

R. G. DEUBEN.
SELECTIVE SIGNALING SYSTEM.

APPLICATION FILED MAY 18, 1903.

2 SHEETS—SHEET 1.

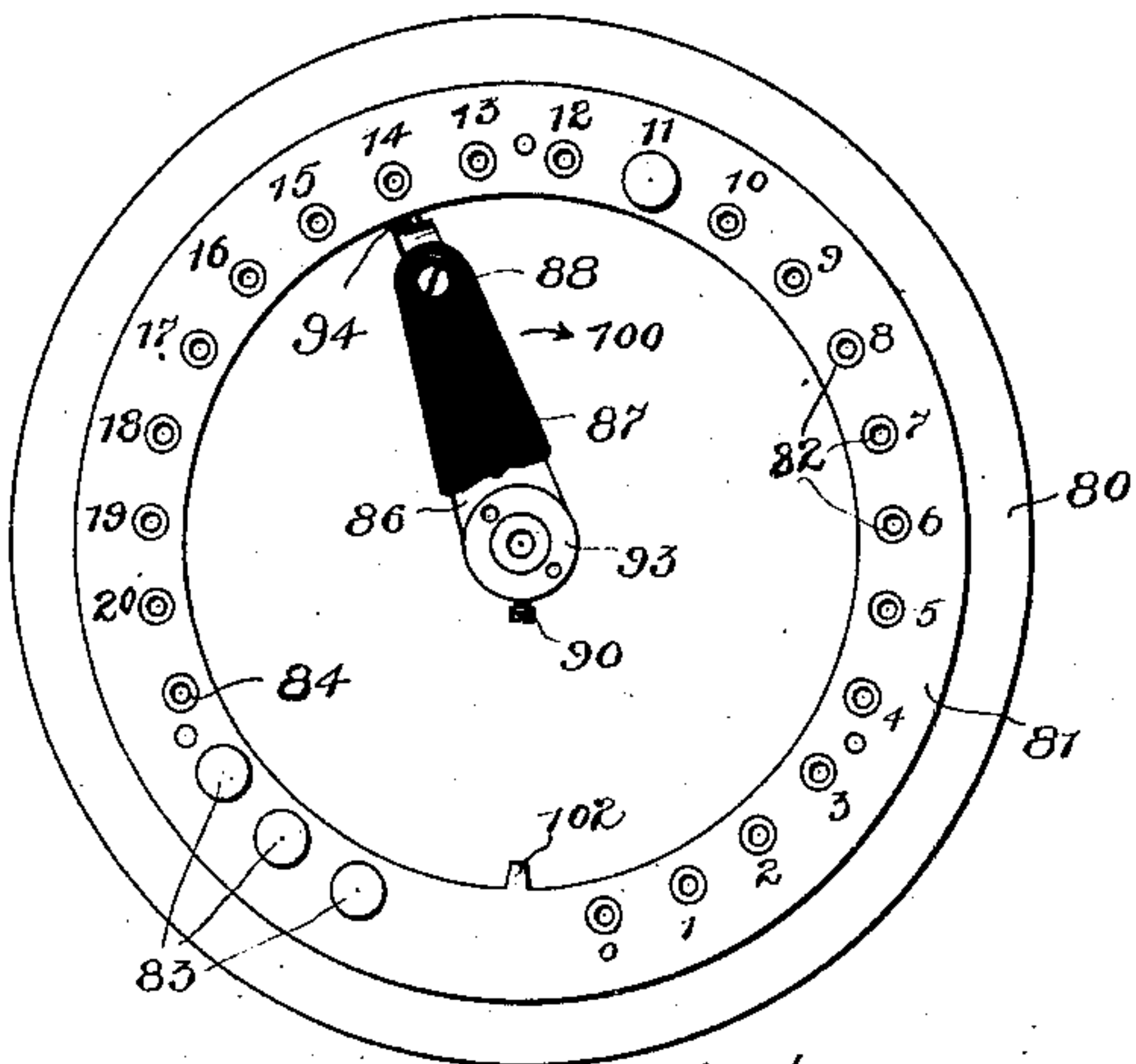


Fig. 1.

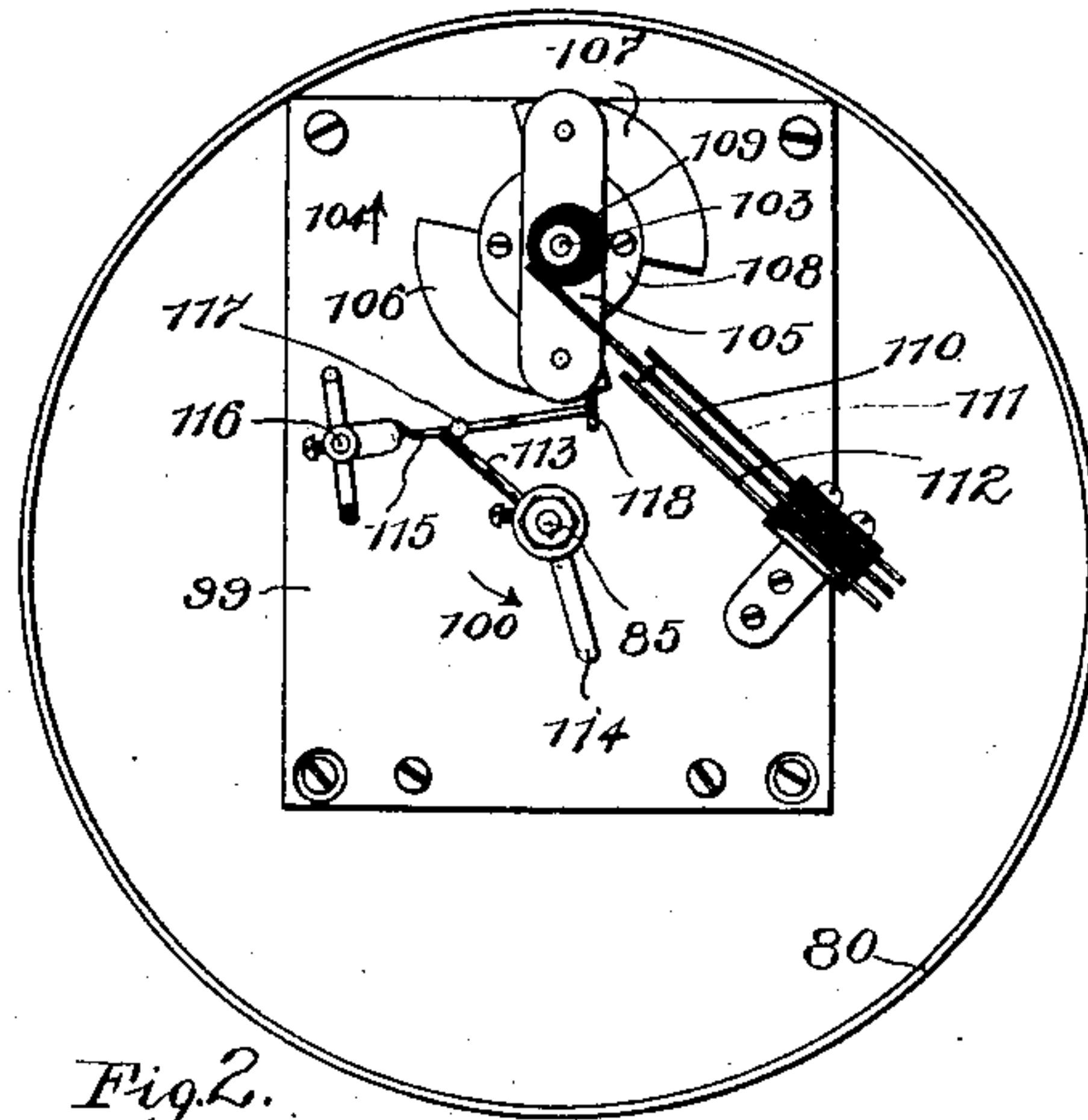


Fig. 2.

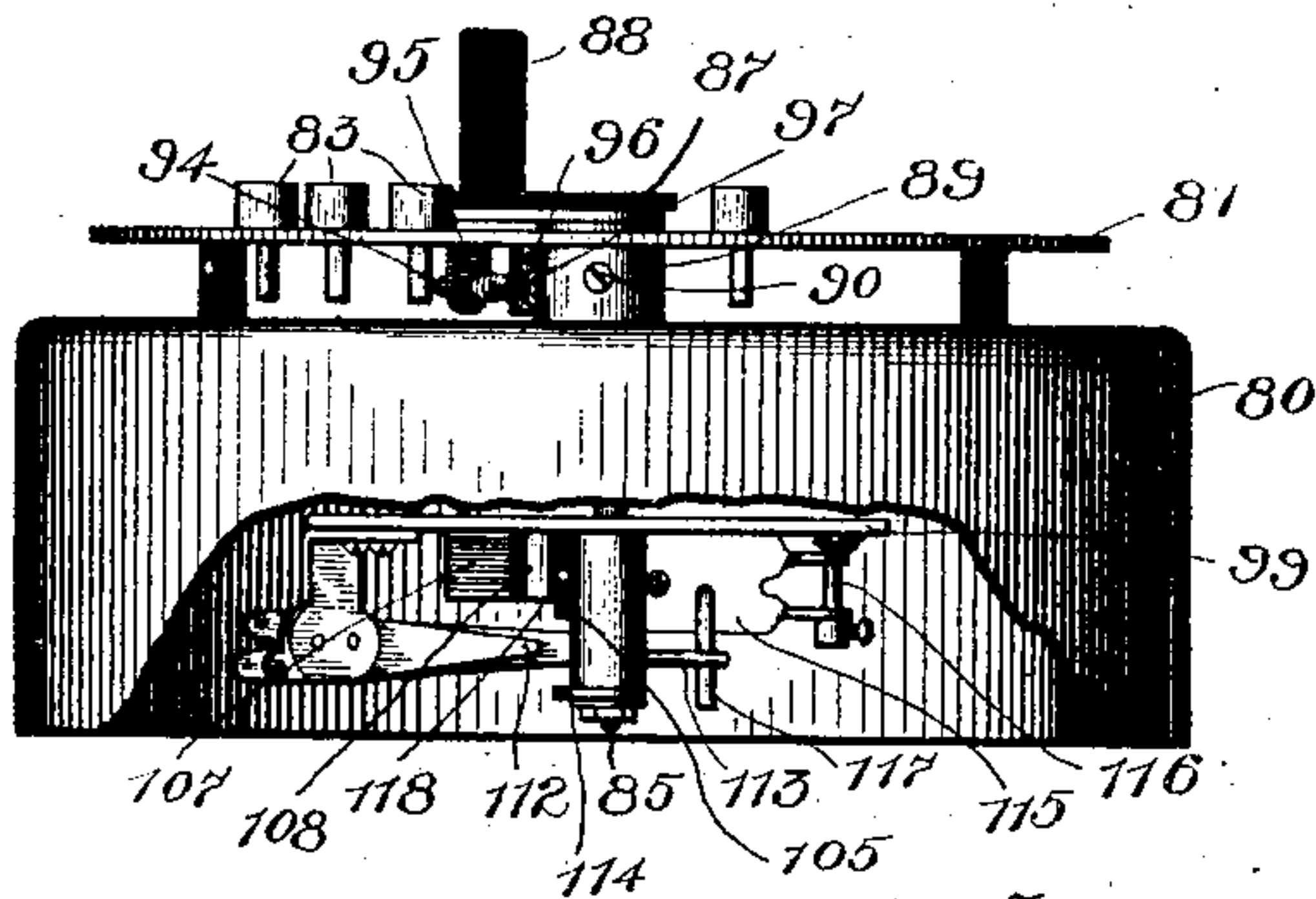


Fig. 3.

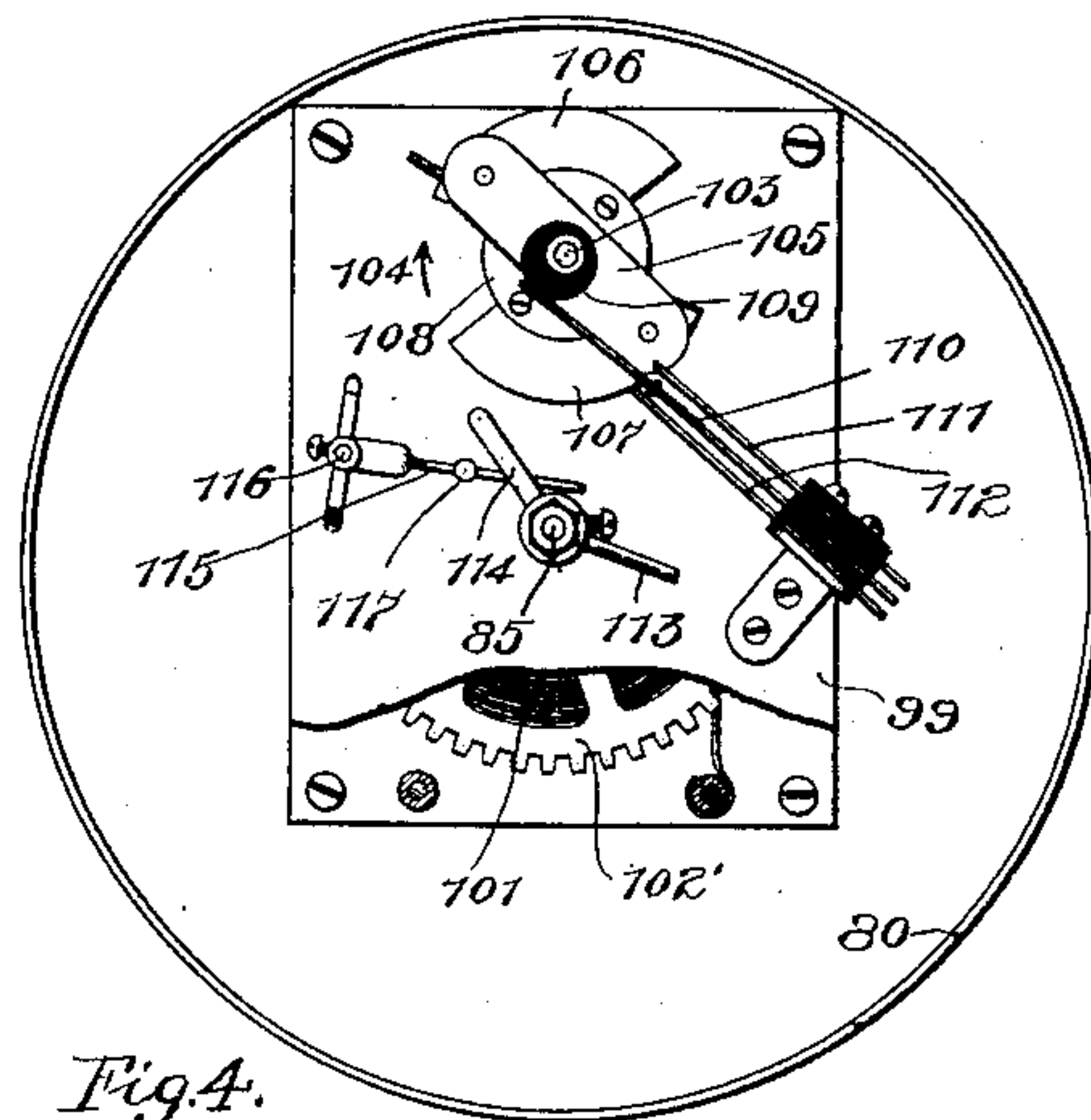


Fig. 4.

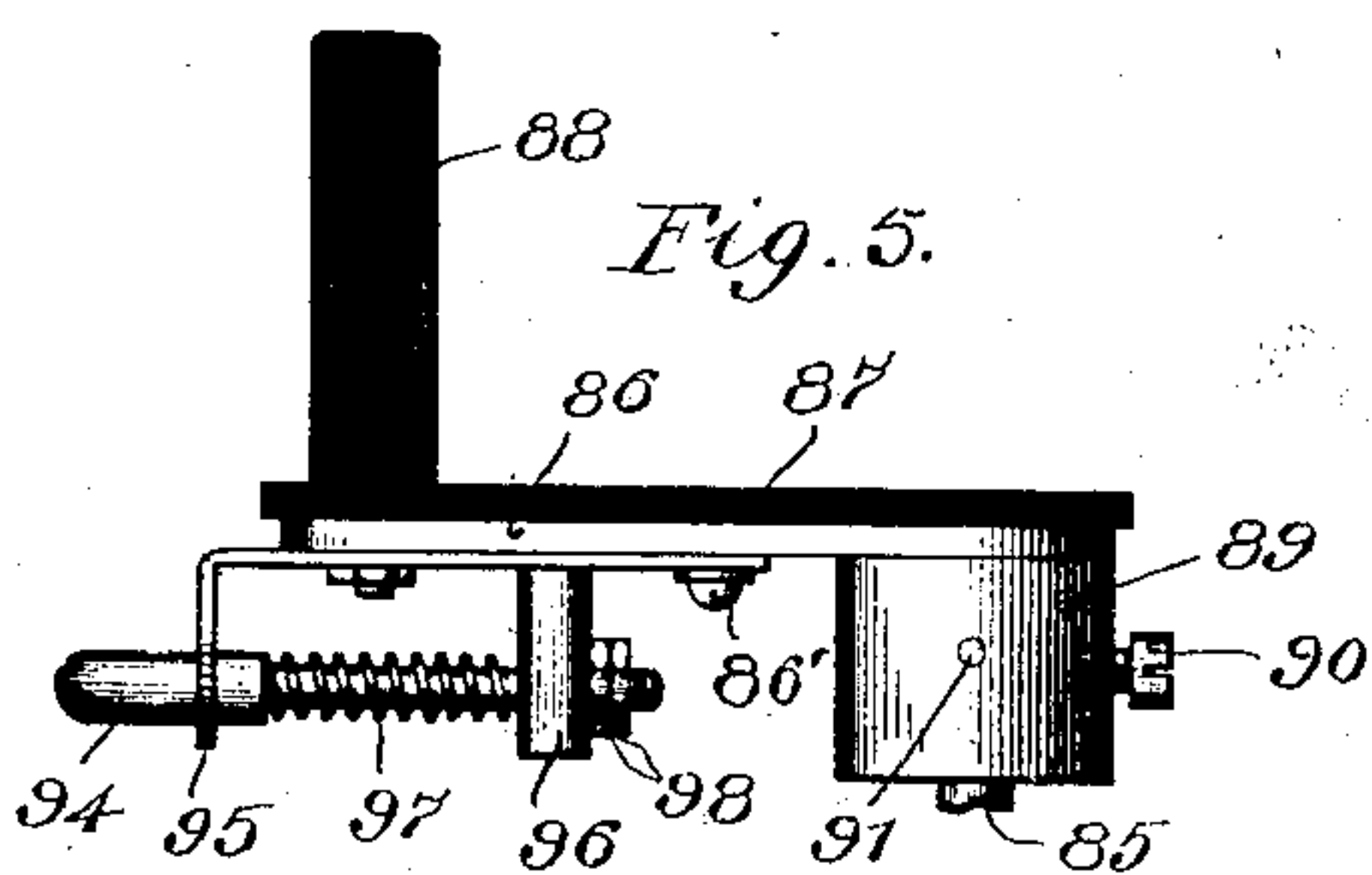


Fig. 5.

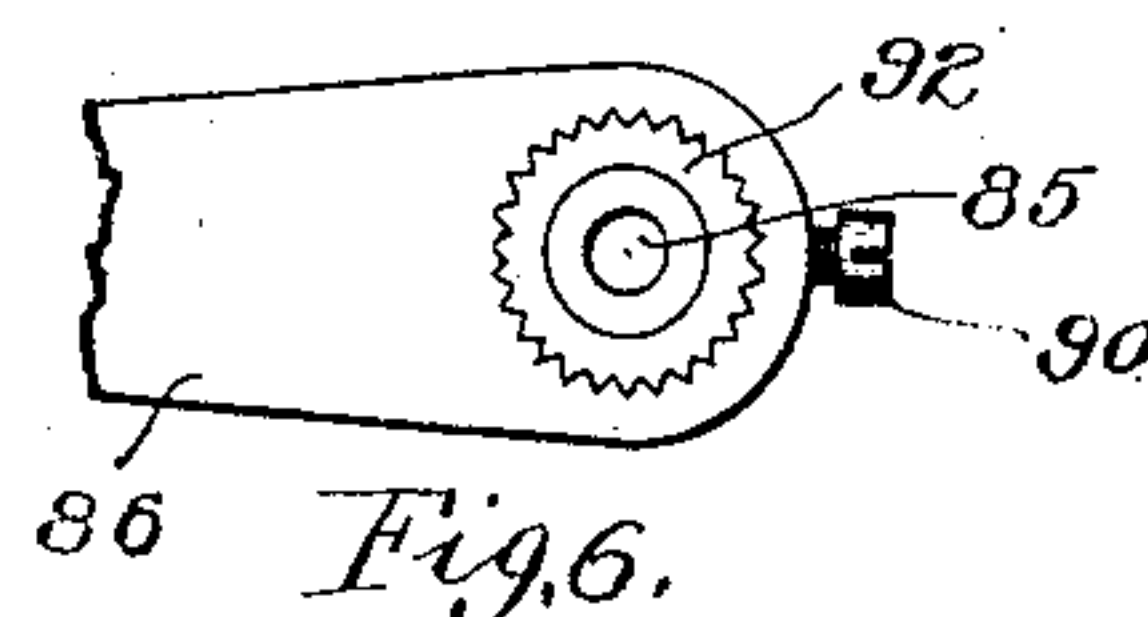


Fig. 6.

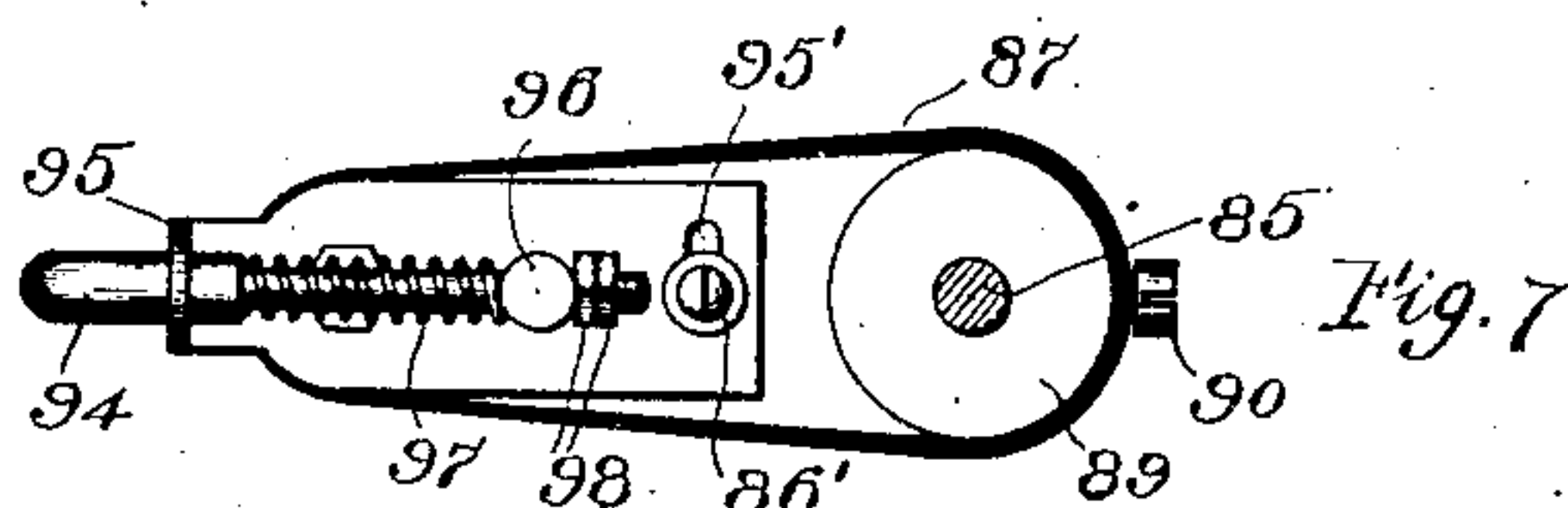


Fig. 7.

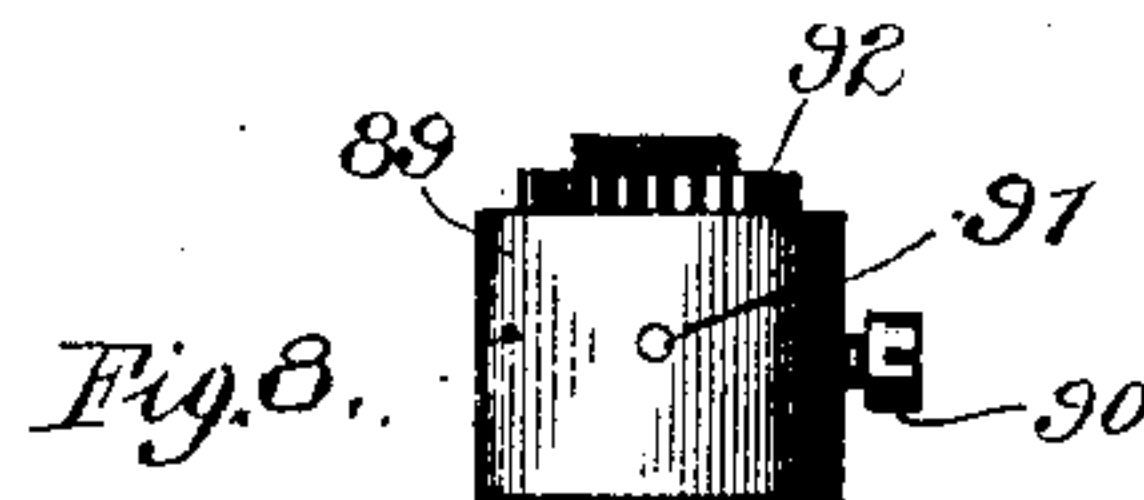


Fig. 8.

Witnesses,

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No. 786,428.

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SELECTIVE SIGNALING SYSTEM.

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2 SHEETS—SHEET 2.

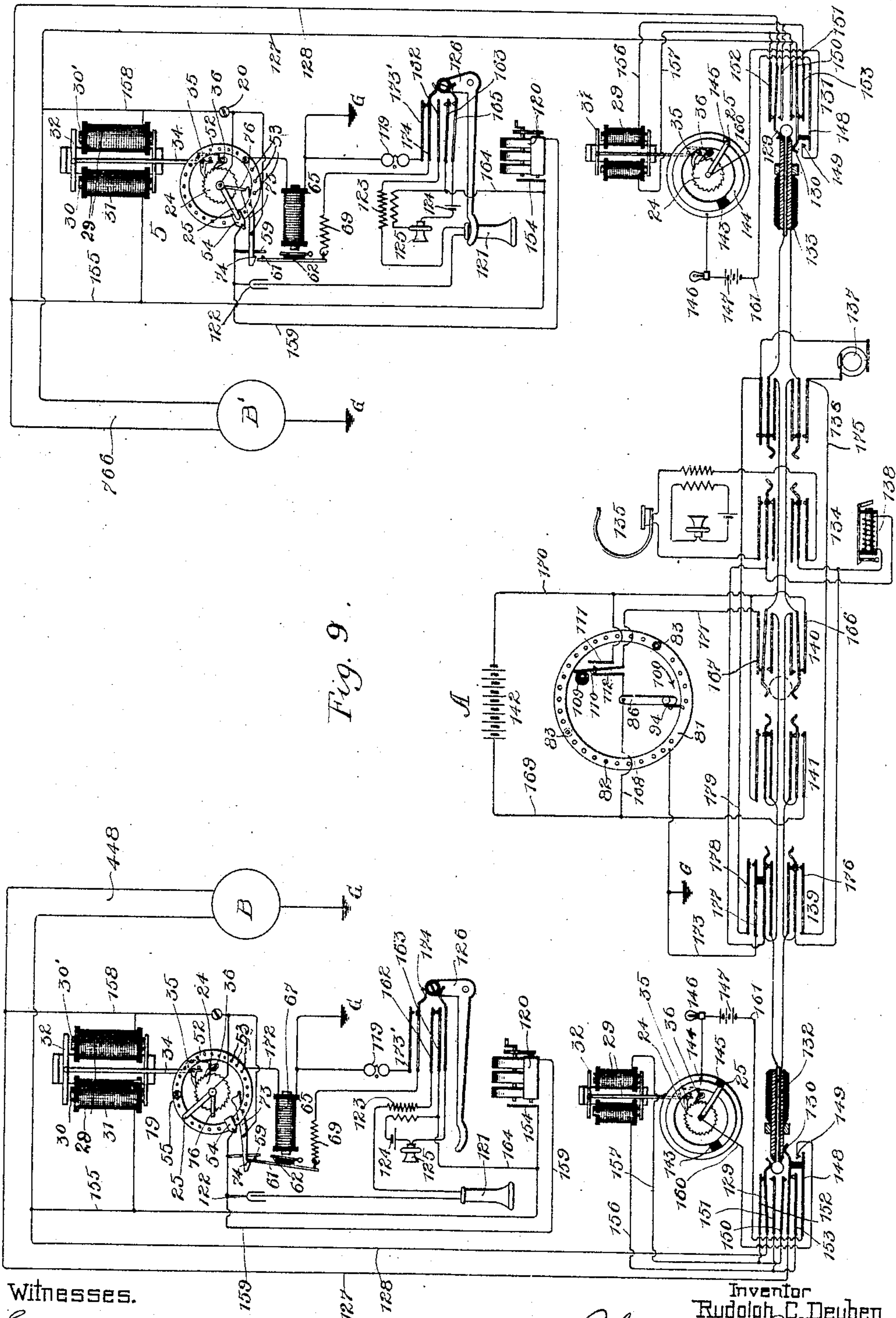


Fig. 9.

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UNITED STATES PATENT OFFICE.

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SELECTIVE SIGNALING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 786,428, dated April 4, 1905.

Application filed May 18, 1903. Serial No. 157,591.

To all whom it may concern:

Be it known that I, RUDOLPH C. DEUBEN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Selective Signaling Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to telephone systems, and more particularly telephone systems employing multiparty lines—that is, telephone circuits to which a large number of subscribers may be connected, any one of which may be selected for signaling and conversation.

My invention consists principally in the provision of certain automatic devices to be located at a telephone central station for the automatic operation of the substation selective apparatus.

The embodiment of my invention herein disclosed is particularly well adapted for use in conjunction with a multiparty-line telephone system described and claimed in the patent to Garrison Babcock, No. 766,357, dated June 28, 1904, and I shall describe my invention as applied to such a telephone system.

I have illustrated in the accompanying drawings the specific details of one embodiment of my invention and a party-line telephone system to which my invention may be applied.

In the drawings, Figure 1 is a plan view of the automatic selective controlling apparatus installed at the central station. Fig. 2 is a bottom view of the same. Fig. 3 is a side elevation of the same, part of the inclosing casing being broken away to more clearly reveal features of the internal construction. Fig. 4 is a bottom view of the same in a different operative position from that shown in Fig. 2. Fig. 5 is a view in side elevation of a crank and switching-arm forming a part of the automatic selective controlling apparatus shown in Figs. 1 to 4, inclusive. Fig. 6 illustrates a detail in the construction of the same. Fig. 7 is a bottom view of the mechanism shown in Fig. 5. Fig. 8 is a side elevation of

the parts shown in Fig. 6. Fig. 9 is a diagrammatic view illustrating the circuit connections to be used in electrically connecting and operating the devices illustrated in the other figures.

In Figs. 1 to 6, inclusive, I have illustrated what I may term an "automatic selector." In these figures I have illustrated a base 80, upon which there is mounted an insulated metal ring 81, this ring being provided with a series of holes 82 82, within any of which may be inserted one of the selector-pins 83 83, which for convenience may be placed when not in use in a series of holes 84 84, provided in the ring 81. A shaft 85 carries at its upper end a crank 86, which is desirably provided with a plate of hard rubber 87 and a hard-rubber crank-handle 88.

I have illustrated an improved means of fastening the crank 86 to the shaft 85, which may be described as follows: Upon the shaft 85 is fastened the hub 89, this hub being secured firmly in position by means of a set-screw 90 and a pin 91, which penetrates both the hub 89 and the shaft 85. Secured to the upper end of the shaft 85 is a toothed disk 92, the teeth in this disk corresponding in pitch with the holes 82 in the ring 81. A spanner-nut 93 is screw-threaded to a stud projecting above the disk 92, this spanner-nut serving to retain the crank 86 seated upon the hub 89. The crank 86 is provided with a spring-plunger switch-arm 94, this switch-arm being guided in its longitudinal movement by a guide-piece 95 and a downwardly-projecting stud 96. The outward movement of the plunger switch-arm 94, due to the compression of the helical spring 97, is limited by the lock-nuts 98. The position of the plunger switch-arm 94 is such that the movement of the crank by a hole 82, into which one of the pins 83 has been inserted, causes a rubbing contact between the end of the plunger 94 and the pin 83, thereby causing an electrical connection between the insulated ring 81 and the metal parts of the automatic selector. The holes 82 are desirably consecutively numbered, as shown.

As best illustrated in Fig. 7, the guide-piece 95 is provided at one end with a slot 95', through which the screw 86' passes to adjustably fasten the guide-piece to the crank 86.

5 The slight sidewise movement of the guide-piece permitted by this adjustable fastening permits a slight angular adjustment of the position of the plunger switch-arm 94.

10 Within a box 99 in the casing 80 there is provided spring mechanism and ratchet mechanism, which need not be more particularly described, such that the movement of the crank 86 in the direction of the arrow 100 winds the spring 101. The rotation of the
15 crank 86 in the direction of the arrow 100 is limited by the stop 102, which engages the guide-piece 95. Upon releasing the crank-handle 88 after having brought the guide-piece into contact with the stop 102 the spring
20 101 causes a reverse rotation of the crank 86 and the gear 102', which meshes with a pinion on the shaft 103, thereby causing its rotation in the direction indicated by the arrow 104. Upon the downwardly-projecting end
25 of the shaft 103 is secured a cross-arm 105, to which are pivoted the lever-weights 106 and 107, these weights serving upon a rotation of the shaft 103 to engage the circular disk 108 to check and govern the speed of rotation of
30 the shaft 103.

There is secured to the shaft 103 an eccentric cam 109, preferably of hard rubber, this cam engaging a contact-spring 110, which upon the rotation of the shaft 103 is oscillated
35 to alternately make connection with contact-springs 111 and 112, as best illustrated in Fig. 2, which shows the apparatus in its normal condition corresponding with that illustrated in Fig. 1. The position of the cam 109 upon the
40 shaft 103 is such that the intermediate contact-spring 110 makes contact neither with the spring 111 nor the spring 112. A rotation of the cam 109 in the direction of the arrow 104 causes a contact of the intermediate spring
45 110 first with the spring 112 and then alternately with the springs 111 and 112. Near the lower end of the shaft 85 is fixedly secured a projecting locking-arm 113. A second trip-arm 114 is adjustably secured to the lower
50 extremity of the shaft 85. A locking-lever 115 is pivotally secured at 116 to the box 99.

The lever 115 is provided with a downwardly-projecting pin 117, which may be engaged either by the locking-arm 113 or the
55 trip-arm 114. A movement of the crank 86 in the direction of the arrow 100 causes a rotation of the arms 113 and 114 from the normal position shown in Fig. 2, first causing a disengagement between the pin 117 and the
60 locking-arm 113 and upon the continued rotation of the shaft 85 causes an engagement of the pin 117 by the trip-arm 114. It will be seen that in Fig. 2 the lever 115 is in a position to engage the stud 118, projecting from
65 the governor-weight 106, thereby preventing

a further rotation of the shaft 103 in the direction of the arrow 104, due to the pressure exerted by the spring 101. The engagement of the pin 117 by the trip-arm, however, serves to disengage the lever 115 from the stud 118, 70 whereby the release of the crank-handle 88 may cause the pressure of the wound spring 101 to be exerted to cause a rotation of the shaft 103 and the parts carried thereby in the direction of the arrow 104, this rotation 75 continuing until the crank 86 has reached its normal position, (indicated in Figs. 1 and 2,) at which time the locking-arm 113 engages the pin 117 to interpose the end of the lever 115 in the path of the stud 118, whereby the con- 80 tinued rotation of the shaft 103 and the parts carried thereby is suddenly arrested.

The position of the arm 114 is adjusted to be such as to cause a disengagement of the stud 118 by the lever 115 only after the crank 85 86 has been rotated sufficiently far to bring the guide-piece 95 into engagement with the stop 102. Thus a partial rotation of the crank 86 toward the projection 102 and its subsequent release will not permit a revolution of 90 the crank to its normal position for the reason that the shaft 103 is still locked by the engagement of the lever 115 with the pin 118. The normal position of the shaft 103 and the parts carried thereby is controlled and fixed 95 by the position of the locking-arm 113. It is desirable that the number of holes 82, which shall be passed by the plunger switch-arm 94 in returning from the initial position near the stop 102 to the normal position, shall be 100 slightly greater than the greatest number of substations connected with any one party-line associated in operation with a given automatic selector. Thus the adjustment shown in Figs. 6 to 9, inclusive, is suitable for use 105 with party-lines on which not more than twelve or thirteen substations are connected. If a greater number of substations is to be connected with any party-line, the number of holes passed by the plunger 94 may be corre- 110 spondingly increased by removing the crank 86 from the toothed disk 92 and replacing it in an advanced position a number of teeth corresponding with the additional number of substations connected with the party-line. 115

Since the pitch of the teeth on the disk 92 corresponds with the pitch of the holes 82, the normal position of the crank and the plunger 94 with respect to the space intervening between adjacent holes 82 will not be changed. 120 This is of particular value, for the reason that the ratio of gearing between the gear 102', which rotates with the shaft 85 and the pinion carried by the shaft 103, is such that the shaft 103 makes one revolution while the plunger 125 94 passes the space from one hole to the next succeeding hole. Thus the number of revolutions of the shaft 103 and the cam carried thereby corresponds with the number of holes passed by the plunger 94 in passing from the 130

initial position near the stop 102 to the normal position, whatever this normal position may be, it being remembered that the normal position is controlled by the position in which the crank 86 is placed upon the toothed disk 92.

It will be seen that the position of the trip-arm 114 upon the lower end of the shaft 85 must be made such that the revolution of the crank 86 from its normal position to its initial position, whatever this arc distance may be, must cause an engagement of the trip-arm 114 with the trip-stud 117 only after the crank 86 has very closely approached its initial position.

The position of the trip-arm 114 must be adjusted, therefore, to correspond with the position of the crank 86 upon the disk 92, which position, it will be remembered, should be made to correspond substantially with the greatest number of substations connected with any one party-line adapted to be actuated by the given automatic selector.

In Fig. 9 I have diagrammatically illustrated the method of automatically conducting the hereinbefore-described apparatus in a telephone system, and I have illustrated a central station A, from which the bimetallic telephone-lines 448 and 766 extend each to a series of substations connected therewith.

While the number of substations connected with those lines may be indefinite, I have illustrated in detail the apparatus for but one substation connected with each line, the circles B and B' indicating that other substations may be similarly connected with the telephone-lines. The substation connected with line 448 and whose apparatus is diagrammatically illustrated in detail may be station No. 19. The apparatus shown in detail connected with line 766 may be that at substation No. 5. There are provided at each of the substations a signal-bell 119 and a generator 120, adapted to supply an intermittent or pulsating direct current of one polarity, and a receiver 121, adapted to be connected in circuit only through the condenser 122, the circuit through the receiver including the secondary of an induction-coil 123, whose primary is connected through the local battery 124 and a transmitter 125. The hook-switch 126 is provided for the accommodation of the receiver 121 when not in use, there being associated with the hook-switch certain switch-contacts which will hereinafter be more fully described. The line-limbs 127 and 128 lead from the substation to the central station, where they are connected one with the tip-spring 129 and the other with the sleeve-spring 130 of a line-jack 131, the jack-springs being adapted for connection with the tip and sleeve contacts of an answering-plug 132 or a calling-plug 133 of an operator's suitable cord connecting apparatus. At each substation I also provide a ratchet-wheel 24, to which is connected a switch-arm 25. An electromagnet

29 has cores 30 and 30', provided with coils 31. An armature 32 for this electromagnet has an arm 34 extending therefrom, terminating in a pawl 35, which engages the ratchet-wheel 24, a stationary pawl 36 also engaging this ratchet-wheel. A stationary metal ring 52 is associated with the arm 25 and is provided with a series of holes 53, the pitch of these holes corresponding with the pitch of the teeth of the ratchet-wheel 24. An insulated contact-piece 54 is secured to the ring 52 and is normally engaged by the arm 25, and a contact 55 is adapted for insertion in any of the holes 53 directly in electrical contact with the ring 52.

In order to connect the subscriber's telephone instruments in bridge of the metallic line-limbs, there is provided a telephone connecting-switch comprising a spring-contact 59 and an insulated switch-arm 61, mounted upon the armature 62, which is mechanically connected with the armature of the electromagnet 65, provided with a winding 67. A spring 69 engages the end of the arm 61. A detent-lever 73 has a catch 74 to engage the end of the switch-arm 61 to retain the switch-arm in its forward or attracted position and against the tension of the spring 69. The ratchet-wheel 24 is also provided with a projecting arm 76, adapted to engage the inner end of the detent-lever 73 to cause its release from the arm 61 when the arm 25 reaches the end of its rotation.

There are associated with the tip and sleeve springs of the jack 130 other contact-springs whose purpose will hereinafter more fully appear.

Under normal conditions, such as are shown in the drawings, there is a continuous circuit through the tip-strand leading between the tip-contact of the answering and calling plugs and a continuous sleeve-strand between the sleeve-contacts of these plugs. The usual operator's ringing and listening keys are provided, the listening-key 134 serving to connect the operator's telephone set 135 in bridge of the cord-strands. The ringing-key 136 serves to connect the ringing-generator 137 with the cord-strands leading to the calling-plug 133. This common ringing-key 136 is employed only when the calling-plug is inserted within the jack of a bimetallic circuit in which the ringing-current traverses the two metallic line-limbs. It is provided for the reason that it is frequently desirable to connect a party-line subscriber with a subscriber who has an individual line. This key 136 performs no useful function and is not operated in any way when subscribers on two-party lines are connected one with the other, as will hereinafter be more particularly described. The clearing-out drop 138 may be connected in bridge of the cord-circuit, as shown. The cord-circuit is provided in addition to the usual listening-key and the common ringing-key with a selective ringing-key

139, which connects one terminal of the generator 137 with the sleeve-strand of the cord-circuit and the other terminal of the generator 137 with the ground G. The calling-key 140 connects the automatic selector with the cord-strands leading to the calling-plug. The releasing-key 141 serves to connect the operating-battery with the cord-strands leading to the calling-plug for the purpose of releasing and restoring the selective apparatus at the substations connected with a line to their normal condition. There is provided at the central station a battery or other source of current 142, adapted to supply current for the purposes of operating the selective apparatus. There is provided at the central station for each of the party-lines what may be called a "dummy subscriber's selective device," this selective device comprising step-by-step switching mechanism which is identical with that hereinbefore described as installed at each of the subscribers' substations, the switch-arm 25 of the dummy set, however, normally resting on a hard-rubber insulator 143. When stepped forward from the normal position, the switch-arm makes contact with a continuous metal ring 144. The forward movement of the switch-arm 25 may be limited by a stop-pin 145. The line-signal lamp 146 and a serially-connected battery 147 includes in its circuit the ring 144, the switch-arm 25, and contacts 148 and 149, associated with the spring-jack 131, these contacts being normally in connection one with the other when the cord connecting-plug is not inserted within the jack. The insertion of a plug within the jack causes a break in the circuit between the contacts 148 and 149. The electromagnet 29 of the dummy selective apparatus at the central station is normally connected, by means of contact-springs 150 and 151, with the jack-springs connected with the line-limbs 127 and 128. An insertion of a cord-connecting plug with the jack 131 causes a connection with the contact-springs 152 and 153, whereby the connection of the electromagnet with the line-limbs is reversed.

The operation of a telephone system utilizing the apparatus of my invention may be described as follows: The selective apparatus at the substations connected with line 448 being in their normal position, as illustrated in Figs. 1 and 5, inclusive, such, for instance, as the subscriber at station No. 19 on line 448 desiring a connection examines the target busy-signal to ascertain if the line is not in use by other subscribers. He then manipulates his ringing-generator 120, this generator producing an intermittent or pulsating direct current in which the pulsations are all in one direction as distinguished from the well-known alternating generators in which the impulses are first in one direction and then in the reverse direction. He then removes his telephone from its switch-hook. The generator 120 is provided

with a contact-switch 154, which makes a connection with the armature-winding only when the generator is being operated by means of the hand-crank provided. The plug 132 is normally not in the jack 131, as shown. A current, therefore, may be traced from the generator 120 through the following circuit: from the switch 154 through the conductor 155 to the line-limb 128, the tip-spring 129, the contact 151, the conductor 156, the coils of the electromagnet 29 of the dummy instrument at the central station to the conductor 157, contact-spring 150, sleeve-spring 130, line-limb 127, conductor 158, to the frame 20 of the selective instrument at substation No. 19, through the frame 20 to the switch-arm 25, the contact-piece 54, and through conductor 159 to the other terminal of the generator 120. It will be noted that the coils 31 of the electromagnets 29 at all of the substations connected with line 448 are connected in bridge of the metallic line-limbs, the coils 31 at substation No. 19 being connected by way of the conductors 155 and 158. The polarization of the armatures 32 of the selective apparatus at all the substations is in the same direction, and the direction of the current impulses generated by the generator 120 is such as to cause an attraction of the armatures 32 toward the poles of the cores 30 of the electromagnets 29. The consequent movement of the levers 34, if there be any movement thereof, is in such a direction as to release the ratchet-wheel and cause a restoration of the switch 25 to its normal position. This effect, however, is merely incidental, as when the apparatus is properly operated all of the switches 25 will be normally in connection with their associated contact-pieces 54, whereupon no releasing or restoration of the switches is necessary at the time of signaling by means of the generator 120, located at any of the substations. Normally—that is, when the plug is out of the jack—the polarization of the dummy instrument at the central station and its direction of normal connection with the line-limbs 127 and 128 is such that the current from the generator 120, which tends to release and restore the selective apparatus at the substations, will cause a forward movement of the switch-arm 25 of this dummy instrument. The number of forward impulses given the switch-arm 25 of the dummy instrument is immaterial so long as there be sufficient impulses (one or more) to remove the switch-arm from the insulating-block 143. Upon this forward movement of the switch-arm 25 the following circuit through the lamp 146 may be traced: from the battery 147 through the lamp 146 to the metal ring 144, the switch-arm 25 of the dummy instrument, the conductor 160, the contact 149, the spring 148, which before the insertion of the plug of the cord connecting apparatus within the jack is in electrical contact with the contact 149, thence through the

conductor 161 to the other terminal of the battery 147. The line signal-lamp is thereupon caused to glow, thus giving the operator a visual signal to indicate that a subscriber on line 448 desires a telephonic connection with some other subscriber. The dummy selective instrument placed at the central station thus serves the purpose of the line-relay which is commonly employed to control the illumination of a line signal-lamp. The operator answers the signal produced by the illumination of the lamp 146 by inserting the calling-plug 133 within the answering-jack 131. The insertion of the plug within the jack 131 causes a break in the contact between the contacts 148 and 149, thus interrupting the circuit through the lamp 146, whereupon the lamp is extinguished, indicating that the signal has been answered by the operator. At the same time the insertion of the plug within the jack 131 changes the direction of connection of the electromagnets 29 of the dummy instrument at the central station with the line-limbs 127 and 128, whereupon the movements of the armature 32 of the dummy instrument are made to correspond with the movements of the armatures 32 of the selective apparatus connected in bridge of the corresponding line. The operator thereupon manipulates her listening-key 134 to connect her telephone set in bridge of the cord-strands connected with the line-limbs 127 and 128, whereupon she may converse with the subscriber at substation No. 19 on line 448 over the following circuit: from the condenser 122 at the subscriber's substation through the receiver 121, the secondary winding of the induction-coil 133, the closed contact-springs 162 and 163, associated with the switch-hook 126, the conductor 164, the conductor 155, the line-limb 128, tip-spring 129, the tip-strand of the cord-circuit leading to the tip-contact of the plug 133, the operator's telephone set, the sleeve-strand of the cord-circuit leading to the sleeve-contact of plug 133, the sleeve-spring 130, line-limb 127, conductor 158, frame 20, switch-arm 25, contact 54, and condenser 122. The subscriber may impress voice-currents upon this circuit through the condenser 122 by means of a local circuit through the transmitter and primary of the induction-coil 123, this local circuit including the spring 165, associated with the switch-hook 126 and the local battery 124. The operator at the central station learns from the calling subscriber, first, the party number of his own substation, (in this case No. 19,) and, secondly, the number of the substation with which the calling subscriber desires connection. Supposing the called substation to be No. 5, the operator first inserts a pin in hole No. 19 of the ring 81 of the automatic selector at the central station. She then turns the crank 86 in the direction indicated by arrow 100 until stopped by the stop 102. This movement of the crank

86 will release the stud 118, whereupon the mechanism of the automatic selector is free to operate, due to the tension of the spring 101, thus returning the crank 86 to its normal position, (which in the present case may be supposed to be in the neighborhood of the hole 22.) The revolution of the cam 109 causes the intermediate contact-spring 110 to make contact first with the spring 112 and thereafter, alternately, with springs 111 and 112. Before releasing the crank 86 the operator manipulates her calling-key 140, thereupon breaking the cord-circuit connection with the plug 132 and connecting the strands of the cord-circuit leading to plug 133 with contact-springs 166 and 167. During the first quarter-revolution of the cam 109 the springs 110 and 112 are brought into contact with each other, whereupon the following circuit may be traced: from the spring 112 through the conductors 168 and 169, the battery 142, the conductor 170, the contact-spring 166, the sleeve-strand of the cord-circuit leading to the sleeve-contact of plug 133, the sleeve-spring of the jack 131, within which this plug has been inserted, the line-limb 127, conductor 158, electromagnet-coils 31 of all the selective apparatus connected in bridge of the line 448, conductor 155, line-limb 128, tip-spring 129, the tip-strand of the cord-circuit, contact-spring 167, conductor 171 to contact-spring 110. The current-flow through this circuit is in such a direction that the armatures 32 of all the selective apparatus are attracted toward the cores 30', thereby advancing the switch-arms 25 of all the selective apparatus associated with line 448 through one step. The cessation of the flow of current through this circuit due to its interruption on account of the break in the contact between springs 110 and 112 permits the armatures 32 and associated levers 34 to resume their intermediate position due to the tension of the springs 42 and 43. Upon the continued revolution of the cam 109 connection is made between the springs 110 and 111, this connection serving to short-circuit the cord-strands leading to the plug 133, whose contacts are connected with the line-limbs 127 and 128. This cycle of connections is repeated for each revolution of the cam 129. Each time there is an electrical connection made between the springs 110 and 112 a current impulse is sent over the line and through the electromagnets 31 of the selective apparatus in such a direction as to cause for each impulse one forward step of the switch-arms 25 at all of the substations connected with the party-line which is being set up for conversation. Each time there is an electrical connection made between the springs 110 and 111 the two metallic line-limbs are short-circuited at the central station. The purpose of this short-circuit connection between the metallic line-limbs between succeeding current impulses through the electromagnets of the selective apparatus

is for the purpose of discharging any static charge to which the line may have been subjected during the preceding current impulse. I have found that this means for preventing static accumulations of electricity in the metallic line-limbs is of great advantage in preventing the false operation of the selective or signaling apparatus. Since there is one revolution of the cam 109 for each hole 82 passed by the plunger-connecting switch of the crank 86, there will be in the present instance twenty-three current impulses sent over the metallic line-limbs. The first of these impulses desirably brings all of the switch-arms 25 to their first position in advance of the contact-pieces 54, there desirably being provided for this position no hole 53 in the ring 52. Each succeeding impulse brings the switch-arms 25 above succeeding holes in the ring 52. Substation No. 19 on line 448 is provided with a contact-point 55 in hole 19 in the ring 52. Thus after twenty forward impulses of the switch-arm 25, due to the passage of twenty current impulses through the electromagnets 29, the switch-arms 25 at all of the substations will have been brought to a position above the holes No. 19 in the rings 52. Each substation having its contact-point 55 inserted in a different hole of the ring 52, there will be but one substation (No. 19) which has its contact-point 55 inserted in hole No. 19. Thus upon reaching this point the switch-arm 25 at substation No. 19 will make an electrical connection between the frame 20 and the insulated metal ring 52. Before reaching its position above the hole No. 19 the switch-arm 25 will have successively made contact with a contact-point 55, inserted in a preceding hole at some one of the other substations connected with line 448; but at the time of the closing of the circuit between the frame 20 and the ring 52 at substation No. 19 there will be no similar circuit through any other of the substations connected with the same line. It will be remembered that a pin has been inserted by the operator within hole No. 19 in the ring 81 of the automatic selector at the central station. Thus a plunger switch-arm 94 upon reaching the hole No. 19 in the ring 81 will, in connection with the switch-arm 25, close the following circuit through the electromagnet 65: from the battery 142 through conductor 170, contact-spring 166, the sleeve-strand of the cord-circuit leading to the sleeve-contact of the plug 133, sleeve-spring 130 of the jack associated with line 448, line-limb 127, conductor 158, frame 20, switch-arm 25, contact-point 55, ring 52, through conductor 172, connected with the insulated ring 52, electromagnet-coil 67, ground G, through the ground to the grounded conductor 173 at the central station, ring 81, the pin inserted in hole No. 19, the plunger 94, the crank 86, conductors 168 and 169 back to the other side of the battery 142. The current-flow through this circuit causes

the attraction of the armature 62, thereby causing a movement of the switch-arm 61 to make connection with the spring-contact 59, the catch 74 of the detent-lever 73 springing into position to catch and retain the telephone connecting switch-arm 61 in connection with the contact 59. It will be remembered that the movement of the lever 73 to catch the switch-arm 61 will now be possible, as the cam projection 76 will be prevented from interfering on account of its rotation away from the normal position due to the advancement of the ratchet-wheel 24, with which it is associated. It will be seen that the controlling-circuit through the electromagnet-coil 67 is jointly controlled by a connection through the switch-arm 25 and a connection through the plunger 94 of the automatic selector at the central station. A completed circuit through the electromagnet-coil 67 can occur only when the switch-arm 25 makes connection with the contact-point 55 and when at the same time the plunger switch-arm 94 makes connection with a pin 83, inserted in one of the holes 82 of the ring 81 of the automatic selector. Thus while the switch-arms 25 will have successively made contact with the contact-points 55 inserted in one of the holes at each of the substations connected with the line which is being set up there will at the same time have been no connection afforded through the crank 86 and the plunger switch-arm 94, for the reason that there will have been no pin inserted in any of the holes of the ring 81 corresponding with these other positions assumed by the switch-arms 25 of the selective apparatus at the substations. Thus while the crank of the automatic selector returns from its initial position to its normal position there will have been a circuit closed through but one electromagnet 65, whereupon the telephone connecting switch-arm 61 at but a single substation (substation No. 19) will have been actuated and detained by the catch 74. The switch-arms 25 at all of the substations will have been removed during this operation from their normal position, in connection with the contact-pieces 54, to a position in the neighborhood of the hole 22, it being assumed that there are not more than twenty-one stations connected with the party-line. It will be remembered that the circuit through which the subscriber signaled the central operator by an actuation of a generator 120 included a connection between the contact-piece 54 and the switch-arm 25. This connection having been broken, it is apparent that no substation is in a condition whereby the actuation of the generator 120 may signal the central station or effect the release of the selective apparatus at the substations connected with the same line. In the same manner the circuit which was traced through the telephone instruments of the calling-substation in notifying the central operator of the connection desired included a

connection between the contact-piece 54 and the switch-arm 25. This circuit having been broken, as hereinbefore described, there is no means by which the other substations connected with the same line may obtain telephonic communication either with the central operator or with each other. Thus there is provided a simple, efficient, and very effective lockout, by reason of which the use of the telephone party-line by any subscriber cannot be interfered with by any other subscriber connected with the same party-line. The telephone-circuit for substation No. 19 may now be traced as follows: from the sleeve-spring 130 of the line-jack 131 through line-limb 127, conductor 158, frame 20, detent-lever 73, switch-arm 61, contact 59, condenser 122, telephone-receiver 121, the secondary of the induction-coil 123, contact-spring 162, contact-spring 163, conductor 164, conductor 155, and line-limb 128 to tip-spring 129 of the line-jack at the central station. The operator after having thus connected the telephone set of substation No. 19 of line 448 with the metallic line-limbs and having locked out all the other subscribers connected with the same line thereupon removes the plug 133 from the jack 131 and inserts the answering-plug proper, 132, within this jack and removes the pin 83 from hole No. 19 of ring 81. Connection being desired with substation No. 5 on line 766, the operator inserts her calling-plug 133 in the line-jack 131 of this line 766. She inserts a pin 83 within hole No. 5 of the ring 81. The calling-key 140 is then manipulated, thus breaking the connection to that part of the cord-strands leading to the answering-plug and connecting the springs 166 and 167, which are the terminal springs of the automatic selector, with the part of the cord-strands leading to the contacts of plug 133. As has already been described in connection with substation No. 19 of line 448, the current impulses sent out from the automatic selector upon the return of the crank 86 from its initial to its normal position cause a step-by-step advancement of the switch-arms 25 of all the selective apparatus connected with line 766 and of the switch-arm 25 of the dummy instrument associated with line 766 at the central station. The switch-arm 25 at substation No. 5 on line 766 in passing the contact 55 in the ring 52 causes, in connection with the plunger switch-arm 94 at the central station, the closure of a circuit from the battery 142 through the electromagnet 65, whereupon the telephone connecting switch-arm 61 is attracted. As in the case of the substations connected with line 448, the other substations connected with line 766 will have been locked out by this setting-up operation, whereupon the telephone set at substation No. 5 will alone have been connected in bridge of the line-limbs 127 and 128, for the reason that a pin 83 has been inserted in but the single hole No. 5 of the ring 81. The line signal-lamp

146 associated with the called line will not glow upon the forward movement of the switch-arm 25 of the dummy instrument, for the reason that the lamp-circuit through contacts 148 and 149 will have been broken by the insertion of the plug 133. After having thus caused the actuation of the telephone-connecting switch-arm 61 to connect the subscriber's telephone set in bridge of the line-limbs the operator manipulates her selective ringing-key 139, whereby the ringing-generator 137 is connected in circuit through the bell 119 at substation No. 5 on line 766, through the following circuit: from one terminal of the generator 137 through conductor 175, to contact-spring 176, to the sleeve-strand of the cord-circuit leading to the sleeve-contact of plug 133, through sleeve-spring 130 of the line-jack, line-limb 128 of line 766, conductor 158, frame 20, lever 73, switch-arm 61, spring 69, contact-spring 174, contact-spring 173, through the bell 119, the ground connection G at substation No. 5, through the ground to the ground connection G at the central station, through conductor 173 to contact-spring 177, to contact-spring 178, and through conductor 179 to the other terminal of the generator 137. The alternating or intermittent current traversing this circuit causes an actuation of the signal-bell 119, whereupon the subscriber at substation No. 5 is signaled. The subscriber upon answering the signal removes his telephone-receiver 121 from the switch-hook 126, thereupon interrupting the normally closed circuit at the substation through the signal-bell 119 and serving to complete the connection by way of contact-springs 162, 163, and 165 through the subscriber's telephone set, as hereinbefore described for substation No. 19 on line 448. The desired subscribers now having their telephones respectively connected in circuit, the operator restores her calling-key 140 to its normal condition, thereby closing a continuous circuit through the cord-strands to connect the subscriber at substation No. 19 on line 448 with substation No. 5 on line 766 for conversation. Upon the completion of the conversation by the subscribers either one or both replaces his receiver upon the switch-hook 126, thereby opening the local circuit through the transmitter, opening the telephone-circuit through the receiver 121 and secondary of the induction-coil 123, and closing a connection through the signal-bell 119 between the ground and the line-limb 127, this circuit being traced as follows: from the ground G through signal-bell 119, contact-spring 173, contact-spring 174, spring 69, switch-arm 61, lever 73, frame 20 to line 127, this circuit being subsequently broken. Either subscriber may notify the operator at the central station of the desired disconnection by a slight rotation of the armature of the generator 120. The generator of each of the subscribers who have been con-

nected for conversation may be connected in
 bridge of the telephone-line limbs. A dis-
 connect signaling-current may be traced from
 the generator at substation No. 19 on line 448
 5 as follows: from the contact 154 through con-
 ductor 155, line-limb 128, tip-spring 129, tip-
 strand of the cord-circuit through the discon-
 nect-drop 138, connected in bridge of the cord-
 strands, the sleeve-strand leading to the sleeve
 10 of the plug 132, the sleeve-spring 130, the line-
 limb 127, frame 20, lever 73, switch-arm 61,
 contact 59, conductor 159 to the other terminal
 of the generator 120. The current-flow over
 15 this circuit causes an actuation of the super-
 visory drop 138, thereby notifying the opera-
 tor that the connected lines may be restored
 to their normal condition and interconnecting
 between the lines removed. It will be re-
 membered that the connection of the genera-
 20 tor 120 with the line-limbs is in such a direc-
 tion that the current impulses from this gen-
 erator will tend to release and restore the se-
 lecting apparatus at the various substations
 connected with the same line. As I may not
 25 wish to rely, however, upon this method for
 restoring the selective apparatus at the vari-
 ous substations to its normal condition, I pro-
 vide, therefore, at the central station a special
 releasing-key 141, a manipulation of which
 30 causes a disconnection with the cord-strands
 leading to the answering-plug 132 and serves
 to connect the battery 142 across the cord-
 strands leading through the plug 133 to the
 line-limbs of line 766. It will be seen that
 35 the connection of the battery 142 with the
 telephone-line is upon the manipulation of
 the releasing-key 141 in a direction the re-
 verse of that established by a manipulation
 of the calling-key 140 and the automatic se-
 40 lector. Thus while the actuation of the call-
 ing-key and the automatic selector caused cur-
 rent impulses to be sent out over the line in
 such a direction as to cause a forward step-
 by-step movement of the switch-arms 25
 45 the manipulation of the releasing or restor-
 ing key 141 causes a connection in the re-
 verse direction with the line-limbs, where-
 upon the armatures 32 of the selective ap-
 paratus at the various substations connected
 50 with a line which is being restored are at-
 tracted toward the cores 30 of their electro-
 magnets 31, whereupon their levers 34 are
 actuated to disengage the pawls 35 and 36
 from the ratchet-wheels 24, whereupon the
 55 springs 28 cause a restoration of the switch-
 arms 25 to their normal position in connec-
 tion with the contact-pieces 54. In the same
 manner the switch-arm 25 of the dummy in-
 strument at the central station connected with
 60 line 766 is restored to its normal position above
 the hard-rubber insulator 143. The operator
 thereupon removes the plug 133 from the jack
 connected with line 766 and also removes the
 plug 132 from the line associated with the line
 65 448. In order to restore the selective appa-

ratus connected with line 448 to its normal
 position, the operator then inserts the calling-
 plug 133 within the line-jack associated with
 this line and manipulates her releasing-key
 141 to connect the terminals of the battery 70
 142 across the line-limbs 127 and 128 of line
 448, whereupon the flow of current through
 the associated electromagnets 29 causes the at-
 traction of the armatures 32 toward the cores
 30, thereby disengaging the pawls 35 and 36 75
 from the ratchet-wheels 24 to permit the
 restoration of the switch-arms 25 to their
 normal position in connection with the con-
 tact-pieces 54. The switch-arm of the dummy
 instrument connected with line 448 is also re- 80
 leased in the same manner. The removal of
 the calling-plug 133 from the line-jack asso-
 ciated with line 448 completes the operation,
 whereupon the connected lines are in connec-
 85 tion either to transmit a calling-signal to the
 central station or to be set up for the purpose
 of signaling and telephonically connecting any
 of the substations on the line.

If, as may frequently happen, a connection is
 desired between a substation on any one party- 90
 line with another substation on the same party-
 line, the operator upon ascertaining by tele-
 phonic communication with the calling sub-
 scriber the number of the substation with which
 he desires connection inserts two pins within 95
 the ring 81 of the automatic selector. One of
 the pins corresponds in the number of the
 hole within which it is inserted with the party-
 number of the calling substation, and the other
 pin corresponds in the number of the hole 100
 within which it is inserted with the party-
 number of the called substation. The calling-
 plug 133 of her cord connecting apparatus
 being inserted in the line-jack 131 associated
 with the given party-line, the operator manip- 105
 ulates her calling-key 140, and thereupon ro-
 tates the crank 86 of the automatic selector
 into its initial position near the stop 102.
 Upon releasing the crank 86 current impulses
 are sent over the given party-line, there being 110
 a circuit established through the electromag-
 net 65 of the calling-substation as the plunger
 switch-arm 94 makes electrical connection with
 the pin 83 inserted in the corresponding hole
 of the ring 81 and there being a circuit estab- 115
 lished through the electromagnet 65 at the
 called substation as the plunger switch-arm
 94 passes the pin inserted in the hole corre-
 sponding in number with the number of the
 called party. Thus the energization of the 120
 electromagnets 65 at both the calling and
 called substations will cause an actuation of
 the telephone connecting switch-arms 61 to
 connect the telephone instruments at both the
 calling and the called substations in bridge of 125
 the same bimetallic party-line.

As in the case of the setting-up operation
 hereinbefore more particularly described, all
 the other substations on the same party-line
 will have been locked out by the removal of 130

their switches 25 from the normal contact-pieces 54, whereupon the conversation between the proper calling and called subscribers may not be interfered with by other subscribers connected on the same line. In the same manner the central operator may connect at the same time any number, or indeed all, of the telephone sets at all of the substations on any one line in bridge of the bimetallic line-limbs. Thus the central operator may communicate simultaneously with all of the subscribers on any one line or any one subscriber may simultaneously talk to all the other subscribers connected on the same line.

While I have herein shown and described one preferred embodiment of my invention, it will be apparent that many modifications may be employed without departing from the spirit thereof. I do not, therefore, wish to limit myself to the precise disclosures herein set forth; but,

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

1. In a device of the class described, the combination with a rotatably-mounted shaft 85, of a switch-arm 94 carried thereby, spring mechanism tending to cause the forward rotation of said switch-arm, a contact 83 adapted to be placed in any one of the plurality of equally-spaced positions in which to be engaged by said switch-arm, locking mechanism normally acting to prevent the forward rotation of said switch-arm, and means whereby the backward rotation of said switch-arm to a certain predetermined position causes the release of said locking mechanism to permit the subsequent forward rotation of said switch-arm.

2. In a device of the class described, the combination with a rotatably-mounted shaft 85, of a switch-arm 94 carried thereby, a contact 83 adapted to be placed in any one of the plurality of equally-spaced positions in which to be engaged by said switch-arm, locking mechanism normally acting to prevent the forward rotation of said switch-arm, and means whereby the backward rotation of said switch-arm to a certain predetermined position causes the release of said locking mechanism to permit the subsequent forward rotation of said switch-arm.

3. In a device of the class described, the combination with a rotatably-mounted shaft 85, of a switch-arm 94 carried thereby, spring mechanism tending to cause the forward rotation of said switch-arm, a contact 83 adapted to be placed in any one of the plurality of positions in which to be engaged by said switch-arm, locking mechanism normally acting to prevent the forward rotation of said switch-arm, and means whereby the backward rotation of said switch-arm to a certain predetermined position causes the release of said locking mechanism to permit the subsequent forward rotation of said switch-arm.

4. In a device of the class described, the com-

bination with a rotatably-mounted shaft 85, of a switch-arm 94 carried thereby, a contact 83 adapted to be placed in any one of the plurality of positions in which to be engaged by said switch-arm, locking mechanism normally acting to prevent the forward rotation of said switch-arm, and means whereby the backward rotation of said switch-arm to a certain predetermined position causes the release of said locking mechanism to permit the subsequent forward rotation of said switch-arm.

5. In a device of the class described, the combination with a shaft 85, of a crank 86, mounted thereon, a crank-handle 88 of insulating material, a cover-plate 87 of insulating material adapted to prevent direct electrical contact with said crank, and means adapted to actuate said locking mechanism to stop the rotation of said switch-arm upon reaching its normal position.

6. In a device of the class described, the combination with a rotatably-mounted shaft 85, of a plunger switch-arm 94 carried thereby, spring mechanism tending to cause a forward rotation of said switch-arm, a metal ring 81 having a series of equally-spaced holes 82, each adapted for the reception of a contact-pin 83, governor mechanism geared to said shaft 85, ratchet mechanism interposed between said shaft and the geared connection of said governor mechanism, a projecting pin 118 associated with said governor mechanism, a pivotally-mounted lever 115, normally engaging said pin 118, to prevent a forward rotation of said shaft, and an adjustable trip-arm 114 carried on said shaft 85 adapted, on a backward rotation of said shaft, to engage said lever to permit a subsequent forward rotation of said shaft.

7. In a device of the class described, the combination with a rotatably-mounted shaft 85, of a plunger switch-arm 94 carried thereby, spring mechanism tending to cause a forward rotation of said switch-arm, a metal ring 81 having a series of equally-spaced holes 82, each adapted for the reception of a contact-pin 83, governor mechanism geared to said shaft 85, ratchet mechanism interposed between said shaft and the geared connection of said governor mechanism, a projecting pin 118 associated with said governor mechanism, a pivotally-mounted lever 115, normally engaging said pin 118, to prevent a forward rotation of said shaft, an adjustable trip-arm 114 carried on said shaft 85 adapted, on a backward rotation of said shaft, to engage said lever to permit a subsequent forward rotation of said shaft, and a locking-arm 113 adapted to engage said lever upon the forward rotation of said shaft, whereby said lever is made to engage said projecting pin 118 to stop the forward rotation of said shaft in its normal position.

8. In a device of the class described, the combination with a rotatably-mounted shaft 85, of

a switch-arm 94 carried thereby, spring mechanism tending to cause a forward rotation of said switch-arm, a metal ring 81, having a series of equally-spaced holes 82, each adapted
 5 for the reception of a contact-pin 83, a second shaft 103, having ratchet and geared connection with said shaft 85, a projecting pin 118, carried by said second shaft 103, a pivotally-mounted lever 115, normally engaging said
 10 pin 118, to prevent a forward rotation of said shafts, and an adjustable trip-arm 114 carried on said shaft 85 adapted upon a backward rotation of said shaft to engage said lever to permit a subsequent forward rotation of said
 15 shaft.

9. In a device of the class described, the combination with a rotatably-mounted shaft 85, of a switch-arm 94 carried thereby, spring mechanism tending to cause a forward rotation of
 20 said switch-arm, a metal ring 81, having a series of equally-spaced holes 82, each adapted for the reception of a contact-pin 83, a second shaft 103, having ratchet and geared connection with said shaft 85, a projecting pin 118,
 25 carried by said second shaft 103, a pivotally-mounted lever 115, normally engaging said pin 118, to prevent a forward rotation of said shafts, an adjustable trip-arm 114 carried on said shaft 85 adapted upon a backward rota-
 30 tion of said shaft to engage said lever to permit a subsequent forward rotation of said shaft, and a locking-arm 113 adapted to engage said lever upon the forward rotation of said shaft, whereby said lever is made to en-
 35 gage said projecting pin 118 to stop the forward rotation of said shaft in its normal position.

10. In a device of the class described, the combination with a rotatably-mounted shaft
 40 85, of a switch-arm 94 carried thereby, spring mechanism tending to cause a forward rotation of said switch-arm, a metal ring 81, having a series of equally-spaced holes 82, each adapted for the reception of a contact-pin 83,
 45 a second shaft, having ratchet and geared connection with said shaft 85, a cam of insulating material mounted on said shaft 103, switching mechanism controlled by said cam, a projecting pin 118, carried by said second shaft
 50 103, a pivotally-mounted lever 115, normally engaging said pin 118, to prevent a forward rotation of said shafts, an adjustable trip-arm 114 carried on said shaft 85 adapted upon a backward rotation of said shaft to engage said
 55 lever to permit a subsequent forward rotation of said shaft, and a locking-arm 113 adapted to engage said lever upon the forward rotation of said shaft, whereby said lever is made to engage said projecting pin 118 to stop the
 60 forward rotation of said shaft in its normal position.

11. In a device of the class described, the combination with a rotatably-mounted shaft
 65 85, of the toothed disk 92 rigidly secured thereto, a crank 86 having an opening fitting

said toothed disk, a plunger switch-arm 94 adjustably mounted on said crank, spring mechanism tending to cause a forward rotation of said shaft 85, locking mechanism nor-
 70 mally acting to prevent the forward rotation of said shaft, a ring 81 containing equally-spaced holes 82, the pitch of said holes being equal to that of the teeth of the disk 92, and a pin 83 adapted for insertion in any one of
 75 the said holes.

12. In a device of the class described, the combination with a rotatably-mounted shaft
 80 85, of the toothed disk 92 rigidly secured thereto, a crank 86 having an opening fitting said toothed disk, a plunger switch-arm 94 mounted on said crank, spring mechanism tending to cause a forward rotation of said
 85 shaft 85, locking mechanism normally acting to prevent the forward rotation of said shaft, a ring 81 containing equally-spaced holes 82, the pitch of said holes being equal to that of the teeth of the disk 92, and a pin 83 adapted
 for insertion in any one of the said holes.

13. In a device of the class described, the combination with a rotatably-mounted shaft
 90 85, of the toothed disk 92 rigidly secured thereto, a crank 86 having an opening fitting said toothed disk, a plunger switch-arm 94 adjustably mounted on said crank, spring mechanism tending to cause a forward rotation of
 95 said shaft 85, locking mechanism normally acting to prevent the forward rotation of said shaft, a ring 81 containing equally-spaced holes 82, the pitch of said holes being equal to that of the teeth of the disk 92, a pin 83
 100 adapted for insertion in any one of the said holes, and a stop limiting the backward rotation of said shaft 85.

14. In a device of the class described, the combination with a rotatably-mounted shaft
 105 85, of the toothed disk 92 rigidly secured thereto, a crank 86 having an opening fitting said toothed disk, a plunger switch-arm 94 mounted on said crank, spring mechanism tending to cause a forward rotation of said shaft 85,
 110 locking mechanism normally acting to prevent the forward rotation of said shaft, a ring 81 containing equally-spaced holes 82, the pitch of said holes being equal to that of the teeth of the disk 92, a pin 83 adapted for in-
 115 sertion in any one of the said holes, and a stop limiting the backward rotation of said shaft 85.

15. In a device of the class described, the combination with a rotatably-mounted shaft
 120 85, of the toothed disk 92 rigidly secured thereto, the crank 86 having an opening fitting said toothed disk, a plunger switch-arm 94 adjustably mounted on said crank, spring mechanism tending to cause a forward rotation of
 125 said shaft 85, locking mechanism adapted upon actuation upon the forward rotation of said shaft to stop the forward rotation of said shaft at a certain point, said locking mechanism being adjustable to vary the position of
 130

the point at which the rotation of said shaft is stopped, a ring 81 containing equally-spaced holes 82, the pitch of said holes being equal to that of the teeth of the disk 92, and a pin 83 adapted for insertion in any one of said holes.

16. In a device of the class described, the combination with a rotatably-mounted shaft 85, of the toothed disk 92 rigidly secured thereto, the crank 86 having an opening fitting said toothed disk, a plunger switch-arm 94 mounted on said crank, spring mechanism tending to cause a forward rotation of said shaft 85, locking mechanism adapted upon actuation upon the forward rotation of said shaft to stop the forward rotation of said shaft at a certain point, said locking mechanism being adjustable to vary the position of the point at which the rotation of said shaft is stopped, a ring 81 containing equally-spaced holes 82, the pitch of said holes being equal to that of the teeth of the disk 92, and a pin 83 adapted for insertion in any one of said holes.

17. In a device of the class described, the combination with a rotatably-mounted shaft 85, of the toothed disk 92 rigidly secured thereto, the crank 86 having an opening fitting said toothed disk, a plunger switch-arm 94 adjustably mounted on said crank, spring mechanism tending to cause a forward rotation of said shaft 85, locking mechanism adapted upon actuation upon the forward rotation of said shaft to stop the forward rotation of said shaft at a certain point, said locking mechanism being adjustable to vary the position of the point at which the rotation of said shaft is stopped, a ring 81 containing equally-spaced holes 82, the pitch of said holes being equal to that of the teeth of the disk 92, a pin 83 adapted for insertion in any of said holes, and a stop 102 for limiting the backward rotation of said shaft 85.

18. In a device of the class described, the combination with a rotatably-mounted shaft 85, of the toothed disk 92 rigidly secured thereto, the crank 86 having an opening fitting said toothed disk, a plunger switch-arm 94 mounted on said crank, spring mechanism tending to cause a forward rotation of said shaft 85, locking mechanism adapted upon actuation upon the forward rotation of said shaft to stop the forward rotation of said shaft at a certain point, said locking mechanism being adjustable to vary the position of the point at which the rotation of said shaft is stopped, a ring 81 containing equally-spaced holes 82, the pitch of said holes being equal to that of the teeth of the disk 92, a pin 83 adapted for insertion in any one of said holes, and a stop 102 for limiting the backward rotation of said shaft 85.

19. In a device of the class described, the combination with a rotatably-mounted shaft, of a switch-arm carried thereby, spring mechanism tending to cause a forward rotation of

said switch-arm, a metal ring having a series of equally-spaced holes, each adapted for the reception of a contact-pin, governor mechanism geared to said shaft, ratchet mechanism interposed between said shaft and said governor mechanism, a projecting pin associated with said governor mechanism, a pivotally-mounted lever normally engaging said pin, to prevent a forward rotation of said shaft, and an adjustable trip-arm carried on said shaft adapted, on a backward rotation of said shaft, to engage said lever to permit a subsequent forward rotation of said shaft.

20. In a device of the class described, the combination with a rotatably-mounted shaft, a switch-arm mounted on said shaft, spring mechanism tending to cause a forward rotation of said shaft, and locking mechanism adapted upon backward rotation of said switch-arm to prevent a subsequent forward rotation of said arm until a certain predetermined point has been reached upon backward rotation.

21. In a device of the class described, the combination with a rotatably-mounted shaft, of a switch-arm adjustably mounted on said shaft, spring mechanism tending to cause forward rotation of said shaft with said arm, and locking mechanism for locking said shaft after a certain distance of forward rotation thereof, said locking means serving also upon backward rotation of said arm to lock said shaft against subsequent forward rotation until a certain predetermined point is reached on backward rotation.

22. In a device of the class described, the combination with a rotatably-mounted shaft, of a switch-arm adjustably mounted on said shaft, spring mechanism tending to cause forward rotation of said shaft with said arm, locking mechanism for locking said shaft after a certain distance of forward rotation thereof, said locking means serving also upon backward rotation of said arm to lock said shaft against subsequent forward rotation until a certain predetermined point is reached on backward rotation, and means for releasing said locking mechanism on said shaft to allow forward rotation thereof when said predetermined point has been reached.

23. In a device of the class described, the combination with a rotatably-mounted shaft, of a switch-arm mounted on said shaft, spring mechanism tending to cause forward rotation of said shaft with said arm, an initial position for said arm, means for adjusting the distance of forward travel of said arm around said initial position, means for locking said arm when said distance has been traveled, and means upon backward rotation of said arm toward the initial position for preventing forward rotation thereof until said arm has been moved backward to the initial position.

24. In a device of the class described, the combination with a rotatably-mounted shaft, of an arm mounted on said shaft, spring mechanism

anism tending to cause forward rotation of said shaft with said arm, an initial and a final position between which said arm may travel upon rotation of said shaft, locking means for
5 locking said shaft when said arm reaches the final position, and means for locking said arm against forward rotation when moved backwardly to any intermediate point between the initial and final positions.

10 25. In a device of the class described, the combination with a rotatably-mounted shaft, of an arm mounted on said shaft, spring mechanism tending to cause forward rotation of said shaft with said arm, an initial and a final
15 position between which said arm may travel upon rotation of said shaft, locking means for locking said shaft when said arm reaches the final position, means for locking said arm against forward rotation when moved back-
20 wardly to any intermediate point between the initial and final positions, and means for allowing forward rotation of said arm when said arm has been moved in a backward direction beyond the initial position.

25 26. In a device of the class described, the combination with a rotatably-mounted shaft, of a switch-arm mounted thereon, spring mechanism tending to cause forward rotation of said shaft and arm, a plurality of adjust-
30 able contacts adapted to be engaged by said arm during its rotation, an initial and a final position for said arm, and means for preventing forward rotation of said arm from an intermediary point subsequent to a backward
35 movement of said arm to said intermediary point.

27. In a device of the class described, the combination with a rotatably-mounted shaft, of a switch-arm mounted thereon, spring mechanism tending to cause forward rotation
40 of said shaft and arm, a plurality of adjustable contacts adapted to be engaged by said arm during its rotation, an initial and a final position for said arm, means for preventing forward rotation of said arm from an inter-
45 mediary point subsequent to a backward movement of said arm to said intermediary point, and means for allowing subsequent forward rotation of said arm after said arm has been moved backwardly beyond the initial po-
50 sition.

28. In a device of the class described, the combination with a rotatably-mounted shaft, of a switch-arm adjustably mounted on said shaft to rotate therewith, spring mechanism
55 tending to cause a forward rotation of said shaft, locking mechanism for locking said arm after travel from an initial to a final position, said locking mechanism serving to prevent forward rotation of said arm from an inter-
60 mediary point subsequent to backward movement of said arm to said intermediary point, and means for releasing said locking mechanism to allow forward rotation of said arm after said arm has been moved backwardly
65 beyond its initial position.

In witness whereof I hereunto subscribe my name this 5th day of May, A. D. 1903.

RUDOLPH C. DEUBEN.

Witnesses:

LYNN A. WILLIAMS,
JOHN STAHR.