit with the telephone C, after which the key 47 on the central-station selector which is connected with the plug 66 is depressed at C. This immediately throws all of the selecting devices on that party-line and also that particular selecting device at central into operation, so that the dial-hands are moved simultaneously. When the dial-hand 53 at the central station reaches the connecting-lever at C, it automatically breaks the circuit and stops all of the various telephones, so that no one of them is in circuit except C. It being remembered that the hook on this particular telephone is raised, the current will flow through the central battery 62, through wires 63 and 64, the center pieces of the plugs 66 and 10, spring 58, wires 1 and 68, conducting-rings 37, which are connected at "0," wire 70, hook 4, wire 100, the secondary 102, wires 103, receiver 5, wires 104, 107, 74, and 2, the sleeves in the plugs, and the wires 67 back to the battery. As soon as the operator has inserted the plug into the first party-line and has pressed the key 47 she immediately inserts the plug into the line which has the telephone A connected therewith and presses the key 47 of the selector for that line at A. This immediately starts all of the telephone dial-hands on this line to turning, which continues until the circuit is broken by the central dial-hand when it reaches A. When the hand on the dial at telephone A reaches the desired letter, the call-bell 8 is sounded until the receiver is taken from the hook or until the operator decides that no one is present to answer the telephone, when she returns the same to "0," which she can do by connecting the conducting-rings 44 until her own dial-hand comes to "0." It will be noticed that inasmuch as the hook was elevated at telephone C the call-bell for that telephone did not ring.

Unless some means are provided for preventing such action the circuit through one of the selecting devices at central will flow backwardly through the cable-wires 54 and 55 to the other party-line and will probably turn the dial-hands on said line too far. To avoid this result, I employ an electromagnet 137, about which I pass coils of wire 138, which are connected at their opposite ends to the conducting-rings 44. The wires from each of the selecting devices are insulated from each other in the magnet, so that no current can flow from one selector to the other; but the current from each will energize the magnet. Inasmuch as this magnet forms a circuit between the conducting-rings, I give it a heavy resistance, so as to compel the greater part of the current to pass through the main line. Below this magnet I pivot two armatures 139, so that they will be rocked and their outer ends depressed when their inner ends are lifted by the magnet. This action causes the outer ends of the armatures to close contacts 140 in a local circuit. Now when the current from battery 62 passes through the central selecting device and up the wire 64 if it should return by the wire 54 and pass over to the other party-line it will divide and part of the current will flow through wire 141, the magnet 142, through the contact-points 140 into the wires 143 and 67 to the battery again. When this takes place, the magnet 142 will open the circuit through wire 54 by lifting the armature 144, which will be kept open as long as a current flows through either selecting device. It will thus be seen that it is impossible to get the current from one selecting device into a party-line with which the plug 66 of that device is not connected.

It will be understood that if the central-station selector-plugs were kept in their respective plugs 10 while the telephones which have been connected were in use the magnet 137 could be used for lifting the armature 144. I desire, however, to make it possible to remove the selector-plug 66 as soon as the proper connections have been made, so that they may be again employed for securing

other connections. If so employed, however, the magnet 137 would lift the armature 144, and thereby break the connection in circuits which are in use. I therefore provide each of the cables having the wires 54 and 55 with a separate armature 144, which has its own electromagnet 142, as best seen in Fig. 16, the contacts 140 for each circuit through this magnet being simultaneously closed by the armature 139; but no current can flow through any of the magnets 142 unless it is in circuit with the wires leading to the selector-plugs 66. Consequently no talking-circuit is disturbed by closing the contact-points 140 for that circuit.

When the current is turned into the main line at the party-telephone, which is done by hanging up the receiver, it is necessary to prevent that current from passing across into the other line, and thus turning the dial-hands of those telephones to the wrong points. It is necessary to have the circuit closed somewhere along the line, so that a current may flow, and for this reason I arrange at central a shunt-wire 145, which passes from wire 54 about an electromagnet 146 and connects at its other end with the wire 55. Inasmuch as this shunt-circuit will be closed while the line is engaged, the magnet 146 is given a high resistance and impedance, so that no current will pass in this direction. When the current is turned on from the party-telephone, however, a small current will pass through the wire 145, which will cause the magnet to draw down the armature 147, thus making contact with the wire 148, which affords a short circuit of low resistance between the wires 54 and 55. This short circuit will carry practically all the current flowing over the line, so that not enough will pass over to the other line to cause any disturbance of the selecting devices there. These short circuits will interfere with the proper operation of the main circuits through the central selecting devices if they were permitted to remain closed while the current is flowing, as it would then pass from the battery 62 through line 63, selecting device, and line 64 to the inner members of the plugs, thence down line 54, through the shunts to line 55, and thence back through the sleeves of the plugs and wire 67 to the battery. By taking this course the main part of the current fails to pass through the party-line, and the telephone selecting devices will not be operated. To break these shunt-circuits, I place the magnets 65 in the lines 64 and cause them to lift their armatures 149 to break the circuits at 150 when the current passes around them.

It will be remembered that when one telephone is in use in the party-line all the others are out of the talking-circuit, as their dial-hands do not rest on a key 39. For this reason when the receiver of the telephone which has been in use is hung up and the circuit from its local battery 76 is closed at 71 and 105 no current could flow through the party-line unless a shunt-circuit is established around the other selecting devices. This is the function of the wires 151 and the contact-points 152, heretofore referred to. As soon as the current starts around the circuits through these wires the relays 69 act and close the local circuits at 75, which starts and winds the clockwork mechanism on all the telephones, thus restoring all the dial-hands to their zero positions.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a telephone system, a central station, a line leading from said station, telephones connected with said line and normally in talking-circuit with the central station when their receiver-hooks are released, a selecting device at the central station, a source of electric power connected with said device, means for connecting said device with the line, selecting devices for each telephone, means for closing the circuit from the said source of power through the selecting devices and the line, means whereby the resulting current causes the various selecting devices to operate simultaneously, and thus break the talking-circuits of their respective telephones, means whereby the central selective device automatically opens the circuit from the said source of power after it has been closed a predetermined time to stop the selecting devices and means whereby one of the telephone selecting devices as it comes to rest again places its telephone in condition for use.

2. In a telephone system, a party-line, telephones connected with said line, said telephones being normally in condition for talking when the receiver-hooks have been released, a selecting device connected with each telephone and with said line, means for causing a current to pass through the line and the selecting devices to operate the latter, means for breaking the circuit to stop the current and the selecting devices at any desired time, and means whereby the operation of the various selecting devices first breaks the talking-circuits in all of the telephones and then closes said circuits in one of said telephones to the exclusion of all other talking-circuits on the line.

3. In a system for controlling electric circuits, the combination of a central selecting device, a second selecting device in circuit therewith, means at the central device for closing the circuit for operating the said devices, means for automatically breaking the circuit to stop the devices, and a second circuit connected with the second device which is closed by said device just before it comes to rest.

4. In a system for controlling electric circuits, a normally open main circuit, a central selecting device, a plurality of branch selecting devices in the main circuit therewith, a plurality of branch circuits, one for each

branch selecting device, means for closing the main circuit at the central selecting device to simultaneously release all of the selecting devices, means for causing all of said devices to operate synchronously, means whereby the central selecting device automatically breaks the main circuit to simultaneously stop all of the branch selecting devices, and means whereby one of the branch circuits will be closed at substantially the moment that the main circuit is broken while the other branch circuits will remain open.

5. In a telephone system, a central station, a party-line leading from said station, a plurality of telephones on said line, said telephones being normally in condition for talking, a device at the central station for first throwing all the telephones out of the talking-circuit and then automatically establishing a talking-circuit for the particular telephone desired to the exclusion of all the other telephones on the line, and means controlled by the telephone that has been in use for automatically restoring all the telephones on the line to their original condition.

6. In a telephone system, a central station, a party-line leading from said station, a plurality of telephones on said line, said telephones being normally in condition for talking, a device at the central station for first throwing all the telephones out of the talking-circuit and then automatically establishing a talking-circuit for the particular telephone desired to the exclusion of all the other telephones on the line, and means controlled by the telephone that has been in use for first breaking its own talking-circuit and then simultaneously restoring all the telephones on the line to their original condition.

7. In a telephone system, a central station, a telephone-line, a telephone on said line, means for sending a current from the central station through said line and telephone, means controlled by said current for closing a local circuit in the telephone, a motor in said local circuit which is driven by the current through the same, a shunt-circuit about the motor, a call-bell in said shunt-circuit, and means driven by the motor for opening and closing the shunt-circuit at intervals to cause the bell to ring intermittently while the motor is running.

8. In a telephone system, a central station, a telephone-line and a telephone connected therewith, means for sending a current through said line and telephone, means controlled by said current for closing a local circuit in the telephone, a portion of said circuit being controlled by the receiver-hook, a motor in said local circuit, means for sending a current through said circuit and motor to drive the latter, a shunt-circuit about the motor, a call-bell in said shunt-circuit, means driven by the motor for opening and closing the shunt-circuit to cause the bell to ring intermittently while the motor is running, and means for breaking the circuit through the motor when the receiver is removed from its hook.

9. In a controlling device for an electric circuit, normally insulated conducting-rings in said circuit, a plurality of devices for connecting the same, means for holding said devices out of contact with the conducting-rings and for releasing the same to permit them to engage therewith, and a hand movable over the contacting devices, said hand being adapted to move the devices which have been released back out of contact with the conducting-rings.

10. In a controlling device for an electric circuit, normally insulated conducting-rings in said circuit, a plurality of spring-connectors for said rings, keys for normally holding the connectors out of contact with said rings, but which are adapted to release the same when they are depressed, a motor device controlled by the current in the circuit, and a hand driven by the motor device over the spring-connectors, said hand being adapted to move the connectors which have been released back out of contact with the conducting-rings to break the circuit.

11. In a controlling device for an electric circuit, a dial, conducting-rings in the circuit arranged beneath the dial, a plurality of spring contact-levers for connecting the conducting-rings, said levers extending from the center of the dial, T-slots in the outer end of said levers, keys projecting from the controlling device, and passing through said T-slots, an enlargement on the keys engaging with the levers to hold them out of engagement with the conducting-rings but movable out of engagement therewith to permit the levers to spring into contact with the rings, a motor device which is released when the rings are connected, and a hand driven by said motor device over the dial, said hand being adapted to move the spring-levers which have been released back out of contact with the conducting-rings to break the circuit.

12. In a controlling device for an electric circuit, a dial, conducting-rings in the circuit arranged beneath the dial, a plurality of spring contact-levers for connecting the conducting-rings, said levers extending from the center of the dial, T-slots in the outer end of said levers, keys projecting from the controlling devices and passing through said T-slots, an enlargement on the keys engaging with the levers to hold them out of engagement with the conducting-rings but being movable out of engagement therewith to permit the levers to spring into contact with the rings, a hand movable over said dial and adapted to press the spring-levers out of contact with the conducting-rings, a spring-motor for driving said dial-hand, and an electromagnet in said circuit for releasing the spring-motor and for winding the same.

13. In a telephone system, a switchboard, a party telephone-line leading to said switchboard, a plug for insertion into the switch-

board to connect the operator with the said line, a selecting-plug for insertion into the first-named plug with which it makes electrical contact, a source of electric power in circuit with said selecting-plug, and means for closing the said circuit for a predetermined time to send a current through the party-line to place one of the telephones in condition for use to the exclusion of all the other telephones on the line.

14. In a telephone system, a switchboard, two party-lines leading to said switchboard, telephones on said lines, a selecting device for each party-line, means for connecting said selecting devices with the said party-lines, a source of electric power common to said selecting devices, means in each of said selecting devices for closing a circuit from the source of power through the respective party-lines for predetermined times, and means to prevent the current through one selecting device from passing into the party-line which is connected with the other selecting device.

15. In a telephone system, a switchboard, two party-lines leading to said switchboard, telephones on said lines, plugs for insertion into the switchboard to connect with said lines, wires connecting said plugs, a selecting device for each of the said party-lines, a source of electric power common to said selecting devices, means in each of said selecting devices for closing a circuit from the source of power through the respective party-lines for predetermined times, a magnet in a circuit which is controlled by the current through the party-lines, and a circuit-breaker in one of the wires connecting the said plugs, said circuit-breaker being controlled by said magnet so that the circuit between the plugs is broken while the current flows from the source of power through either party-line.

16. In a telephone system, a switchboard, a plurality of party-lines connected with said switchboard, telephones on each of said party-lines, a plurality of cable-wires 54 and 55 at the switchboard for connecting any pair of party-lines desired, a selecting device at the switchboard for each of the party-lines to be connected, a source of electric power common to said selecting devices, means in said device for closing a circuit from the source of power through their respective party-lines for a predetermined time, a magnet common to said selecting devices which is energized by the current through either party-line, a plurality of magnets the circuits through which are controlled by the first-named magnet, and circuit-breakers in one of the wires for each of the cables, said circuit-breakers being controlled by the said plurality of magnets, the arrangement being such that the circuit in the cable which is connected with the selecting devices will be broken while all the others will remain closed for the purpose specified.

17. In a circuit-controlling device, conducting-rings 37 which are normally disconnected, wires forming an otherwise closed circuit connected to said conducting-rings, connecting-pieces for bridging the conducting-rings which are normally out of contact therewith, a member movable over the connecting-pieces to force the same into contact with the conducting-rings and mechanism for moving said member, the arrangement of the connecting-pieces being such that when the member is in certain positions the circuit will be closed.

18. In a circuit-controlling device, conducting-rings which are normally disconnected, wires which form an otherwise closed circuit connected with said rings, a dial covering said rings, a dial-hand movable over the surface of said dial, keys projecting through the dial so as to be depressed by the dial-hand as it moves, a connecting-piece carried by said keys for bridging the conducting-rings when the keys are depressed, the arrangement being such that when the dial-hand is in certain positions a key will be depressed which will close the circuit through the conducting-rings.

19. In a telephone system, a central station, a party-line leading from said station, telephones on said line, a dial at each telephone, conducting-rings carried by said dial, keys projecting from said dial, contacting-pieces carried by said keys adapted to bridge across the conducting-rings when the keys are depressed, a hand movable over each dial for depressing the keys, clock mechanism for driving the hands synchronously, and means controlled from the central station for stopping and starting the dial-hands simultaneously, the arrangement of the keys being such that when the hands stop but one of them will rest on a key, for the purpose specified.

20. In a telephone system, a central station, a party-line, telephones on said lines, a selecting device connected with each of said telephones, means controlled from the central station for changing all the selecting devices so as to put one of the telephones in the talking-circuit to the exclusion of all the others, a battery 76 at each telephone, means for closing a circuit from said battery through the line and all the telephones when the receiver of the telephone which has been in use is hung up, and means for returning all the telephones to their normal position, said means being controlled by the current through the said circuit.

21. In a telephone system, a party-line, telephones on said line, a dial for each of said telephones, conducting-rings for each of said dials, a dial-hand movable over said dial, keys mounted at intervals on said dials, means whereby the dial-hands normally stand at "0" position, contact-points on the dials which are separated when the hand is on the "0" position but which are closed when the hand moves from said position, a hook for each of said telephones, and contact-points with which said hooks engage when the telephones are not in use, an electric circuit including the contact-points on the dial, the party-line,

the telephones and the hook with its contact-points the same being so arranged that when the dial-hand is off of the "0" position and the hook is pressed down a current will flow through the said circuit for the purpose specified.

22. In a telephone system, a party-line, telephones on said line, said telephones each having a hook for its receiver, a selecting device for each telephone, said device having a dial-hand, a locking device connected with the hook of each telephone, means controlled by the dial-hands of the various selecting devices for maintaining the locking device for that telephone in an inoperative position when the dial-hand is in its normal position, and means for causing the locking device to lock the hook from movement when the dial-hand moves from normal position.

23. In a telephone system, a party-line, telephones on said line, normally separated conducting-rings for each telephone, means for connecting said rings, an arm movable about said conducting-rings for operating said means, the hooks for the various telephones, and means for locking each of said hooks except when their respective conducting-rings have been connected, for the purpose specified.

24. In a telephone system, a switchboard, two party-lines connected with said switchboard, telephones on each of said lines, means connected with the switchboard for placing one telephone in each line in condition for use to the exclusion of all other telephones on that line, an electric battery connected with each telephone, connection whereby the batteries of the telephones which have been in use restore all of the telephones on their respective lines to their original condition, and means for preventing the current from one of said batteries from passing into the other party-line, for the purpose specified.

In testimony whereof I affix my signature in the presence of two witnesses.

ALBERT J. SPRINGBORN.

Witnesses:
S. E. FOULSZ,
C. N. FISCUS.