

No. 741,282.

PATENTED OCT. 13, 1903.

C. B. SMITH.  
TELEPHONE SYSTEM.

APPLICATION FILED FEB. 3, 1899. RENEWED OCT. 22, 1902.

NO MODEL.

6 SHEETS—SHEET 1.

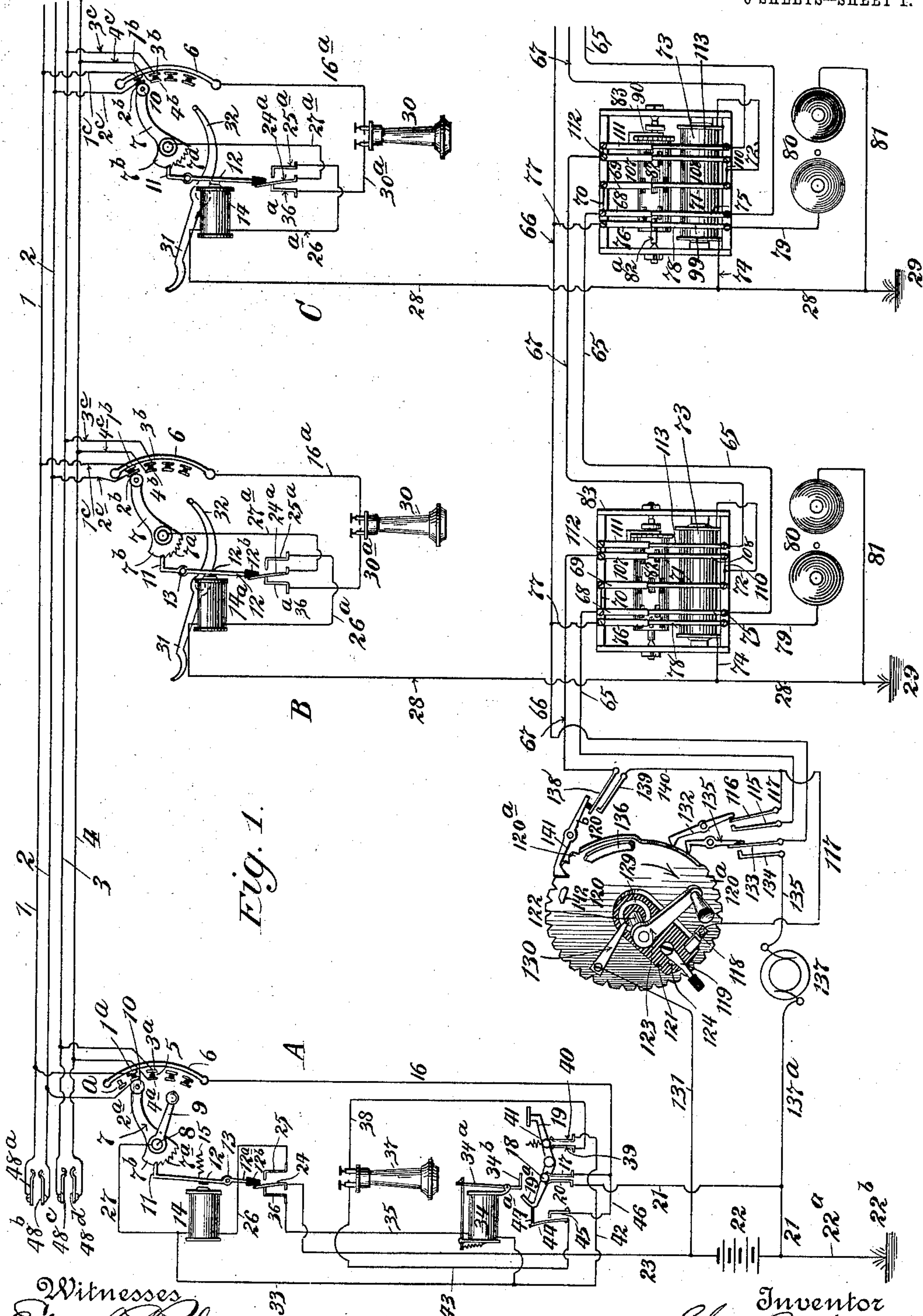


Fig. 1.

Witnesses  
Edward Rowland  
C. Heerbrandt

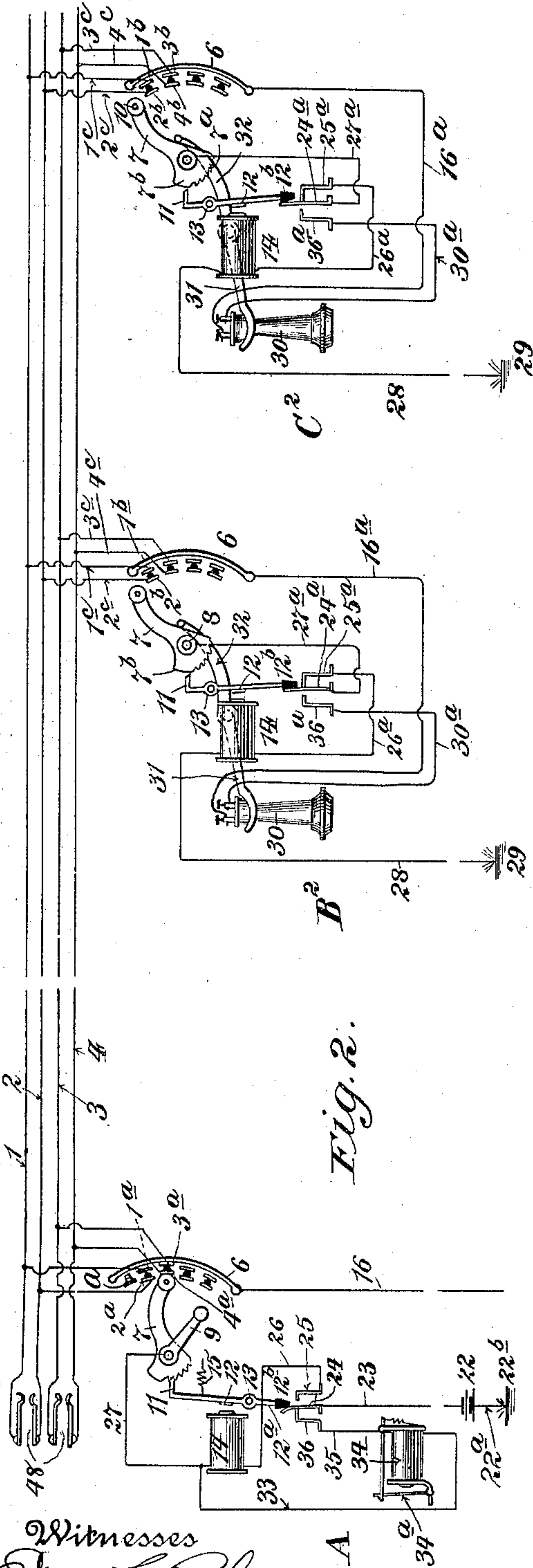
Inventor  
C. B. Smith  
By his Attorney  
D. F. Bourne

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TELEPHONE SYSTEM.

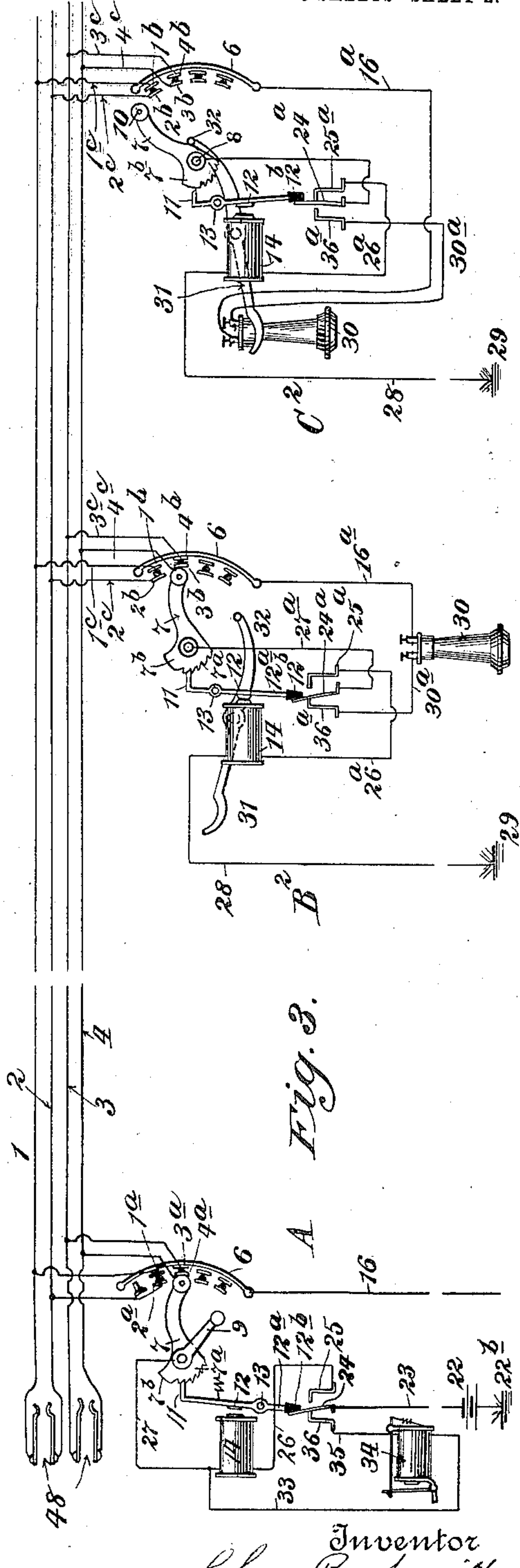
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6 SHEETS—SHEET 2.



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6 SHEETS—SHEET 3.

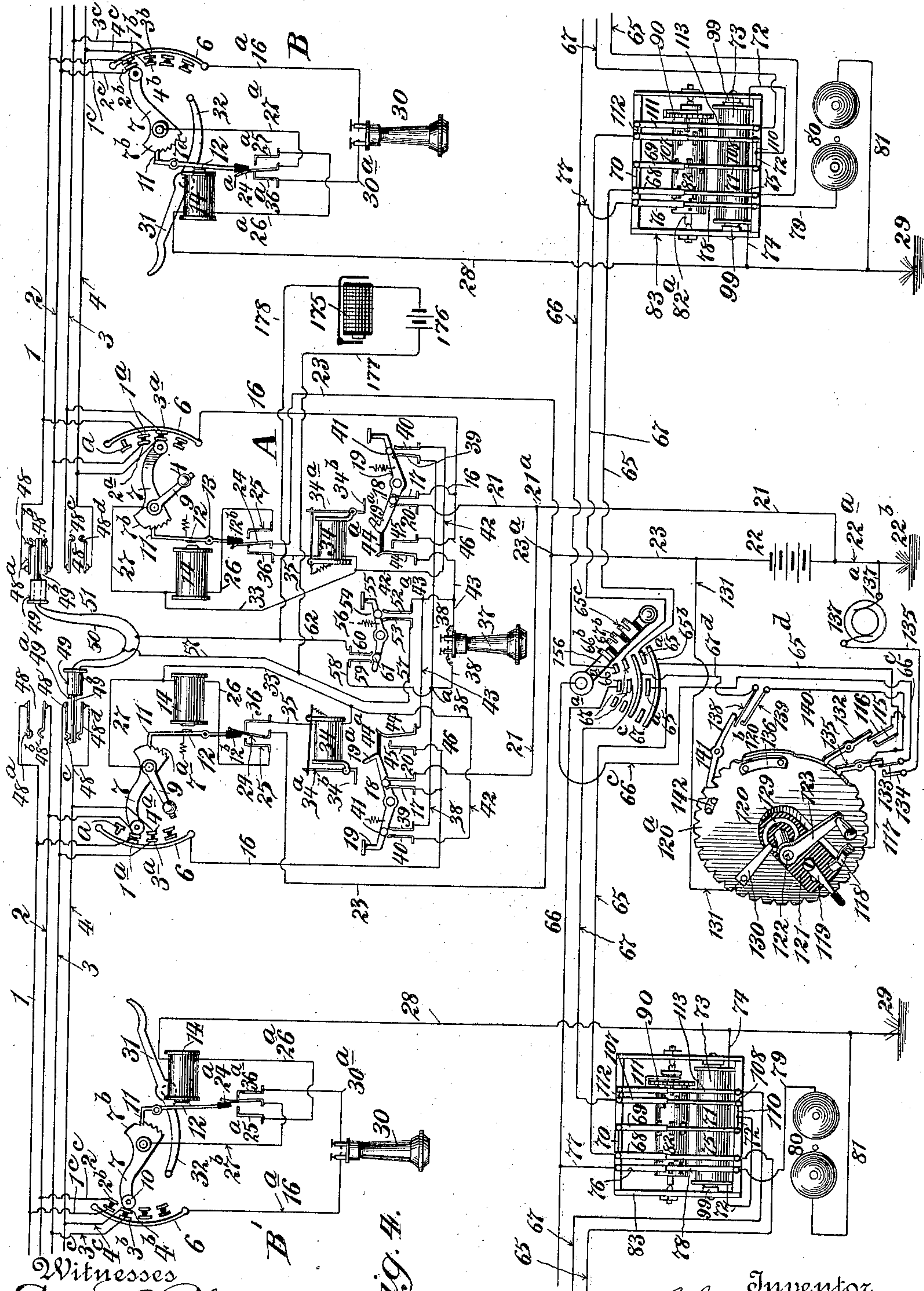


Fig. 4.

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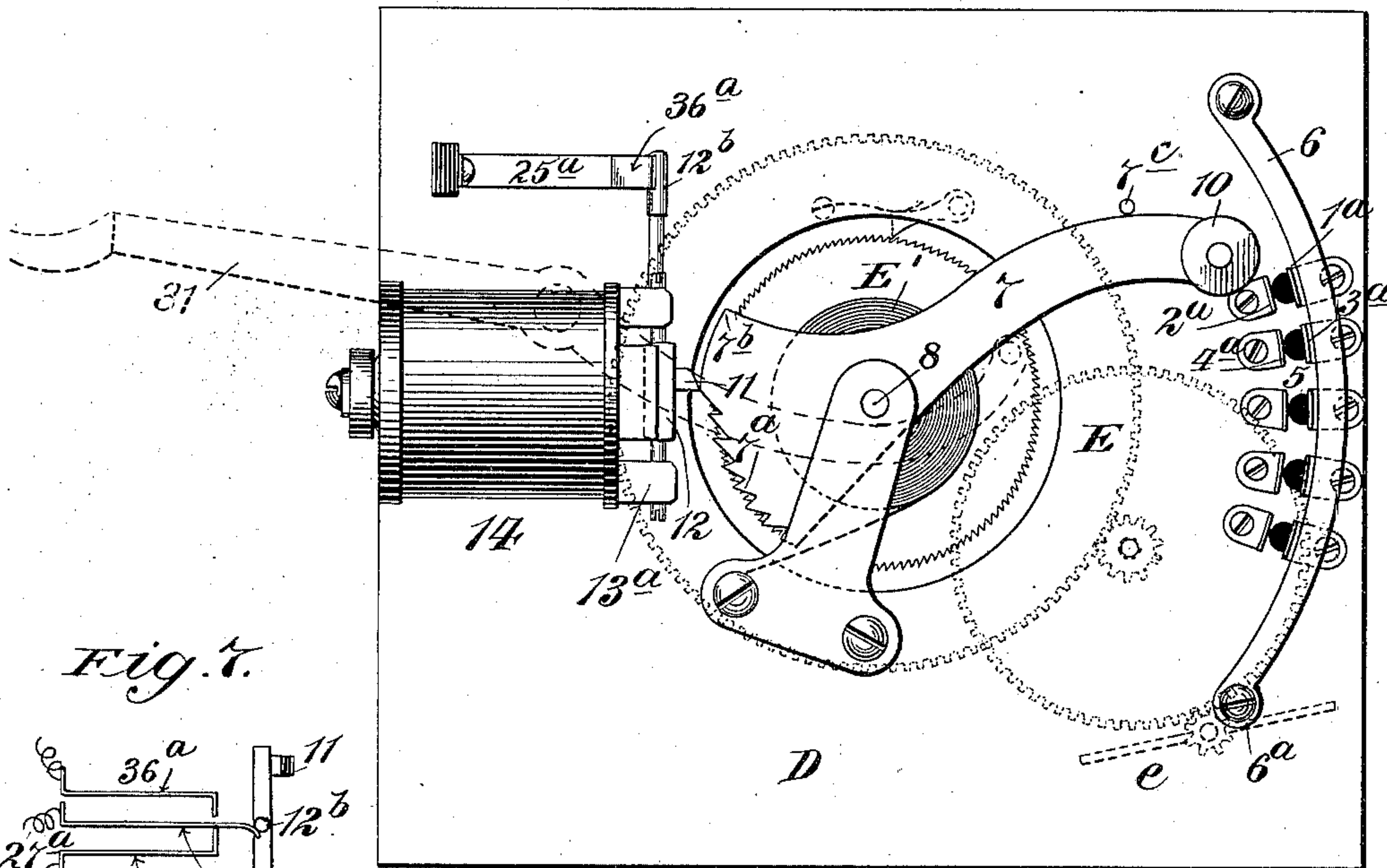
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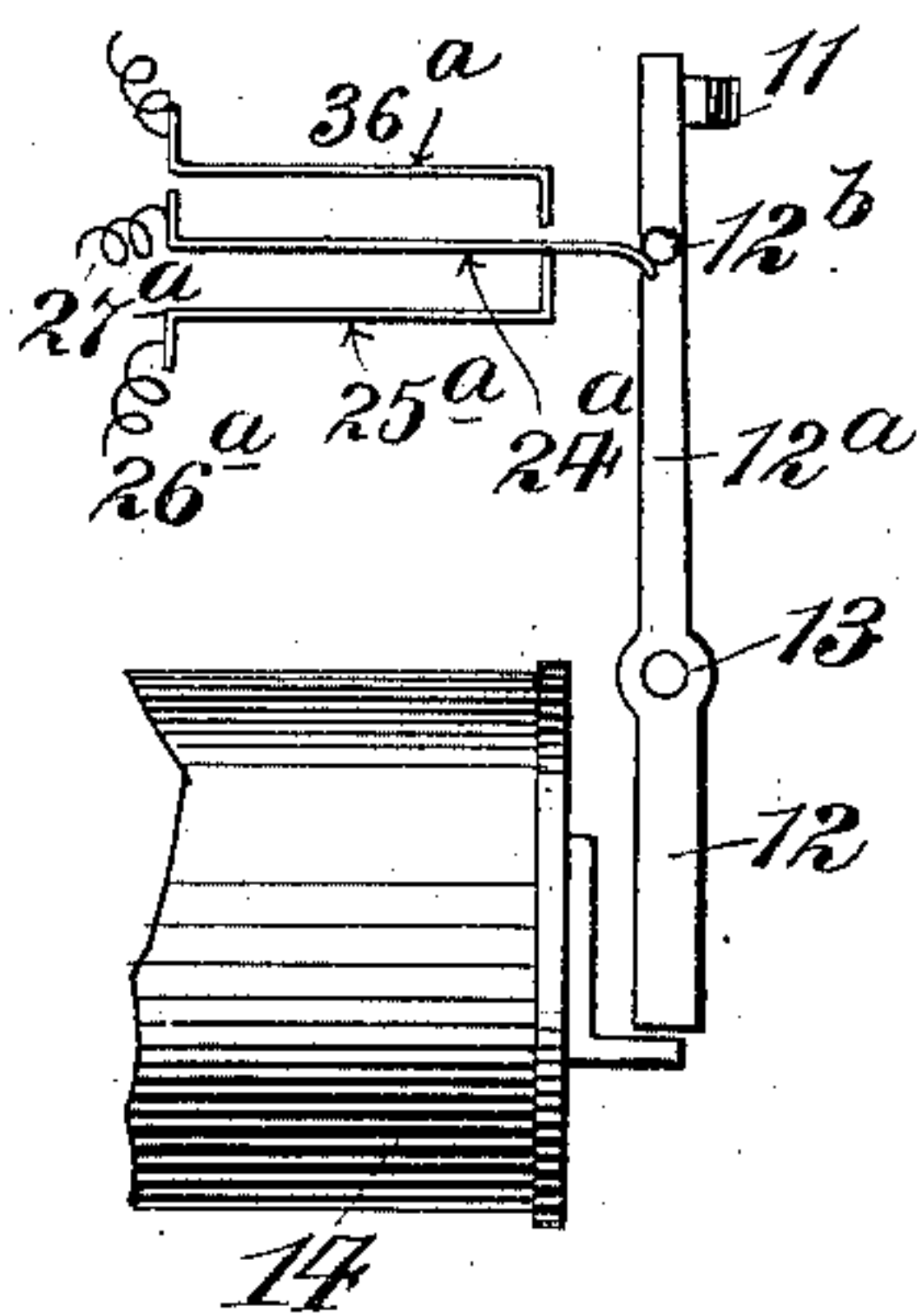
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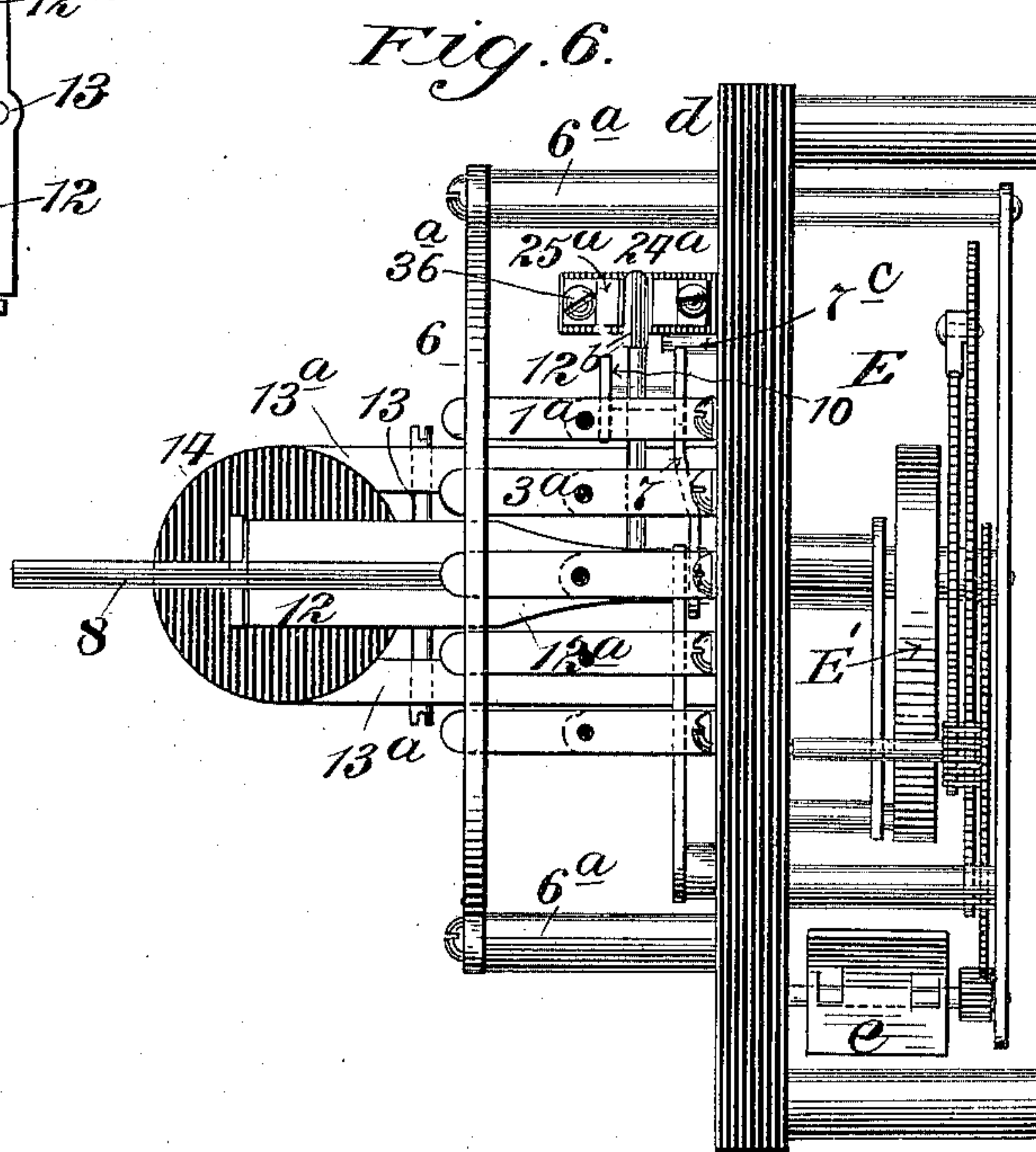
*Fig. 5.*



*Fig. 7.*



*Fig. 6.*



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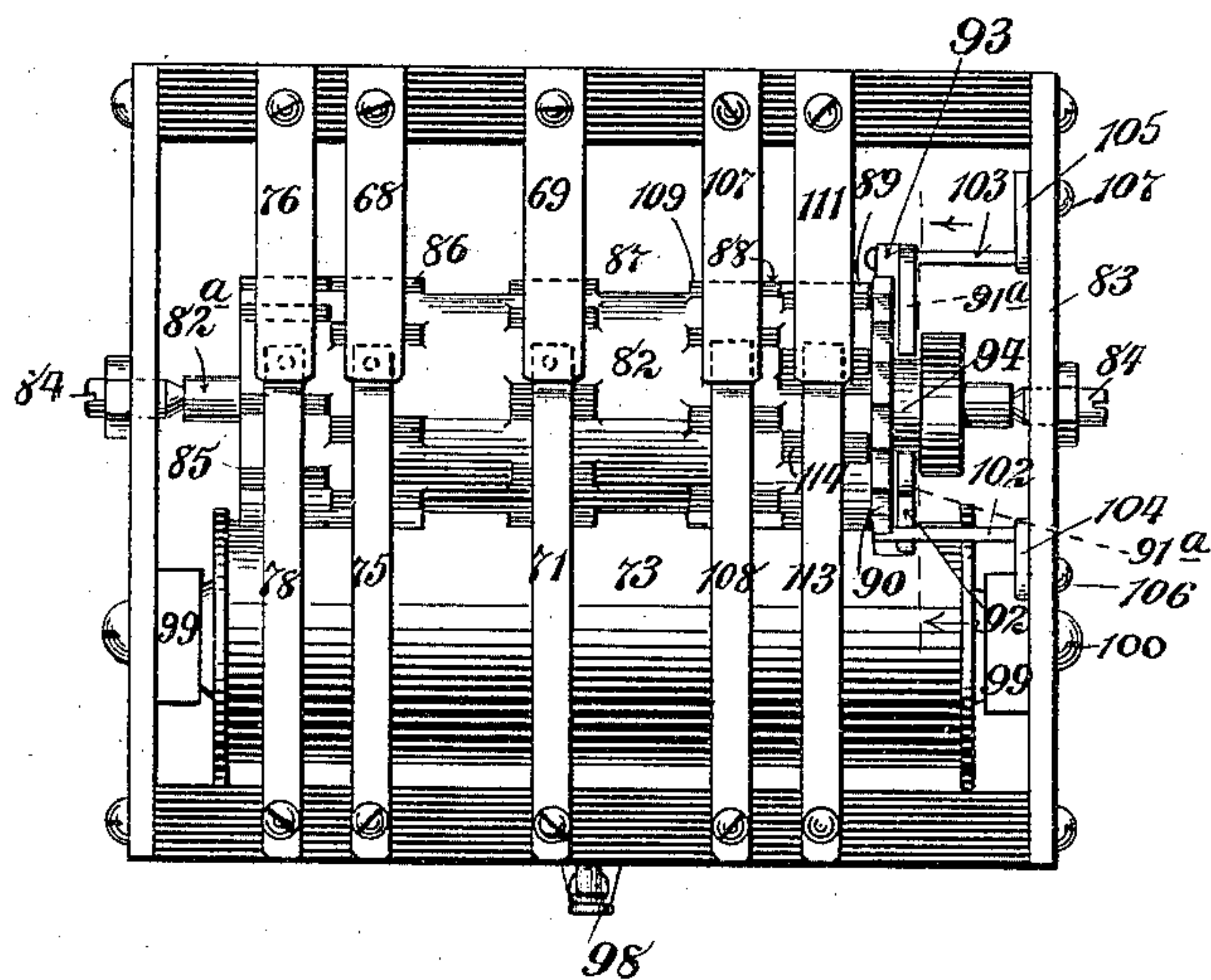
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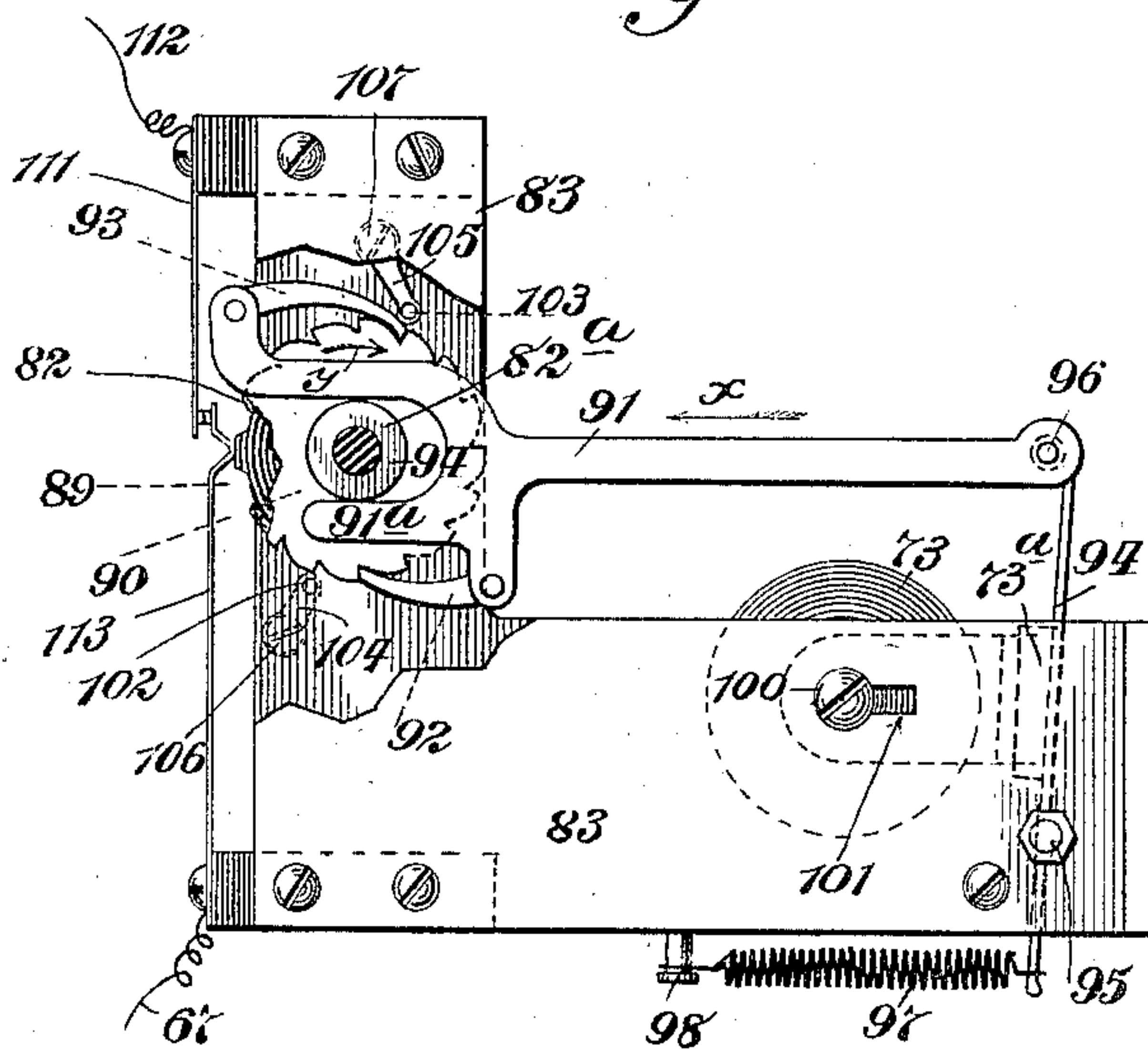
NO MODEL.

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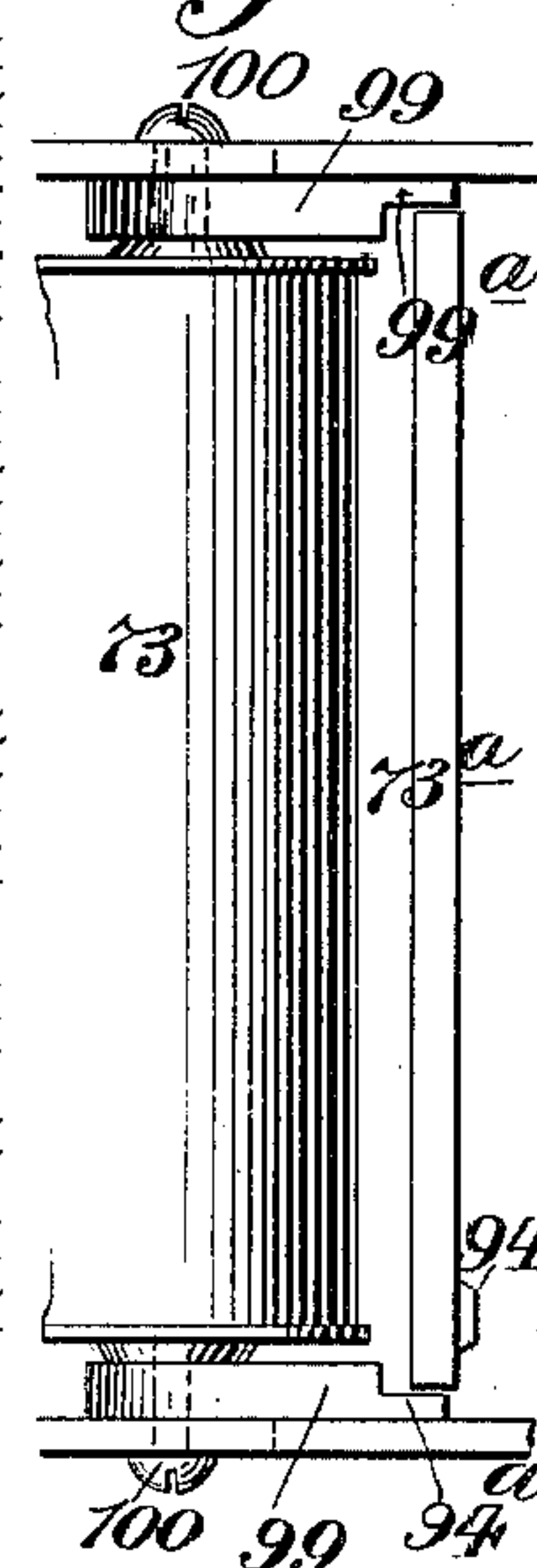
*Fig. 8.*



*Fig. 9.*



*Fig. 10.*



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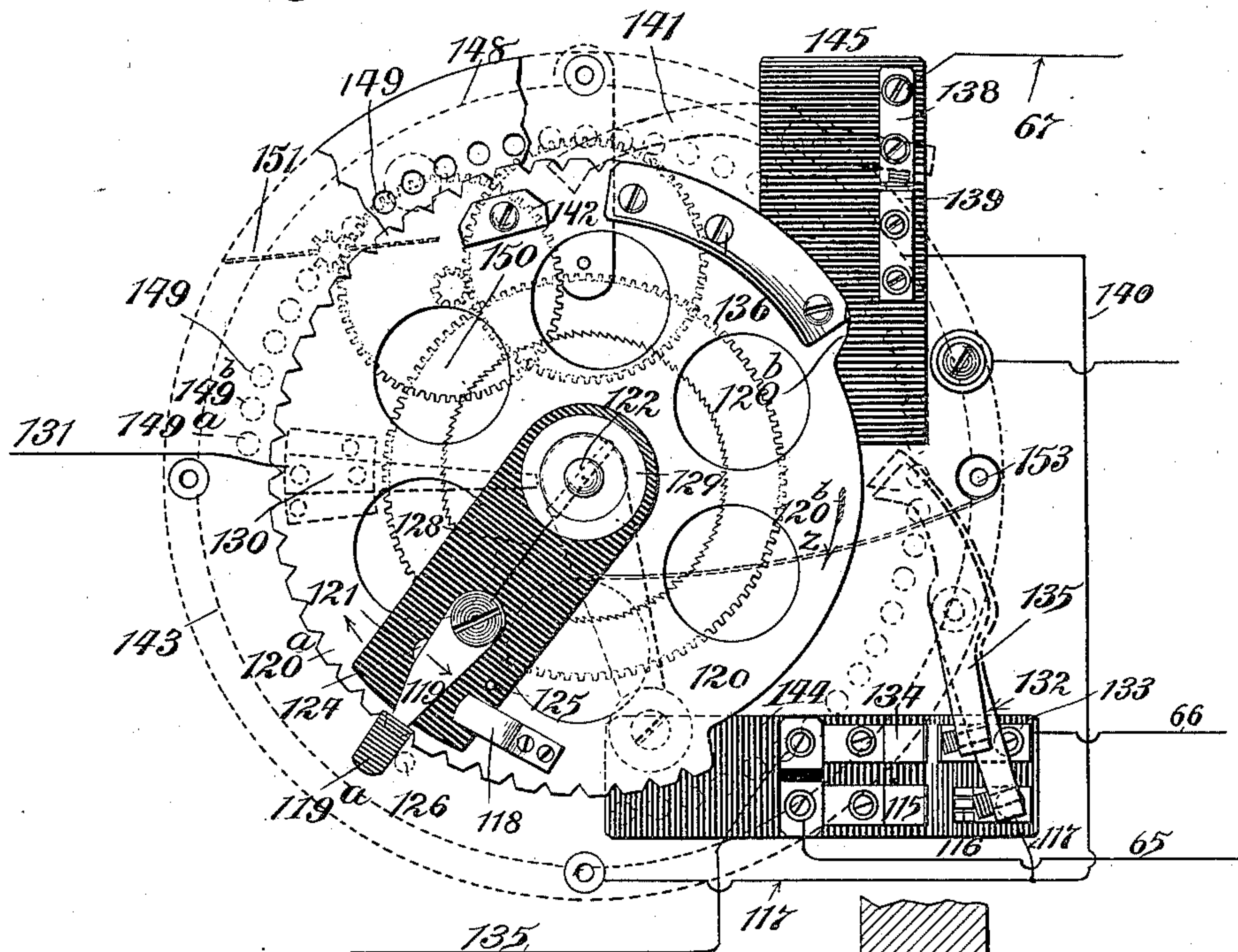
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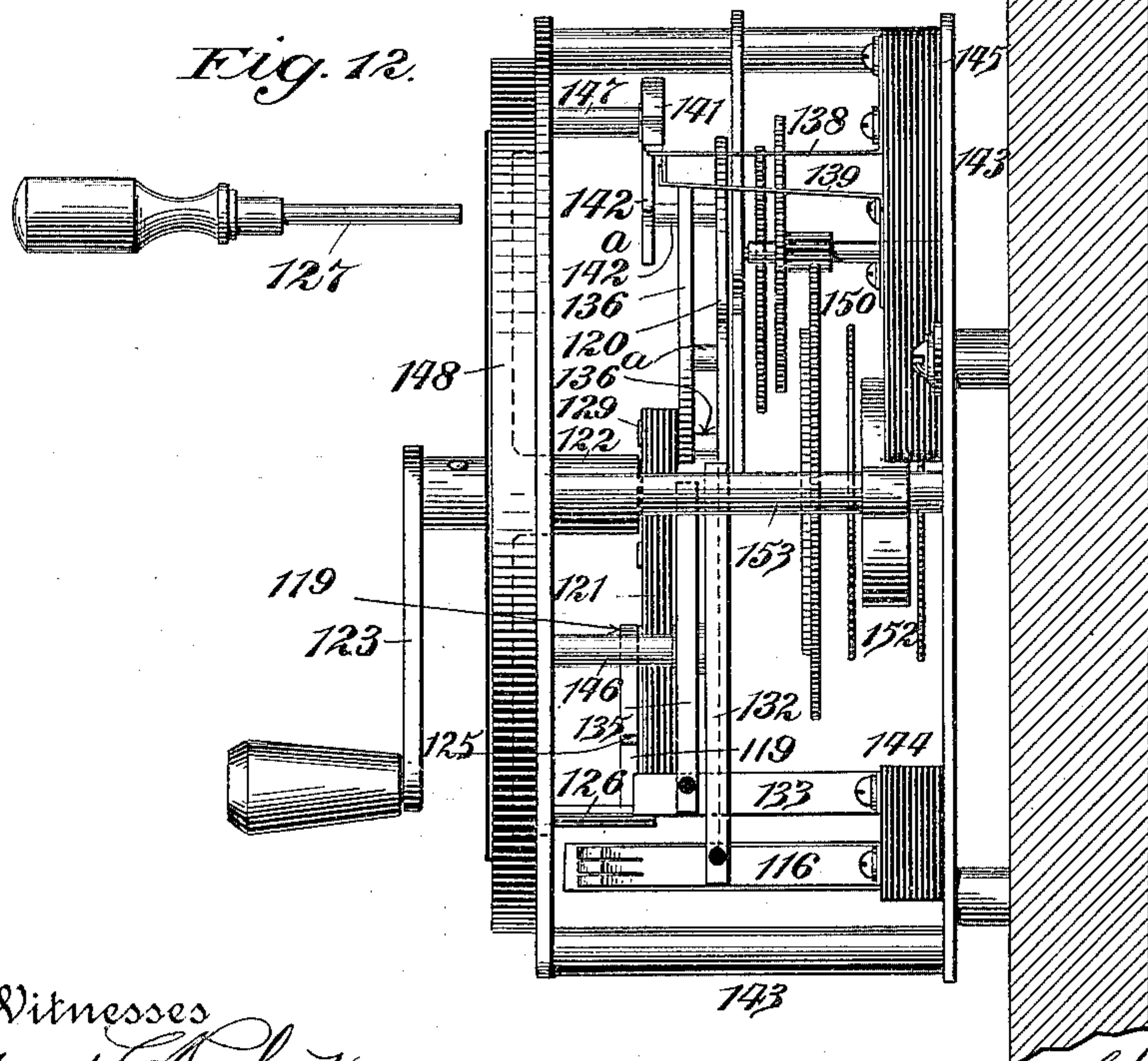
NO MODEL.

6 SHEETS—SHEET 6.

*Fig. 11.*



*Fig. 12.*



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# UNITED STATES PATENT OFFICE.

CHARLES B. SMITH, OF NEW YORK, N. Y.

## TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 741,282, dated October 13, 1903.

Application filed February 3, 1899. Renewed October 22, 1902. Serial No. 128,245. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES B. SMITH, a citizen of the United States, residing in New York city, county and State of New York, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates more particularly to the class of telephone systems which embrace a central office with accessories and circuits leading therefrom, each having a plurality of stations or telephone instruments and their accessories, which circuits are commonly known as "party-lines."

One object of my invention is to enable instruments at a central office to select and make connection with an idle conductor or a pair of idle conductors from a plurality of conductors on a party-line, so as to enable instruments in a calling-station to select and make electrical circuit with the same selected idle conductor or conductors, and to also enable the corresponding instruments in a called station to select and make electrical connection with the same conductor or pair of conductors. By means of the devices I use one subscriber can call central over such selected conductor without producing a signal in another station, and the telephone instruments in the calling and a called station may be connected for telephonic purposes over the conductors selected for them at the central office. In carrying out this portion of my invention I provide a central office and party-lines leading therefrom, each party-line having a plurality of conductors whose circuits are normally open, and at central I provide for each party-line instruments to select an idle circuit, which instruments embrace a movable arm and electrically-operating devices and circuits arranged to cause said arm to come to rest in connection with one of the idle circuits and to disregard such circuits as may be in use to establish a calling-line to central for the outlying stations, and devices are also arranged at central for connecting the telephone thereat with such selected conductor. At the outlying stations instruments are provided to select the same conductor that has been selected at central to enable a call to be sent to central while disregarding a conductor that is in use and also to establish a

circuit for the telephones at the stations over such selected circuits. By this means the devices at central connected with a party-line normally keep an idle conductor in condition to be selected by a calling subscriber, and after said subscriber has appropriated such conductor and has obtained a circuit with the party desired the devices at central can select another idle conductor to be used by another subscriber on the party-line. At central suitable devices, such as jacks and plugs, are used to connect different party-lines.

Another object of my invention is to enable the operator at central to conveniently connect the telephone thereat with the selected wires of a calling and a called station.

A further object of my invention is to provide improved devices both at the central office and at the outlying stations for enabling central to conveniently select and signal the station desired. In carrying out this portion of my invention I provide each party-line with main conductors leading from central through the stations, one of which conductors I term an "operating-line," another I term a "calling-line," and the other a "restoring-line," and in each station there are connected with these conductors devices adapted to be operated by electrical impulses sent over the various lines from central to first select and place in circuit the signaling instrument of the station desired and after such instrument is operated to restore the various devices and circuits to their normal conditions. At central is provided an instrument adapted to send the various impulses over said conductors to effect the operations of the instruments at the various stations. At central, also there are provided switching devices to enable the appropriate impulses to be sent over the various party-lines from the central office impulse-transmitting instrument.

The invention also consists in the novel details of improvement that will be more fully hereinafter set forth and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming part hereof, wherein—

Figure 1 is a diagrammatic view illustrating a central office and a party-line leading therefrom embracing two stations, showing the telephones at such stations connected in



a closed metallic circuit and the arm at central in connection with the conductors in use by said stations. Fig. 2 is a diagrammatic view of the telephone portion of the party-line system shown in Fig. 1, but showing the arm at central in connection with a different pair of conductors and the devices at the stations in their normal conditions when not in use. Fig. 3 is a view similar to Fig. 2, but showing the devices at one station as having selected the pair of conductors that are in connection with the arm at central, the devices at the other station being in their normal conditions, but capable of selecting the same pair of conductors. Fig. 4 is a diagrammatic view showing two party-lines leading from the central office and illustrating the devices at central for connecting two party-lines together and also illustrating the devices at central for enabling a call to be sent over any party-line from the call-producing devices at central. Fig. 5 is an enlarged detail face view of the devices adapted to select idle conductors. Fig. 6 is a side view of the same looking from the right in Fig. 5. Fig. 7 is a detail plan view of the arm-controlling magnet and its detent. Fig. 8 is a detail face view of the devices at the subscribers' stations for selecting the signaling instrument desired and restoring the circuits to their normal conditions. Fig. 9 is a side view thereof, part being broken away, looking from the right in Fig. 8. Fig. 10 is a detail plan view of the magnet and its armature used in said devices. Fig. 11 is an enlarged detail view, part being broken away, of the devices at central for transmitting impulses over the subscriber's selecting and calling circuit; and Fig. 12 is a side view of the same complete looking from the right in Fig. 11.

Similar numerals and letters of reference indicate corresponding parts in the several views.

I will first describe the party-line telephone circuits, including the arrangements by which idle conductors are selected at central and the arrangements by which a subscriber calls central, and the telephone instruments of two subscribers are placed in circuit over selected idle conductors, and I will then describe how the operator at central calls the desired station on any party-line.

A indicates generally a central office at which are located the devices to be hereinafter described, and B, B', B<sup>2</sup>, C, and C<sup>2</sup> indicate stations on telephone-circuits or party-lines leading from central, at which stations are located telephone instruments and devices for connecting such instruments with the appropriate conductor of the circuit or party-line, and devices are also located at said stations to enable central to select and call the desired station. For the sake of clearness of illustration I have omitted from the drawings the transmitters, induction-coils, local circuits, &c., that are usually used in conjunction with the receivers shown.

Each party-line has a plurality of conductors for telephonic purposes and for calling central. In the drawings I have shown four conductors or wires 1 2 3 4, forming a party-line leading from central through the stations, and by preference I utilize such conductors in pairs for forming a closed metallic circuit for the telephone instruments. In the arrangement shown the conductors 1 2 constitute one pair and 3 4 the other pair; but it will be understood that said conductors can be used individually or separately to form grounded circuits. At central the conductors 1 2 3 4 lead to contacts 1<sup>a</sup> 2<sup>a</sup> 3<sup>a</sup> 4<sup>a</sup>, and other similar contacts are shown for connection with other such conductors if they are used on a party-line. It will be seen that the contacts 1<sup>a</sup> 2<sup>a</sup> form one pair and 3<sup>a</sup> 4<sup>a</sup> another pair, and between these pairs of contacts is located insulation 5, so that one contact, as 2<sup>a</sup> 4<sup>a</sup>, can act to press the opposite contact, as 1<sup>a</sup> or 3<sup>a</sup>, into electrical engagement with a long contact 6 without establishing circuit between the contacts forming pairs. At central are located devices for automatically selecting any conductor or pair of conductors that are not in use or are "idle," (and for thereupon holding the corresponding contact 1<sup>a</sup> or 3<sup>a</sup> in connection with the contact 6,) whereby an initial or normal circuit is established to central to enable a subscriber to call central, and these devices operate both mechanically and electrically. The arrangements I have shown for the purpose are as follows: 7 is an arm secured to or hung upon a shaft 8, suitably supported, and 9 is a handle for manually operating the arm 7. The arm 7 is preferably composed of an electric conductor, such as metal, (or it may carry a conductor,) and by preference carries a roller 10, that is adapted to engage the contacts 2<sup>a</sup> 4<sup>a</sup>, &c., and the relative arrangement of the parts is such that when said roller or arm engages such contact it will press the same toward the corresponding contact 1<sup>a</sup> 3<sup>a</sup>, &c., and through the medium of the insulation 5 will press the last-mentioned contacts into engagement with the contact 6. The arm 7 is to stop in connection with a contact of an idle conductor and for this purpose is shown provided with a series of teeth 7<sup>a</sup> and with a broad tooth 7<sup>b</sup>, which are adapted to be engaged by a detent 11, formed on, connected with, or operated by an armature 12, that is shown carried by or part of an arm 12<sup>a</sup>, pivotally supported, as at 13, and adapted to be attracted by a magnet 14. The arm 7 is adapted to sweep back and forth across the contacts above mentioned, (except when stopped by detent 11,) and while these parts are illustrated diagrammatically in Figs. 1, 2, 3, and 4 they are shown more fully in detail in Figs. 5, 6, and 7 in structural form. In the last-named figures D indicates a suitable frame or box in which the shaft 8 is suitably journaled, and the contact 6 is shown carried by posts 6<sup>a</sup>, the



magnet 14 being suitably supported on said box or frame, and the pivot 13 is shown supported on uprights 13<sup>a</sup>, the contacts 1<sup>a</sup> 2<sup>a</sup> 3<sup>a</sup> 4<sup>a</sup> being supported on suitable insulation *d*, such as rubber or fiber. The arm 7 is to be moved by means of the handle 9 into position to enable it to travel to select the contacts 2<sup>a</sup> 4<sup>a</sup>, &c., and 7<sup>c</sup> is a stop to limit the movement of said arm by the operator. Said arm is preferably controlled by means of a gear-train E, having a fan *e*, the spring E' of which train is secured to the shaft 8 and to the frame D in any well-known manner, whereby as the handle 9 is turned upwardly in the drawings the spring will be wound and will act to depress the arm when said handle is released.

The devices described for use at central for selecting idle conductors are also used at the various stations on a circuit for similarly selecting the same conductors, but with modifications that will be pointed out hereinafter.

The detent 11 is to cause arm 7 to come to rest in connection with an idle conductor 2 or 4 and is controlled through the action of magnet 14 and its spring 15, the arrangements for which at central A are as follows: *a* is a contact adapted to be engaged by arm 7 or its roller 10 and to be thereby pressed into engagement with contact 6. From contact 6 extends a conductor 16, that leads to a contact 17, normally engaged by a contact 18, controlled by a key 19, (for a purpose hereinafter explained,) which contact 18 normally engages a contact 20, connected by a conductor 21 with a battery 22, from which a conductor 23 extends to a contact 24. The contact 24 is in engagement with a contact 25 when the detent 11 is in engagement with the broad tooth 7<sup>b</sup> of arm 7, (which occurs when the arm 7 is in its uppermost position ready to descend to select an idle conductor of the party-line.) The contact 24 is controlled by arm 12<sup>a</sup>, operated by armature 12 and having insulation 12<sup>b</sup> to engage and operate contact 24. From the contact 25 a conductor 26 leads to magnet 14, and from the opposite terminal of said magnet a conductor 27 is electrically connected with arm 7. Thus when arm 7 is raised by the operator at central to enable it to travel to select an idle conductor—such, for instance, as 2 in Fig. 1—the tooth 7<sup>b</sup> will act upon detent 11 to move the armature 12 toward magnet 14 and allow contacts 24 25 to engage. As arm 7 now descends it will first engage contact *a* and move it against contact 6, whereupon a circuit for magnet 14 will be established as follows: From contact *a* through 6 16 17 18 20 21, battery 22 23 24 25 26, magnet 14, conductor 27, and arm 7, back to contact *a*. Magnet 14 will now be energized and will hold detent 11 from engagement with a tooth 7<sup>a</sup> until arm 7 passes into engagement with a contact 2<sup>a</sup> or 4<sup>a</sup> of an idle conductor of the party-line, whereupon circuit through magnet 14 will be broken, and spring 15 will draw detent 11 into engage-

ment with a tooth 7<sup>a</sup> of arm 7 to hold said arm in connection with such idle conductor, at the same time moving contact 24 to break the circuit at 24 25. Thus an idle conductor will be selected at central. The relative positions of the contacts *a* 2<sup>a</sup> 4<sup>a</sup>, &c., should be such that roller 10 of arm 7 is always bridged between two of such contacts. Assuming that the pair of conductors 1 2 in Fig. 1 are idle, the arm 7 will stop in connection with them because when the arm passes from contact *a* the circuit before described through magnet 14 will be broken and the arm 7 will be stopped by detent 11 in connection with contacts 1<sup>a</sup> 2<sup>a</sup>, arm 7 thereby pressing contact 1<sup>a</sup> into engagement with contact 6. As the contact is now broken at 24 25 the circuit through magnet 14 is open at said points. The described positions of the parts now enable a subscriber to call central over the idle conductor so selected. (If arm 7 should have passed over a contact belonging to a conductor that was in use in any station, circuit would have been kept up through magnet 14 to prevent the arm from stopping upon said contact, so as to enable the arm to pass on to a conductor not in use, as will be explained hereinafter.)

To permit a subscriber to call central, devices are located at each station on the party-line to select the same conductor that the arm 7 at central has selected. These devices are substantially the same as the devices used at central and comprise the arm 7, having teeth 7<sup>a</sup> and 7<sup>b</sup>, and roller 10, armature 12, pivotally carried at 13, arm 12<sup>a</sup>, insulation 12<sup>b</sup>, and magnet 14. In each station also contacts 1<sup>b</sup>, 2<sup>b</sup>, 3<sup>b</sup>, and 4<sup>b</sup>, insulation 5<sup>a</sup>, and a contact 6 are arranged similarly to contacts 1<sup>a</sup>, 2<sup>a</sup>, 3<sup>a</sup>, 4<sup>a</sup>, insulation 5, and contact 6 at central, and the contacts 1<sup>b</sup>, 2<sup>b</sup>, 3<sup>b</sup>, and 4<sup>b</sup> are connected with the conductors 1, 2, 3, and 4, respectively, as by spur wires or conductors 1<sup>c</sup>, 2<sup>c</sup>, 3<sup>c</sup>, and 4<sup>c</sup>. The circuit for magnet 14, however, is somewhat changed from that at central. In this case a conductor 27<sup>a</sup> leads from arm 7 to contact 24<sup>a</sup>, and a conductor 26<sup>a</sup> leads from contact 25<sup>a</sup> to magnet 14, contacts 24<sup>a</sup> 25<sup>a</sup> being adapted to make and break circuit by the action of armature 12, arm 12<sup>a</sup>, and insulation 12<sup>b</sup>. From magnet 14 a conductor 28 leads to ground 29 at the corresponding station, although conductors 28 could lead to a return-wire common to the stations on a party-line. The receivers 30 at the stations B B' B<sup>2</sup> C C<sup>2</sup>, &c., when not in use preferably hang upon hooks 31 in well-known manner, and the hooks 31 each have or control an arm 32, that is adapted to engage and lift the corresponding arm 7, so as to hold it above or out of engagement with the corresponding contacts 1<sup>b</sup> 2<sup>b</sup>, &c., as shown in Fig. 2, and at station C<sup>2</sup> in Fig. 3. The arrangement is such that when receiver 30 is lifted from its hook 31 the arm 32 will descend, thus releasing arm 7 to allow the latter also to descend. It will be understood that when arm 7 is raised by arm 32 tooth 7<sup>b</sup>



will engage detent 11 and hold armature 12 away from magnet 14, whereupon contact 24<sup>a</sup> will engage contact 25<sup>a</sup>, as in Fig. 2, and these are the normal positions of the parts. The purpose of arm 7 in a station is to select and make connection with the same party-line conductor that is selected at central, whereby a call may be sent to central and telephonic communication established over such conductor. For this purpose a battery-circuit is to be established for magnet 14, which I have shown arranged as follows: Passing now to the central office A, it will be seen that a conductor 33 leads to an indicating instrument 34 of any suitable kind. The instrument I have shown is an annunciator having a drop 34<sup>a</sup>. The drop 34<sup>a</sup> is shown provided with a finger or projection 34<sup>b</sup> and adapted to be actuated by key 19 or a projection or finger 19<sup>a</sup>, connected therewith, to restore said drop to its normal position when key 19 is operated. From the instrument 34 a conductor 35 leads to a contact 36, adapted to be engaged by contact 24 when detent 11 is holding arm 7 in connection with an idle party-line conductor, contact 24 being connected by conductor 23 with battery 22. Battery 22 is also connected by a conductor 22<sup>a</sup> with ground 22<sup>b</sup>, although it could be connected with the common return-wire before mentioned. Now assume that arm 7 at central has selected an idle conductor, as 2, and is held by detent 11 in connection therewith, as at central in Fig. 1, and that a subscriber on a party-line at a station, as B, desires to call central. His (the subscriber's) instruments must select the same conductor that was selected at central, as 2. The subscriber now lifts his receiver 30 from hook 31, whereupon arm 32 descends and allows the corresponding arm 7 to travel, it being remembered that tooth 7<sup>b</sup> by acting on detent 11 when arm 7 was in the upper or normal position allowed contacts 24<sup>a</sup> 25<sup>a</sup> to engage. Arm 7 now makes electrical connection with contact 2<sup>b</sup> of conductor 2, (likewise pushing contact 1<sup>b</sup> into engagement with contact 6,) as in Fig. 2, whereupon a circuit will be established between magnet 14 of the operating-station and the indicating instrument 34 at central as follows: from ground 29 through 28, magnet 14 26<sup>a</sup>, contacts 25<sup>a</sup>, 24<sup>a</sup>, (which are still in engagement, as in Fig. 2,) and 27<sup>a</sup> to arm 7, thence through 2<sup>b</sup> and 2<sup>c</sup> to conductor 2, (all at B,) thence along conductor 2 to 2<sup>a</sup> at central and through 27 and 33 to instrument 34, thence through 35, 36, 24, 23, battery 22, and 22<sup>a</sup> to ground 22<sup>b</sup>. Current now flows from battery 22 and causes instrument 34 to operate to indicate a call at central and also energizes magnet 14 at the calling-station B, whereupon armature 12 at B is attracted and causes detent 11 to engage a tooth 7<sup>a</sup> of arm 7, thus arresting said arm in connection with contact 2<sup>b</sup>. Thus it will be seen that by simply raising the receiver 30 from its hook a subscriber is enabled to select a conductor of a party-line that has been previously selected at central and to produce a

call at central. The circuit in a station for the telephone is as follows: From contact 6 a conductor 16<sup>a</sup> leads to one terminal of receiver 30, and from the other terminal thereof a conductor 30<sup>a</sup> leads to a contact 36<sup>a</sup>, that is adapted to be engaged by contact 24<sup>a</sup>, and this engagement occurs when armature 12 is attracted by magnet 14 to cause arm 7 to select a conductor of the party-line. The normal positions of the parts will be seen in Fig. 2.

It will now be shown how telephonic communication can be established between central and a station, and by preference a closed metallic circuit is established for the telephones over the pair of selected conductors. 37 is a telephone-receiver at central A, from one terminal of which extends a conductor 38, that leads to a contact 39, adapted to be brought into electrical circuit with contact 40 by a contact 41, carried by key or switch 19 and insulated therefrom. From contact 40 a conductor 42 leads to conductor 33. From the other terminal of receiver 37 a conductor 43 leads to a contact 44, normally disengaged from but adapted to engage a contact 45, that is connected by a conductor 46 with conductor 16. Contact 44 is normally held out of engagement with contact 45 through the medium of key 19, insulation 44<sup>a</sup> being shown carried by 19. Circuit through the receiver is normally broken at 39, 40, 41, and at 44, 45. The subscriber having called central, as before explained, the operator presses key 19, whereupon a closed metallic circuit through the telephones at central and at the calling-station B will be established as follows: from arm 7 at central through 27, 33, 42, 40, 41, 39, 38, receiver 37, 43, 44, 45, (which now engage,) 46, 16, 6, and 1<sup>a</sup>, (which is held in engagement with 6 by arm 7,) to conductor 1, thence along conductor 1 to the calling-station B through 1<sup>c</sup> and 1<sup>b</sup> to 6, (1<sup>b</sup> and 6 being held in engagement by arm 7 at B,) thence to 16<sup>a</sup>, receiver 30, 30<sup>a</sup>, 36<sup>a</sup>, and 24<sup>a</sup>, (which are now in engagement,) 27<sup>a</sup>, arm 7, contact 2<sup>b</sup>, and 2<sup>c</sup> to conductor 2, thence along 2 from B to 2<sup>a</sup> at central and to arm 7 again. The calling subscriber then tells central what subscriber he wishes and central calls such subscriber, as will be explained hereinafter. If the called subscriber, as C, is on the same party-line as the calling subscriber he merely removes his receiver 30 from its hook, whereupon the arm 7 in his station will select and make electrical connection with the same party-line conductor with which the calling-station is already connected. This selection of said conductor occurs because the arm 7 at central still remains in connection with said conductor, and the magnet 14 at the called station will be energized in the same manner as that described with reference to station B—that is to say, the circuit will be from ground 29 at C through 28, 14, 26<sup>a</sup>, 25<sup>a</sup>, 24<sup>a</sup>, 27<sup>a</sup>, 7, 2<sup>b</sup>, and 2<sup>c</sup>, to 2 at C, thence over conductor 2 to contact 2<sup>a</sup> at central, thence through 7, 27, 33, 34, 35, 36, 24, 23, battery 22



and 22<sup>a</sup> to ground 22<sup>b</sup>. Armature 12 at C will now be operated to cause arm 7 to come to rest in connection with contact 2<sup>b</sup>, and contacts 24<sup>a</sup> 36<sup>a</sup> will be brought together. The 5 telephones in the calling and the called stations B C will now be in a closed metallic circuit, (shown in Fig. 1,) which is as follows: from arm 7 in station B, through 27<sup>a</sup>, 24<sup>a</sup>, 36<sup>a</sup>, 30<sup>a</sup>, receiver 30, 16<sup>a</sup>, 6, 1<sup>b</sup>, 1<sup>c</sup> to conductor 1, 10 thence over said conductor to station C, through 1<sup>c</sup>, 1<sup>b</sup>, 6, 16<sup>a</sup>, 30, 30<sup>a</sup>, 36<sup>a</sup>, 24<sup>a</sup>, 27<sup>a</sup>, arm 7, 2<sup>b</sup>, and 2<sup>c</sup>, to conductor 2, thence to station B, through 2<sup>c</sup> and 2<sup>b</sup>, back to arm 7.

If the subscriber to be called had been located on a party-line different from that on 15 which the calling subscriber was located, the operator at central would call such subscriber, as hereinafter explained, who would remove his receiver from its hook 31, and the arm 7 20 at the called station would then select the conductor of its party-line that had previously been selected by the corresponding arm 7 at central. The operator at central would then connect the selected conductors of the two 25 party-lines by suitable devices at central, as will be explained hereinafter.

Now that I have explained how the arm 7 at central selects and remains in connection with an idle party-line conductor, how the 30 arm 7 at a station selects the same idle conductor, and how these conductors are connected together through the telephone at said station it will be convenient to explain how the arms 7 disregard conductors that are in 35 use and only select a conductor that is idle. It is the purpose to always have arm 7 at central in connection with an idle conductor whenever there is one such on a party-line. Assuming that conductors 1 2 are in use by a subscriber 40 or subscribers on a party-line, as before described, as in Fig. 1, the operator at central next turns handle 9, and thereby arm 7, to the starting-point and then releases the same. Arm 7 immediately descends, and when it 45 (or its roller 10) engages contact *a* the local circuit for magnet 14 at central will be closed, as before described, to hold detent 11 from teeth 7<sup>a</sup>. Arm 7 next passes to contact 2<sup>a</sup>, and when it leaves contact *a* a new circuit 50 for magnet 14 will be established as follows: from arm 7 through 27, 14, 26, 25, 24, (which are still in engagement,) 23, battery 22, 21, 20, 18, 17, 16, 6, and 1<sup>a</sup> to conductor 1, thence to the station using the line B and through 55 1<sup>c</sup> to 1<sup>b</sup>, 6, 16<sup>a</sup>, receiver 30, 30<sup>a</sup>, 36<sup>a</sup>, 24<sup>a</sup>, 27<sup>a</sup>, arm 7, contact 2<sup>b</sup> and 2<sup>c</sup> to conductor 2, thence back to central at 2<sup>a</sup> and to arm 7 again. Magnet 14 will thus still be energized to keep detent 11 from stopping arm 7. Arm 7 there- 60 fore continues to travel, seeking an idle conductor. If the next conductors reached by arm 7 were in use, the same character of circuit would be maintained through magnet 14 over such conductors, and so on through the 65 pairs of conductors that are in use until idle conductors are reached; but suppose the conductors 3 4 are not in use, then when arm 7

reaches the contact 4<sup>a</sup> of idle conductor 4 and leaves contact 2<sup>a</sup> the circuit through magnet 14 will be broken, because the conductors 3 and 4 70 will be open beyond the central office. Spring 15 will now draw detent 11 into engagement with a tooth 7<sup>a</sup> of arm 7, thus arresting arm 7 in connection with conductors 3 4, as shown 75 in Figs. 2 and 3. Thus notwithstanding that conductors 1 and 2 are in use a line is established to central for any other subscribers on the same party-line. The arm 7 at central is shown in Fig. 2 on the second pair of con- 80 ductors 3 4, the first pair of conductors being supposedly busy.

Now suppose a subscriber on the party-line, say at station B<sup>2</sup> in Fig. 2, desires to call central. He first removes his receiver 30 from 85 its hook, whereupon his arm 7 travels. Arm 7 (at B<sup>2</sup>, Fig. 3) first reaches contact 2<sup>b</sup>; but as arm 7 at central is not in engagement with contact 2<sup>a</sup> there will be no circuit through conductor 2 to battery 22, so said arm travels 90 on past contact 2<sup>b</sup>; but when it reaches contact 4<sup>b</sup> a circuit will be established from ground 29 at B<sup>2</sup>, through magnet 14 thereat to ground 22<sup>b</sup> at central, through instrument 34 and battery 22, thus producing a call at 95 central, as before explained, and holding arm 7 in station B<sup>2</sup> in contact with 3<sup>b</sup>. The position of the parts will be seen in Fig. 3—that is to say, the arms 7 at central and at station B<sup>2</sup> are in connection with conductors 3 4; but 100 the arm at station C<sup>2</sup> is in its normal condition. If the subscriber at station C<sup>2</sup> should be wanted, his arm 7 after he removes his receiver 30 from hook 31 will travel past the contacts of conductors 1 2 and will be stopped 105 in connection with the contacts of conductors 3 4, as explained with relation to station B<sup>2</sup>.

It will be understood that after the operator at central ascertains that two subscribers are in telephonic communication he will re- 110 turn his arm 7 to the starting-point and release it, whereupon it will descend to seek any idle conductor, the object being to always have an arm at central in connection with an idle conductor of the party-line, provided there is such idle conductor. 115

While I have shown a local circuit at the central office for magnet 14 established through contacts *a* and 6, Fig. 1, by the ac- 120 tion of arm 7, as before described, it will be understood that this local circuit can be dispensed with, in which case magnet 14 will only be energized to hold detent 11 from teeth 7<sup>a</sup> when arm 7 engages a contact of a conductor that is in use by an outlying station over the circuit previously described through said 125 station; but the purpose of this local circuit is to cause magnet 14 to be first energized on a short circuit, so as not to require it to attract armature 12 by current on a long circuit, and thus when this local circuit is used 130 the passage of arm 7 from contact *a* to contact 2<sup>a</sup> merely requires the current on the circuit through magnet 14 between the central office and an outlying station to be sufficiently



strong to hold armature 12 attracted. No such local circuit for magnet 14 is required at the stations.

Having thus far described how the devices at the central office select and establish a circuit for an idle conductor of a party-line, how the devices at a station also select the same selected line and produce a call at central, how the devices at central and at a station are adapted to establish a closed metallic circuit through their telephones, and how a closed metallic circuit is established through the telephones at two stations on one party-line, I will now explain how the operator at the central office connects together the selected conductors of two party-lines and establishes telephonic communication between two stations on such party-lines and also communication between central and said subscribers. The arrangement for this purpose is illustrated in Fig. 4. The respective pairs of conductors 1 2 and 3 4 are provided with jacks 48 or other suitable devices for connecting such conductors electrically. These jacks are shown composed of contacts 48<sup>a</sup> 48<sup>b</sup> 48<sup>c</sup> 48<sup>d</sup>, connected, respectively, to conductors 1 2 3 4 and arranged in pairs 48<sup>a</sup> 48<sup>b</sup> and 48<sup>c</sup> 48<sup>d</sup>. 49 indicates plugs for connection with such jacks and shown connected by wires 50 51 in well-known manner. The plugs 49 are shown having a contact 49<sup>a</sup>, connected with wire 50, and a contact 49<sup>b</sup>, connected with wire 51, which contacts are insulated from each other. By inserting plugs 49 in the jacks 48 of two party-lines the pairs of conductors of such party-lines can be connected, as shown in Fig. 4. While I have heretofore described an independent circuit for the receiver 37 at central for each party-line, I have shown in Fig. 4 an arrangement whereby one receiver 37 will suffice for a number of party-lines. In this case the parts 16, 17, 18, 19, 20, 21, 33, 34, 38, 39, 40, 41, 42, 43, 44, 44<sup>a</sup>, 45, and 46 are the same for each party-line, as before described; but the conductors 21 for each party-line are shown connected together at 21<sup>a</sup> and the conductors 23 are connected together at 23<sup>a</sup>. The conductors 38 of each party-line are shown connected together at 38<sup>a</sup>, one of which leads to one terminal of receiver 37, and the conductors 43 of each party-line are shown connected together at 43<sup>a</sup>, one of which leads to the other terminal of receiver 37. The conductors 43, however, are connected with a contact 52, adapted to be electrically connected with a contact 53 by a contact 54, carried by a key or switch 55, but insulated therefrom, preferably having a spring 56 to normally hold contact 54 out of engagement with contacts 52 53. The contact 53 is connected by a conductor 57 with wire 50. The conductors 38 are connected by a conductor 58 with a contact 59, adapted to be electrically connected with a contact 60 by a contact 61, carried by switch or key 55, and the contact 60 is connected by a conductor 62 with wire 51.

When the operator at central desires to communicate telephonically with a subscriber on a party-line who has called central, as B, said operator depresses key 18 at the right in Fig. 4, connected with said party-line, which breaks the circuit of conductor 16 to ground 22<sup>b</sup> at 17 18 20 and closes the circuit for the telephone at 39 40 41 and at 44 45, whereupon the circuit will be from 16, through 46, 45, 44, 43, 37, 38, 39, 41, 40, 42, 33, and 27, to arm 7, &c. Likewise if a subscriber on another party-line, as B', had called central the operator thereat would operate key 19 at the left in Fig. 4, establishing the same character of circuit for receiver 37. After the operator at central has connected two party-lines together by the jacks 48, plugs 49, and wires 50 51 and he desires to ascertain if the subscribers are in communication he operates key 55, keys 19 being in their normal positions to break circuit at 39 40 41. Circuit through receiver 37 will now be established simultaneously to both party-lines as follows: from the jacks and conductor 50, through 57, 53, 54, 52, 43, 37, 38, 58, 59, 61, 60, 62, and 51, back to the jacks. After the operator at central ascertains that the subscribers are in communication he releases key 55, whereupon the circuit is broken at 52 53 54 and at 59 60 61. It will be seen that as contacts 44 45 are at this time out of engagement the circuit just described is made possible, notwithstanding that the conductors 38 of two or more party-lines and the conductors 43 of the same party-lines are respectively joined together at 38<sup>a</sup> 43<sup>a</sup>.

It will be seen in Fig. 4 that conductors 1 2 of the party-line on the right and conductors 3 4 of the party-line on the left are joined together through the plugs and jacks while the arm 7 at central at the right is in connection with conductors 3 4 and that the arm 7 at central at the left is in connection with conductors 1 2 of the other party-line. The arrangement shown is for the purpose of illustrating how the arms 7 at central of the different party-lines select idle conductors and disregard conductors that are in use. Therefore assume that the subscriber at station B called central while the corresponding arm 7 at central was in connection with contacts 1<sup>a</sup> 2<sup>a</sup>, for which reason arm 7 at station B was arrested in connection with conductors 1 2. Assume also that thereafter the operator at central restored arm 7 of that party-line to its starting-point and that in its next travel it disregarded conductors 1 2 and selected the next pair of idle conductors, such as 3 4, whereupon it came to rest to enable another subscriber on said party-line to make connection with said conductors. Also assume that when central next called the subscriber at station B' the conductors 1 2 of the corresponding party-line were in use by some other station and that arm 7 at the left at central was at rest in connection with conductors 3 4, so that when the subscriber at station B' removed his receiver



from its hook the arm 7 thereat disregarded the conductors 1 2 and made connection with the conductors 3 4. Suppose also that after such connection was made the subscriber using conductors 1 2 at the left in Fig. 4 had finished and hung his receiver upon its hook, so that when the corresponding arm 7 at central again sought to select idle conductors it stopped in connection with conductors 1 2, as at the left in Fig. 4. The foregoing explanation shows how the arms 7 in Fig. 4 are enabled to assume the positions shown. The position of the arms 7 at central indicate to the operator thereat which conductors of the party-line are to be connected through their jacks and plugs. Thus the operator at central is readily enabled to connect the selected conductors of the calling subscriber's party-line with the selected conductors of a called-subscriber's line. When the subscribers have finished talking and they hang their receivers upon their respective hooks 31, the corresponding arms 7 at such stations return to their normal positions and break connection with the conductors that have been in use, leaving such conductors in an idle condition ready to be again selected by the arms 7 at central.

The arrangement I have shown for enabling the operator at central to select and call the station desired on any party-line without producing a call in any other station is as follows: Each party-line has a plurality of conductors 65 66 67, leading through the stations B B' C B<sup>2</sup> C<sup>2</sup>, &c., and in each station are located signaling instruments and devices adapted to select the signaling instrument of the station desired to establish a circuit for the same from central and to restore these devices and circuits to their normal conditions all by current sent by the operator at central. The line 65 I term an "operating-line," because it is over this line that the selection of the desired signaling instrument is effected. This line is not a through-line from central to each station, but is divided in each station or made in sections, the first section leading from central to ground at the first station on a circuit and the other sections leading from an open point in one station to ground in the next succeeding station, and so on for all the stations on a party-line. The section of line 65 that extends into a station is connected with a contact 68 and also with a contact 69, as by a conductor 70. The contact 69 in each station is normally in engagement with a contact 71, that is connected by a conductor 72 with a magnet 73, and the opposite terminal of said magnet leads to ground, being shown connected by a conductor 74 with the conductor 28, leading to ground 29. Thus the section of the party-line that leads from central is normally grounded in the first station B on the party-line and is broken from the section of the line that leads from station B to the next station, as C; but these grounds are adapted to be

broken and the several sections of the line connected together in the stations to form a through-line from central to the station desired. For this purpose in each station the section of line 65 leading from the station is connected with a contact 75, that is normally out of engagement with contact 68, but adapted to be engaged thereby, and the arrangement is such that when circuit through contacts 69 71 is broken circuit through contacts 68 and 75 will be established, thus joining two sections of the line together.

The calling-conductor 66 extends unbroken through all the stations on a party-line; but in each station it is connected with a contact 76, as by a spur-wire 77, and the contact 76 is normally out of engagement with a contact 78, which is connected by a conductor 79 with a signaling instrument 80, from which a conductor 81 leads to ground, being shown connected with conductor 28, and thus leading to ground at 29. The arrangement is such that when contacts 76 78 in any station are brought into circuit the signaling instrument in that station can be operated by current thrown on the line 66 from central, as through 66, 77, 76, 78, 79, 80, and 81 to ground; but this will not be done until the station desired is selected over the operating-line 65.

Any suitable devices may be provided for making and breaking circuit through the contacts above mentioned. The arrangement I have shown for the purpose is as follows: 82 is a cylinder or roller pivotally supported in a suitable frame 83, Figs. 8 and 9, being shown provided with a shaft 82<sup>a</sup>, journaled on pivots 84, carried by said frame. Said roller or cylinder is provided with a plurality of projections arranged in series around the periphery thereof, each series being adapted to control a pair of contacts. 85 indicates projections for contacts 76 78. 86 indicates projections for contacts 68 75. 87 indicates projections for contacts 69 71, and 88 89 are projections for other contacts to be described. By preference the roller 82 and its projections are made of insulating material, such as fiber or rubber, so that no circuit will be established between the contacts and the roller, although this may be provided for in any other suitable manner. The relative arrangement of these various projections is such as to make and break contact between the corresponding pairs of contacts at the proper times. In the arrangement shown the normal positions of the projections 85 and 86 relatively to contacts 76 78 and 68 75, respectively, are such that said contacts will be normally disengaged, and the positions of the projections 87 relatively to the contacts 69 71 are such that said contacts will be normally in engagement. The roller 82 is to be rotated step by step by means of current sent from central through magnet 73 in conjunction with a spring. For this purpose I have shown a ratchet-wheel 90 connected with roller 82, (see Fig. 9,) and 91 is a rod or



arm carrying pawls or dogs 92 93, adapted to engage and operate said ratchet-wheel. The rod or arm 91 is shown provided with a forked portion 91<sup>a</sup>, that straddles the shaft 82<sup>a</sup> and is shown as receiving a bushing or enlargement 94 on said shaft, whereby said rod is guided to reciprocate. The pawls or dogs 92 93 are shown extending in opposite directions and are so arranged that when rod 91 moves in the direction of the arrow  $x$  in Fig. 9 pawl 92 will rotate the ratchet 90 and roller 82 the distance of one tooth of the ratchet-wheel, thereby moving the pawl 93 back over two teeth of the ratchet-wheel, and when rod 91 is moved in the reverse direction pawl 93 will likewise rotate ratchet-wheel 90 and roller 82 the distance of one tooth in the same direction, whereupon dog 92 will travel over two teeth of the ratchet-wheel. This reciprocation of rod 91 causes roller 82 to be rotated successively in one direction, as shown by the arrow  $y$  in Fig. 9. The rod 91 is reciprocated through the medium of magnet 73 and a spring, for which purpose I have shown the armature 73<sup>a</sup> of said magnet as supported by a lever or arm 94, pivoted to frame 83, as at 95, and pivotally connected with rod 91 at 96, and 97 is a spring connected with lever 94 and with frame 83, as by a post 98. In the arrangement shown when the magnet 73 attracts armature 73<sup>a</sup> pawl 92 will act to rotate roller 82, and when spring 97 acts upon lever 94 rod 91 will be drawn back and pawl 93 will act to rotate said roller. I have shown armature 73<sup>a</sup> as extending parallel to magnet 73, and for this purpose I have provided pole-pieces 99, that are connected with the core of the magnet by screws or the like 100. These screws also support magnet 73 in frame 83, and in order to permit adjustment of the pole-pieces 99 toward and from the armature 73<sup>a</sup> I have shown frame 83 as slotted at 101 to receive the screws 100. I have shown the outer ends of the pole-pieces 99 as provided with recesses 99<sup>a</sup> to receive the ends of the armature 73<sup>a</sup>, (see Fig. 10,) whereby strong magnetic attraction is effected. This arrangement of the magnet, pole-pieces, and armature enables said magnet to lie parallel with the roller 82 in frame 83, while rod 91 can reciprocate at right angles to said roller. In order to prevent the magnet and spring from moving the roller 82 too far at each stroke of rod 91, so as to assure that the projections carried by said roller will always come to rest in the exact position required relatively to the contacts to be operated thereby, I provide stops against which the dogs 92 93 can abut. These stops are shown in the form of pins 102 103, carried by arms 104 105, adjustably connected with frame 83, as by screws 106 107. The stops or pins 102 103 can thus be adjusted so as to cause the dogs 92 93 to come to rest in any desired position, and, furthermore, the positions of these stops or pins relatively to the dogs is such that when the dogs engage them said dogs will be crowded against the

ratchet-wheel 90, whereby the latter will be checked in its movement and rotation through its momentum will be prevented.

The arrangement for restoring the parts and circuits is as follows: The line 67, Fig. 1, which I term the "restoring-line," is normally closed through the various stations on a party-line, but is adapted to be broken in each station and connected with the magnet 73 thereat and thence to ground. For these purposes the line 67 is made in normally closed sections between central and the first station and also between the other stations on a line, and each section of line 67 that leads into a station connects with a contact 107, which is normally out of engagement with a contact 108; but circuit through these contacts can be made and broken by means of projections 109 on roller 82. The contact 108 is connected with conductor 72, as by a conductor 110, so that when contacts 107 108 are in engagement circuit from line 67 in a station will be established from 107 through 108 110 72, magnet 73, 74, and 28 to ground 29, whereby said magnet can be energized by current sent from central over the restoring-line. Each section of line 67 that leads into a station is likewise connected with a contact 111, as by a conductor 112, and the contact 111 is normally in engagement with a contact 113, and roller 82 has projections 114, that are adapted to make and break circuit through contacts 111 and 113. Each section of the line 67 that leads from one station to another station is connected with the respective contact 113. In the normal position of the roller 82 the projections 109 and 114 cause contact to be broken between contacts 107 and 108 and to be established between contacts 111 and 113, respectively.

The manner of selecting and operating from central the desired signaling instrument 80 and of restoring these selecting devices and their circuits to their normal condition is as follows: If the first station from central on a circuit is desired, as B, the operator at central sends an impulse over the operating-line 65, which passes from ground and battery at central to contact 69 at the station, thence to contact 71, as a projection 87 of roller 82 normally keeps said contacts in engagement, thence through 72 to magnet 73 and through 74 and 28 to ground 29. Magnet 73 now attracts armature 73<sup>a</sup>, Fig. 9, which causes rod 91 to move in the direction of the arrow  $x$ , whereupon pawl 92 moves roller 82 one step, and a projection 85 of roller 82 then causes contacts 76 and 78 to engage to close the calling-circuits, projection 86 moves up toward but does not operate contacts 68 75, while projection 87 still keeps contacts 69 and 71 in engagement. Projection 109 does not yet cause contacts 107 108 to be connected, and projection 114 moves on, causing contacts 111 113 to disengage. While the parts are in this position current from the generator at central is sent over the line 66, which then passes



to the station to be called, B, through 77, 76, 78, 79, 80, and 81 to ground 29, thereby producing a call. Both currents are then cut from the lines at central, whereupon spring 97 draws armature 91 back and pawl 93 rotates roller 82 forwardly another step, and then projection 85 passes from contacts 76 78, thus breaking the calling-circuit in the station. Projection 87 passes from contacts 69 71, thus breaking the operating-circuit through magnet 73, and at this time a projection 86 passes under contacts 68 75, causing circuit to be closed through them. This action joins two sections of the operating-line together, so that at this moment there will be a circuit from central over the operating-line through the first station to ground 29 at the next station. The same movement of roller 82 caused a projection 109 to move contacts 107 108 into engagement, thus establishing a circuit to ground 29 for the section of the restoring-line 67, leading from central to the operating-station through magnet 73, as follows: from 67, through 107, 108, 110, 72, magnet 73, 74, and 28 to ground 29. As it was not designed to signal in the next station, the roller 82 must be again rotated to restore the parts and circuits to their normal conditions. This is done by throwing current upon the restoring-line 67, which finds ground at 29, as before stated, whereupon magnet 73 again attracts armature 73<sup>a</sup>, and rod 91 and dog 92 rotate roller 82 another step forward. This movement of the roller moves projection 109 away from contacts 107 108, thus breaking this restoring-circuit, whereupon spring 97 draws rod 91 back, and dog 93 rotates roller 82 another step, bringing it to its normal position, whereupon projection 87 will close the circuit through contacts 69 71, and projection 114 will close the circuit through contacts 111 113, thus restoring the parts to their normal positions.

Had it been desired to call a station beyond B an impulse would have been sent over the operating-line 65, whereupon the roller 82 at B would have been rotated two steps to disconnect two contacts 69 71 and contacts 76 78 and to join contacts 68 75 and contacts 107 108 for the restoring-line through magnet 73. Another impulse would then be thrown on the party-line 65, which would travel through 68 and 75 in the first station to the section of line 65 leading to the next station and thence at the last-named station through 70, 69, 71, 72, magnet 73, 74, and 28 to ground 29, whereupon the roller 82 at the last-named station would be moved one step to join contacts 76 78 for the calling-circuit to break the circuit of the operating-line and the circuit through the restoring-line and close a ground-circuit for said restoring-line. The signaling instrument of the desired station is thus selected. Current now being thrown on the calling-line 66 passes direct through station B and at station C through 77, 76, 78, 79, instrument 80, 81, and 28 to

ground 29, producing a call. Thereupon current will be thrown on the restoring-line, which first operates magnet 73 in station B to restore the parts there to their normal conditions, completing the line 67 through said station at 111 113, whereupon the current flows over line 67 to station C and through 107, 108, 110, 72, magnet 73, 74, and 28 to ground 29. Magnet 73 will operate to likewise restore the instruments and circuits at station C to their normal conditions. Thus it will be seen that station B can be selected and called without signaling in any station beyond on the same party-line; also, that station C can be selected and called without signaling in any intermediate station, as B, and any station can be called by sending a separate impulse over the party-line 65 for each station to and including the desired station. It will thus be seen that the operating-line 65 is a normally sectional or broken line adapted to have the sections joined in each station and that the restoring-line 67 is a normally through-line adapted to be broken into sections as each station is selected and also that as current is sent over this restoring-line the same will be again completed as a through-line and the operating-line 65 will be again broken into sections.

Any suitable means may be provided at central for sending the appropriate impulses over the lines 65 66 67 to select the station desired, operate the signaling instrument thereat, and restore the selecting instruments and the circuits to their normal conditions. The arrangements I have shown for these purposes are first set by the operator at central and then operated automatically, and these devices are as follows: Line 65 at central connects with a contact 115, that is adapted to make and break circuit with a contact 116, that is connected with a battery, as 22; but this battery is normally out of circuit with the contact 116. In the devices shown a conductor 117 connects with contact 116 and is in electrical connection with a contact 118, that is normally out of engagement with but adapted to be engaged by a pivoted contact 119, which is carried by but insulated from a rotative support 120, being shown mounted upon insulation 121, carried by said support. Said support is shown in the form of a wheel secured upon a shaft 122, suitably journaled, and 123 is a handle connected with said shaft for rotating it. 124 and 125 are stops or pins (shown carried by insulation 121; see Fig. 11) for limiting the oscillation of contact 119. 126 is a pin or stop adapted to be engaged by insulation 119<sup>a</sup>, carried by 119, (see Fig. 11,) so that when the support or wheel 120 is in the home position contact 119<sup>a</sup> by making engagement with said stop or pin will move arm 119 out of connection with contact 118. 127 is a plug adapted to be placed in the path of contact 119, so that when the latter is moved from the home point and reaches the plug 127 said contact will be moved into engage-



ment with contact 118. Thus by means of the stop 126 and plug 127 the contact 119 can make and break circuit with contact 118. Contact 119 is electrically connected, as by a conductor 128, with a contact 129, shown carried by the insulation 121, the contact 129 being shown in the form of a ring or plate, and 130 is a contact or spring that bears upon the contact 129 at all times. Contact 130 is connected by a conductor with battery 22, being shown connected by a conductor 131 with conductor 23 at central, and thereby through the battery 22 and 22<sup>a</sup> with ground 22<sup>b</sup>. From this it will be seen that when contacts 115 116 and 118 119, respectively, are in engagement circuit will be established from ground at 22<sup>b</sup> through 22<sup>a</sup>, battery 22, conductors 23 and 131, contacts 130 and 129, conductor 128, contacts 119 118, conductor 117, and contacts 116 115 to the conductor 65. For the purpose of causing contacts 115 116 to make and break circuit as often as required I have shown a rocker-arm 132, adapted to operate contact 116 to make and break circuit, and the wheel 120 is provided upon its periphery with a series of teeth 120<sup>a</sup> 120<sup>b</sup>, adapted to engage and rock the arm 132 as said wheel rotates. The arrangement is such that when contacts 118 119 are in engagement and wheel 120 rotates its teeth 120<sup>a</sup> 120<sup>b</sup> will rock the arm 132 to make and break circuit at 115 116 to transmit one impulse over the operating-line 65 for each tooth.

The calling-line 66 at central leads to a contact 133, that is adapted to make and break circuit with a contact 134, and 135 is a rocker-arm pivotally supported and adapted to operate contact 133. The arm 135 is to be rocked by a projection or tooth 136, carried by wheel 120, and the relative positions of tooth 120<sup>b</sup> and projection 136 are such that while tooth 120<sup>b</sup> is in engagement with rocker-arm 132 to close the circuit at 115 116 of the operating-line projection 136 will engage rocker-arm 135 to close circuit at 133 134 of the calling-line. Contact 134 is connected by a conductor 135 with an electric generator 137, preferably a power-generator, the opposite terminal of which is connected to ground, being shown connected by conductor 137<sup>a</sup> with conductor 21, that leads to ground 22<sup>b</sup>. Thus when contacts 133 134 are in engagement the circuit will be from 22<sup>b</sup> through 22<sup>a</sup>, 21, 137<sup>a</sup>, 137, 135, 134, and 133 to the calling-line 66, whereupon current will be thrown on said line to operate the signaling instrument 80 at a selected station.

The restoring-line 67 at central is connected with a contact 138, adapted to make and break circuit with a contact 139, and the contact 139 is connected by a conductor 140 with conductor 117. 141 is a rocker-arm pivotally supported and adapted to actuate contact 138 to make and break circuit with contact 139, and 142 is a projection or the like carried by the wheel 120 and adapted to engage and rock arm 141.

The devices just described for controlling the station selecting and calling circuit are illustrated in diagram in Figs. 1 and 4 and are omitted from Figs. 2 and 3, and in Figs. 11 and 12 these devices are shown in structural form. In this case the shaft 122 is shown journaled in a suitable frame 143, the contacts 115 116 133 134 are shown mounted upon insulation 144, carried by said frame, and the contacts 138 139 are shown mounted upon insulation 145, also carried by said frame. The rocker-arms 132 and 135 are shown journaled upon a projection or stud 146, carried by said frame, and the rocker-arm 141 is shown carried by a projection or stud 147, also carried by said frame. The rocker-arm 132 in Fig. 12 is shown in line with the teeth of wheel 120, while the projection 136 is shown carried by said wheel at one side of and at a distance therefrom, so as to be in line with rocker-arm 135, pins 136<sup>a</sup> being shown connecting parts 120 and 136. (See Fig. 12.) The projection 142 is also shown carried by wheel 120, as by pins or the like 142<sup>a</sup>, but out of line with the wheel 120 and the projection 136, as shown in Fig. 12. The tooth 120<sup>b</sup> is much longer than the teeth 120<sup>a</sup> of wheel 120, and tooth 120<sup>b</sup> and projection 136 are shown located side by side; but said tooth extends beyond said projection, so that the rocker-arm 132 will remain in connection with said tooth after projection 136 has passed from under rocker-arm 135. Rocker-arm 141 and its projection 142 are in such position that the latter will operate the former after tooth 120<sup>b</sup> leaves rocker-arm 132. Conductor 117 is shown leading to the frame 143, and contact 118 is shown carried by and in electrical connection with wheel 120, so that the circuit will be from 117 through frame 143, shaft 122, wheel 120, and contact 118, part of the mechanism thus constituting part of the circuit for the restoring and calling lines. The teeth 120<sup>a</sup> 120<sup>b</sup> upon wheel 120 each correspond to a station on a party-line, there being as many such teeth as there are stations. The front plate or dial 148 of the frame 143 is provided with an annular series of holes 149 149<sup>a</sup> 149<sup>b</sup> to receive the plug 127, each of said holes corresponding to a station on the circuit, and said holes are in such position that when the plug 127 is placed therein it will come in line with the contact 119 or its insulation 119<sup>a</sup>. By this means when a station is to be selected and called the operator at central places the plug 127 in a hole corresponding to such station and turns handle 123 in the direction of the arrow Z in Fig. 11 until contact 119 engages said plug, whereupon said contact will be moved into engagement with contact 118 to close the circuit at that point for the battery. Now when wheel 120 moves toward the home point it will operate the rocker-arms 132, 135, and 141 at the proper times, and when said wheel reaches the home-point the stop 126 will engage the contact 119 or its insulation 119<sup>a</sup> and restore it to its nor-



mal position, thus breaking circuit at 118 119 and stopping wheel 120. By preference wheel 120 is moved to the home point by a gear-train 150, that is provided with a fan 151 to retard the movement of wheel 120. The spring 152 of said gear-train is connected with a post 153 of frame 143 and with shaft 122 in well-known manner, so that as wheel 120 is moved away from the home point said spring will be wound ready to return the wheel when handle 123 is released.

The manner of selecting and calling a station by means of the above-described devices is as follows: Assume that the first station on a party-line is to be selected and called, as B. The operator at central places plug 127 in the hole corresponding to said station, as 149<sup>a</sup>, and turns handle 123 in the direction of the arrow Z in Fig. 11, whereupon tooth 120<sup>b</sup> rides under arm 132, thus closing circuit at 115 116. Projection 136 likewise rides under arm 135, thus closing circuit at 133 134, and projection 142 rides under and past arm 141; but there will be no current on the restoring or operating lines at this moment. The continued movement of wheel 120 causes contact 119 or its insulation 119<sup>a</sup> to encounter plug 127, whereupon contact 119 will be moved into engagement with contact 118, and current will flow along the operating-circuit to station B as follows: from ground 22<sup>b</sup> at central through 22<sup>a</sup>, battery 22, 23, 131, 130, 129, 128, 119, 118, wheel 120, and through the mechanism to conductor 117, thence through contacts 116 115 to conductor 65, leading to station B, thence at B through 70 69 71 72, magnet 73, 74, and 28 to ground 29, circuit being maintained at 116 115 and 133 134. Magnet 73 now attracts armature 73<sup>a</sup>, which moves the roller 82 one step to close the circuit of the calling-line at 76 78. The signaling instrument 80 at B will now be operated over a circuit as follows: from ground 22<sup>b</sup> to 22<sup>a</sup> 21 137<sup>a</sup>, generator 137, 135, 134, and 133 to conductor 66, thence to 77 at B, through 76, 78, 79, 80, and 81 to ground 29. Handle 123 having been released and wheel 120 now returning to the home point, these circuits are maintained until projection 136 passes from rocker-arm 135, which breaks the calling-circuit at 133 134, and thereafter tooth 120<sup>b</sup> passes from rocker-arm 132, thus breaking the operating-circuit at 115 116, whereupon spring 97 will cause rod 91 to move roller 82 another step, thereby breaking the calling-circuit at 76 78 and the operating-circuit at 69 71, also breaking the restoring-circuit at 111 113 and closing the restoring-circuit at 107 108 through magnet 73 to ground 29, likewise joining two sections of line 65 at 68 75. Projection 142 next operates arm 141 to close the restoring-circuit at 138 139, whereupon a circuit for magnet 73 will be established as follows: from ground 22<sup>b</sup> at central through 22<sup>a</sup>, battery 22, 23, 131, 130, 129, 128, 119, 118, wheel 120, and the mechanism to conductor 117, thence through 140, 139, and 138 to conductor 67, thence to 107 at B, through

108 110 72, magnet 73, 74, and 28 to ground 29. Magnet 73 now attracts armature 73<sup>a</sup>, causing rod 91 to move roller 82 another step, thereupon breaking the circuit through magnet 73 at 107 108 and breaking circuit of line 65 at 68 75, and spring 97 next causes rod 91 to move roller 82 another step, thereupon restoring the roller 82 and the various circuits controlled thereby to their normal conditions. When wheel 120 arrives at the home point, contact 119 will be moved out of engagement with contact 118 by the stop 126, and projection 142 will remain under rocker-arm 141, whereupon the impulse-transmitting devices and circuits at central will be restored to their normal conditions. Had it been desired to call a station on a party-line beyond B—say the second station C—the operator at central would have placed the plug 127 in the aperture corresponding to the second station, as 149<sup>b</sup>. He would then turn handle 123, and during the movement of wheel 120 tooth 120<sup>b</sup> would pass under rocker-arm 132, and the first of the series of teeth 120<sup>a</sup> would also pass under said rocker-arm and come to rest against said arm, thus closing circuit 115 116. During this movement projection 136 passes under and away from rocker-arm 135 and projection 142 likewise passes under and away from rocker-arm 141. While the tooth 120<sup>a</sup> engages rocker-arm 132 the contact 119 encounters plug 127 and is thereupon moved into engagement with contact 118, thus closing the circuit of the operating-line at 118 119, and thereupon current flows to ground 29 over the operating-line, as before described, thus causing the roller 82 to move one step. As tooth 120<sup>a</sup> next passes from rocker-arm 132, the circuit will be broken at 115 116 and spring 97 will cause roller 82 to move another step, thereupon joining two sections of the party-line 65 together in the first station on the circuit at 68 75, likewise breaking the through-circuit of the restoring-line 67 and establishing a circuit for the first section thereof at 107 108 to ground 29. When tooth 120<sup>b</sup> passes under rocker-arm 132, circuit for the operating-line will be again closed at 115 116, whereupon current will flow to ground 29 at station C, (the one to be called,) passing through contacts 68 75 in the intermediate station, and thence to 70 and through 69 71 72, magnet 73 74, and 28 to ground 29 at C, whereupon roller 82 thereat will move one step and close the calling-circuit thereat through 76 78, &c., to ground 29. Projection 136 will now cause arm 132 to close the calling-circuit at 133 134, whereupon the signaling instrument at station C will be operated over the circuit before explained, the circuit, however, passing directly along line 66 past the intermediate station, as contacts 76 78 thereat are out of engagement. Projection 136 and tooth 120<sup>b</sup> next pass from rocker-arms 135 and 132, breaking the circuits, whereupon spring 97 will cause roller 82 to move another step to



establish a circuit to ground 29 at C for the second section of the restoring - line, and thereupon projection 142 will cause rocker-arm 141 to close circuit at 138 139. Roller 82 at B will now be moved to restore the circuits to their normal condition, thus closing circuit over restoring-line 67 at 111 113 in B to enable current to flow through magnet 73 to ground 29 at C, whereupon magnet 73 at C will cause roller 82 to move one step to break the circuit at 107 108 and reestablish circuit at 111 113. Thus it will be seen that when current is sent over restoring-line 67 the rollers 82 in the stations that have been operated will be returned successively to their normal positions.

From the foregoing it will be understood that wheel 120 has a tooth for every station on a circuit, that tooth 120<sup>b</sup> corresponds in action to the station to be called, and that this tooth is preferably longer than the teeth 120<sup>a</sup> to cause the calling-circuit at the desired station to be held closed while current is being transmitted over the calling-circuit. Thus for every station on a circuit between central and the station to be called a tooth 120<sup>a</sup> passes under rocker-arm 132, and thereby as wheel 120 returns to the home point an impulse will be sent over the operating-line to cause the proper connections to be made in each intermediate station or stations to establish a through-line out of the sections of the operating-line 65 to ground at the station desired. Therefore the operator at central by placing a plug 127 in the aperture corresponding to the station desired and turning handle 123 until it comes to rest sets the subscriber selecting and signaling devices in operative condition, and as wheel 120 returns to the home point automatically the desired station will be selected and signaled to and the circuits and devices restored to their normal conditions without signaling in any station between or beyond central and the station called. These subscriber selecting and signaling devices have been described with reference to a single party-line, and one set of such devices may be used for selecting and signaling the subscribers on a number of party-lines. The arrangement I have shown for enabling the operator at central to switch these devices into circuit with any desired party-line of a number of such lines are shown in Fig. 4 and are as follows: The sections of line 65 that lead from central on the various party-lines each start from a contact 65<sup>a</sup>, and 65<sup>b</sup> is a contact adapted to be brought into electrical connection with either contact 65<sup>a</sup> by a contact 65<sup>c</sup>, carried by and insulated from an arm 156. From contact 65<sup>b</sup> a conductor 65<sup>d</sup> extends to contact 115, so that when contact 65<sup>c</sup> engages contacts 65<sup>a</sup> and 65<sup>b</sup> the circuit will be from 117 through 116 115, (when they are in engagement,) 65<sup>d</sup>, 65<sup>b</sup>, 65<sup>c</sup>, and 65<sup>a</sup> to the corresponding section of line 65. The calling-line 66 for each party-line connects at central with a contact 66<sup>a</sup>, that

is adapted to be engaged by a contact 66<sup>b</sup>, carried by and in electrical engagement with arm 156, and from arm 156 a conductor 66<sup>c</sup> leads to contact 133, so that when contact 66<sup>b</sup> is in engagement with a contact 66<sup>a</sup> and contacts 133 134 are also in engagement the circuit will be from ground 22<sup>b</sup> through 137<sup>a</sup>, generator 137, 135, 134, 133, 66<sup>c</sup>, 156, 66<sup>b</sup>, and 66<sup>a</sup> to the conductor 66 of the party-line of the station to be called. At central the section of each restoring-line 67 leads to a contact 67<sup>a</sup>, that is adapted to be engaged by a contact 67<sup>b</sup>, carried by and insulated from arm 156, and contact 67<sup>b</sup> is adapted to engage a contact 67<sup>c</sup>, that is connected by a conductor 67<sup>d</sup> with contact 138, so that when contacts 67<sup>a</sup>, 67<sup>b</sup>, and 67<sup>c</sup> and contacts 138 and 139 are in connection the restoring-circuit will be from 117, through 140, 139, 138, 67<sup>d</sup>, 67<sup>c</sup>, 67<sup>b</sup>, and 67<sup>a</sup>, to the corresponding section of the restoring-line 67. Now if a subscriber is to be called on the party-line having stations B and C the operator at central turns arm 156 to bring contacts 65<sup>a</sup> 65<sup>b</sup> 65<sup>c</sup> and 66<sup>a</sup> 66<sup>b</sup> and contacts 67<sup>a</sup>, 67<sup>b</sup>, and 67<sup>c</sup>, respectively, that belong to that party-line, into electrical engagement. Likewise if a subscriber on a different party-line is to be called the operator at central will move the arm 156 to bring the corresponding sets of contacts into electrical engagement for that party-line. By this means the devices at central for selecting and signaling to a subscriber are thrown into circuit with the corresponding conductors of the required party-line. The arm 156 and the corresponding contacts connected with the party-lines and interposed in Fig. 4 between the transmitting device and the lines 65, 66, and 67 are shown in Fig. 1 to enable the operator at central to switch the transmitting device onto any desired party-line.

The complete operation of a central-office party-line system installed in accordance with my invention may be summarized as follows, and I will describe the same more particularly in connection with Fig. 4: First, suppose that the subscriber at B on one party-line desires to call the subscriber at B' on another party-line. It will be assumed that the arm 7 at central belonging to the party-line of station B is at rest in connection with contacts 1<sup>a</sup> 2<sup>a</sup> of conductors 1 2, as shown in Fig. 1, and that the arm 7 at central of the party-line of station B' is at rest in connection with contacts 3<sup>a</sup> 4<sup>a</sup> of conductors 3 4 of that party-line, as in Fig. 4, and that the plugs 49 are not yet connecting the said pairs of conductors. The subscriber at station B now removes his receiver 30 from its hook 31, whereupon his arm 7 travels, and when it reaches contact 2<sup>b</sup> circuit will be established to ground 22<sup>b</sup>, through battery 22 at central, from ground 29 at B for magnet 14 at B and indicating instrument 34 at central. Drop 34<sup>a</sup> now operates, and magnet 14 at B causes detent 11 to stop the arm 7 in connection with contact 2<sup>b</sup>. The operator at central now responds by



pressing key 19, thereupon closing circuit at 39 40 41, at 44 45, also restoring the drop 34<sup>a</sup> and breaking circuit at 17 18 20. The subscriber now tells the operator at central the number of the subscriber he desires, whereupon the operator at central releases key 19 and swings arm 156 so as to connect his subscriber selecting and signaling devices with the party-line of the station desired B'. The operator thereupon places a plug 127 in the aperture 149, &c., corresponding to the desired station and turns handle 123 until it comes to rest, thereupon releasing the same. Wheel 120 now returns to the home point, thereupon establishing circuit over the party-line 65 to the desired station, producing a call thereat over line 66 and restoring said circuits and their devices to their normal condition over line 67, as before described. The operator at central may then raise arm 7 of the selecting devices belonging to the circuit of station B to enable it to select and make connection with an idle party-line of said circuit, whereupon it will come to rest in the position shown in Fig. 4 in connection with contacts 3 4. The subscriber at B' hearing the call removes his receiver 30 from its hook 31, whereupon his arm 7 will travel down and will disregard the idle conductors 1 2 of its circuit and will establish connection to central over conductor 3, with which the corresponding arm 7 at central is now in connection, as before explained. The operator at central by observing which pair of conductors of the party-line had been selected by the corresponding arms 7 next connects such conductors by the jacks 48, plugs 49, and wires 50 51, whereupon conductors 1 2 of the party-line of station B and conductors 3 4 of the party-line of station B' will be joined in a closed metallic circuit, as shown in Fig. 4, which circuit may be described as follows: from arm 7 at station B, through 27<sup>a</sup>, 24<sup>a</sup>, 36<sup>a</sup>, 30<sup>a</sup>, receiver 30, 16<sup>a</sup>, 6, 1<sup>b</sup>, 1<sup>c</sup>, and conductor 1 to contact 48<sup>a</sup> of jack 48 at the central office, thence by wire 50 to contact 49<sup>a</sup> of the next plug 49, thence to contact 48<sup>c</sup> of the jack 48 of conductors 3 4 of the party-line of station B', thence through conductor 3 to 3<sup>c</sup> at B', thence through 3<sup>b</sup>, 6, 16<sup>a</sup>, 30, 30<sup>a</sup>, 36<sup>a</sup>, 24<sup>a</sup>, 27<sup>a</sup>, 7, 4<sup>b</sup>, and 4<sup>c</sup> to conductor 4, thence to contact 48<sup>d</sup> of jack 48 and contact 49<sup>b</sup> of plug 49 at central, through wire 51 to contact 49<sup>b</sup> of the plug 49 and contact 48<sup>b</sup> of jack 48 of the party-line of station B, thence through conductor 2 of that party-line to 2<sup>c</sup> at B, and through 2<sup>b</sup> to arm 7 again. Closed metallic circuit is thus established through the telephones at the calling and the called stations. The operator at central may determine that said subscribers are in communication by pressing key 55, thereby closing circuit at 52 53 54 and at 59 60 61 through the receiver 37 and wires 50 51, thereby establishing a circuit for his receiver with the circuit of the subscribers, and he thereafter releases key 55. The operator at central may then return the arm 7 of the party-line of sta-

tion B' to its normal position, whereupon when it descends it will select the first pair of idle conductors, as 1 2, and remain in connection with them, as shown in Fig. 4. When the subscribers have finished talking, they hang their receivers 30 upon their respective hooks, whereupon the corresponding arms 7 are restored to their normal positions to break the circuit with the conductors that have been in use by them. It will be understood that if another subscriber on the same party-line attempted to call central he could not find a circuit over conductors of the party-lines that were connected by the jacks and plugs, as shown in Fig. 4, for the reason that when his arm 7 reached the contacts connected with such conductors it could not find a circuit to ground at central for its magnet 14, and it would thereby pass onto the first idle conductor in its path. It will be understood that grounded circuits may be utilized instead of closed metallic circuits for the telephones.

While I have described a telephone system having party-lines, it will be understood that the party-lines can be connected at central with the ordinary telephone-circuits in well-known manner.

I do not limit my invention to the precise details of construction shown and described, as they may be varied without departing from the spirit thereof.

A clearing-out signal at central may be provided as follows: A high-retarding target 175 and battery 176 are bridged across the plug-cord strands 50 51 by means of conductors 177 178, which are shown connected to wires 57 and 62, respectively. When a plug is in a line-jack at central and a receiver at a station is in circuit with the corresponding line, the target is operated to display a signal, and as soon as said receiver is hung upon its hook the target 175 is deenergized, thereby giving a clearing-out signal. When two subscribers are in communication, as in Fig. 4, the target will show that the line is in use until both receivers are placed upon their respective hooks.

Having now described my invention, what I claim is—

1. A telephone system comprising a central office, a plurality of conductors leading therefrom, a movable arm or contact at central to make connection therewith, devices having a magnet to check said arm, a circuit for said magnet having contacts that are closed when said arm is at the starting-point and adapted to be broken to cause the devices to operate to check the arm, an indicating instrument at central, a circuit therefor connected with said arm and adapted to be established over said conductor when said devices operate to check the arm, whereby said indicating instrument will be placed in circuit with the conductor selected by said arm.

2. A telephone system comprising a plurality of conductors, a movable arm or contact to make connection therewith, devices hav-



ing a magnet to check said arm, a circuit for said magnet having contacts that are closed when said arm is at the starting-point and adapted to be broken when the devices operate to check the arm, an indicating instrument, a circuit therefor connected with said arm adapted to be established over said conductor when said devices operate to check the arm, another movable arm or contact, and electrically-operating devices therefor having a magnet, the circuit for said magnet having contacts adapted to be broken when said arm makes connection with the conductor that has been selected by the first-mentioned arm.

3. A telephone system comprising a plurality of conductors, a movable contact or arm to make connection therewith, devices having a magnet to check said arm, a circuit for said magnet having contacts that are closed when said arm is at the starting-point and adapted to be broken when the devices operate to check the arm, an indicating instrument, a circuit therefor connected with said arm, normally broken, and adapted to be closed when said devices operate to check the arm whereby said indicating instrument will be placed in circuit with the conductor selected by said arm, and other electrically-operating devices adapted to check said arm and having a magnet, a circuit for said magnet having contacts adapted to be broken when said arm makes connection with the conductor that has been selected by the first-mentioned arm, and telephone instruments having a normally open circuit provided with contacts adapted to be closed when the last-mentioned contacts are separated.

4. A telephone system comprising a plurality of conductors, contacts connected therewith, a movable arm to connect with contacts, a magnet, a circuit for said magnet leading to said arm, a detent to control said arm and adapted to be operated by said magnet, contacts in said circuit to be controlled by said magnet, and means for establishing circuit through certain of said conductors whereby when said arm reaches a conductor that is in use circuit through said magnet will be maintained and when said arm reaches an idle conductor circuit through the magnet will be broken and the detent caused to hold said arm in connection with said conductor.

5. In a telephone system the combination of a plurality of conductors, contacts connected with said conductors, an arm adapted to engage said contacts, a magnet, a circuit connecting said magnet with said arm, contacts in said circuit, a detent, an armature for said magnet adapted to operate said detent, an arm to be operated by said armature to make and break said contacts, and a spring to coact with said arm, whereby when the first-mentioned arm reaches a contact of an idle conductor-circuit through said magnet will be

broken and the arm will be stopped in connection with said conductor.

6. In a telephone system the combination of a plurality of conductors, contacts connected with said conductors, an arm adapted to engage said contacts, a magnet, a circuit connecting said magnet with said arm, contacts in said circuit, a detent, an armature for said magnet adapted to operate said detent, an arm to be operated by said armature to make and break said contacts, a spring to coact with said arm, and means for establishing a circuit through certain of said conductors, whereby when said circuit is so established and the arm reaches a conductor that is in use said magnet will be energized to permit said arm to find a conductor that is idle, and whereby when said arm finds such idle conductor circuit will be broken through said magnet to cause the detent to stop the arm in connection with such conductor.

7. In a telephone system the combination of a plurality of conductors, a contact for each conductor, an arm adapted to connect with the contacts, a magnet, a circuit connecting said arm with said magnet and having contacts, devices to be operated by said magnet adapted to check said arm and break the circuit through the magnet, an indicating instrument, a circuit for the same leading to said arm and having contacts adapted to be operated by the devices that check the arm, means for causing the circuit through the magnet to be established when the arm reaches a conductor that is in use, and means for selecting the conductor that is connected with said arm.

8. In a telephone system a plurality of conductors and means for selecting and maintaining connection with an idle conductor, in combination with an arm at a subscriber's station, a magnet, a circuit for the magnet leading to said arm, and devices adapted to be operated by said magnet to break its circuit and check said arm in connection with a selected conductor.

9. In a telephone system a plurality of conductors and means for selecting and maintaining connection with an idle conductor, in combination with an arm at a subscriber's station, a magnet, a circuit for said magnet leading to said arm and having contacts, devices to be operated by said magnet to break the circuit of said magnet and check said arm in connection with a selected conductor, a telephone instrument, and a normally open circuit for said instrument adapted to be closed through said arm when said devices are operated by said magnet.

10. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors, an indicating instrument at central, devices at central to select an idle conductor and establish a circuit for the same through the indicating in-



strument, and automatic devices at the subscribers' stations for selecting the conductor that has been selected at central to establish and maintain a circuit between the subscriber and said indicating instrument.

11. A telephone system comprising a central office having a telephone, a party-line leading therefrom having a plurality of conductors arranged in pairs, means at central for selecting and maintaining connection with a conductor of any pair, means at central for connecting its telephone instrument with the selected pair of conductors, and automatic means at subscribers' stations for selecting the selected pair of conductors, producing a call at central and joining them in a closed metallic circuit in two stations.

12. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors arranged in pairs, an indicating instrument and electrically-operating devices at central to select an idle conductor of any pair and establish a circuit between the same and the indicating instrument, and electrically-operating devices at subscribers' stations to select the conductor that has been selected at central and establish a circuit through the indicating instrument at central to thereupon operate the same.

13. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors arranged in pairs, an indicating instrument and telephone instruments at central, electrically-operating devices at central to select a pair of said conductors and establish a circuit for the indicating instrument through a conductor of the pair, means at central for connecting the telephone instrument with the selected pair of conductors, and electrically-operating devices at subscribers' stations to select the pair of conductors that has been selected at central, establish a circuit over one of said conductors to the indicating instrument at central, operate the same, and establish a closed metallic circuit over the selected pair of conductors between the telephone instruments at central and at the station.

14. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors arranged in pairs, an indicating instrument and telephone instruments at central, electrically-operating devices at central to select a pair of said conductors and establish a circuit for the indicating instrument through a conductor of the pair, means at central for connecting the telephone instrument with the selected pair of conductors, and electrically-operating devices at subscribers' stations to select the pair of conductors that has been selected at central, establish a circuit over one of said conductors to the indicating instrument at central, operate the same, and establish a closed metallic circuit over the selected pair

of conductors between the telephone instruments in two stations.

15. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors arranged in pairs, an indicating instrument and telephone instruments at central, electrically-operating devices at central to select a pair of said conductors and establish a circuit for the indicating instrument through a conductor of the pair, means at central for connecting the telephone instrument with the selected pair of conductors, and electrically-operating devices at subscribers' stations to select the pair of conductors that has been selected at central, establish a circuit over one of said conductors to the indicating instrument at central, operate the same, and establish a closed metallic circuit over the selected pair of conductors between the telephone instruments at central and at the station, and between the telephone instruments in two subscribers' stations.

16. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors, an indicating instrument at central and electrically-operating devices to select an idle conductor and connect the indicating instrument therewith, telephones and electrically-operating devices at the subscribers' stations to select the conductor that has been selected by central, establish a circuit over the same and operate the indicating instrument at central, and establish a closed metallic circuit through two telephones over the pair of conductors that have been selected at central.

17. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors, a movable arm or contact at central adapted to make connection with conductors, a magnet, a normally open circuit for said magnet leading to said movable arm or contact, devices to be operated by said magnet to cause the movable arm or contact to select and maintain connection with an idle conductor and to break the circuit of said magnet, and electrically-operating devices in the subscribers' stations to select and establish connection with the conductor that has been selected at central.

18. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors, a movable arm or contact at central adapted to make connection with conductors, an indicating instrument at central, a circuit therefor, a magnet, a normally open circuit for said magnet leading to said movable arm or contact, devices to be operated by said magnet to cause the movable arm or contact to select and maintain connection with an idle conductor, to break the circuit of said magnet and establish the circuit of the indicating instrument with the selected conductor, and electrically-oper-



ating devices in the subscribers' stations to select and establish connection with the conductor that has been selected at central to thereby operate the indicating instrument at central.

19. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors, a movable arm or contact at central adapted to make connection with the conductors, an indicating instrument at central, a circuit therefor, a magnet, a normally open circuit for said magnet leading to said movable arm or contact, devices to be operated by said magnet to cause the movable arm or contact to select and maintain connection with an idle conductor, break the circuit of said magnet, and establish a circuit of the indicating instrument with the selected conductor, and electrically-operating devices in the subscribers' stations to select and establish connection with the conductor that has been selected at central to thereby operate the indicating instrument at central, and telephones at the subscribers' stations to be placed in circuit with the selected conductor by the electrically-operating devices thereat.

20. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors, contacts connected with said conductors and arranged in pairs, a contact 6 for engagement with certain of said contacts at central, a movable arm or contact at central to establish connection with certain contacts and to cause the corresponding contact of a pair to engage contact 6, a magnet, a circuit for said magnet having normally closed contacts and connected with said arm, devices to be operated by said magnet to stop said arm in connection with a contact and break the circuit of the magnet, a telephone instrument at central having a normally open circuit extending from said arm to the contact 6, means to close said circuit, and electrically-operating devices at subscribers' stations to select the conductor that has been selected at central and establish a closed metallic circuit through the corresponding telephone instrument.

21. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors, contacts connected with said conductors and arranged in pairs, a contact 6 for engaging with certain of said contacts at central, a movable arm or contact at central to establish connection with certain contacts and to cause the corresponding contact of a pair to engage contact 6, a magnet, a circuit for said magnet having normally closed contacts and connected with said arm, an indicating instrument at central, a circuit for the same leading from said arm and having normally open contacts, devices to be operated by said magnet to stop said arm in connection with a contact, break the circuit of the magnet, and establish the

circuit of the indicating instrument, a telephone instrument at central having a normally open circuit extending from said arm and contact 6, means to close said circuit and electrically-operating devices at subscribers' stations to select the conductor that has been selected at central, operate the indicating instrument thereat, and establish a closed metallic circuit through the corresponding telephone instrument.

22. A telephone system comprising a central office, a plurality of party-lines leading therefrom, each party-line having a plurality of conductors, means at the central office to connect an idle conductor with an indicating instrument, electrically-operating devices at subscribers' stations to select and maintain connection with the conductor that has been connected with the indicating instrument at central, and means at central for connecting the conductors of two selected party-lines.

23. A telephone system comprising a central office, a plurality of party-lines leading therefrom each party-line having a plurality of conductors, electrically-operating devices for each party-line adapted to select and maintain connection with a conductor thereof, electrically-operating devices at subscribers' stations to select and maintain connection with the conductor that has been connected with the indicating instrument at central, and means at central for connecting the conductors of two selected party-lines.

24. A telephone system comprising a central office, a plurality of party-lines leading therefrom each party-line having a plurality of conductors, an indicating instrument for each party-line at central, electrically-operating devices at central to select an idle conductor and establish a circuit for the same through the corresponding indicating instrument, means at central for connecting the selected conductors of two party-lines, and electrically-operating devices at subscribers' stations for selecting and establishing a circuit with the conductor of the same party-line that has been selected at central.

25. A telephone system comprising a central office, a plurality of party-lines leading therefrom each party-line having a plurality of conductors, an indicating instrument for each party-line at central, electrically-operating devices at central to select an idle conductor and establish a circuit for the same through the corresponding indicating instrument, means at central for connecting the selected conductors of two party-lines, and electrically-operating devices at subscribers' stations for selecting and establishing a circuit with the conductor of the same party-line that has been selected at central, and means at central for connecting the telephone thereat with the conductors of party-lines that have been connected together at central.

26. A telephone system comprising a central office, a plurality of party-lines leading



therefrom each party-line having a plurality of conductors, electrically-operating devices for each party-line adapted to select and maintain connection with an idle conductor of the corresponding party-line, a telephone instrument at central, means for establishing a circuit between the telephone instrument and the selected conductor of any party-line, and means at the subscribers' stations for selecting and establishing connection with the conductor of the corresponding party-line that has been selected at central.

27. A telephone system comprising a central office, a plurality of party-lines leading therefrom each party-line having a plurality of conductors, electrically-operating devices for each party-line adapted to select and maintain connection with an idle conductor of the corresponding party-line, means at central for connecting the selecting-conductors of two party-lines, a telephone instrument at central, means for establishing a circuit between the telephone instrument and the selected conductor of any party-line, and means also at central for establishing a circuit between said telephone and the two party-lines that have been connected at central, and means at the subscribers' stations for selecting and establishing connection with the conductor of the corresponding party-line that has been selected at central.

28. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors, electrically-operating devices having a movable arm or contact to select and establish connection with an idle conductor, and a normally open temporary circuit for said devices adapted to be closed during the initial movement of said arm to cause said devices to permit said arm to seek an idle conductor and to be broken upon said arm reaching said idle conductor to allow said devices to hold said arm in connection with such idle conductor.

29. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors, a movable arm or contact to select and maintain connection with an idle conductor, a magnet, electrically-operating devices controlled by said magnet to permit said arm to travel while said magnet is energized, a temporary normally open circuit for said magnet adapted to be closed during the movement of said arm and to be maintained over a conductor that is in use and to be broken upon said arm reaching an idle conductor.

30. A telephone system comprising a central office, a party-line leading therefrom having a plurality of conductors, contacts connected with said conductors, a contact 6 for connection with certain of said conductors, a

contact *a* to connect with the contact 6, a movable arm, a magnet, a circuit for the same adapted to be established through said arm and through the contacts 6 and *a*, electrically-operating devices controlled by said magnet to check said arm, said arm being arranged to close said circuit upon reaching the contact *a* to cause said magnet and devices to permit said arm to select an idle conductor whereupon said circuit will be broken to cause said arm to maintain connection with such idle conductor.

31. The combination of a conductor, a contact connected therewith, a movable arm to establish circuit through said contact having teeth connected therewith, a detent to engage said teeth, an armature to operate said detent, a magnet and a circuit therefor having contacts, means to control said contacts by the action of said armature, one of said teeth being arranged to hold the armature to the magnet to keep the circuit of the magnet closed whereby when said arm breaks the circuit of the magnet the movement of the armature will break the circuit through said contacts.

32. The combination of a movable arm, teeth connected therewith, a detent to engage said teeth, an armature to operate said detent, a magnet, a circuit for said magnet having contacts normally closed, and means for establishing said circuit by the movement of said arm whereby when the magnet attracts the armature the detent will check the movement of the arm and break the circuit of said magnet through said contacts.

33. In a telephone system a central office and a party-line leading therefrom, means at central for selecting and maintaining connection with an idle conductor of the party-line, and automatic means at subscribers' stations for selecting the same conductor, combined with a calling-circuit leading from central to the subscribers' stations and having electrically-operating devices to select and signal to the station desired.

34. A telephone system comprising a central office, a plurality of party-lines leading therefrom each party-line having a plurality of conductors, said conductors leading to normally open contacts, and devices at central adapted to electrically connect the contacts of the conductors of the different party-lines to close the circuit of the corresponding conductors and automatic devices at substations to select an idle conductor of the corresponding party-line.

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Witnesses:

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