No. 822,973

PATENTED JUNE 12, 1906.

A. A. MONSON.

AUTOMATIC TELEPHONE SYSTEM.

APPLICATION FILED JAN. 24, 1905.

3 SHEETS—SHEET 1.

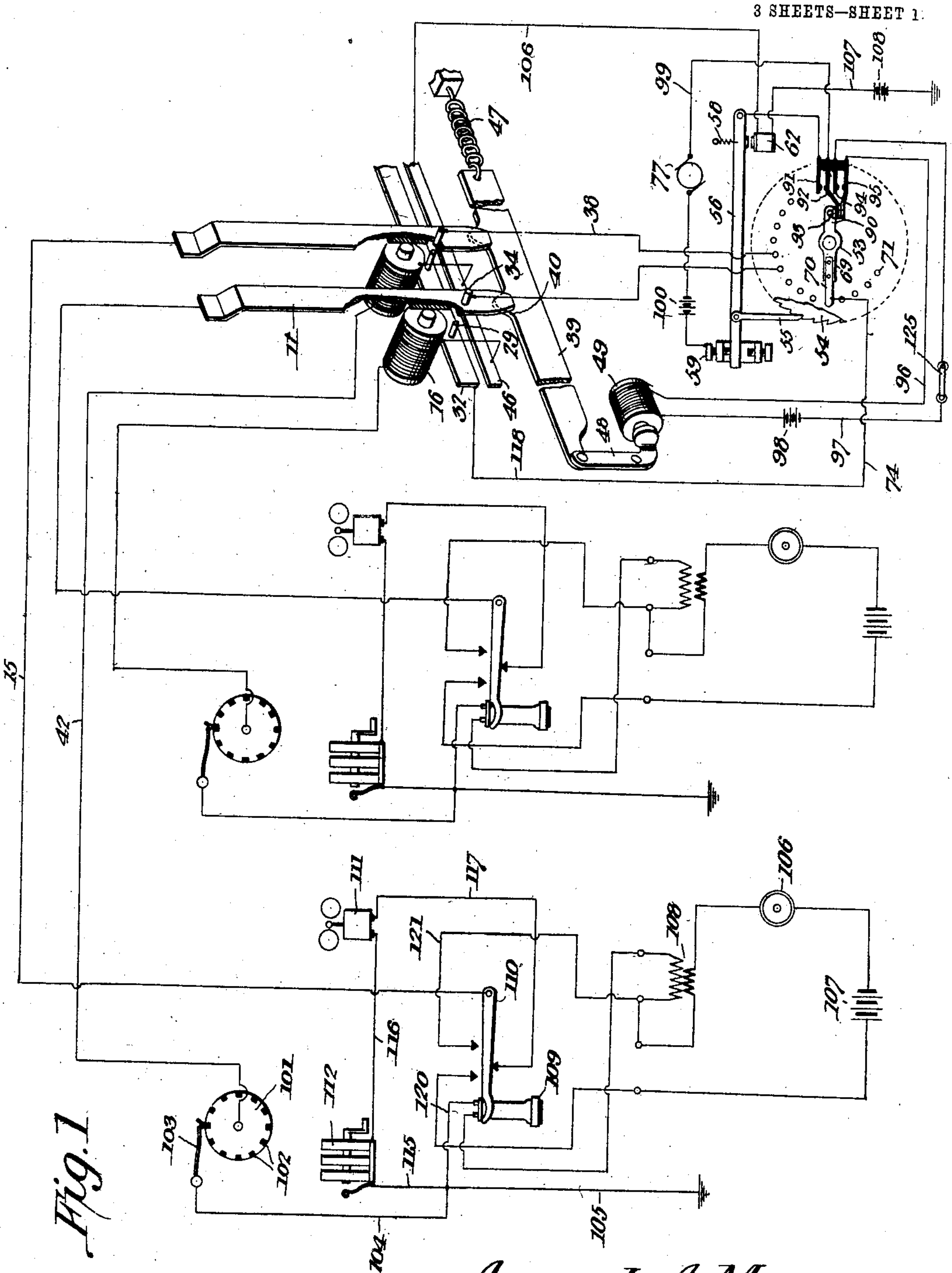

Fig. 1

Witnesses

[signatures]

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3 SHEETS—SHEET 2.

Fig. 3.

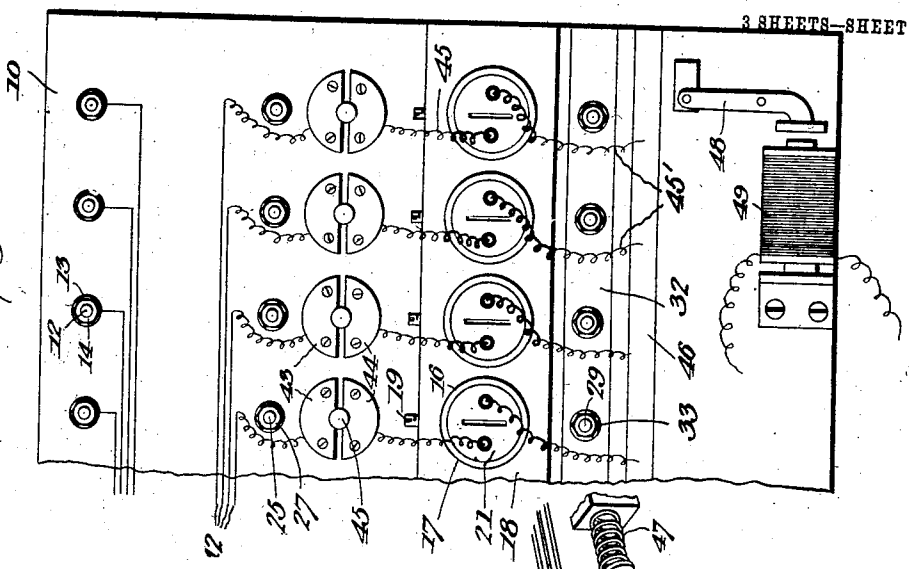
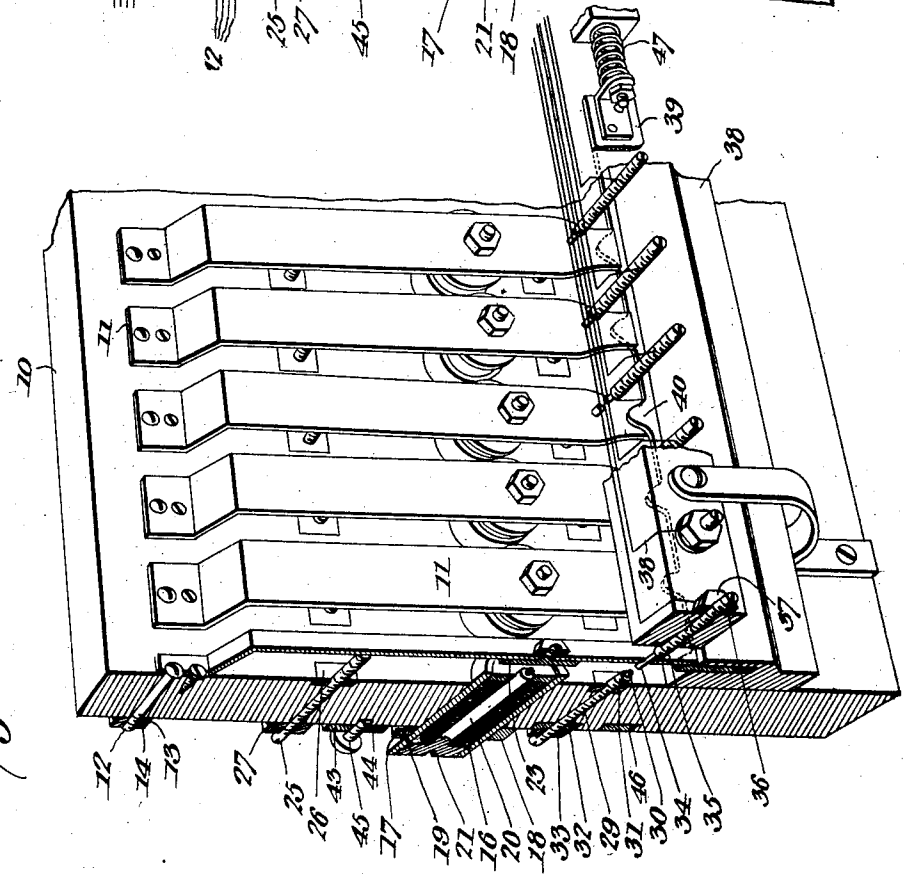


Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 4.

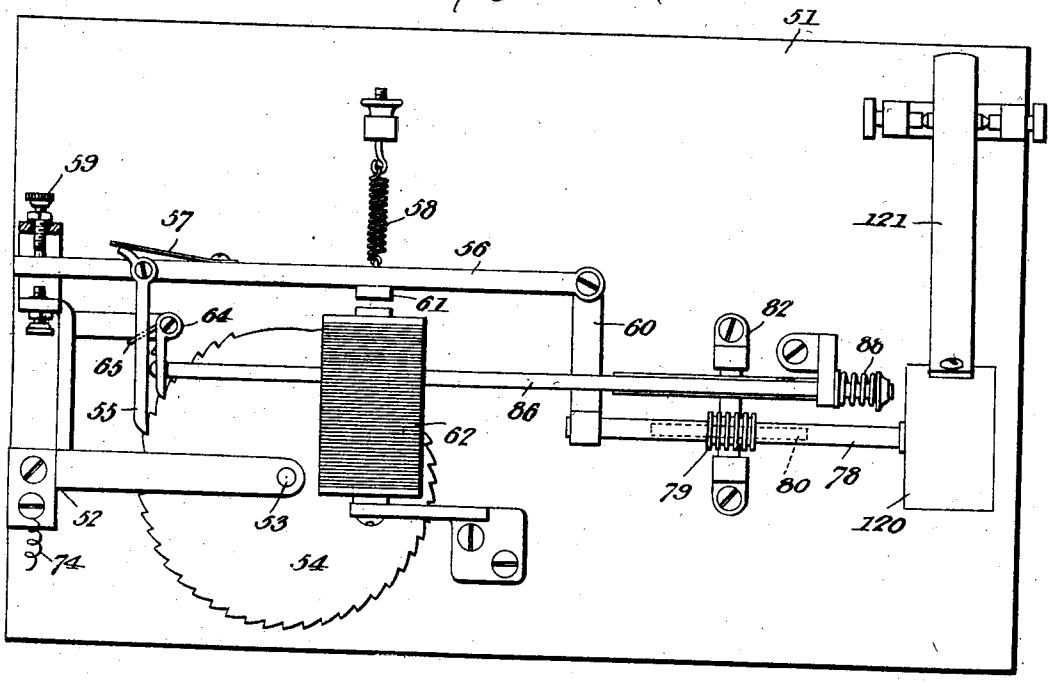
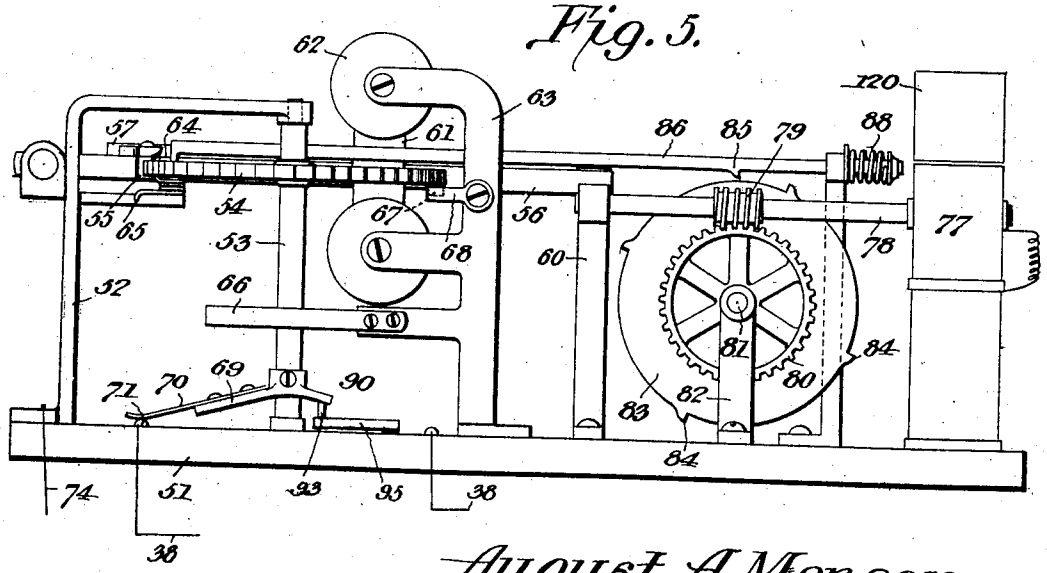


Fig. 5.



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UNITED STATES PATENT OFFICE.

AUGUST ALVIN MONSON, OF GREY EAGLE, MINNESOTA.

AUTOMATIC TELEPHONE SYSTEM.

No. 822,973. Specification of Letters Patent. Patented June 12, 1906.

Application filed January 24, 1905. Serial No. 242,549.

To all whom it may concern:

Be it known that I, AUGUST ALVIN MONSON, a citizen of the United States, residing at Grey Eagle, in the county of Todd and State of Minnesota, have invented a new and useful Automatic Telephone System, of which the following is a specification.

This invention relates to telephony, and has for its principal object to provide means whereby any substation may be automatically connected to another substation without the intervention of an operator at a central station.

A further object of the invention is to provide an automatic switchboard and automatic circuit-controlling devices of a most simple and economical construction and of a character that will permit of ready repair and adjustment.

A still further object of the invention is to provide an automatic system of this class in which provision is made for preventing the operation of the switchboard or any of the circuit-controlling devices while any two subscribers are connected, so that a strictly-private system is insured.

A still further object of the invention is to provide an improved mechanism of the automatic-switchboard type in which the construction is such as to permit a private or a conditionally public system, so that by the simple opening of a local circuit at a central station the switchboard will respond to calls from any number of subscribers while others are connected, so that more than two substations may be connected at the same time.

With these and other objects in view, as will more fully hereinafter appear, the invention consists in certain novel features of construction and arrangement of parts hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportions, size, and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings, Figure 1 is a diagram of a telephone system arranged in accordance with the invention, the diagram illustrating the connections between a central and two sub stations. Fig. 2 is a sectional perspective view of a portion of the automatic switchboard. Fig. 3 is a rear elevation of the same. Fig. 4 is a plan view of the circuit-controlling device. Fig. 5 is an elevation of the same.

Similar numerals of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

The switchboard 10 is formed, preferably, of wood, and to its front face are secured circuit-closing strips 11 of a number equal to the number of substations. These strips are preferably formed of spring-brass, and their upper ends are secured to the board by two screws, one of which, 12, is extended through to the rear of the board and is provided with a washer 13 and nut 14, between which may be clamped the end of a talking-wire 15, there being one of such wires leading from each substation to the central station and each being separately connected to one of the strips 11.

The switchboard is provided with openings for the reception of electromagnets 16, that preferably are formed of spools arranged within cylindrical casings 17, these casings being passed through openings in a strip 18 at the rear of the switchboard and locked in place by a set-screw 19. The cores 20 of the spools are provided with integral heads or end portions 21, that are slotted to receive a screw-driver or similar tool. The periphery of each head is threaded and screws directly into the surrounding casing of the electromagnet. In each head are insulated eyes for the passage of the wires. An electromagnet is arranged immediately to the rear of each of the strips 11, and each of said strips carries an armature 23, formed of soft iron. Normally the armatures are held outward away from the ends of the electromagnets by the brass springs 11, and each spring rests on an adjustable fulcrum in the form of a screw 25, that passes through an opening in the switchboard. The screw is threaded into a nut 26, that is seated in a recess in the front of the board, and the rear end of the screw carries a lock-nut 27, by means of which it may be rigidly held in any position of adjustment.

At a point below the electromagnets is arranged a series of contacts in the form of screws 29, that preferably are provided with contact-points 30, formed of platinum or similar material. The screws 29 pass through nuts 31, arranged in recesses at the front of the board, and at the rear end said screws extend through openings in a strip 32, formed of brass or similar material, so that the rear ends of all of the screws are electric-

ally connected to each other. Each screw is locked in place by a nut 33.

The lower portion of each of the brass strips 11 carries a pin 34, which extends completely through the strip and forms a double contact, one end of which is arranged to engage the contact 30, while the outer end of the pin is adapted to engage a contact carried by a screw 35. The screws 35, of a number equal to the number of strips, extend through a bar 36, formed of wood or other non-conductor and supported at the front of the board. Each of these screws is held in adjusted position by a lock-nut 37, the latter forming also a binding-post to which may be connected a wire 38, and these wires lead, as will be hereinafter described, to a circuit-controlling device also arranged at the central station. Under normal conditions the talking-wire of each of the several stations is electrically connected through the screw 12, strip 11, contact 34, contact 35, and wire 38 to its circuit-controlling device; but when the electromagnet is energized the armature 23, carried by the strip, will be attracted and the circuit will be broken between contacts 34 and 35 and will be established between contacts 34 and 30.

Near the bottom of the switchboard is secured a bar 38′, that is provided with a longitudinal groove, carrying a strip 39, formed of hard rubber, vulcanized fiber, or other non-conductor. The upper edge of this strip is provided with lugs or ears 40 of a number equal to the number of strips 11; but normally said lugs alternate with the strips, or, in other words, are disposed between the strips, so that the latter will be free to move when their armatures are attracted by the electromagnets. After movement of any one strip by the energizing of its electromagnet the strip 39 will also be moved until all of the lugs are in alinement with the strips 11, and thereupon the strips which first have been moved will be locked in place, while the lugs or ears of the remaining strips will pass behind the latter and prevent any movement should the electromagnets of said strips be energized.

Leading from each of the substations is a signal-wire 42, that is connected to a plate 43 on the back of the switchboard. Adjacent to the plate 43 is a similar plate 44, and the two may be connected by a plug 45 in order to complete the circuit of the wire 42 to the electromagnet 16. The removal of this plug cuts out any desired substation. As will appear from Fig. 3, the signaling-circuit is continued from the magnet 16 through wire 45′ to a strip 46, formed of copper or other good conducting material, all of said signaling-wires being connected to the strip and all being thus connected in multiple.

The locking-strip 39 of the switchboard may be operated in any suitable manner, but preferably is held in inoperative position by a spring 47 and is moved to locking position by a pivotally-mounted armature 48, having one end disposed within the field of force of an electromagnet 49, the latter being energized when the signaling-circuit of any substation is completed. At each of the substations is arranged a calling device or circuit-closing mechanism of the character shown in Fig. 1.

On a suitable base 51 is arranged a standard or bracket 52, which in connection with a step-bearing at the base forms a support for a vertically-disposed shaft 53. On this shaft is secured a step-by-step ratchet-wheel 54, with which engages a pawl 55, the latter being carried by a lever 56 and being held in contact with the ratchet-wheel by means of a spring 57. Under normal conditions—that is to say, when there is no current on the line—the lever 56 will be held outward by means of a spring 58 and will engage a contact 59, forming one terminal of a local circuit which controls the movement of some of the parts of the apparatus. The lever 56 is pivoted on a standard 60 and carries an armature 61, disposed within the field of force of an electromagnet 62, the latter being supported by an iron frame 63. Each time the electromagnet is energized the armature 61 will be attracted and lever 56 and pawl 55 will be moved in such manner as to cause rotative movement of the ratchet-disk 54 to the extent of a single tooth. To prevent rearward movement of the ratchet-disk as the lever 56 moves outward, a locking-pawl 64 is employed, said pawl being held in engagement with the ratchet-wheel by a spring 65.

In order to restore the ratchet-wheel to its initial position at the completion of each selecting movement, a spring 66 is employed. One end of the spring is secured to the frame 63 and its opposite end to the shaft or spindle 53. The spring is placed under tension as the ratchet-wheel is turned and in expanding restores the ratchet-wheel to its initial position, this position being determined by an ear 67 on said ratchet-wheel coming into contact with a stop 68, carried by frame 63.

Secured to the lower end of the shaft 53 is an arm 69, from which extends a spring-contact 70. This spring engages an annular series of contacts 71, carried by the base and insulated from each other. Each contact is connected to one of the wires 38. Normally the contact 70 rests at zero out of engagement with any of the contacts 71; but it engages with said contacts as the ratchet-disk receives step-by-step movement and finally rests in engagement with contact 4 5 6 or any other contact corresponding to the number of the substation with which it is desired to communicate. The spring-contact 70 is electrically connected to the arm 69, shaft 53, bracket 52, and a wire 74 to the brass strip 32 of the switchboard.

On the base 51 is mounted a small motor 77, having an armature-shaft 78, on which is secured a worm 79. The worm intermeshes with a worm-wheel 80, that is secured on the shaft 81, arranged in suitable bearings formed in brackets 82, and on the same shaft is secured a tappet-disk 83, having a plurality of fingers or tappets 84, which may engage a lug 85 on a slidable bar 86. The bar 86 is mounted in suitable guides and at one end is arranged for engagement with the two pawls 55 and 64. At the opposite end the bar carries a spring 88, that serves to restore the bar to initial position. When the motor is energized, the armature-shaft 78 is revolved, and shaft 81 is turned through the worm-gearing, whereupon the tappets 84, or one of them, will engage the lug 85 and move the bar 86 in the direction of the pawls, said pawls being both moved to release position, and the spring 66 thereupon acting to restore the step-by-step ratchet-disk to its initial position.

To the lower portion of the shaft 53 is secured an arm 90, and said arm carries a pin 93.

The base is provided with two contacts 91 and 92, that under normal conditions are held disengaged from each other by said pin 93, these contacts closing when the ratchet-disk moves in starting the selecting operation. The base further carries two contacts 94 and 95, that normally are held out of engagement with each other by contact with the pin 93; but as soon as a selecting movement starts and the pin moves from engagement with the contacts said contacts will engage and close a local circuit in which the electromagnet 49 is connected. This local circuit is completed through wires 96 97 and a battery 98. The contacts 91 and 92 are arranged in a circuit including a wire 99 and battery 100 and the motor 77.

At each substation is a circuit making and breaking device, this in the present instance being shown in the form of a disk 101, having in its periphery a series of blocks 102, formed of non-conducting material. The signal-wire 42 of each substation is electrically connected to the disk, the latter being of brass or other conducting material, and bearing on the periphery of the disk is a spring 103, through which the circuit may be completed by a wire 104 and wire 105 to the ground.

Each of the local stations includes a transmitter 106, primary battery 107, an inductorium 108, receiver 109, a switch-hook 110, a polarized bell 111, and a magneto-generator 112.

Under normal conditions a block of insulating material 102 is under the contact-spring 103 at each of the substations, and all of the signaling-contacts are therefore open. Should any subscriber wish to call another, he turns the disk 102 a sufficient distance to make and break the circuit the required number of times. For instance, if No. 6 be desired the disk 102 will be turned until the contact-spring 103 has engaged the periphery of the disk six distinct times. The circuit may be traced from the ground at the substation through wire 105, wire 104, contact 103, disk 101, wire 42, plate 43, plug 45, plate 44, electromagnet 16, wire 45′, strip 46, wire 106, electromagnet 62, wire 107, battery 108 to ground at the central station. This immediately energizes the electromagnet 16, that is connected to the substation making the call, and the armature 23 in front of said electromagnet will be attracted, causing the strip 11 to move, while all of the remaining strips on the board remain in initial position, and this occurs at the first closing of the circuit at the local station. Movement of the strip 11 causes disengagement of the contacts 34 and 35 and effects engagement of contact 34 with contact 30, these completing a circuit hereinafter described.

The electromagnet 62 being energized attracts the armature 61, and lever 56 is moved, causing the pawl 65 to advance the ratchet-wheel to the extent of a single tooth, and at each subsequent energizing of the magnet by further movement of the calling-disk 101 the ratchet-wheel may be advanced a tooth. The first effect of this movement is to move pin 93 from contacts 91, 92, 94, and 95, and this partly closes motor-circuit and closes the circuit between 94 95 and through wires 96 and 97 to the electromagnet 49. The energizing of electromagnet 49 attracts the armature 48, and the latter moves the strip 39 until all of the ears or lugs 40 are in alinement with the lower ends of the brass strips 11. One of the lugs or ears 40 will pass in front of the strip, which has been moved by the energizing of its magnet at the beginning of its operation and will lock said strip in the position to which it is moved. The remaining lugs will pass to the rear of the remaining strips, and if any other subscriber attempts to call central the lug 40 at the rear of the strip to which his station is connected will prevent any movement of said strip, and the brass strip belonging to this station will not be moved to effect closing of the talking-circuit.

The step-by-step movement of the ratchet-disk causes the spring 70 to engage successive contacts 71 until it finally rests on the contact corresponding to the number of the station to be called—the sixth in the present instance. Resting on this contact a circuit may be traced from the ground at the calling-station through wire 105, wire 115, magneto-generator 112, wire 116, call-bell 111, wire 117, receiver-hook 110, the talking-wire 15, to the central station, and thence by screw 12 to brass strip 11 of the calling-station. This brass strip has been moved, as previously

described, until its contact 34 engages contact 30, and the circuit is completed through these two contacts to screw 29 and brass strip 32, from whence it may be traced through a wire 118, wire 74, to the bracket 52, shaft 53, arm 69, contact 70, and the said sixth contact 71. From this sixth contact 71 the circuit may be followed through wire 38, which leads along the wooden bar 36 to the contact-screw 35 of the sixth station, and from thence through contact 34 of the brass strip 11 belonging to said sixth station, and thence by the talking-wire 15 back to the sixth substation and by way of the receiver-hook 110, wire 117, call-bell 111, wire 116, magneto-generator 112, wire 115, and wire 105 to the ground at said station, thus completing a circuit from ground at the calling-station to ground at the sixth station, and if the magneto-generator at the calling-station is operated both of the call-bells at said stations will be sounded.

After the signal has been sounded both subscribers remove their receivers from the hooks, and the talking-circuit may then be traced from ground at the calling-station through wire 105, wire 120, receiver 109, the secondary of the induction-coil 108, wire 121, receiver-hook 110, wire 15 to central station, thence through the brass strip belonging to the calling-station, contacts 34 and 30, screw 29, the brass strip 32, wire 118, wire 74, frame 52, shaft 53, arm 69, contact 70, contact 71 of the sixth station, wire 38, screw 35, contact 34 to the brass strip 11 of the sixth station, and thence out over the talking-wire 15 of said sixth station to ground in the manner previously described with reference to the calling-station.

After the conversation the subscribers return their receivers to the hooks, and the disk 101 at the calling-station is turned until one of the insulating-blocks 102 rests under the contact-strip 103, thus breaking the circuit over the signaling-wire, which up to this time has been kept closed. As soon as this circuit is broken the electromagnet 62 is de-energized, and the armature 56 moves outward under the influence of spring 58, whereupon the lever 56 engages the contact-screw 59. This completes the motor-circuit through contacts 91 92, battery 100, wire 99, motor 77, frame 60, lever 56, and the motor is operated. As the motor revolves the worm 79 turns the worm-wheel 80, and one of the tappets 84 will engage the lug 85 and bar 86, moving said bar in the direction of the pawls 55 and 64. The pawls are disengaged from the ratchet-wheel, and the latter is restored to its initial position by means of the spring 66, its initial position being determined by contact of the ear 67 with the stop 68. The pin carried by the arm 90 engages the contacts 91 92 94 95, and all are separated, so that the motor-circuit is broken and the motor stops, and at the same time the circuit in which the strip-moving magnet 49 is included is also broken, and the locking-strip is restored to its initial position by means of the spring 47.

Above the electrical motor 77 is arranged a permanent magnet 120, that is carried by a pivoted arm 121. When the field-magnet of the motor is energized, its poles are closed to those of the permanent magnet, and the latter will be elevated to some extent. When the field-magnet is deënergized, it becomes, in effect, merely a mass of iron. It acts as an armature and attracts the permanent magnet, the latter descending and pressing a brake-block carried thereby against the revoluble armature, thus stopping the motor.

In use the mechanism shown in Figs. 2, 3, 4, and 5 is all arranged within the same casing at the central station.

With a system arranged as described it is impossible for any substation to call another while two substations are connected; but in many cases it is desirable to permit communication between a number of telephones, and for this purpose a switch 125 is located in the circuit-wire 96, leading to the electromagnet 49. When this switch is opened, the electromagnet will no longer be energized, and the locking-strip will remain stationary, so that the system may be made either strictly private or optionally public.

Having thus described the invention, what is claimed is—

1. In telephony, a central station, an automatic switchboard and a selecting device arranged at the central station, an electromagnet for moving the selecting device, independent selecting and talking circuits extending from each substation to the central station, each of such selecting-circuits being normally broken at the substation and connected to the electromagnet of the selecting device at the central station and thence to a return, an independent electromagnet for each selecting-circuit, said magnets forming part of the switchboard and controlling the closing of the talking-circuits, means at each substation for making and breaking the selecting-circuit, thereby controlling at the central station the energizing of said independent electromagnets and the connection of the talking-circuits to the selecting mechanism, the operation of the electromagnet of the selecting mechanism for a predetermined number of times serving to connect the talking-circuit of the called station to the talking-circuit of the calling-station through said selecting mechanism.

2. In telephony, a central station including an automatic switchboard and a selecting mechanism, an electromagnet for operating the selecting mechanism, independent selecting and talking circuits leading from each substation to the central station, the select-

ing-circuit being normally broken at the substation and extending through an electromagnet at the switchboard to the electromagnet of the selecting mechanism and thence to ground at the central station, means at each substation for making and breaking the selecting-circuit and effecting on the first movement through the energizing of the switchboard-magnet, a connection between the talking-circuit of the calling-station and the selecting mechanism, and by continued making and breaking of the selecting-circuit serving to connect the talking-circuit of the calling-station to the talking-circuit of a called station through said selected mechanism.

3. The combination with a central station, of a switchboard, a plurality of contacts carried thereby, electromagnets for operating said contacts, a selecting device also arranged at the central station and having a plurality of contacts electrically connected to those of the switchboard, an electromagnet for operating the selecting device, a plurality of substations, and line-wires extending from the substations to the switchboard, the circuit of one of said line-wires for each substation being extended through the operating-magnet of the selecting device.

4. In telephony, a central station, a switchboard arranged at the central station, contact-strips carried by the switchboard, electromagnets for moving said strip, a selecting device having contacts normally in circuit with those of the switchboard, an operating-magnet for the selecting device, a plurality of substations, line-wires extending therefrom to the central station, the circuit of one of said line-wires for each substation being continued through the operating-magnet of the selecting device and one of the contact-operating magnets of the board, a contact-locking strip, an electromagnet for operating the same, and a local circuit in which said strip-operating magnet is connected, said strip being under the control of the selecting device.

5. In telephony, a central station, a switchboard arranged at the central station, spring-contacts carried by the switchboard, an electromagnet for each contact, a pair of opposed stationary contacts with either of which the switch-contacts may be engaged, a selecting device at the central station, and including a plurality of spaced contacts, each connected separately to one set of stationary contacts of the board, an operating-magnet for the selecting device, a revoluble contact-arm forming a part of the selecting device and movable over the stationary contacts thereof, said movable contact being connected to the second series of stationary contacts of the board, a plurality of substations, a line-wire extending from ground at the substations to the spring-contact of the switchboard, and thence by way of the first set of stationary contacts of said board to the stationary contacts of the selecting device, a second line-wire extending from each substation to the central station, and grounded at the latter point, the circuit to the second line-wire being broken at the substation, and circuit-closing means arranged at the substation for closing the circuit of the second line-wire, and means connecting said second line-wire in circuit with one of the strip-operating magnets, and the operating-magnet of the selecting device.

6. In telephony, a central station having an automatic switchboard including a plurality of circuit-closing strips, electromagnets for operating said strips, a locking-slide for engaging all of the strips after the movement of one of them, and preventing movement of said remaining strips, an electromagnet for operating the slide, a circuit in which the electromagnet is arranged, an automatic circuit-closer, and a switch also arranged in the circuit whereby the system may be rendered strictly private or optionally public.

7. In telephony, an automatic switchboard arranged at a central station, spring circuit-closing strips on the switchboard, an armature carried by each strip, an independent operating-magnet carried by the board and arranged adjacent to each armature, a pair of sets of contacts for each of the strips, and with one of which the strip normally engages, said strip engaging the second contact when its armature is attracted, a locking-slide engaging the end portions of the several strips, and an electromagnetically-operated means for imparting movement to said locking-slide.

8. In an automatic switchboard, a base, a plurality of spring-pressed strips secured at one end to the base, an adjustable screw forming a fulcrum and tension member for the spring, a pair of stationary contacts with either of which said spring may engage, an electromagnet for each of the springs, an armature carried by each spring and disposed within the field of force of the electromagnet, a longitudinally-movable slide having ears or lugs for engaging said springs, a slide-operating magnet, and an armature disposed adjacent to said slide-operating magnet and connected to the slide.

9. In selecting mechanism, a spindle, a step-by-step ratchet-disk secured thereto, an operating-pawl, and a locking-pawl engaging the disk, an electric motor, means operated thereby for disengaging both pawls from the disk, a circuit in which said motor is connected, and means under the control of the selecting mechanism for opening and closing said circuit.

10. In selecting mechanism, a spindle, a step-by-step ratchet-disk secured thereto, a spring tending to restore the ratchet-disk to initial position, a stop carried by the disk for

determining such initial position, a pair of pawls engaging the ratchet-disk, an armature-lever carrying one of said pawls, an armature secured to the lever, an electromagnet for attracting the armature, an electric motor, a circuit within which said motor is arranged, circuit-controlling devices controlled in part by the electromagnet, and in part by the spindle, and means operated by the motor for effecting release of the pawls from the disk.

11. In selecting devices, a spindle, a ratchet-disk secured thereto, a spring tending to restore the disk to initial position, a stop carried by the disk for determining such initial position, a plurality of stationary contacts, a contact-arm secured to the spindle and adapted to successively engage said contacts, an electromagnet, an armature disposed within the field of force of the electromagnet, a lever carrying said armature, an operating-pawl carried by the lever, a locking-pawl for holding the ratchet-disk in adjusted position, a circuit-closing means at the free end of the lever, an electric motor, a worm carried by the armature-shaft of the motor, a worm-wheel with which the worm intermeshes, a tappet-disk revoluble with said worm-wheel, a pawl-disengaging rod having an ear or lug to be engaged by said tappets, a spring for restoring the rod to its initial positon, a pair of contacts carried by the spindle, and a circuit connecting the motor, the contacts and the circuit-controlling devices at the end of the armature-lever with a source of electrical energy.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

AUGUST ALVIN MONSON.

Witnesses:
LOU MOSEMAN,
S. N. THOMPSON.