

C. E. NICHOLAS.
 SELECTING APPARATUS FOR TELEPHONE SYSTEMS.
 APPLICATION FILED DEC. 18, 1901.

944,460.

Patented Dec. 28, 1909.

2 SHEETS—SHEET 1.

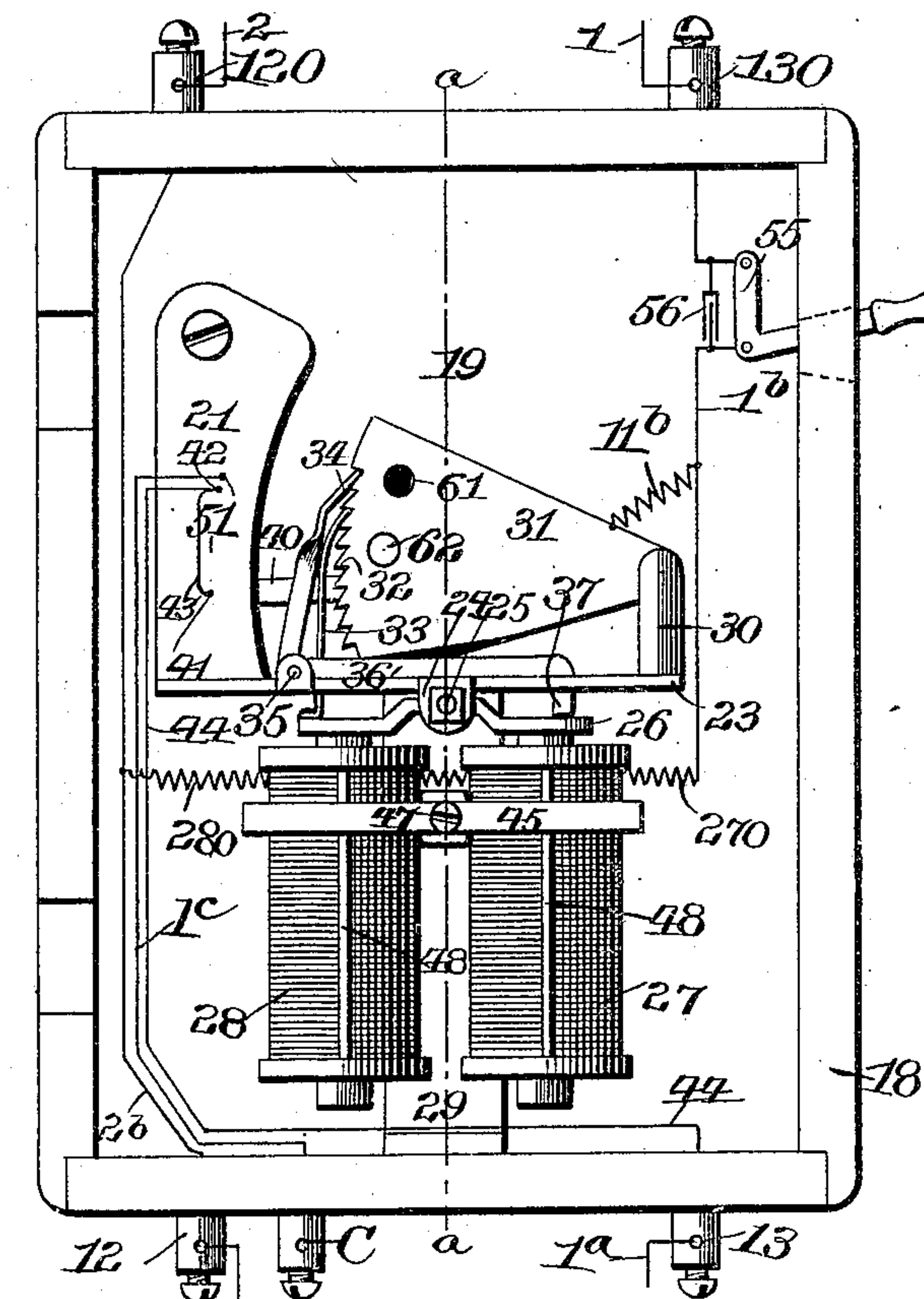


Fig. 1

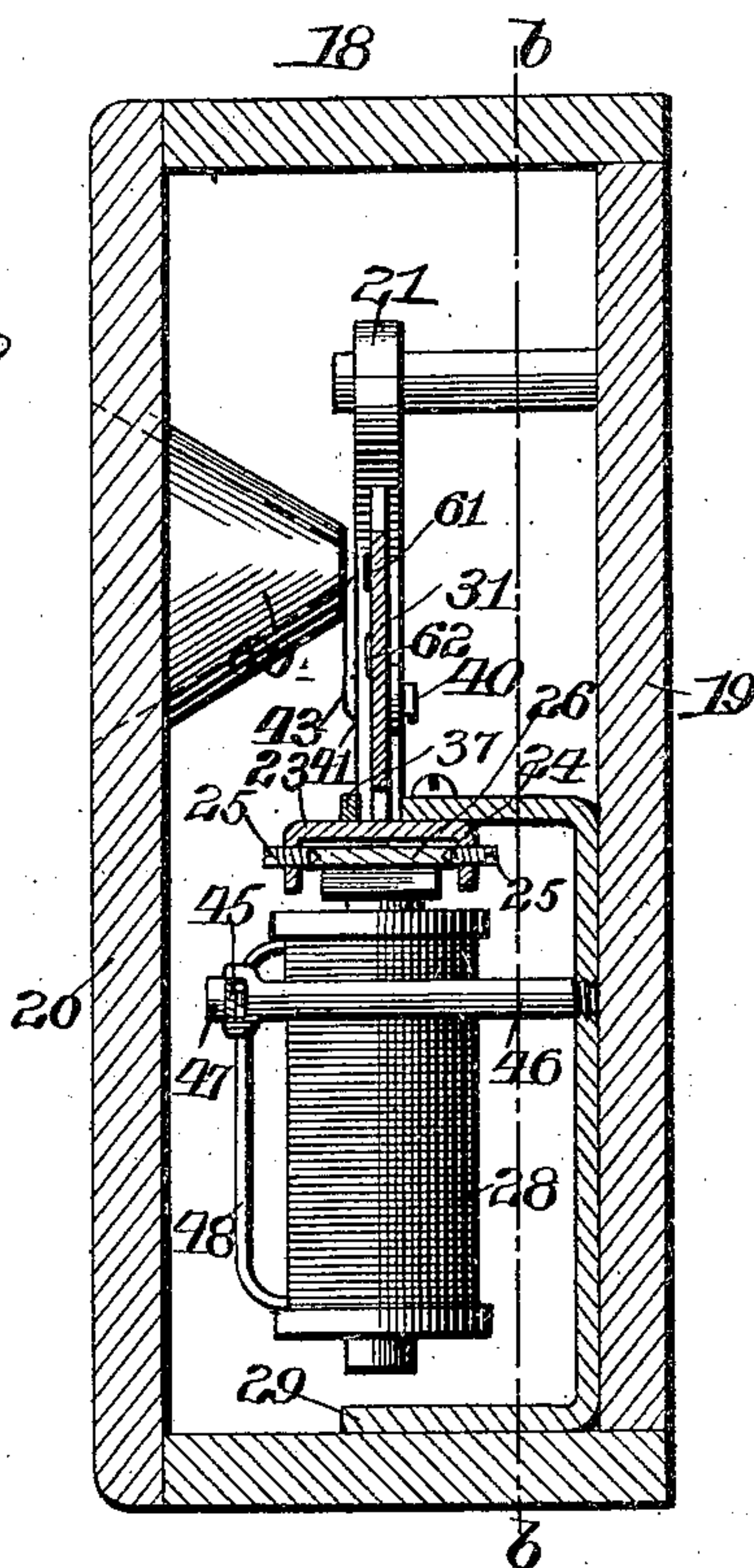


Fig. 2

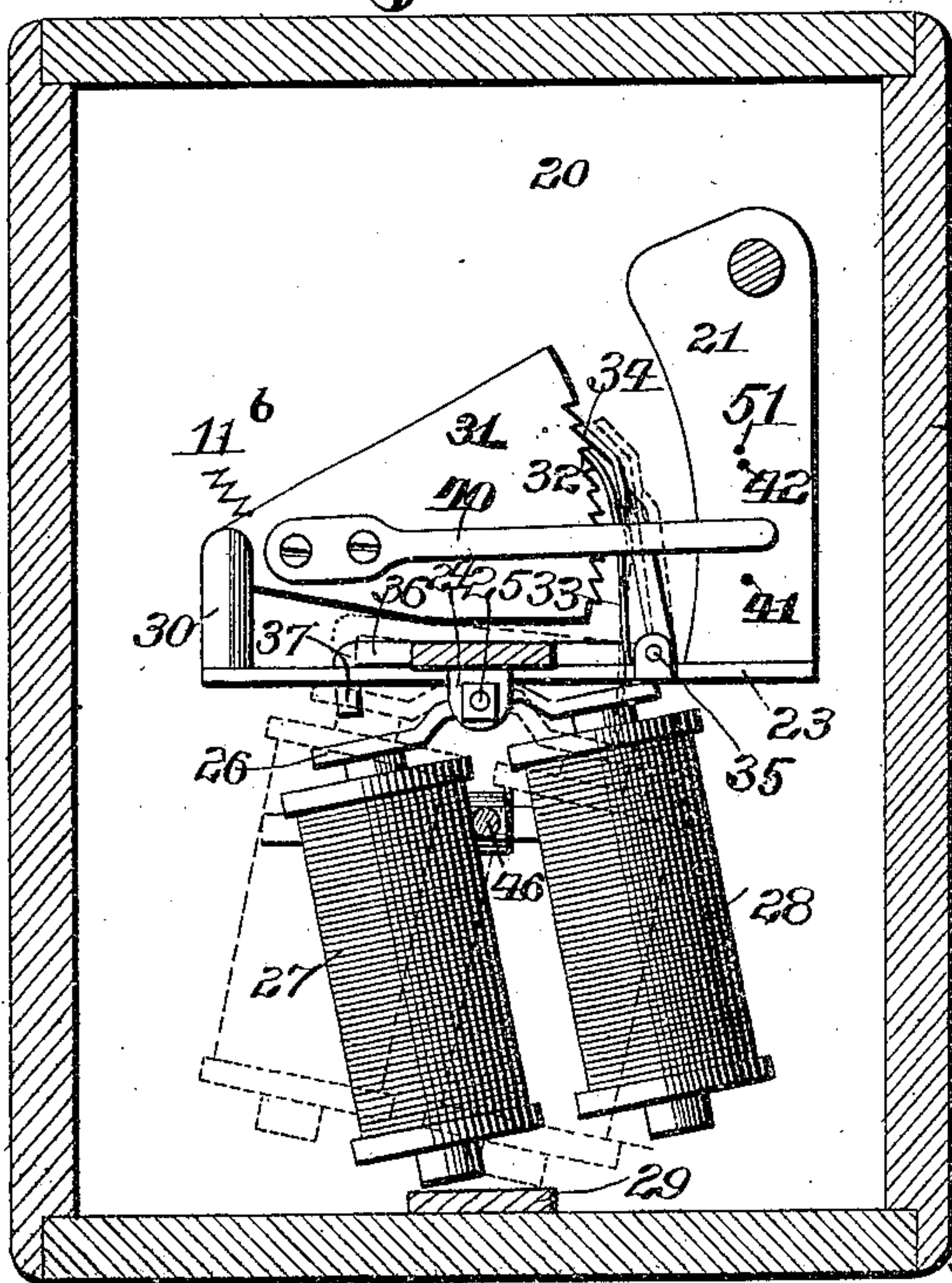


Fig. 3

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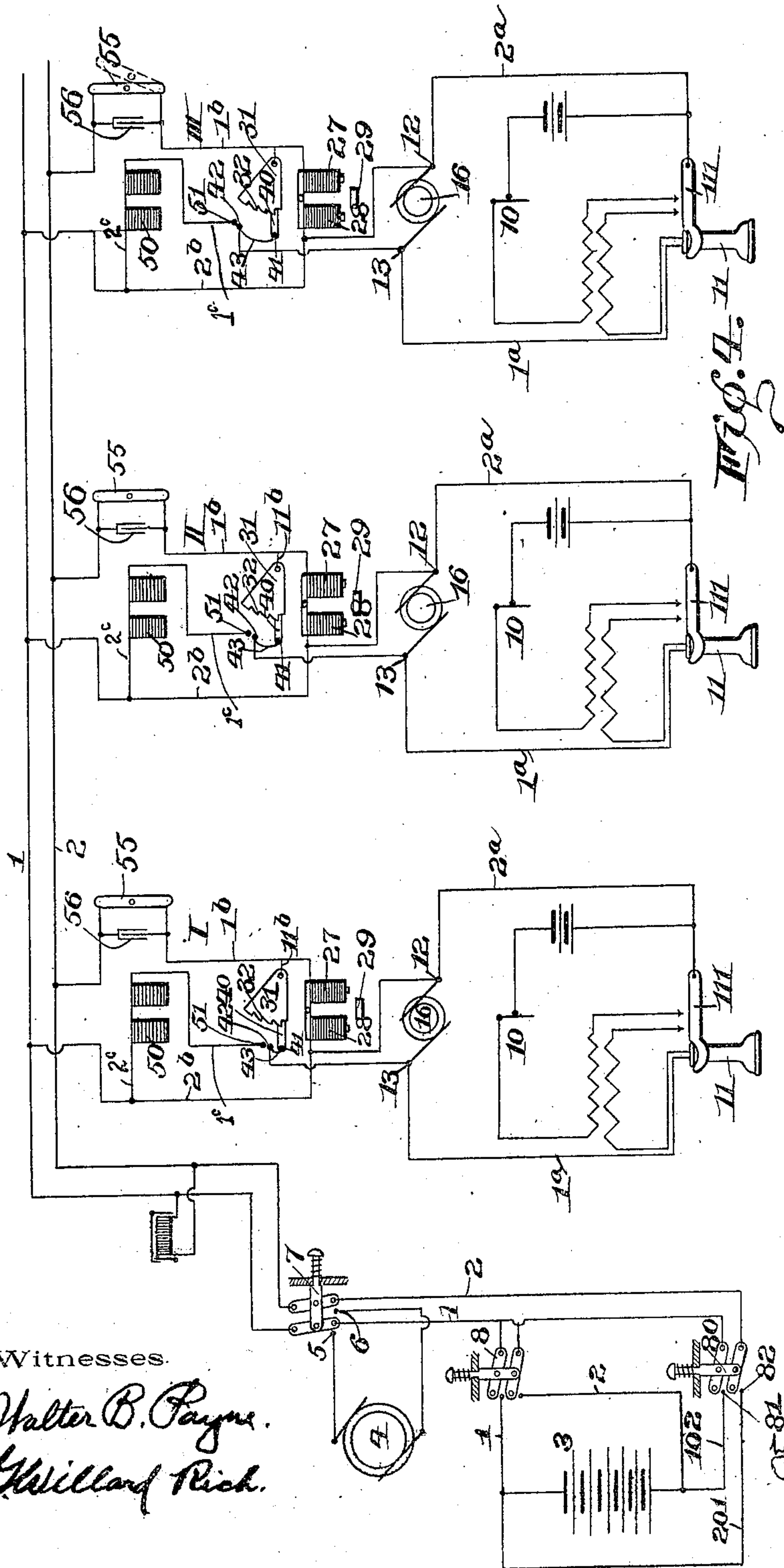
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2 SHEETS—SHEET 2.



Witnesses.

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 Willard Rich.

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UNITED STATES PATENT OFFICE.

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SELECTING APPARATUS FOR TELEPHONE SYSTEMS.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES E. NICHOLAS, of Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Selecting Apparatus for Telephone Systems; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the reference characters marked thereon.

My present invention relates to telephony and particularly to that branch known as multiple circuits, in which a plurality of telephone instruments are connected to a single circuit, and it has for its object to provide a selecting device operating in connection with each of the instruments on said circuit, whereby when one of the instruments is in operation the others will be disconnected from the circuit and in which all of the instruments may be restored to their normal position in connection with said circuit after each operation.

My invention has for its further object to provide means by which communication may be had between any two instruments on a single circuit and the remaining instruments disconnected therefrom.

To these and other ends, the invention consists in certain improvements in construction and combination of parts, all as will be hereinafter fully described, the novel features being pointed out in the claims at the end of this specification.

In the drawings: Figure 1, is a front elevation of a selecting device for a multiple telephone system constructed in accordance with my invention, shown with the front of the casing removed. Fig. 2, is a cross sectional view thereof on the line *a-a* of Fig. 1; and Fig. 3, is a rear view taken on the line *b-b* of Fig. 2. Fig. 4, is a diagrammatic view of a multiple telephone system of three instruments. Fig. 5, is a similar view showing in detail the contact points of the several selectors connected to said instruments.

Similar reference numerals in the several figures indicate similar parts.

In illustrating my device I have shown it

in connection with mechanism employed for operating the usual form of a metallic telephone circuit, a number of which are controlled from a central station.

The main wires forming the circuit are indicated by 1 and 2 which lead to the line battery 3 at the central station and at which point they may be connected in the usual or any preferred manner to the usual signaling devices, as will be understood, and in place of the battery 3 a dynamo may be employed to furnish the requisite continuous current, if desired.

8 indicates a switch arranged in the main circuit wires for the purpose of disconnecting the batteries 3 from the circuit when the latter is at rest.

The telephone instruments I have employed in connection with my device are of the usual type embodying a transmitter 10 and a receiver 11 arranged in the usual manner between the line wires 1^a and 2^a terminating in the binding posts 12 and 13 on the selector and also connected to said posts is a magneto generator 16. Each of the instruments connected to the main circuit constitutes a sub-circuit complete in itself, and it will be understood that any desired kind of instrument may be employed as well as the telephone instrument which I have selected to illustrate the operation of my device.

The selecting device, the detail construction of which is shown in Figs. 1, 2, and 3, is mounted in a small cabinet 18 having the back 19 and the door or front 20, and it consists generally of a support 21 of insulated material having a series of contacts thereon with which engages a contact arm or switch and also provided with suitable means for operating the latter, as will be further described.

23 indicates a frame or support from which are downwardly extending ears or lugs 24 carrying adjustable trunnion screws 25 and between the latter is pivoted a beam arm 26 connecting the coils of an electromagnet which extend parallel with each other and are indicated by 27 and 28. Arranged between and slightly below the ends of the cores of the magnet is the end of a permanent or bar magnet 29, whereby one

arm or the other will be attracted toward the permanent magnet according to the direction of the flow of current through the coils, as will be understood, causing the beam 26 to swing on the bearing 25 to the positions shown in full and dotted lines in Fig. 3. Rigidly mounted on the frame 23 is a post 30, to which is pivoted a plate 31 provided in its outer edge with a series of notches or teeth 32 and engaging therewith is a pawl 33 attached to the beam or arm 26 and adapted when the latter is operated in one direction on its pivot to move the plate 31 upwardly a distance equal to the space of one tooth, and when the beam is operated to the limit of its movement in the opposite direction to be carried out of engagement with the plate. In order to lock the plate in adjusted position I provide a pawl or lock member 34, pivoted to the frame at 35, having an arm 36 provided with a finger or extension 37 extending downwardly and adapted to cooperate with one end of the beam or arm 26 to release the pawl, simultaneously with the disengagement of the pawl 33, to permit the plate to return to its original position. Attached to the rear of the plate 31 is a contact finger 40 adapted, when the plate is in its normal or lower position, to engage a contact point 41 and when adjusted to a predetermined point to engage a second contact point 42, said points being connected by a wire 43 and also connected by a wire 44 with the binding post 13.

The contacts 41 are located in the same position in each of the selectors and for convenience will be termed "home" points, and when the devices are in their normal position the contact fingers 40 engage therewith. The points 42 however are arranged in a different position in each selector, being separated from the home points by a number of such spaces traversed by the contact arm as the plate is actuated, a tooth at a time, such spaces corresponding to a predetermined number given to any particular instrument. This will be readily understood by reference to Fig. 5 in which a series of selecting instruments are indicated by I, II, III. In the first, the contact point 42 is separated from the home point by a single space, the second separated two spaces and the third three spaces. The selector for any subsequent instruments that might be added to the circuit would be similarly arranged by increasing the distances between the contacts by one step for each of said instruments. From the above it will be seen that by arranging all the selectors for simultaneous operation and operating them all the same number of times, any of the local signaling and telephone circuits may be connected to the main circuit while the remainder are disconnected therefrom. In Fig. 5, the plates 31 have been actuated three times,

carrying the contact arms 40 to the third position, where said arm of the third selector, engages its contact 42, the plates of the selectors connected to the instruments I and II having been actuated correspondingly, their contact fingers are out of engagement with their respective contacts 42. When in this position it is impossible for either of the signal or telephone instruments at stations I and II to be used until restored to the line, as will be further described.

The operation of the selectors is controlled from the central station by means of the spring operated switch 8 which normally stands in the open position, as shown in Fig. 4. The coils of the electro-magnet are bridged into the main circuit wires 1 and 2 or connected in shunt therewith, by the wires 1^b and 2^b, so that each time the switch 8 is closed the current, which for the purpose of explanation I will term a positive current, passing over the line, will energize the electro-magnets in each selector, causing the coils 27 to be attracted toward the permanent magnets 29 while the coils 28 are repelled therefrom, causing them to tilt to the position shown in full lines in Fig. 3, the pawl 33 operating the plate 31 the distance of one of the teeth 32 when it is locked by the pawl 34. While the current passes over the circuit continuously, the magnets remain in this position, but when the current is interrupted by opening the switch, the electro-magnets immediately assume their normal position, as shown in Fig. 1, and subsequent positive impulses operating the magnets as before, will cause the selectors to be operated a sufficient number of times to bring the desired instrument into the circuit through its individual contact 42. The weight of the electro-magnets being entirely below their pivotal center is liable to cause them to swing unduly when the current is broken and to arrest this movement I provide a friction brake in the form of a light leaf spring 45, supported upon a post 46 and secured by a screw 47 and bearing against small bars 48 forming bearing surfaces upon the sides of the magnet coils. The screw 47 being arranged between the latter may be regulated to adjust the tension of the spring equally upon both of them.

As the electro-magnets are polarized, or their coils wound in different directions, they are operated in one direction by a positive current, to actuate the plate 31, and in the opposite direction by a negative current, to disengage the actuating and locking pawls, to permit the return of the selector plate to its normal position, as shown in dotted lines in Fig. 3. This is accomplished by means of a pole changer 80 arranged at the central station connected to the circuit conductors 1 and 2 and adapted to engage the contacts 81 and 82 of the wires 102 and 201 respectively,

said wires leading from the sides of the battery 3 opposite to those to which the wires 1 and 2 are connected.

The selector is adapted to control the instrument or local circuit and to accomplish this, one of said circuit conductors 2^b passes directly through the device and for convenience in construction, said conductor is provided in each selector, terminating in the binding posts 12 and 120 arranged at the upper and lower sides respectively of the cabinet. The other circuit conductor 1^b enters and leaves the selector, by the binding posts 13 and 130 respectively, and intermediate the latter are arranged the contacts 41 and 42 which form dual terminals for one end of said conductor and to which it is connected by the wire 44, the other terminal of this circuit being formed by the switch arm 40 from which leads a conductor 11^b connected to the main circuit at the post 130. The circuit through the coils forming the ends 27 and 28 of the electro-magnets is connected by the wires or conductors 270 and 280 to the conductors 2^b and 11^b, but on account of the resistance afforded by coils of the electro-magnet there is no short circuiting through the shunt, thus formed, which will interfere with the operation of the instrument.

In order that the signal device or bell shall be operated only on the instrument it is desired to bring into the circuit, I connect the coils of said bell, indicated by 50 to the circuit by the conductors 1^c and 2^c, one of which, the former, as shown, terminates in a contact 51 arranged adjacent the contact 42 and adapted to be engaged by the finger 40 when the latter engages the contact 42 and to be bridged into the main line through the conductors 11^b and 1^b. And while I have not shown the signaling device arranged in the selector cabinet it may be located therein, or the conductor 1^c may be connected to a binding post C and the circuit completed from thereon, as usual.

Intercommunication may be had between two or more instruments on the same main circuit while the selectors connected to the remaining instruments will cause the latter to be disconnected, by arranging in the conductor 1^b of each station a circuit-breaking switch 55 and in shunt therewith a high resistance for continuous currents preferably in the form of a condenser 56. The latter prevents the passage of a continuous current sufficiently strong to operate the electro-magnet or the bell 50 but permits the passage of speaking or undulatory or pulsatory current by which speech may be transmitted. When, therefore, it is desired to connect two instruments on the same line, the switch 55 of the calling subscriber is opened by him and the remaining selectors operated by the central operator, opening

and closing switch 8 the number of times required to connect the desired instrument through its contact 42 and finger 40, when the switch 55 may be closed, the finger 40 of this selector being in contact with the home point 41. The condenser 56 might be dispensed with, but as speech may be transmitted through it, the operator or subscriber is informed by the reply of the person called or by the central operator, of the proper time to restore his instrument to the line by closing the switch. By reference to Fig. 4 it will be seen that intercommunication may be had between instruments I and III, in the above manner, if the selecting device connected to the former is disconnected from the circuit by opening the switch 55, and the central operator actuates the selectors on instruments II and III, three times, thereby closing the circuit to the latter through its contact 42, leaving the instrument II off the line, operates the calling signal, as will be described, of station III, and then by closing the switch at station I the first instrument is connected to the circuit with its selector parts in their normal position. The operation may be reversed, as will be understood.

To provide a means whereby a person can readily determine whether a particular telephone instrument is connected to or is off the circuit, I arrange an aperture 60 in the front or door 20 opposite the plate 31 and on the latter are provided two colored or otherwise distinguishable indicating spots 61 and 62, the former being visible through the aperture when the plate is in its normal position, and the latter when the selector has been operated to bring its contact finger 40 into engagement with the contact 42.

The operation of the device will be readily understood. When in the normal position all of the selectors are in the position shown in full lines in Figs. 1 and 4, with their contact fingers 40 engaging the contacts 41 and the respective telephone instruments operating in connection therewith are connected to the circuit wires 1 and 2 through the conductors 1^a, 44, wire 43, contact 41, arms 40, and conductor 11^b, and conductors 2^a and 2^b, the local telephone instruments being in circuit as usual, controlled by the usual receiver switch 111, these parts being shown conventionally. To connect any particular telephone, for illustration say instrument III, the operator closes the switch 8 three times, causing electric impulses of one polarity to operate the electro-magnets three successive times in the same direction. The impulses operating the coils 27 toward the permanent magnets 29 cause the pawls 33 to actuate all the plates 31, moving them the distance of three teeth and carrying the arms 40 upwardly until the arm on selector III completes the circuit to its respective instrument

through the contact 42. At the same time the contact finger engages the contact 51, completing the circuit through the signaling device or bell 50 of this particular instrument permitting it to be operated in the usual manner. The calling circuit may be operated by what is termed "central energy" and I have shown an alternating current generator 4 having the wires terminating in the contacts 5 and 6 which may be connected with the circuit wires 1 and 2 by means of a switch 7. When the latter is moved into engagement with the contacts 5 and 6 only the bell 50 of the selected instrument will be operated. The switch 8 after being operated the desired number of times is permitted to remain in the open position, disconnecting the line wires 1 and 2 from the battery 3, which allow the coils 27 and 28 and the pawl 33 carried thereon to gravitate to their normal position, shown in Fig. 1. The current subsequently supplied to the main line to ring the bells 50 is obtained from the alternating current generator 4 when the switch 7, at the central station is moved into engagement with the contacts 5 and 6. This current entering the coils 27 and 28 causes them to be charged alternately with positive and negative impulses of current which change too rapidly to allow either coil to be attracted toward the permanent magnet 29 with sufficient force to overcome the inertia of their combined weight on their pivotal points or trunnions 25. The several instruments are restored to the main circuit, simultaneously, by means of the pole changer 80, which, when engaged with the contacts 81 and 82, causes the coils 28 to be attracted toward the permanent magnets 29. This movement throws the pawls 33 out of the path of the teeth 32 and the beam arms 26 engaging the tripping fingers 37 will move the locking members or parts 34 out of engagement with said teeth, releasing the plates 31 and permitting them to return to their normal position, carrying the arms 40 into engagement with the home contact points 41 when all of the instruments will be connected to the circuit, as before described.

The device which I have described enables me to provide a system in which a plurality of telephone instruments may be arranged upon a single circuit and any desired one selected without the necessity of employing either a grounded connection or neutral conductor, thereby removing the possibility of disturbances in any of the instruments from local causes. While I have confined the description of the operation of my device to its employment in connection with single telephones it will be understood that it may also be used to connect supplemental station circuits with a main central station circuit, and further while the selec-

tor is particularly adapted for telephone systems it may be used equally well in connection with other forms of instruments, the operation of which it may be desirable to control from a single point or station.

The construction I have described may be varied by those skilled in the art without departing from the spirit of my invention, and I do not desire to be confined to the precise arrangement of the parts shown.

I claim as my invention:

1. The combination with a main circuit, a continuous current generator, an alternating current generator either of which is adapted to be connected to the main circuit and a plurality of local circuits each embodying a signaling instrument responsive to alternating currents only, and each provided with a stationary contact, of a plurality of selectors one for each local circuit, each embodying a movably supported polarized electro-magnetic coil arranged in the main circuit, a movable switch arm adapted to cooperate with said contact, a member operated by the movement of the coil for adjusting the arm when it is moved in one direction by successive impulses of continuous current of one polarity, the contacts of different local circuits being arranged at different distances from a neutral or normal position, a retaining device for the member released by the movement of the coil in a different direction when acted upon by currents of opposite polarity.

2. The combination with a main circuit, a continuous current generator, an alternating current generator adapted to be connected to the main circuit and a plurality of local circuits each embodying a signaling instrument responding to alternating currents, of a plurality of selectors one for each local circuit each embodying a polarized electro-magnet arranged with its coils in the main circuit embodying a movable part moving in different directions when energized by continuous electrical impulses of different polarity, a progressively movable member adapted to engage the contact, a pawl actuated by said part, and cooperating with the member when the current in the magnet is of one polarity, contacts controlled thereby connecting the signaling device to the main circuit, the contacts of different local circuits being arranged at different distances from a neutral or normal position and a retaining device for each member adapted to be released by the armature when the current in the magnet is of different polarity.

3. The combination with a main circuit, a generator and a local telephone circuit connected thereto, a switch for breaking the connection and means for retaining the latter in operated position, of a polarized electro-magnetic operating device comprising a

movable coil, an arm actuated thereby and cooperating with the switch to move it into engagement with the retaining means to break the circuit when said coil is energized by currents of one polarity, said coil operating to actuate said means to release the switch when energized by currents of a different polarity.

4. The combination with a main circuit, a generator and a local telephone circuit connected thereto, a gravity operated switch in the local circuit for breaking it and a retaining device cooperating therewith to hold the switch in operated position, of a polarized electromagnetic operating device comprising a movable coil, an arm actuated thereby and cooperating with the switch to move it into engagement with the retaining device to break the circuit when said coil is operated in one direction by currents of one polarity, said coil operating it to release the switch when moved in the opposite direction by currents of a different polarity.

5. The combination with a main circuit, a continuous current generator and an alternating current generator either of which is adapted to be connected to the main circuit, of a plurality of stations, each having a signaling device responding to one kind of current arranged in a circuit having a contact, a selecting device for each station embodying a progressively movable member, a retaining device therefor, a pivoted electromagnet having a polarized armature and arranged in the main circuit an arm actuated thereby and cooperating with said member to operate it by successive continuous current impulses of one polarity, into engagement with its respective contact, to connect the signaling device to the main circuit, said magnet being adapted to cooperate with and release the retaining device when acted upon by a continuous current of opposite polarity.

6. The combination with the main circuit, a plurality of stations each having a local telephone circuit and a local signal circuit, a contact in each circuit, of a plurality of electro-magnetic selecting devices one for each station and each embodying a polarized magnet in the main circuit having a movable part responding differently to currents of opposite polarity, a progressively movable member cooperating with said contacts and an arm cooperating with the member and actuated into engagement therewith by said part when acted upon by currents of one polarity to control the signal and telephone circuits, the contacts for each station being arranged at a different distance from the neutral or normal position of the member, a retaining device for the member adapted to be released by the movement of said movable part when energized by a current of opposite polarity.

7. The combination with a main circuit, and a plurality of stations each having a local telephone circuit and a local signal circuit, of a plurality of selecting devices one for each station embodying a progressively movable member, actuated step by step by separate electric impulses in the main circuit and connecting the local circuits of each station successively with the main circuit, a switch for opening the main circuit, a shunt leading around the switch and means located therein for controlling the operation of the selecting device.

8. The combination with a main circuit, a generator and a telephone circuit, of a selecting device embodying a movable member arranged in the telephone circuit and adapted to be operated by electric impulses in the main circuit and a resistance device arranged in the main circuit and adapted to prevent the operation of the selecting device without destroying the telephone circuit.

9. In a signaling device, the combination with a stationary circuit contact, a movable circuit contact, pawl and ratchet mechanism for operating the movable contact progressively into engagement with the stationary contact, and a retaining device for said movable contact, of a polarized electromagnet having a part engaging the pawl and ratchet mechanism when the magnet is energized by currents of one polarity, said magnet operating in a different direction to release the retaining device when energized by currents of opposite polarity.

10. The combination with a main circuit and a plurality of stations having local circuits adapted to be connected to the main circuit, of selecting devices at each station embodying a polarized armature and a relatively movable electromagnet coil included in the main circuit, local circuit contacts, a progressively movable member, an arm operated by the successive movements of the coil in one direction relatively to its armature to adjust the member step by step into engagement with said contacts, a retaining device for the member actuated to release it by the movement of the coil in a different direction relatively to its armature.

11. The combination with a main circuit, a direct current generator, a pole changer, and a plurality of subcircuits normally connected to the main circuit, of a selector for each sub-circuit having a movable arm forming one terminal of said circuit, a contact point forming the other terminal, said contact points in the several selectors being arranged in series, and electro-magnetic devices in the several selectors connected to the main circuit movable in one direction to engage the arm of each selector and actuate it a single step for each electrical impulse of one polarity in the main circuit and move it into engagement with the contact point,

said device operating in a different direction to return the arm to its normal position by a single electrical impulse of opposite polarity in the circuit.

5 12. The combination with a main circuit composed of two conductors, a generator, and a series of local stations and telephone instrument circuits connected to the main circuit conductors, of a selecting device for
10 each instrument circuit having contacts for their respective instrument circuits, an operating device for each selector controlled by a current on the main circuit conductors, movable arms simultaneously actuated by
15 said devices for closing the instrument circuit contacts and means at each local station to control the flow of current from the main circuit to prevent the movement of the operating devices of the selector without de-
20 stroying the instrument circuit.

13. In a telephone system, the combination with a main circuit composed of two conductors, and a telephone instrument circuit connected to the main circuit conductors, of a selecting device arranged in the
25 main circuit embodying a contact forming one terminal of the instrument circuit and an arm movable into engagement therewith and forming the other terminal of said circuit, an electro-magnetic operating mechanism connected to the main circuit conductors for actuating the arm and a switch arranged
30 between the main circuit and said operating device for controlling the operation of the latter.
35

14. In a multiple telephone system, the combination with a main circuit composed of two conductors, a generator, and a plurality of local circuits, adapted to be connected to the main circuit conductors, of a
40 selecting device arranged in each instrument circuit having a home contact and a separate instrument contact connected thereto and forming dual terminals for one end of the instrument circuit, a movable switch arm
45 forming the other terminal of said circuit and normally engaging the home contact point, electro-magnetic devices for operating the arm having a polarized armature and connected to the main circuit and operated by a current thereon to move the arm
50 into engagement with the instrument contact and means for regulating the operating device by controlling the current flowing from the main circuit, without disconnecting the instrument circuit therefrom.
55

15. In a multiple telephone system, the combination with a main circuit, a generator, and a plurality of local telephone instrument circuits connected to the main circuit, of a selector arranged in each local circuit having a home contact point and a separate instrument contact connected thereto
60 said contact points forming dual terminals for one end of the local circuit, a movable
65

contact member normally engaging the home contact, and operating devices for the member connected to the main circuit and actuated by a current therein to move the member into engagement with the instrument contact, a switch controlling the circuit to said operating device, and a resistance in shunt around the switch whereby the operation of the selector may be prevented without disconnecting the telephone instrument
70 circuit during the actuating of the operating devices of the selectors of the remaining instruments.
75

16. The combination with a main circuit and an instrument circuit, of a selecting device having a contact forming one terminal of the instrument circuit, a movable switch arm forming the other terminal of said circuit, a movable electro-magnetic operating device connected to the main circuit and controlled by a current thereon, a pawl carried on the operating device to move the switch arm into engagement with the contact, when said device is moved in one direction and to be disengaged from the arm when the device is moved in a different direction, a retaining device operated by said electromagnetic device when responding to the impulses of current on the main circuit differing in polarity from those actuating the switch
80 arm.
85 90 95

17. The combination with a main electrical circuit, an instrument circuit, and a selecting device having a contact point forming one terminal of the instrument circuit, a switch arm forming the other terminal and a pawl operating the arm into engagement with said contact, of an electro-magnetic device comprising a movable coil connected to the main circuit adapted to be operated in one direction to operate the pawl and cause the switch arm to be actuated relatively to the contact point and also adapted to disengage the pawl when moved in the opposite direction, a locking device holding
100 said arm in adjusted position, means operated by the coil to disengage said locking device and permit the arm to be disengaged from the contact.
105 110

18. The combination with a main electric circuit, and an instrument circuit, of a selecting device having a contact point forming one terminal of the instrument circuit, a signaling device adapted to be placed in shunt with the main circuit, a second contact forming a terminal thereof and a switch arm adapted to cooperate with both contacts and forming a terminal for both the signaling and instrument circuits, an operating device in the main circuit actuating the arm, a switch in the operating and the instrument circuits, and a condenser bridging the switch.
115 120 125

19. The combination with a main circuit and an instrument circuit, of a selecting de-
130

vice having a contact forming one terminal of the instrument circuit, a switch arm forming the other terminal, and a movable electro-magnetic device in the main circuit having a polarized armature and controlled by a current thereon, a pawl carried by said device and coöperating with the arm for moving the latter into engagement with the contact when the device is operated in one direction by currents of one polarity, a retaining mechanism for the arm, and means for disengaging the latter operated by said magnetic device when moved in a different direction by currents of different polarity.

20. The combination with a main circuit and a continuous current generator adapted to be connected thereto and a local circuit connected to the main circuit, of a selecting device having a contact point forming one terminal of the local circuit, a movable contact adapted to engage the first and forming the other terminal of said circuit, and pivoted electro-magnet coils having a stationary polarized armature and arranged in the main circuit and swung in opposite directions by current of opposite polarity, an arm coöperating with the movable contact and operated by the movement of the coils to close the local circuit when said coils swing in one direction and to disconnect said circuit terminals when the coils swing in the other direction.

21. The combination with a main circuit, a generator therein, a local circuit having two terminals and a movable contact coöperating therewith for closing said circuits, either in normal or selected position, of electromagnet coils arranged in the main circuit and suspended from a pivoted support, a relatively stationary polarized armature for the coils and an arm operated by the swinging movement of the coils for advancing the movable contact from the normal to the selected position.

22. The combination with a main circuit, a continuous current generator and a local circuit, of a selecting device having a contact forming one terminal of the local circuit, a movable contact arm forming the other terminal for said circuit, teeth carried

by the arm, an electro-magnet in the main circuit comprising pivoted coils and a relatively stationary polarized armature and an actuating finger engaging the teeth to move the arm one step relatively to the contact point for each movement of the coils in one direction, a pivoted retaining member normally engaging the teeth and provided with a tripping finger operated by the movement of the coils in the opposite direction to disengage said locking member.

23. The combination with a main circuit, a generator, a local circuit connected thereto and a selecting device having a contact forming one terminal of the local circuit, a movable contact arm forming the other terminal for said circuit and teeth carried by the arm, of an electro-magnet in the main circuit comprising pivoted coils and a relatively stationary polarized armature, an actuating finger carried by the coils and engaging the teeth to move the arm one step relatively to the contact point for each movement of the coils in one direction, a pivoted retaining member engaging the teeth and a tripping finger operated by the movement of the coils in the opposite direction to release the arm when the actuating finger is moved out of engagement with the teeth.

24. The combination with a main circuit, a generator, a local circuit connected to the main circuit, a selecting device having a contact point forming one terminal of the local circuit, and a movable contact arm, of a pivoted polarized magnet connected to the arm to actuate the latter relative the contact point at each movement of the magnet in one direction, a locking member engaging the arm to retain it in adjusted position, a tripping finger engaged by the magnet when moved in the opposite direction, and a restraining device to prevent excessive movement of the magnet when returning to its normal position after its operation in either direction.

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Witnesses:

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