

(No Model.)

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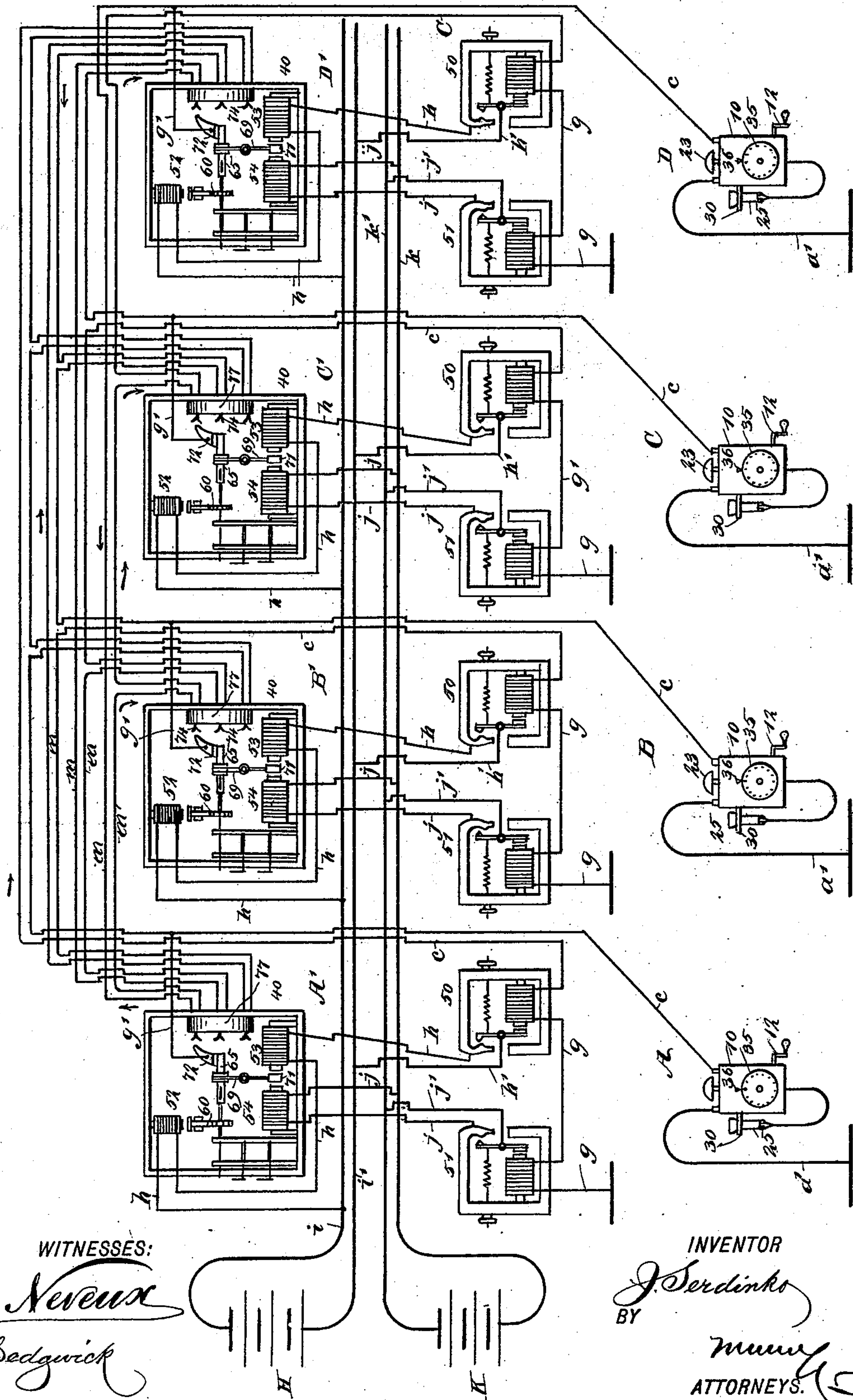
J. SERDINKO.

AUTOMATIC TELEPHONE EXCHANGE SYSTEM.

No. 510,195.

Patented Dec. 5, 1893.

Fig. 1



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(No Model.)

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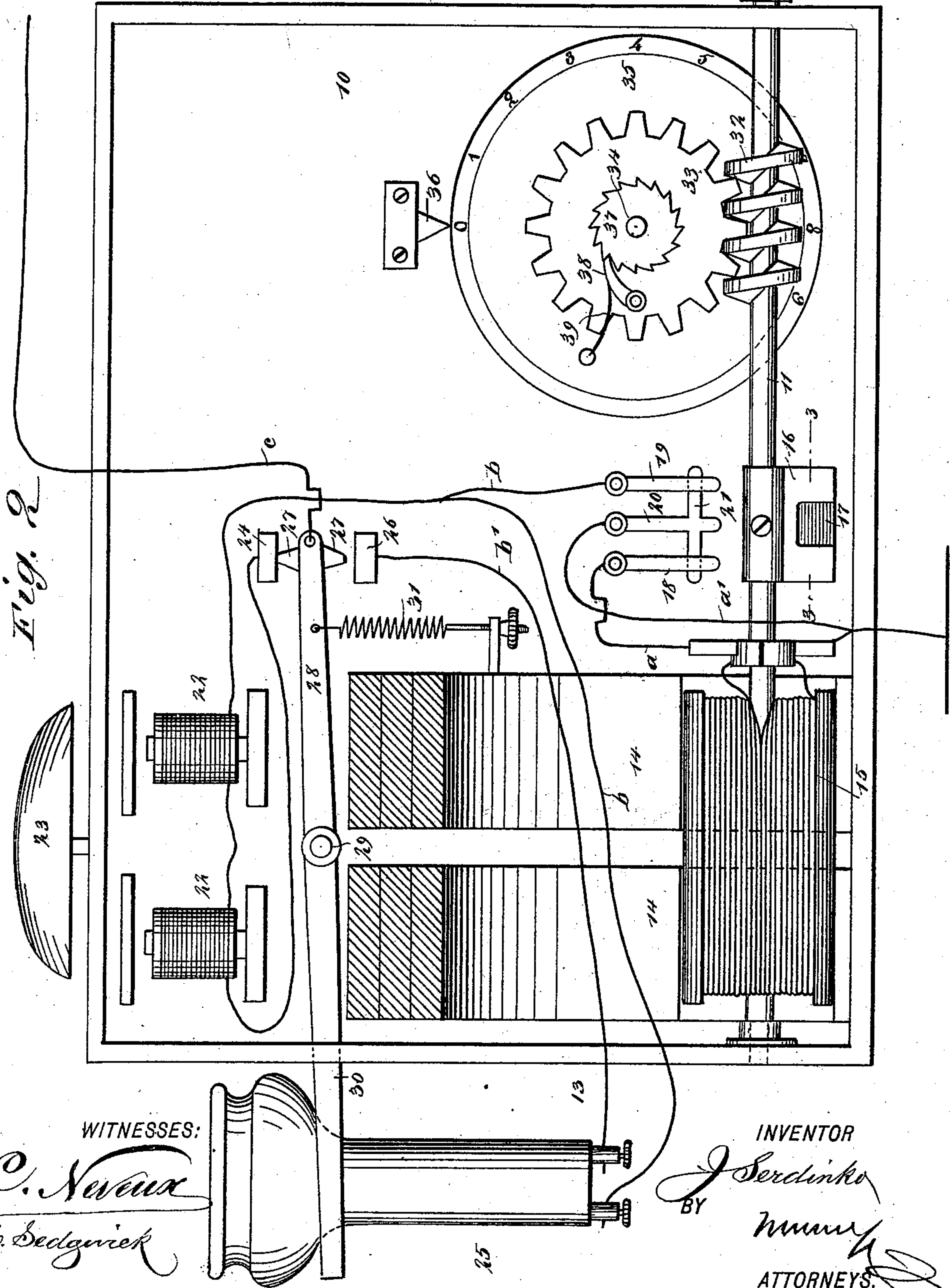
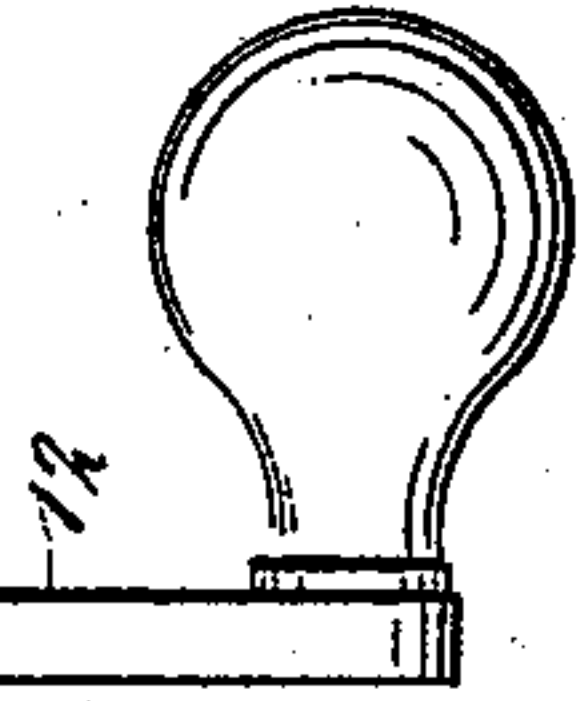
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Patented Dec. 5, 1893.

Fig. 5



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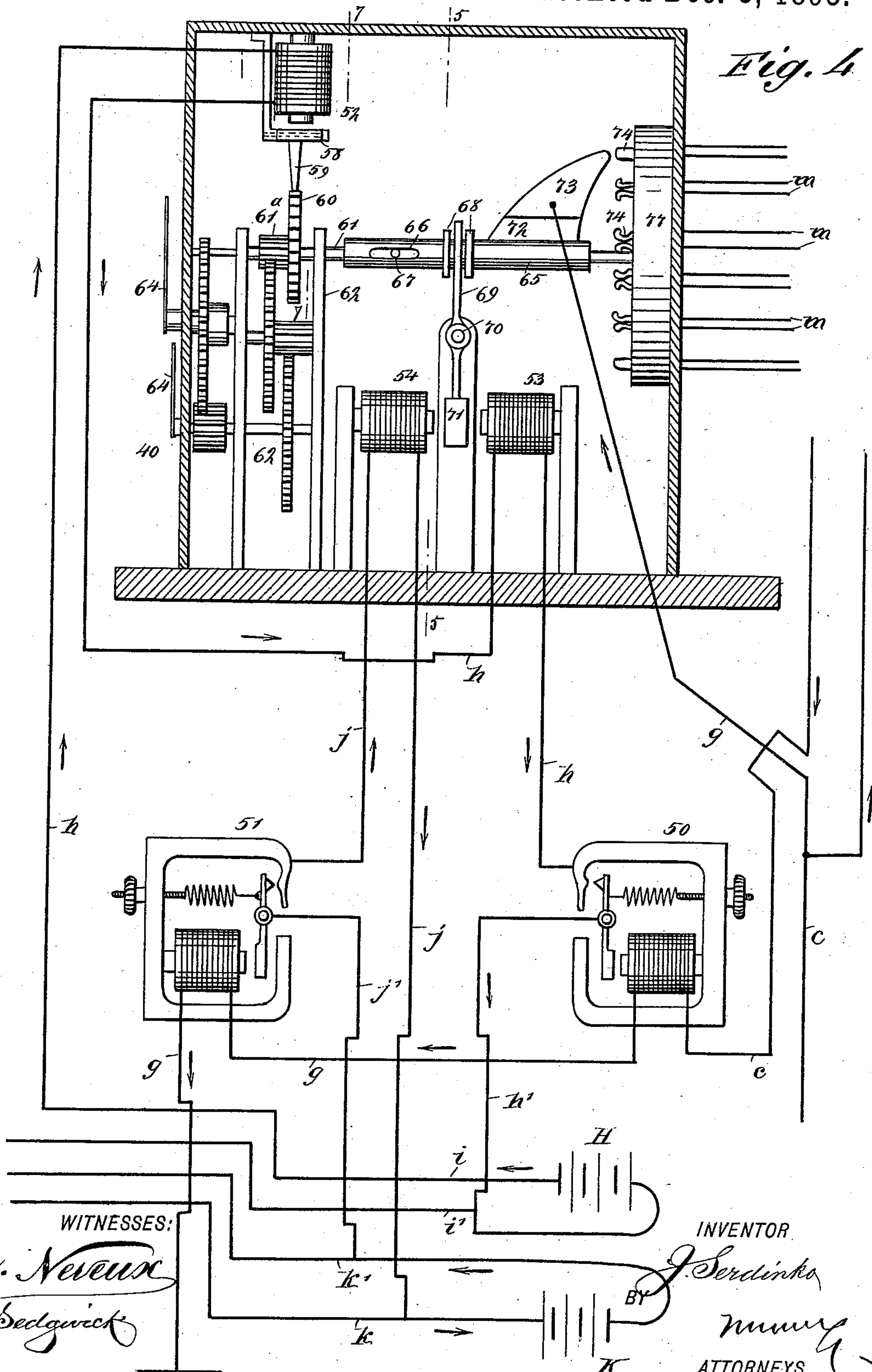
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AUTOMATIC TELEPHONE EXCHANGE SYSTEM.

No. 510,195.

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AUTOMATIC TELEPHONE EXCHANGE SYSTEM.

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Fig. 5

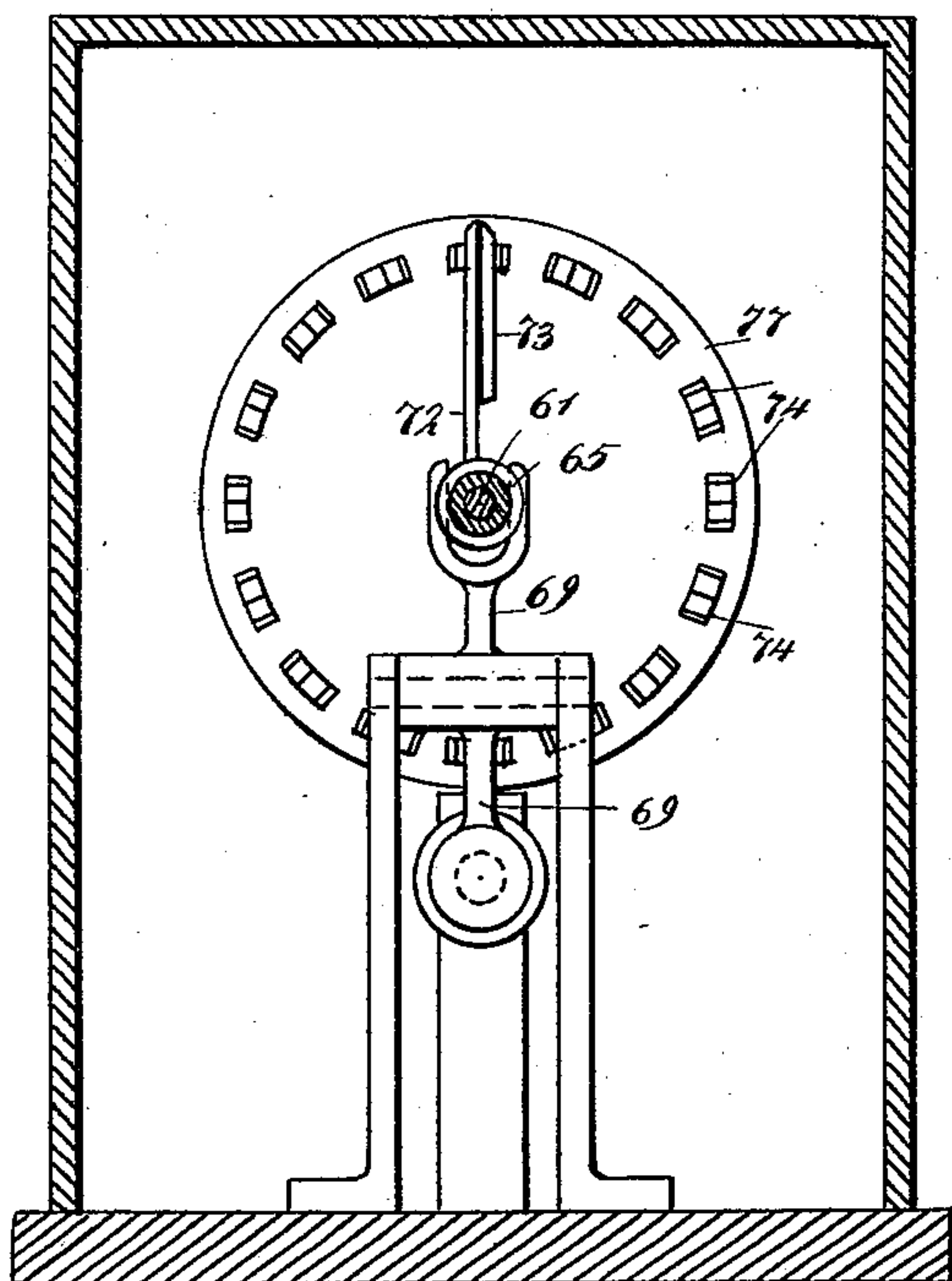


Fig. 6

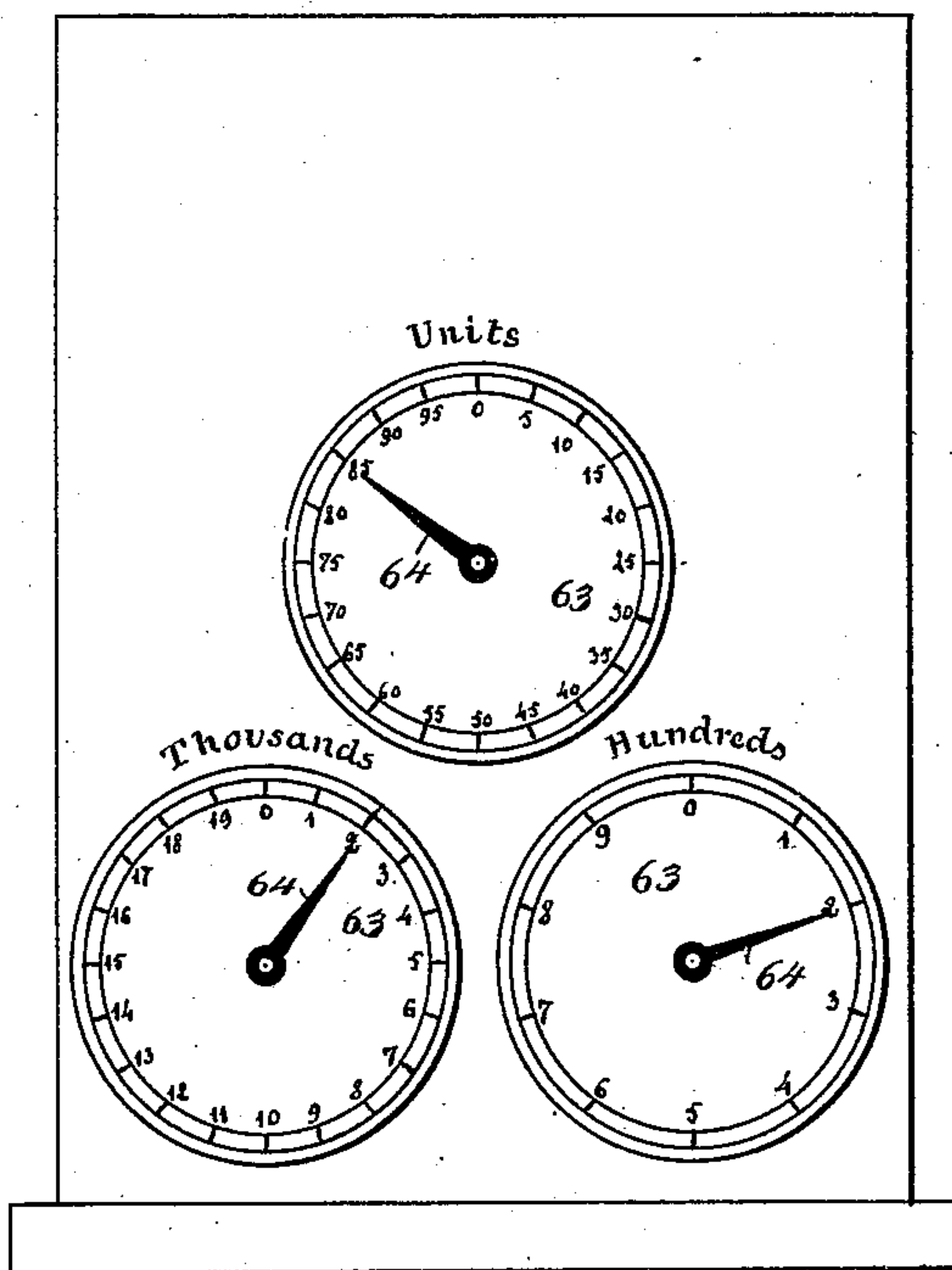


Fig. 7

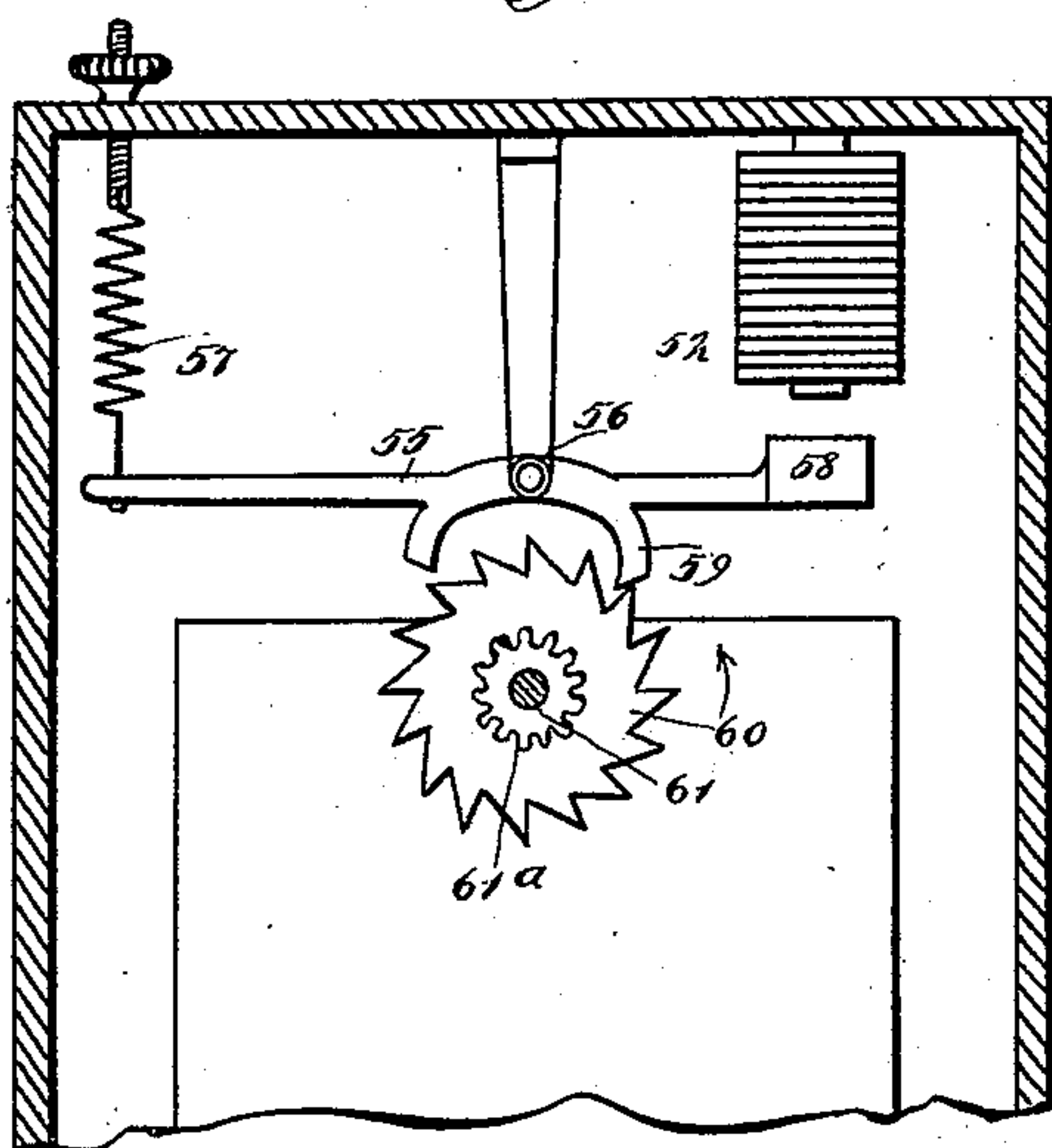


Fig. 8

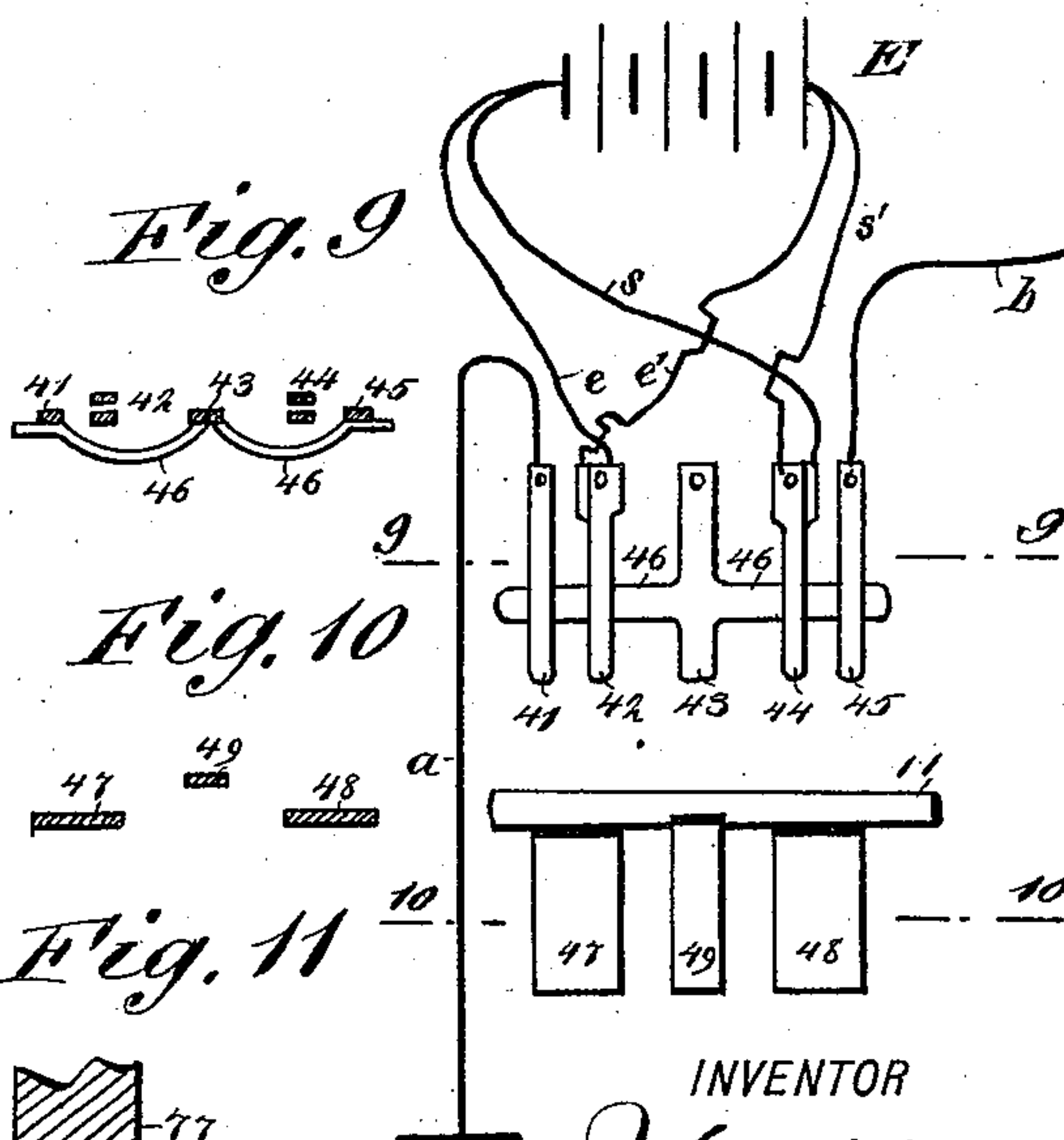


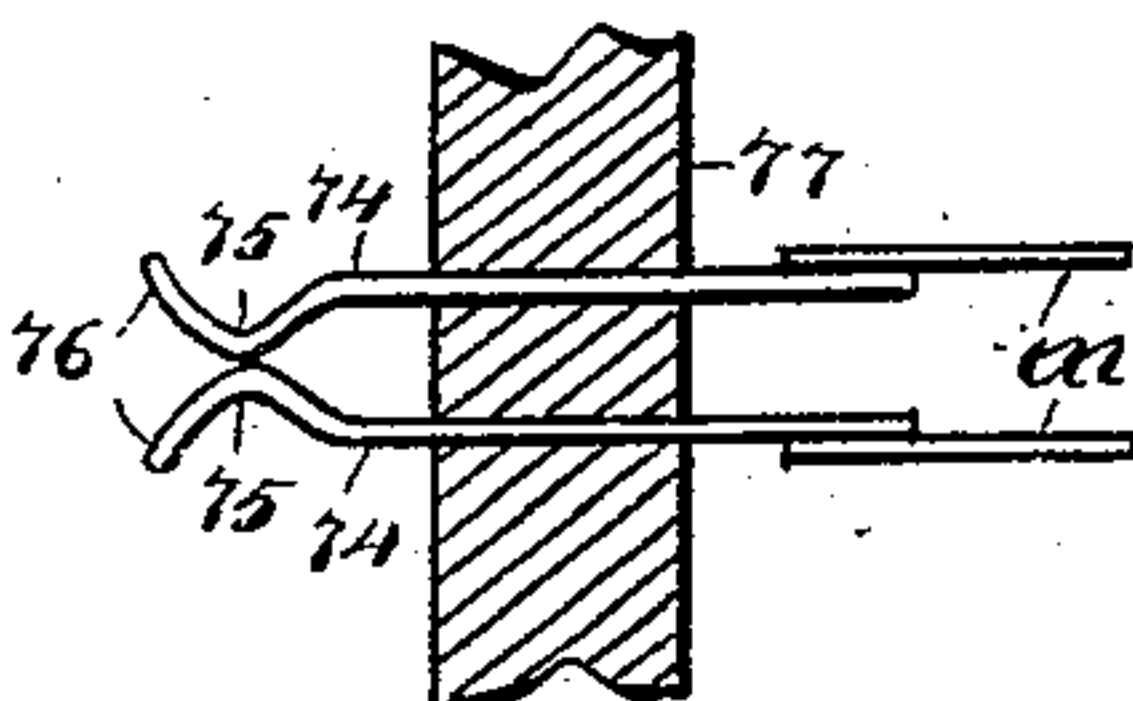
Fig. 9

Fig. 10

Fig. 11

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UNITED STATES PATENT OFFICE.

JOHN SERDINKO, OF NEW BRAUNFELS, TEXAS.

AUTOMATIC TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 510,195, dated December 5, 1893.

Application filed April 22, 1893. Serial No. 471,390. (No model.)

To all whom it may concern:

Be it known that I, JOHN SERDINKO, of New Braunfels, in the county of Comal and State of Texas, have invented a new and Improved Telephone-Exchange System, of which the following is a full, clear, and exact description.

My invention relates to improvements in exchanges for telephone, telegraph and similar systems; and the object of my invention is to produce a simple system and arrangement which is especially adapted for a telephone exchange, which enables the instruments to be connected by a single wire, which dispenses with the use of an operator at the central station, which has automatic means for registering the messages sent by each subscriber, and which is provided with an automatic switching device by means of which one subscriber may connect with any other.

To these ends my invention consists in certain features of construction and combinations of parts, as will be hereinafter described and claimed.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar figures and letters of reference indicate corresponding parts in all the views.

Figure 1 is a diagrammatic view of my improved system, showing it arranged for four subscribers or instruments. Fig. 2 is an enlarged detail sectional view of the generator which is used in connection with each instrument. Fig. 3 is a detail cross section on the line 3—3 in Fig. 2, of the arm moved in sending positive and negative impulses over the line wire. Fig. 4 is a detail diagrammatic view, partly in section, of one of the registering and switching devices used in connection with my system. Fig. 5 is a vertical cross section on the line 5—5 in Fig. 4. Fig. 6 is an outside elevation of the registering device. Fig. 7 is a detail cross section on the line 7—7 in Fig. 4, and shows the pawl and ratchet device for operating the automatic switch. Fig. 8 is a diagrammatic view of a modified means of sending positive and negative impulses, showing how the apparatus may be used in connection with a battery instead of with a mechanical generator. Fig. 9 is a cross section on the line 9—9 in Fig. 8. Fig. 10 is a cross section on the line 10—10 in Fig. 8; and

Fig. 11 is a detail sectional view of the separable spring terminals which are used in connection with the automatic switch.

The generator 10 shown in Fig. 2, is used for sending positive and negative impulses over the line wire, and in connection with the system is used a differential or alternating current which is produced in the manner hereinafter described. The generator 10 is provided with a revoluble shaft 11 which has a suitable crank 12 at one end by which it may be turned, and the shaft is journaled in suitable supports in the case 13 of the generator. In the generator are horse-shoe magnets 14, between the poles of which is arranged an armature 15 which is carried by the shaft 11 and which therefore revolves with the shaft, and as the armature is turned, positive and negative currents are generated so as to send impulses over the wire with which the armature connects and impulses will be sent at each revolution of the armature.

The sending of the impulses is accomplished by the following mechanism:—On the shaft 11 is an arm 16 which is of conducting material and which is slotted, the two members of the arm being connected by an insulating strip 17 which projects slightly from the face of the arm, as shown best in Fig. 3. Arranged adjacent to the arm and in its path are the spring contacts or terminals 18, 19 and 20, and a wire *a* leads from the armature 15 to the spring terminal 18 and a wire *a'* leads from the armature to the terminal 20 and to the ground. The spring or terminal 20 is provided with a cross arm 21 which is arranged behind the springs or terminals 18 and 19 and which normally touches the two so as to connect them electrically. A wire *b* leads from the spring terminal 19 and connects with the bell magnets 22 which are arranged to ring the bell 23 in the usual manner, the details of the bell being omitted from the drawings as they form no part of this invention. The wire *b* also connects with a contact 24 and with one binding post of the receiver 25, which is of the usual kind and which connects also by means of a wire *b'* with a contact 26 which is arranged beneath the contact 24, both these contacts 24 and 26 being arranged in the path of the movable contacts 27 on the

lever 28, which lever is fulcrumed in the case 13, as shown at 29, and projects therefrom in the customary way, terminating at its outer end in a hook 30 which carries the receiver 5 25 in the usual manner. The lever 28 connects with the line by means of a wire *c* and when the receiver is hung up in the hook one of the contacts 27 strikes the contact 24, thus closing the circuit through the bell magnets 10 22 and this enables the bell to be sounded in sending a signal. When, however, the receiver is removed from the hook 30, the inner end of the lever 28 is depressed by a spring 31 so as to throw one of the contacts 27 against the con- 15 tact 26, thus throwing the receiver into the line and breaking the circuit through the bell magnets. On the shaft 11 is a worm 32 which engages a worm wheel 33, this being journaled on a shaft 34 which is arranged at right angles to 20 the shaft 11. The shaft 34 also carries a dial 35 which is numbered from 0 to 15 in the present instance, but which may be numbered in any necessary way, and the dial turns opposite a hand or pointer 36 which is stationary. 25 On the shaft 34 is a ratchet wheel 37 which is engaged by a pawl 38 which is pivoted on the worm wheel 33 and is pressed into engagement with the ratchet wheel by a spring 39. It will thus be seen that when the shaft 11 is turned 30 in one direction, it will turn the worm wheel 33, and the pawl 38 will turn the ratchet wheel and the dial connected therewith, but when the shaft 11 is turned in the other direction, the pawl rides over the teeth of the 35 ratchet wheel and the dial is not moved.

In connection with each sending instrument or generator is a switching and recording device 40, which is arranged at the central station and which is connected up in the 40 manner hereinafter described.

In Figs. 8 to 10 I have shown a modified means of generating the impulses necessary to work the system, these being produced from a battery instead of from a mechanical 45 generator, and as here shown, a plurality of spring terminals 41, 42, 43, 44 and 45 are arranged parallel with each other and adjacent to the shaft 11, which is rotated as above described, and also provided with the dial and 50 its actuating mechanism. The terminal 41 connects by a wire *a* with the ground, as above specified, and the terminal or spring 45 connects by a wire *b* with the bell magnets and receiver in the same way that the 55 spring terminal 19 is connected. The spring terminals 42 and 44 are double and are arranged one behind the other, so as to be separated by insulating material, and the terminal or spring 43 is connected with the springs 60 41 and 45 by a bent cross arm 46, the curves of which carry it around the springs 42 and 44. The two springs 42 connect by wires *e* and *e'* with the opposite poles of a battery *E*, and the two springs 44 connect by wires *s* and *s'* 65 with the poles of the same battery. The shaft 11 is provided with arms 47, 48 and 49, which are insulated from each other and also from

the shaft, and the arm 47 is adapted to strike the springs 41 and 42, the arm 48 to strike the springs 44 and 45, and the arm 49 to strike 70 the spring terminal 43.

The operation of the generating and sending impulses over the line is as follows:—If the mechanical generator shown in Fig. 2 is 75 used, the operator, by turning the crank in one direction causes the arm 16 to be turned and make contact with the springs 18, 19 and 20. The insulation 17 of the arm, being a little in advance of the sides of the arm, will 80 first strike the spring 20 and push the cross arm 21 out of contact with the springs or terminals 18 and 19, thus disconnecting it from them. Both sides of the arm 16 will now 85 touch the springs 18 and 19, thus connecting them together alternately. At the same time one of the poles of the armature of the generator will send an electric impulse over the line, the current passing out from the arma- 90 ture through the wire *a*, the spring terminal 18, the arm 16, the spring terminal 19, the wire *b*, the magnets 22, the contact 24, the lever 28, and the wire *c*. After the arm 16 passes the springs, the cross arm 21 will again connect the spring terminals 18 and 19 and there are no opposite impulses sent from the 95 armature to the line. As often as the crank 12 is turned will the armature send electrical impulses, there being one impulse for each revolution of the armature. By turning the crank in the opposite direction, the arm 16 100 will swing from the opposite side and will first push the springs 18 and 19 away from the cross arm 21, and the armature will now send positive impulses only, and only one im- 105 pulse at each revolution of the crank and armature. In its normal position, the generator is in the position shown in Fig. 2, the signal bell magnets 22 being in a line and the receiver out of circuit.

When the pole changer shown in Figs. 8 to 110 10 is used, the operation is as follows:—When the shaft 11 is turned in one direction, the arm 49 will first strike the spring 43 and push the cross arm 46 out of contact with the 115 springs or terminals 41 and 45. Then the arm 47 will make contact with the springs 41 and 42, thus connecting them together, and the arm 48 will make contact with the spring terminals 44 and 45, connecting them. This closes the circuit and makes an electric im- 120 pulse sent to the line in one direction from the local battery. By turning the shaft in the opposite direction, the reverse action takes place, the springs 41, 42, 44 and 45 being first pushed from the cross arm 46 and an 125 opposite impulse is sent over the line. At the central station is a switching and registering device 40, previously alluded to, there being one of these for each sending instrument or generator, and any number may be 130 used although, as shown, four are employed, and the generators are lettered from A to D while the corresponding registering and switching devices are lettered from A' to D'.

The registering and switching mechanism is shown best in Figs. 4 to 7, and each apparatus is provided with polarized relays 50 and 51 with a magnet 52 for operating the registering mechanism and with magnets 53 and 54 which operate the switch, as described below. Near the magnet 52 is a tilting armature lever 55 which is fulcrumed on a support 56 and which is pressed by a spring 57 so as to hold the armature 58 thereon out of contact with the magnet and so as to throw one of the pawl teeth 59 into engagement with a ratchet wheel 60 which is carried by a shaft 61 beneath the lever. The impulses sent over the line will therefore cause the armature lever to vibrate and this will cause the pawl to act, tooth by tooth, on the ratchet wheel so as to turn the shaft 61. The shaft 61 has a pinion 61^a thereon, which is geared to a registering device 62, this being of a common kind and not shown in detail, and it has the usual dials 63 made to express units, hundreds and thousands, and they may be made to express any larger numbers if desired. Over the dials move the indicating hands 64 which are carried by the gear mechanism in the usual way. On the shaft 61 is a sliding sleeve 65 which is slotted longitudinally, as shown at 66, and through the slot projects a pin 67 which is secured to the shaft 61 and which therefore permits the sleeve to slide on the shaft, but causes it to turn with the shaft. The sleeve is provided with parallel collars 68 between which extends the forked end of a tilting lever 69 which projects downward from the sleeve, is fulcrumed near the center, as shown at 70, and terminates at its lower end in an armature 71 which hangs between the magnets 53 and 54 and is adapted to be operated by both magnets. On the sleeve 65 is a switch arm 72 which has a conducting face 73 thereon, this being insulated from the rest of the arm, and the arm is pointed at its outer end so that it may project readily between the separable spring terminals 74, which are arranged circumferentially around the shaft 61 and in pairs, so that each pair comes opposite the point of the switch arm as the latter is turned. Each pair of spring terminals 74 are bent so as to touch normally, as shown at 75, and they have flaring outer ends 76, see Fig. 11, this construction causing them to be normally in contact, but enabling the switching arm to be pushed easily between them. It will be observed that when the magnet 53 is energized and the armature 71 attracted by it, the lever 69 will be tilted so as to slide the sleeve 65 on the shaft 61 and throw the contact arm away from the spring terminals 74, but when the magnet 54 is energized, the armature 71 is attracted by it and the lever 69 tilted so as to slide the sleeve 65 in the opposite direction and to force it between two of the spring terminals 74. The ratchet wheel and the magnetic mechanism for operating it not only actuates the registering apparatus, as described, but it also turns

the shaft 61 and sleeve 65 so as to bring the switch arm opposite the appropriate spring terminals 74, as will appear hereinafter. 70

The connections are as follows:—The wire *c* from each generator leads to one pair of springs 74 of each switching device, except the one belonging to its own generator, to the relays 50 of its appropriate switching and registering device, as shown in Figs. 1 and 4, and it also connects by means of a wire *g* with the conducting face 73 of the switch arm 72. From the frame of the relay 50 leads a wire *h* which passes through the magnets 53 and 52, and from thence to one wire *i* of a battery H, and from the armature of the relay, leads a second wire *h'* to the second wire *i'* to the battery H. The frame of the relay 51 connects by a wire *j* with the magnet 54 and with one wire *k* of a local battery K, and the armature of the relay 51 connects by a wire *j'* with the return wire *k'* of the battery K. 75 80 85

The operation of the system is as follows:—We will suppose that A wishes to talk to C, reference to be had to the diagram in Fig. 1. A will turn the crank 12 toward him three times, and this causes the dial 35 to turn to the left and the figure 3 on the dial will come up to the pointer 36. The shaft 11 will also cause the generator, either the mechanical one shown in Fig. 2 or the one connected with the battery shown in Figs. 8 to 10, to send three distinct electrical impulses, in one direction, over the line wire *c* and this causes the current to pass first to one of the double springs 74 of the switch at B', thence back and to the double spring of the switch at C', thence to the double spring of a switch at D', and so on through all the switches if there are more of them and thence back to the relays 50 and 51 of the apparatus at station A' and thence to the ground. As will be seen the wire *c* of station A is not connected to any of the double springs 74 of A', but to one pair of double springs of all the other switches B', C' and D' and so, on the other hand, the wire *c* of station D is not connected to any of the double springs 74 of its apparatus D' but it is connected to one pair of springs of all the other apparatus A', B', C'. The relay 50 is wound to respond to electric currents of one way or negative kind, although the arrangement may be reversed, and the relay responds three times to the three impulses and its armature closes the circuit through the wire *h* and the magnets 53 and 52 and passes through the wires *h h'* and *i i'* to the battery H. The sleeve 65 is thus thrown to the left and out of contact with the spring terminals 74 and the armature lever 55 is vibrated three times, thus turning the ratchet wheel 61 a distance of three teeth and actuating the ratchet mechanism 62 and also turning the contact or switch arm 72 so as to advance it a distance corresponding to the space between three pairs of spring terminals 74. A will now turn his crank 12 from him several times around. The dial 35 will not now be turned, as the pawl 38 will ride over the teeth of the 90 95 100 105 110 115 120 125 130

ratchet wheel 37. The generator 10 sends electrical impulses in the opposite direction, when positive, to the central station; the current in this instance will pass when A is connected to C by the wire *g'* to the arm 73, thence to one spring of the double spring 74 of the switch of A', thence to the corresponding double spring of the switch at D' and out to the station C. The station C, as will be plainly seen, is now cut out from its apparatus at C so that the impulses sent from A will not pass through the relays 50 and 51 of the apparatus at C'. Part of the current sent from A will, however, also pass as before by the wire *c* and into the double springs 74 of the switch at B', double spring of the switch at C', one double spring of the switch at D', and to each switch, if there are more switches, and to the relays 50 and 51 of the apparatus at A' and from thence to the ground. The relays 50 and 51, being wound at high resistance, though grounded, will not interfere with telegraphic or telephonic communications between the stations A and C. The relays 50 and 51 are always in circuit with the respective stations to which they belong and are only out when another station wishes to connect. A station that connects with another station always cuts out the apparatus 40 belonging to it, but none of the others with which it connects. This is accomplished by one side of the insulated arm 72, the double terminals 74 and the wire *c* or *m* leading around the switches before it goes to its respective apparatus 40. The arm 72 is insulated on the proper side, and the wires *c* are soldered to the double springs so that the arm 72 connects itself direct to the station to which the message is to be sent. The relay 51 being wound for positive electricity, now responds and closes the circuit through the magnet 54 from the battery K. The magnet 54 being energized, pulls upon the armature 71 so as to throw the sleeve 65 toward the support 77 in which the spring terminals 74 are held, and the switch arm is thus forced between the spring terminals which are connected with the apparatus C, the switch arm being electrically connected by the wire *g'* to the line *c* of station A before it comes to the relays or other apparatus. As the switch arm is insulated on one side, it will only connect with one certain spring which connects with a wire *m*, *c*, see Fig. 1, leading around direct to the station C and not to the apparatus C' which is now cut out; and A, by turning his crank from him, will ring the bell of C and call him up. After communication, A will turn his crank toward him which will cause the dial 35 to turn to the left again and also send negative impulses to the line. A will turn his crank thirteen times, or until the O on the dial comes opposite the pointer 36. The negative electricity causes the relay 50 to act also thirteen times, and the electro magnet 53 and the tilting lever 69 pulls the switch arm 72 out of the springs 74, which will connect C to C', while the electro magnet 52

causes the ratchet wheel 60 to turn thirteen teeth more, completing with its three former movements, one revolution, which is duly indicated on the dial of the registering mechanism 62. The object of insulating one side of the switch arm 72 is to cut out, by means of the double springs or spring terminals 74, the apparatus C' from the station C, and to connect itself with C, as above shown, or any other stations in the same way, so that when the station A is sending its negative or positive impulses when connected with the station C, it will not go to the apparatus C' and work or disturb the same. The apparatus A' is, however, connected and so is C; on the other hand, if it calls up A and is connected, A is cut out from the apparatus A' while the apparatus C' stays in circuit. In the example given, when A has called up C and is connected, A can be rung up by any other station, as the switch 72 is connected electrically at a point before the line *c* reaches the central station apparatus 40. By the arrangement described, one station can thus call and connect with any station without interfering with the others, the result being all accomplished with the use of only a single line wire from each station to the central station. See Fig. 4.

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

1. In an exchange system, the combination with a plurality of sending instruments adapted to send positive and negative impulses over a line wire, a central registering device for each sending instrument, a switch arranged adjacent to the registering mechanism and adapted to be automatically operated to connect a sending instrument with any similar instrument, a magnet arranged in the circuit, a vibrating lever arranged to respond to the impulses sent through the magnet, a ratchet wheel operated by the lever, and apparatus connections between the ratchet wheel and the registering mechanism and between the ratchet wheel and the automatic switch, substantially as described.

2. A telephone exchange system, comprising a plurality of generators or sending instruments adapted to send positive and negative impulses over a line and a central switching and registering device for each sending instrument, the registering device comprising a magnet, a vibrating lever operated by the magnet, a revoluble ratchet wheel turned by the lever, a registering device geared to the ratchet wheel, a revoluble and sliding switch arm, a plurality of separable spring terminals arranged circumferentially around the axis of the switch arm, the spring terminals being connected with the similar terminals of the other instruments, a magnet operated lever adapted to throw the switch arm into and out of contact with the spring terminals, electrical connections between the switch arm and the line, polarized relays to control the direction of movement of the switch arm,

and operative electrical connections, substantially as described.

3. A telephone exchange system, comprising a plurality of generators or sending instruments adapted to send positive or negative impulses over the line and a registering and switching device for each sending instrument, the device being connected with the sender by a single wire, the registering and switching device comprising a registering mechanism, a ratchet wheel geared thereto, a vibrating lever to turn the ratchet wheel, a magnet to operate the vibrating lever, a sliding sleeve mounted on the shaft of the ratchet wheel and held to turn therewith, a switch arm carried by the sleeve and having an insulated conducting face, a plurality of separable spring terminals arranged circumferentially around the axis of the switch arm and adapted to contact therewith, the terminals of one instrument being connected with those of the other instruments, a tilting lever to move the sleeve to and from the separable spring terminals, magnets arranged on opposite sides of the tilting lever, one of the said magnets being in circuit with the magnet operating the ratchet wheel, polarized relays connected with the magnets operating the sleeve and with local batteries, and electrical connections between the line, the switch arm, the relays and spring terminals, substantially as described.

4. In a telephone exchange system, the sending instrument comprising a generator adapted to generate positive or negative impulses, a tilting lever to carry a receiver the lever having contacts on its opposite sides, stationary contacts to engage the contacts of the lever,

electrical connections between the lever and the line, a revoluble crank shaft, a spring terminal arranged adjacent to the shaft and in connection with the generator, a second spring terminal electrically connected with a signaling mechanism in the generator and with the receiver of the generator, a receiver, stationary contacts arranged in the path of the lever contacts, electrical connections between the receiver, the stationary contacts and the second spring terminal, a third spring terminal arranged adjacent to the first two and provided with a cross arm to contact with the same, the third terminal being in connection with the generator and with the ground, and a revoluble contact arm held to turn against the spring terminals, the arm having a raised insulated surface to engage the third terminal, substantially as described.

5. The combination, in a telephone exchange system, of the generators adapted to send positive or negative impulses over the line, a sliding and revoluble switch arm connected with the line, separable spring terminals arranged circumferentially around the axis of the switch arm and adapted to be separated by the switch arm, a tilting armature lever for sliding the switch arm, and magnets arranged on opposite sides of the lever and in connection with the line, the magnets being differentially wound so as to respond respectively to positive and negative impulses, substantially as described.

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Witnesses:

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