

No. 768,272.

PATENTED AUG. 23, 1904.

T. C. DRAKE.
PARTY LINE TELEPHONE SYSTEM.

APPLICATION FILED NOV. 9, 1903.

NO MODEL.

2 SHEETS—SHEET 1.

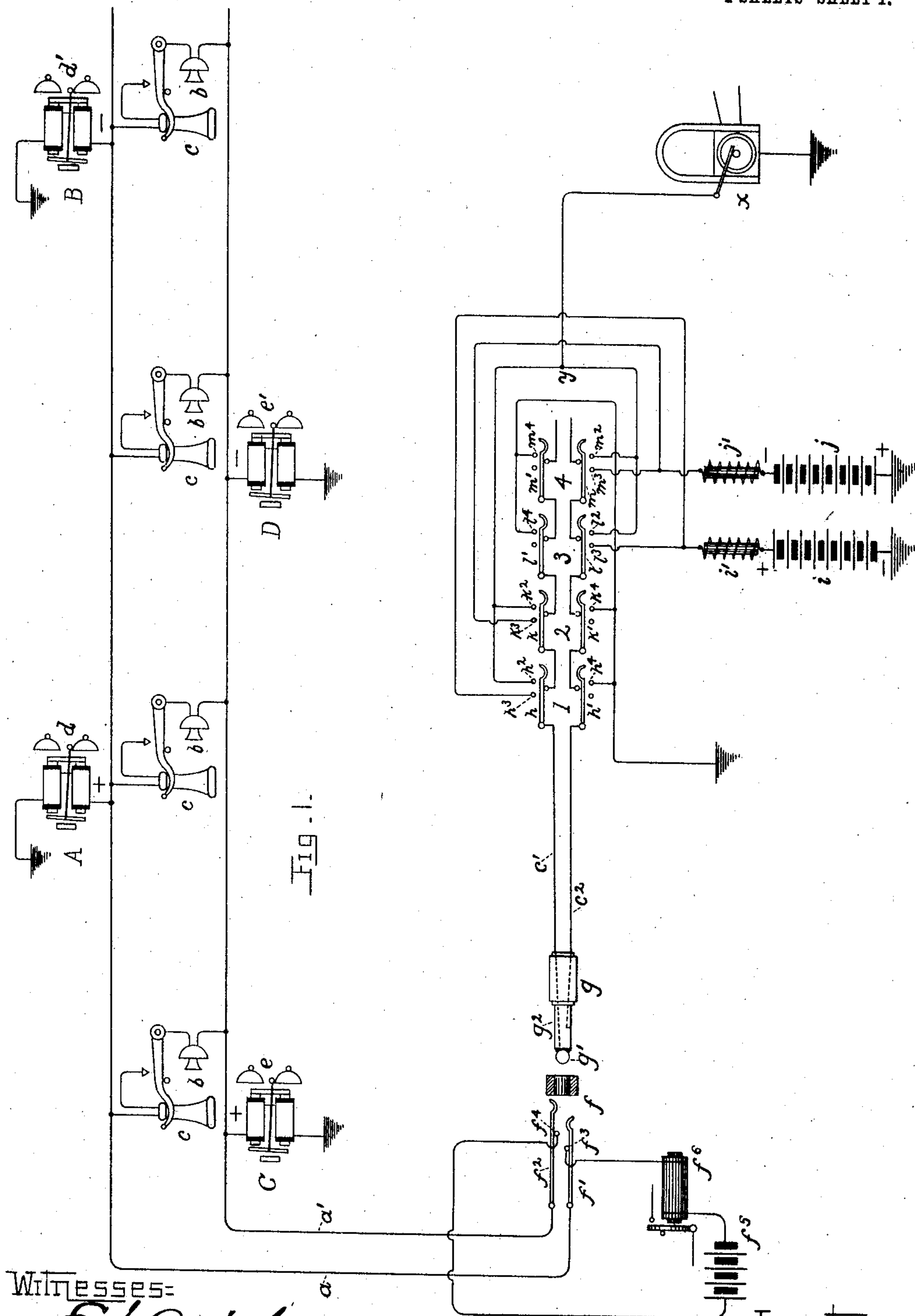


Fig. 1.

Witnesses:

E. J. Carriek.
A. Hurbin

INVENTOR:

Thomas C. Drake.

No. 768,272.

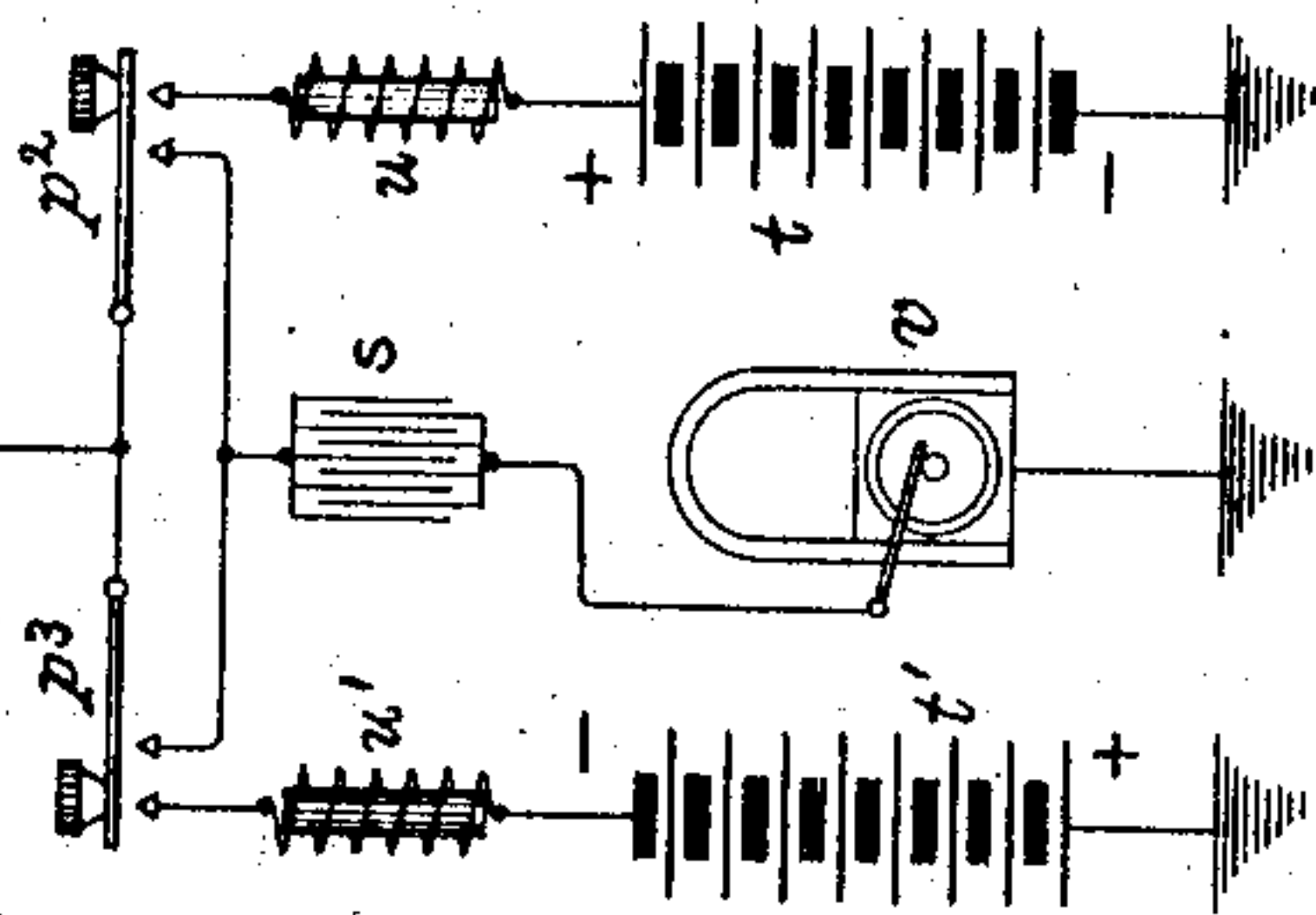
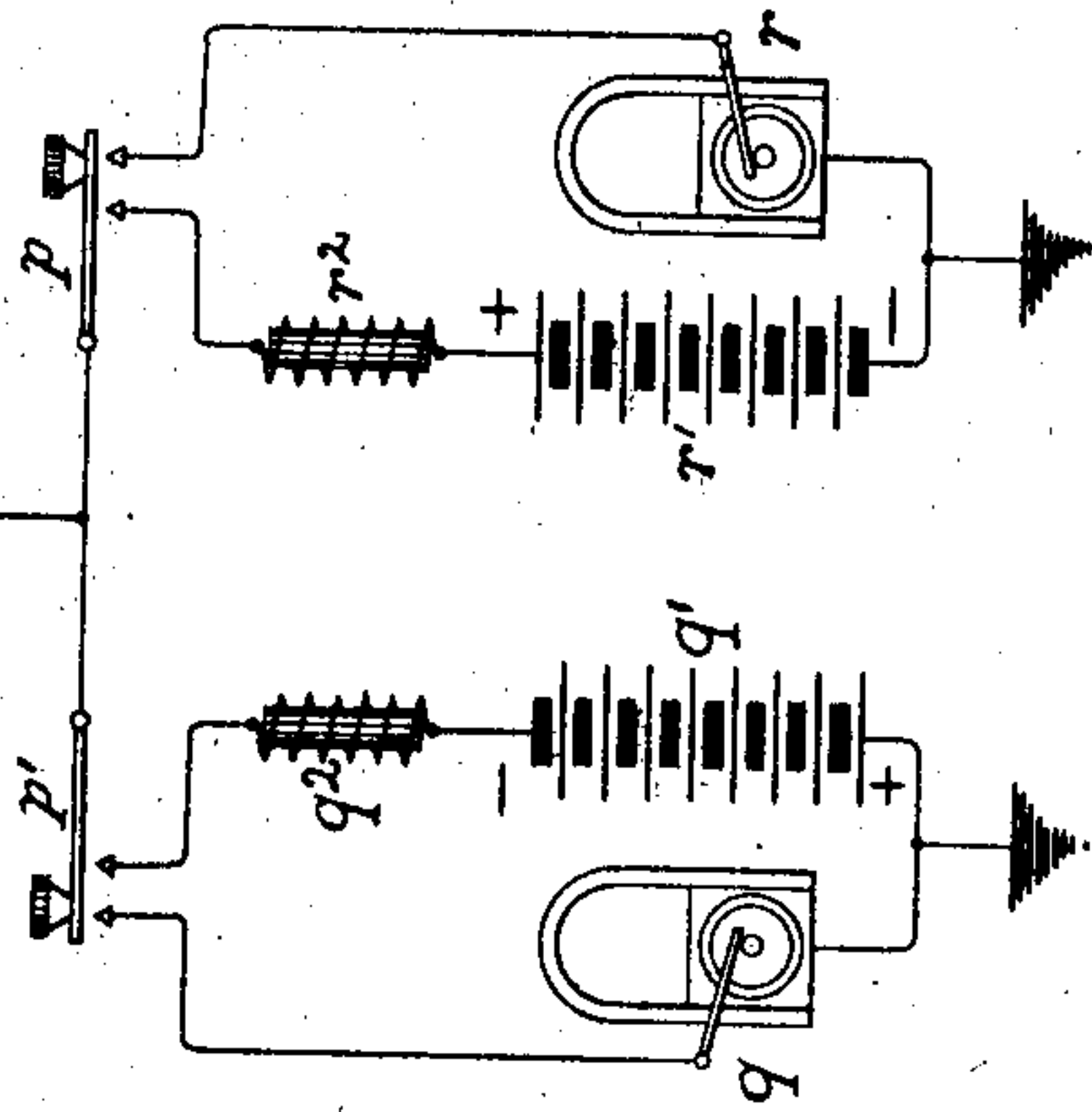
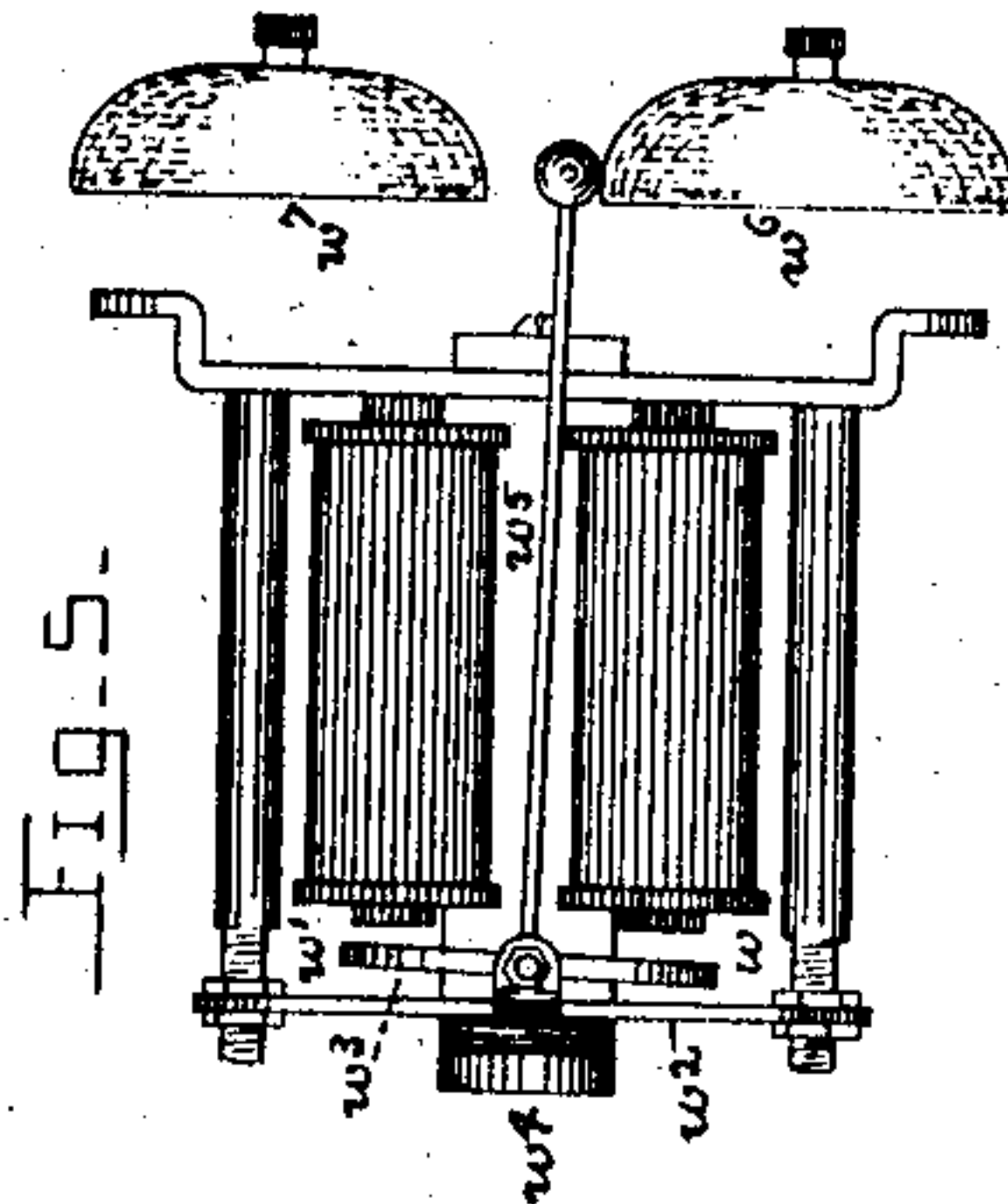
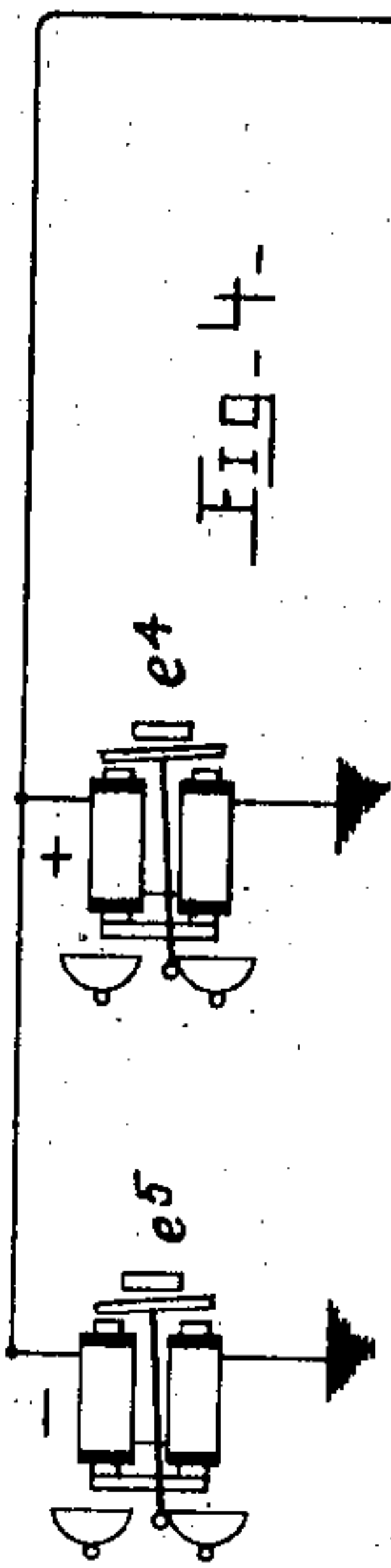
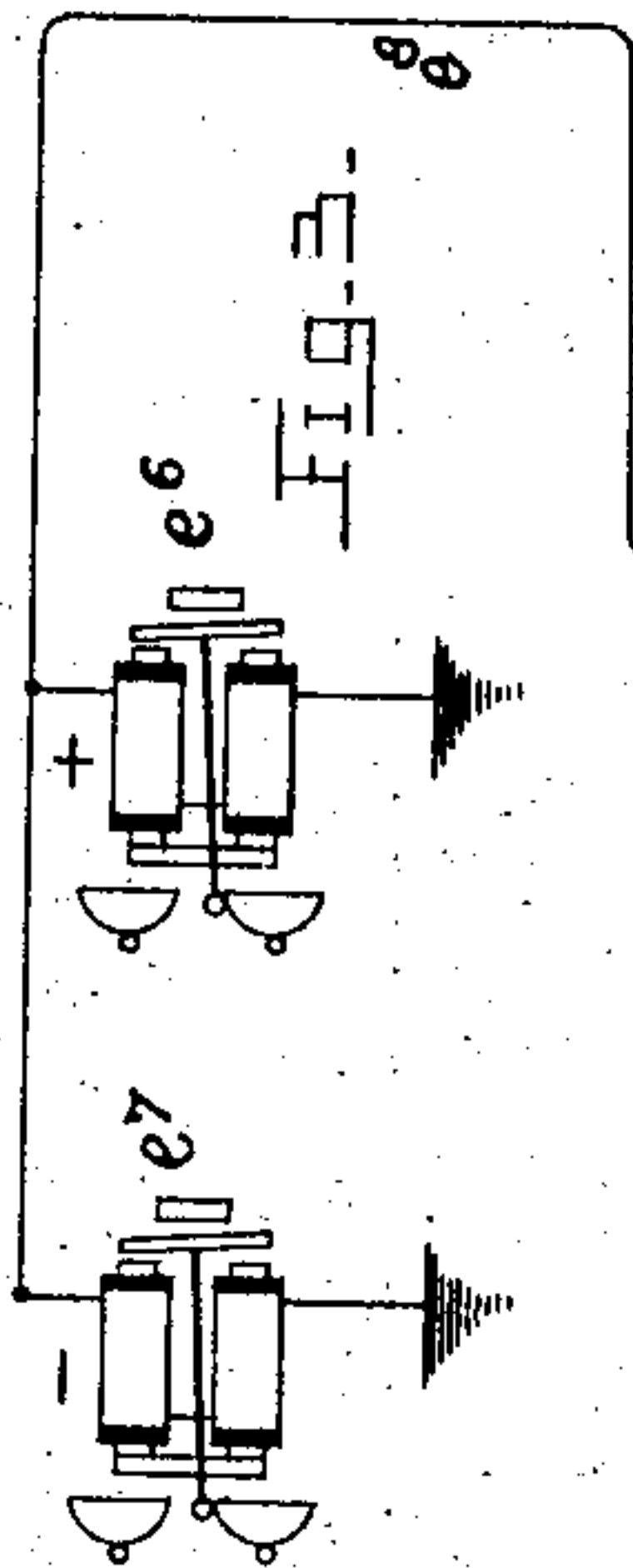
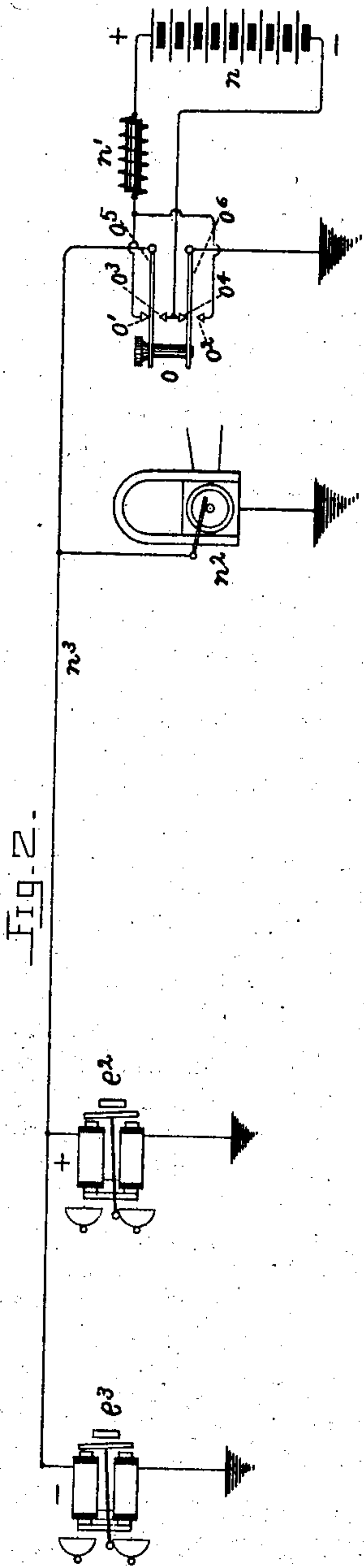
PATENTED AUG. 23, 1904.

T. C. DRAKE.
PARTY LINE TELEPHONE SYSTEM.

APPLICATION FILED NOV. 9, 1903.

NO MODEL.

2 SHEETS—SHEET 2.



Witnesses:

E. J. Curick
A. Hurbin

Inventor:

Thomas C. Drake.

UNITED STATES PATENT OFFICE.

THOMAS C. DRAKE, OF MALTA, OHIO.

PARTY-LINE TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 768,272, dated August 23, 1904.

Application filed November 9, 1903. Serial No. 180,476. (No model.)

To all whom it may concern:

Be it known that I, THOMAS C. DRAKE, a citizen of the United States, residing at Malta, in the county of Morgan and State of Ohio, have invented certain new and useful Improvements in Party-Line Telephone Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to party-line telephone systems with selective or non-interfering bells.

The object of my invention is to provide an improved method of selectively ringing biased polarized call-bells in party-line telephone systems.

In the prior art it has been proposed to connect two oppositely-biased polarized bells on either side of a metallic circuit and ring over the different circuits formed by using the ground as a return-circuit for both sides of the line. The bells or ringers have been biased by means of a light spring acting upon the pivoted armature to retain the armature normally in a position toward which it would be attracted by a current in a direction not intended to operate the bell. With two ringers thus oppositely biased and connected from one limb of the line in their operative condition a pulsating "plus" or "minus" current has been sent over the limb of the line to selectively operate the ringer adapted to respond to the current sent out in a predetermined direction, the other ringer being unresponsive, for the reason that the current operating one will assist the light spring in retaining the bias of the other. In systems of this character the biasing-spring of the ringer has been depended upon entirely for the return or retracting stroke of the polarized armature after having been actuated against the bias by a pulsation of the proper polarity, and careful and exact adjustment of the armature and spring with reference to the energizing pulsating current has been required in order to obtain satisfactory operation of the ringer. If the pulsations vary in strength by reason of a change in speed of the generator or from change in resistance of the line, the bells re-

quire an adjustment to conform to the varying condition in order to operate perfectly.

One object of my invention is to obviate this deficiency and make it possible to operate a biased bell under greatly varying conditions as regards speed or frequency of the ringing-machine and the resistance of the line-circuit.

My invention contemplates giving the polarized armatures of the ringers a certain amount of bias either by gravity or by a spring, magnet, or other means; but I do not depend upon the bias entirely for the return or retracting stroke or movement of the armature after having been actuated in opposition or against the biasing force by a pulsation or alternation of the required strength and polarity. My invention contemplates employing an alternation or half-wave of a definite strength and polarity to assist the biasing force in actuating the polarized armature in the direction of its normal bias or trend. In practice I prefer to arrange suitable ringing apparatus in such a manner as to obtain an alternation or half-wave for assisting the bell's biasing force in the retracting stroke of the armature of approximately one-third the electromotive force of the alternation or half-wave employed to actuate the armature in opposition to the biasing force.

Throughout the specification and claims I will refer to the alternations or half-waves which are intended to actuate the polarized armature against the biasing force as the "heavy" or "major" alternations or half-waves and to the alternations or half-waves which are intended to assist the biasing force in the retracting stroke of the armature as the "light" or "minor" alternations or half-waves.

By means of my present invention I am enabled to operate polarized bells entirely satisfactory by mounting the same in such a manner that the weight of the tapper-wire and ball only are depended upon for the biasing force of the armature, and as the usual spring is obviated the ringer is much more sensitive and will therefore operate through greater resistance.

In practice I prefer to mount the bell so

that the same is biased by the weight of its own moving element; but I do not limit my invention to bells mounted in this manner, as any polarized bell properly biased with a spring or other means will operate satisfactory.

Another object of my invention is to obviate the trouble incident to operating biased bells with pulsating current over long lines and underground cables, as the inductance and static capacity of such lines discharge current through the biased bells in the wrong direction at the instant of interrupting the generator-circuit to produce the pulsating current. By operating the biased bells in the manner herein set forth the circuit through the ringing apparatus is not interrupted, as is the case with a pulsating-current generator. Therefore the discharge due to static capacity and inductance finds path through low resistance at the ringing apparatus instead of through the biased bells at the subscribers' stations.

An important feature of my invention relates to the amount of resistance practical to place in each bell-circuit. According to my invention the ringers or the circuits including the ringers may be as high as fifty thousand ohms; but in practice the resistance is preferably less, for the reason that fifteen thousand to twenty thousand ohms has been found sufficient for all conditions under which the system may be required to operate at the present time. This is accomplished when obviating the usual type of biased ringer in which pulsating current is counteracted by a spring. This comparatively high resistance gives to my system several important features which are not present in party-line systems in use before my invention—namely, the constant loss of current through the ringers when working the system on common battery-circuits is reduced to a minimum, the margin in line resistance between the talking and signaling condition of the system is sufficient for properly operating the line-relays and cord-circuit relays in common battery systems, and the "kick" due to self-induction and static capacity of the switchboard apparatus will not interfere with the biased bells not being signaled.

In so far as connecting the ringers with the line-circuit is concerned my invention does not contemplate a method different from systems in common use at the present time; but instead of employing the usual plus and minus pulsating current to selectively operate the bells I employ an alternating current, as before stated.

In practice I employ an alternating current with approximately ninety volts potential in one alternation or half-wave and approximately thirty volts potential in the alternation or half-wave of opposite sign. I prefer to produce the desired alternating cur-

rent by connecting a source of steady current, such as a battery in multiple or a derived circuit, with an alternating generator of the usual type for ringing telephone-bells. The source of steady current is employed to suitably counteract the positive alternation or half-wave from the alternating generator for ringing a bell biased in one direction and to suitably counteract the negative alternation or half-wave from the alternating generator for ringing a bell biased in the opposite direction.

Referring to the accompanying drawings, Figure 1 is a diagrammatic view of a four-party telephone system operated according to my invention. Fig. 2 is an embodiment of my invention in which a single source of steady current is adapted to counteract the positive or negative alternations from an alternating generator. Fig. 3 is an extraction of Fig. 1. Fig. 4 is an embodiment of my invention in which two alternating generators are employed, each generator being connected in multiple with an individual source of steady current; and Fig. 5 is the preferred type of polarized bell biased by the weight of its moving element.

Like characters refer to like parts in Fig. 1.

Referring to Fig. 1, the limbs a a' of the party telephone-line extend to the four substations, and the transmitters b and receivers c are connected between the metallic limbs a a' , the receivers being adapted when on the switch-hooks to open the circuits, and thus cut the telephone apparatus out of circuit in the usual manner in the idle condition of the system. At substations A and B are provided biased polarized bells d and d' , respectively, the bells being biased in opposition to each other and connected in multiple with limb a and the ground as a return-circuit. One of the bells, d , is biased, so that a positive major alternation or half-wave will actuate the polarized armature in opposition to the biasing force and a negative minor alternation or half-wave will assist the biasing force in the return stroke of the armature, and the other bell is biased oppositely, so that a negative major alternation or half-wave will actuate the polarized armature in opposition or against the biasing force and a positive minor alternation or half-wave will assist or augment the biasing force in the return stroke of the armature. At substations C and D are provided biased bells e e' , respectively, the bells being connected between limb a' and the ground in the same manner as the bells on the other side of the metallic circuit. Bell e is biased, so that a positive major alternation or half-wave will actuate the polarized armature against the biasing force, and a negative minor alternation or half-wave will assist the biasing force in the return stroke of the armature, while the other bell, e' , is oppositely biased and requires a negative major alternation or half-

wave to counteract the bias and a positive minor alternation or half-wave to assist the biasing force in operating the bell to signal. The limbs $a a'$ of the telephone-line terminate in a spring-jack f at the central station, which according to this diagram comprises line-springs $f' f''$, with which the terminals of the plug g are adapted to make contact when the plug is inserted into the spring-jack. The tip-contact g' of the plug is adapted to register with the short line-spring f' , while the sleeve-contact g'' is adapted to register with the long line-spring f'' . As this circuit is traced the two line-springs $f' f''$ normally rest against contact-anvils $f^3 f^4$, respectively, the contact-anvils being connected directly with a common battery f^5 and an individual-line relay f^6 . When any one of the receivers are removed from the switch-hooks, the common battery energizes the individual-line signal to apprise the central operator that her assistance is required. When the receivers are restored to the switches, the line-signal is inactive, for the reason that the high resistance of the ringers bridged with both sides of the line to ground allow but a very slight current to escape through the line-signal. The operator's listening-in key has been omitted from the drawings for clearness; but it may be of any suitable arrangement as employed in the art. The operator's cord is provided with four selective ringing-keys of the usual construction, which for ready identification are numbered 1, 2, 3, and 4. The keys are provided with contact-springs $h k l m'$, and $h' k' l' m$, respectively, normally resting against contacts which are adapted to maintain the cord-circuit continuous to a mate plug, which plug is not shown. All of the contact-springs have suitable back contacts by means of which the various combinations of positive and negative steady current and alternating ringing-current may be connected with the proper limb of the metallic circuit for selectively ringing the desired bell. Referring to Fig. 5, the arrangement and construction of a suitable ringer or call-bell may be understood. This is the apparatus by means of which an audible signal is produced at the various substations. The general construction of the ringer is similar to the commercial forms now universally adopted in telephone-work and depends for its mode of action upon the same principles.

In front of the electromagnets, the coils w w' , of which are connected in series, is pivoted in a yoke w^2 an armature w^3 . This armature is given a permanent magnetization by means of a permanent magnet w^4 in the usual manner. The bell-hammer wire w^5 is securely attached to the middle of the armature and carries at its outer end the usual ball for striking the gongs. In order to give this ringer movement a gravitational set or tendency toward one side only, I mount the ringer with its greater dimensions vertically instead

of horizontally—that is, I mount the ringer with magnet w' above magnet w —so that the tapper-wire w^5 and ball will vibrate in a vertical plane and be held against gong w^6 by the force of gravity, thus biasing the bell by the weight of its own moving element. I am aware that this is not good practice if the ringers were to be actuated by means of plus and minus pulsating current according to the prior art; but with my system it is perfectly practicable and desirable to mount the ringer movement in this manner.

Referring to Fig. 2, n^2 is a generator of alternating current of suitable frequency and potential for ringing telephone call-bells. This generator is bridged with the line n^3 . Two oppositely-biased call-bells $e^2 e^3$ are also bridged with the line n^3 . A pole-changing key o is suitably connected with a source of steady current n and adapted to bridge the source of steady current with the line n^3 in the act of selectively ringing either one of the biased call-bells. The source of steady current is connected in series with an impedance or resistance coil n' in order to prevent short circuit of the alternating generator n^2 through the battery or steady-current source. In the act of selectively ringing call-bell e^2 to the exclusion of call-bell e^3 the pole-changing key o connects the positive terminal of the steady source n with the line-circuit and the negative terminal to ground. The circuit may be traced through spring o^5 , back contact o' , impedance or resistance coil n' , battery n , contact-anvil o^4 , spring o^6 to ground. When the source of steady current is thus connected in multiple with the alternating generator n^2 for ringing call-bell e^2 , the negative alternations or half-waves are partially counteracted, thus producing the major positive alternations or half-waves required to actuate call-bell e^2 against the biasing force and the minor negative alternations or half-waves required to assist the biasing force in the return stroke of the biased armature. In the act of selectively ringing call-bell e^3 to the exclusion of call-bell e^2 the pole-changing key o is depressed, thus reversing the polarity of the steady-current source and connecting the same negative to line and positive to ground. In the depressed condition of the key the circuit may be traced through spring o^5 , contact-anvil o^3 , negative pole of battery n , impedance-coil or resistance-coil n' , contact-anvil o^2 , spring o^6 to ground. When the source of steady current is thus connected in multiple with the alternating generator n^2 , the positive alternations or half-waves are partially counteracted by the steady current, thus producing the major negative alternations or half-waves required to actuate call-bell e^3 against the biasing force and the minor positive alternations or half-waves required to assist the biasing force in the return or retracting strokes of the biased armature. It is obvious that either call-bell

may be selectively rung and the oppositely-biased call-bell silenced by simply reversing the polarity of the steady current connected in multiple with the usual bell-ringing or alternating-current generator. I do not limit myself to a single source of alternating current and a single source of steady current, as is diagrammed in Fig. 2, as two alternating generators and two sources of opposite-polarity steady current may be employed, each altering generator being connected with a particular polarity of steady current for operating one particular biased bell, as is diagrammed in Fig. 4, where r' is a positive steady-current source connected with an alternating generator r and adapted to partially counteract the negative alternations or half-waves from generator r in the act of selectively ringing call-bell e^4 on pressing key p , which key connects battery r' through the impedance-coil r^2 in multiple with the generator r . In this same figure, q' is a source of negative steady current adapted to be connected in multiple with generator q for partially counteracting the positive alternations or half-waves for producing the major negative alternations and the minor positive alternations required to selectively ring call-bell e^5 on pressing key p' .

Referring to Fig. 3, my invention is represented as operating with two sources of steady current and one source of alternating current. In this figure v represents a generator of bell-ringing current. This generator may be an alternator or a pulsating-current generator. In case of it being a pulsating generator a condenser s is inserted into the circuit, the function of which is to change the pulsating current into alternating current, according to well-known principles. In practice the condenser is usually connected in the circuit, as shown, in order to prevent a metallic connection between the two sources of current, whether the generator v is alternating or pulsating. The steady source t is connected with the negative terminal to ground and the positive terminal with key p^2 , the current passing through the impedance-coil u when the key is pressed in the act of selectively ringing one of the call-bells. The steady source t' is connected with the positive terminal to ground and the negative terminal with key p^3 , the current passing through impedance-coil u' when the key is pressed in the act of selectively ringing the oppositely-biased call-bell. The two call-bells are bridged with the line-wire e^8 , which terminates in suitable keys $p^2 p^3$. When it is desired to ring the positively-biased call-bell e^6 and have the negatively-biased bell e^7 remain silent, the key p^2 is pressed. This operation connects the positive steady current t , through impedance u , and also ringing-generator v , through condenser s , with line-wire e^8 , and through the bells e^6 and e^7 in multiple to ground. Call-bell e^6 is biased to ring when

the steady current t partially counteracts the alternations or half-waves which are of opposite polarity to the steady-current polarity, thereby producing the major and minor alternations or half-waves required to operate call-bell e^6 . When it is desired to ring the negatively-biased call-bell e^7 and have the positively-biased bell remain silent, key p^3 is pressed. This operation connects the negative steady current t' , through impedance-coil u' , and also ringing-generator v , through condenser s , with line-wire e^8 , and through bells e^6 and e^7 in multiple to ground, as before. Call-bell e^7 is biased to ring when the steady current t' partially counteracts the alternations or half-waves which are of opposite polarity to the steady-current polarity, thereby producing the major negative alternations and the minor positive alternations necessary to ring call-bell e^7 . It is obvious that when ringing call-bell e^6 the counteracted alternations or half-waves are of opposite polarity from those which were counteracted when ringing call-bell e^7 .

Referring to Fig. 1, the circuits will be traced for operating four substations on a metallic circuit. The alternating generator x has one terminal grounded and the other terminal connected with back contacts $h^2 h^3 l^2 m^2$ of the selective ringing-keys 1 2 3 4, respectively. Keys 1 and 3 have their back contacts h^3 and l^3 respectively connected through impedance-coil i' with the source of positive steady current i , the negative terminal of which is grounded. Keys 2 and 4 have their back contacts h^2 and m^2 respectively connected through impedance-coil j' with the source of negative steady current j , the positive terminal of which is grounded. The coils $i' j'$ may be ordinary resistance or retardation coils, and their function is to prevent short circuit of the alternating generator x through the sources of steady current when operating the various selective keys to ring the substation-bells. When it is desired to ring the bell at substation A, the key 1 is pressed. This will close the circuit from alternating generator x and positive steady current i in multiple through back contacts $h^2 h^3$, key-spring h , cord-strand c' , tip g' of plug g , short-line spring f' , limb a of the metallic circuit, and through the two bells d and d' in multiple to ground. The steady-current source i , being connected positive to line and in multiple with the alternating generator x , will partially counteract the negative alternations or half-waves of generator x , thereby producing the required major and minor alternations for selectively operating the biased call-bell d at substation A, the major alternations actuating the biased armature in opposition to the biasing force and the minor alternations assisting the biasing force in the return or retracting strokes of the armature. When it is desired to ring the bell at substation B, the

key 2 is pressed. This will close the circuit from alternator α and negative steady current j in multiple through back contacts $k^2 k^3$, key-spring k , cord-strand c' , tip g' of plug g , short-line spring f' , limb a of the metallic circuit, and through the two bells d and d' in multiple to ground. The steady-current source j , being connected negative to line and in multiple with the alternator α , will partially counteract the positive alternations or half-waves of generator α , thereby producing the required major and minor alternations for selectively operating the biased call-bell d' at substation B, the major negative alternations actuating the biased armature in opposition to the biasing force exerted thereon and the minor positive alternations assisting the biasing force in the return or retracting strokes of the armature. When it is desired to ring the bell at substation C, the key 3 is pressed. This will close the circuit from alternator α and positive steady current i in multiple through back contacts $l^2 l^3$, key-spring l , cord-strand c^2 , sleeve g^2 of plug g , long-line spring f^2 , limb a' of the metallic circuit, and through the two bells e and e' in multiple to ground. The steady-current source i , being connected positive to line and in multiple with alternator α , will partially counteract the negative alternations or half-waves of generator α , thereby producing the required major and minor alternations for selectively operating the biased call-bell e at substation C, the major positive alternations actuating the biased armature in opposition to the biasing force exerted thereon and the minor negative alternations assisting the biasing force in the return or retracting strokes of the armature. When it is desired to ring the bell at substation D, the key 4 is pressed. This will close the circuit from alternator α and negative steady current j in multiple, through back contacts $m^2 m^3$, key-spring m , cord-strand c^2 , sleeve g^2 of plug g , long-line spring f^2 , limb a' of the metallic circuit, and through the two bells e and e' in multiple to ground. The steady-current source j , being connected negative to line and in multiple with alternator α , will partially counteract the positive alternations or half-waves of generator α , thereby producing the required major and minor alternations for selectively operating the biased bell e' at substation D, the major negative alternations actuating the biased armature in opposition to the biasing force exerted thereon and the minor positive alternations assisting the biasing force in the return or retracting strokes of the armature. In circuits of this character some means are usually provided to prevent the accidental ringing of the two like bells on the opposite sides of the metallic circuit when any party has a receiver off the switch. It is obvious from the diagram that it is proposed to ground that limb of the line not being rung over—

for instance, on depressing key 1 to ring substation A key-spring h' grounds limb a' while ringing over limb a . The circuit may be traced from ground through back contact h^4 , key-spring h' , cord-strand c^2 , sleeve g^2 of plug g , long-line spring f^2 , and limb a' . Should a telephone-receiver be removed from a switch-hook at any of the substations while ringing-current is being projected over the line, the low resistance thus provided through the telephone instrument and line to ground will shunt the ringing-current to such a degree that the bells will remain silent. Selective keys 2, 3, and 4 are likewise provided with grounded back contact h^4 , l^4 , and m^4 , respectively, the function of which is to ground one limb of the line while ringing over the other.

In Fig. 1 I have shown a connection-plug equipped with four party-line keys. Instead of providing this number of keys for each cord-circuit of the switchboard a single set of keys may be provided and adapted to be connected with any particular set of cord conductors that may be for the time in use.

Throughout this specification I have shown and described my system with ground-returns and for metallic circuits; but this is by no means the limitation of my invention, it being readily applicable to common return systems and telephone-switchboard circuits of almost any character. I have also shown and described my invention in connection with a specific line-circuit in which the bells are permanently grounded or connected therewith; but it is obvious that my invention is applicable to operating biased-bell party-line systems in which the bells are normally disconnected from the line, but in operative relation therewith, and adapted to be connected with the line in their operative condition by suitable means, such as relays.

By the term "engaged steady current" or "means to engage the steady current," as employed in certain claims, I wish to be understood as meaning the steady current which is in use or connected with the line-circuit when selectively ringing one of the biased call-bells.

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

1. In a party-line telephone system, the combination with a line-circuit, of two oppositely-biased call-bells connected therewith in their operative condition, means to selectively operate one of the bells to the exclusion of the other, the means comprising an alternating-current generator connected with the line, and a source of steady current connected in a derived circuit with said alternating generator for partially counteracting one of the alternations or half-waves generated by said generator, substantially as described.

2. In a party-line telephone system, the combination with a line-circuit, of two oppositely-

biased call-bells connected therewith in their operative condition, one of said bells being organized to respond to a major positive alternation and a minor negative alternation, and the other bell being organized to respond to a major negative alternation and a minor positive alternation, means connected with the line-circuit to selectively operate one of said bells to the exclusion of the other, the means consisting of an alternating generator, a source of steady current connected in multiple with the generator for partially counteracting one of the alternations, and an impedance in series with the steady-current source to prevent short-circuit of the alternating generator, substantially as described.

3. In a party-line telephone system, the combination with a line-circuit, of two oppositely-biased call-bells connected therewith in their operative condition, one of said bells being organized to respond to a major positive alternation and a minor negative alternation, and the other bell being organized to respond to a major negative alternation and a minor positive alternation, and means organized to selectively ring either one of the bells to the exclusion of the other, the means consisting of an alternating generator, and a source of steady current connected in multiple with said generator for suitably counteracting one alternation or half-wave in the act of selectively ringing one bell, and means to reverse the polarity of the steady current for suitably counteracting the opposite alternation or half-wave in the act of selectively ringing the oppositely-biased call-bell, substantially as described.

4. In a party-line telephone system, the combination with a line-circuit, of two oppositely-biased call-bells connected therewith in their operative condition, one of said bells being organized to respond to a major positive alternation and a minor negative alternation, and the other bell being organized to respond to a major negative alternation and a minor positive alternation, and means organized to selectively ring either one of the bells to the exclusion of the other, the means consisting of an alternating generator, and a source of positive steady current connected in multiple therewith for producing the major positive alternations and minor negative alternations, and a source of negative steady current in multiple with said generator for producing the major negative alternations and minor positive alternations, and means in series with the steady-current sources to prevent short-circuit of the alternating generator while ringing the call-bells, substantially as described.

5. The combination in a party-line telephone system, of biased call-bells connected with a line-circuit, an alternating-current generator connected with the line-circuit to selectively operate the call-bells biased in one direction and a source of steady current connected in multiple with the alternating generator for

suitably counteracting the alternations or half-waves of one polarity, whereby the armatures of the biased bells intended to ring will be actuated against the biasing force by major alternations or half-waves, and actuated toward or in the same direction as the biasing force by minor alternations or half-waves, substantially as described.

6. In a party-line telephone system, two polarized call-bells biased in opposition to each other and connected with a line-circuit for signaling, the bells being organized to operate with a heavy alternation of current to actuate the biased armatures of the bells in opposition to the biasing force exerted thereon, and a light alternation of current of opposite polarity to assist the biasing force in the operation of the biased armatures in the direction of their normally biased trend, and means organized to be connected with the line-circuit by means of suitable keys for producing the required heavy and light alternations of current, the means consisting of an alternating-current generator, and a source of steady current connected in multiple with the alternating-generator, substantially as described.

7. In a party-line telephone system, two polarized call-bells biased in opposition to each other and connected with a line-circuit for signaling, the bells being organized to operate with a heavy alternation of current to actuate the biased armatures of the bells in opposition to the biasing force exerted thereon, and a light alternation of current of opposite polarity to assist the biasing force in the operation of the biased armatures in the direction of their normally biased trend, an alternating-current generator and a source of steady current connected in multiple with the generator for producing the heavy and light alternations required to operate one of the biased bells, and means to reverse the polarity of the steady-current source for producing the heavy and light alternations required to operate the oppositely-biased bell, and an impedance in series with the steady-current source to prevent short-circuit of the alternating-current generator, substantially as described.

8. In a party-line telephone system, two polarized call-bells biased in opposition to each other and connected with a line-circuit for signaling, the bells being organized to operate with a heavy alternation of current to actuate the biased armatures of the bells in opposition to the biasing force exerted thereon, and a light alternation of current of opposite polarity to assist the biasing force in the operation of the biased armatures in the direction of their normally biased trend, an alternating-current generator, a source of positive steady current, and a source of negative steady current, means organized to connect the alternating-current generator and positive steady current in multiple with the line-

circuit for selectively ringing one of the bells to the exclusion of the other, and means organized to connect the alternating-current generator and the negative steady current in multiple with the line-circuit for selectively ringing the oppositely-biased bell to the exclusion of the other, and an impedance to prevent short-circuit of the alternating generator through the steady-current sources while ringing, substantially as described.

9. In a party-line telephone system, the combination with a line-circuit, of two polarized call-bells connected therewith for selective signaling, said bells being biased in opposition to each other, one of said bells being organized to operate with a heavy positive alternation of current which will actuate its armature in opposition to the biasing trend, and a light negative alternation of current which will assist the biasing trend in the operation of its armature in the direction of its normal position, the other bell being organized to operate with a heavy negative alternation of current which will actuate its armature in opposition to the biasing trend, and a light positive alternation of current which will assist the biasing trend in the operation of its armature in the direction of its normal position, means for producing the required heavy and light alternations of current for selectively operating the bells, the means consisting of an alternating-current generator and sources of positive steady current and negative steady current, and apparatus to connect either positive or negative current in multiple with the alternating generator when operating either bell to the exclusion of the other, substantially as described.

10. In a party-line telephone system, the combination with a line-circuit, of two polarized bells connected therewith for selective signaling, said bells being biased in opposition to each other by the weight of their moving elements, one of said bells being organized to operate with a heavy positive alternation of current which will actuate its armature in opposition to the gravitational trend, and a light negative alternation of current which will assist the gravitational trend in the operation of its armature in the direction of its normal position, the other bell being organized to operate with a heavy negative alternation of current which will actuate its armature in opposition to the gravitational trend, and a light positive alternation of current which will assist the gravitational trend in the operation of its armature in the direction of its normal position, and means adapted to be connected with the line-circuit by means of suitable keys for producing the required heavy and light alternations of current, the means consisting of an alternating-current generator and a source of steady current connected in multiple with the alternating-current generator, substantially as described.

11. In a party-line telephone system, the combination with two metallic limbs extending from the central station through four substations, of a telephone set at each of said substations connected in a normally open bridge extending between the two metallic limbs, whereby the telephone set at any one of the substations may be individually connected between the metallic limbs, a polarized call-bell at each of said substations, two of said call-bells being oppositely biased and connected between one of said limbs and the ground in their operative condition, the remaining two call-bells being oppositely biased and connected between the other limb and ground in their operative condition, the call-bells being organized to require a major alternation to actuate the biased moving element in opposition to the biasing force thereof, and a minor alternation to assist the biasing force in the retracting stroke of said biased moving element, four keys at the central station organized to connect suitable alternating current over the metallic limbs for selectively operating the four bells, two of said keys being connected with positive steady current and an alternating-current generator in multiple for producing the required major and minor alternations for operating the two similar biased bells on either metallic limb, and means in series with the positive steady-current source to prevent short-circuit of the alternating-current generator, the remaining two keys being connected with negative steady current and said alternating generator in multiple for producing the required major and minor alternations for operating the remaining two similar biased bells on either metallic limb, and means in series with the negative steady-current source to prevent short-circuit of the alternating-current generator, substantially as described.

12. In a party-line telephone system, the combination with a line-circuit, of two oppositely-biased call-bells connected therewith in their operative condition, one of said bells being organized to respond to a major positive alternation and a minor negative alternation, and the other bell being organized to respond to a major negative alternation and a minor positive alternation, and means organized to selectively ring either one of the bells to the exclusion of the other, the means consisting of an alternating-current generator, and a source of steady current connected in multiple with said alternating generator for suitably counteracting one alternation or half-wave in the act of selectively ringing one bell, and a key to substitute a steady-current source of opposite polarity in the act of selectively ringing the oppositely-biased bell, and a resistance-coil in series with the steady-current source to prevent short-circuit of the alternating generator, substantially as described.

13. In a party-line telephone system, the combination with a line-circuit, of two oppositely-biased call-bells connected therewith in their operative condition, one of said bells being organized to respond to a major positive alternation and a minor negative alternation, and the other bell being organized to respond to a major negative alternation and a minor positive alternation, two keys for selectively ringing the bells, an alternating-current generator, a source of positive steady current, and a source of negative steady current, one of said keys being organized to connect the alternating generator and the source of positive steady current in multiple for producing the major positive and minor negative alternations, and the other key being organized to connect the alternating generator and the source of negative steady current in multiple for producing the major negative and minor positive alternations, and a resistance-coil in series with the steady-current sources to prevent short-circuit of the alternating generator while ringing either one of the biased call-bells, substantially as described.

14. In a party-line telephone system, the combination with a line-circuit of two polarized call-bells connected therewith for selective signaling, said bells being biased in opposition to each other by the weight or gravitational trend of their moving elements or gong-striking mechanism, one of said bells being organized to operate with a heavy positive alternation which will actuate its gong-striking mechanism in opposition to the gravitational trend, and a light negative alternation which will assist the gravitational trend in operating the gong-striking mechanism toward its normal position, the other bell being organized to operate with a heavy negative alternation which will actuate its gong-striking mechanism in opposition to the gravitational trend, and a light positive alternation which will assist the gravitational trend in operating the gong-striking mechanism toward its normal position, two keys for selectively ringing the bells, an alternating-current generator, a source of positive steady current, and a source of negative steady current, one of said keys being organized to connect the alternating generator and the source of positive steady current in multiple for producing the heavy positive and light negative alternations, and the other key being organized to connect the alternating generator and the source of negative steady current in multiple for producing the heavy negative and the light positive alternations, and a resistance-coil in series with the steady-current sources to prevent short-circuit of the alternating generator while ringing either one of the biased call-bells, substantially as described.

15. In a party-line telephone system, the combination with a line-circuit, of two call-bells connected therewith for selective signal-

ing, said bells being oppositely biased by the weight of their moving elements, one of said bells being organized to operate with a heavy positive alternation which will actuate its armature in opposition to the gravitational trend, and a light negative alternation which will assist the gravitational trend in the operation of its armature in the direction of its normal position, the other bell being organized to operate with a heavy negative alternation which will actuate its armature in opposition to the gravitational trend, and a light positive alternation which will assist the gravitational trend in the operation of its armature in the direction of its normal position, means to produce selective signaling-current with heavy and light alternations to ring said bells, the means consisting of a source of positive steady current, and a source of negative steady current, and mechanism to engage either source of steady current with the line-circuit while ringing one bell to the exclusion of the other, and an alternating-current generator bridged with the engaged source of steady current while ringing, and a resistance-coil in the engaged steady-current path, substantially as described.

16. In a party-line telephone system, the combination with a line-circuit, of two polarized call-bells connected therewith for selective signaling, said bells being oppositely biased by the weight of their moving elements, and adapted to be rung by means of an alternating current with one alternation or half-wave of greater potential than the alternation or half-wave of opposite sign, an alternating-current generator, a positive steady-current generator, and a negative steady-current generator, and means to connect the alternating-current generator and either of the steady-current generators in multiple and with the line-circuit for selectively ringing either of the call-bells to the exclusion of the other, substantially as described.

17. In a party-line telephone system, the combination with a line-circuit, of two polarized call-bells connected therewith for selective signaling and arranged to be biased in opposition to each other by the weight of their moving elements, an alternating-current generator adapted to be connected with the line-circuit in the act of selectively ringing the bells, and a source of positive steady current adapted to be connected in multiple with the alternating-current generator for producing suitable selective alternating current for ringing the positively-biased bell, and a source of negative steady current adapted to be connected in multiple with the alternating-current generator for producing suitable selective alternating current for ringing the negatively-biased bell, substantially as described.

18. In a party-line telephone system, the combination with a line, of two call-bells associated therewith and biased in opposition to

each other by the weight of their gong-striking mechanism, an alternating-current generator associated with the line in the act of selectively ringing either call-bell to the exclusion of the other, and a source of steady current bridged with said generator for converting the alternating current generated by said generator into selective signaling-current, and a resistance-coil in series with the steady-current source, substantially as described.

19. In a party-line telephone system, the combination with a line-circuit, of two polarized call-bells biased by the weight of their gong-striking mechanism, one of said bells being adjusted to respond to major positive alternations and minor negative alternations, and the oppositely-biased bell being adjusted to respond to major negative alternations and minor positive alternations, an alternating-current generator associated with the line in the act of selectively ringing either call-bell to the exclusion of the other, and a source of steady current bridged with said generator for converting the alternating current generated by said generator into suitable major and minor alternations, and a resistance-coil in series with the steady-current source, substantially as described.

20. In a selective ringing telephone system, the combination with a metallic line-circuit, of four polarized call-bells biased by the weight of their gong-striking mechanism, two of said bells being oppositely biased and associated with one limb of the line, the remaining two bells being oppositely biased and associated with the other limb of the line, an alternating-current generator and means to connect the same with either limb of the line, a source of steady current bridged with said generator for converting the alternating current generated by said generator into selective signaling-current, and a resistance-coil in series with the steady-current source, substantially as described.

21. In a party-line telephone system, the combination with a line-circuit, of two oppositely-biased call-bells connected therewith in their operative condition, an alternating-current generator, and a source of steady current connected in multiple therewith for producing alternating selective signaling-current with one alternation of greater potential than the alternation of opposite sign, and means to connect said generator and source of steady current with the line-circuit, substantially as described.

22. In a party-line telephone system, the combination with a line-circuit, of two oppositely-biased call-bells connected therewith in their operative condition, selective signaling apparatus for producing selective signaling-current with the positive alternations of greater strength than the negative alternations for ringing one of the bells, and selective current with the negative alternations of

greater strength than the positive alternations for ringing the oppositely-biased bell, the selective signaling apparatus comprising an alternating-current generator and a steady-current generator connected in multiple with each other, and means associated with the line-circuit for uniting the selective signaling apparatus with the line-circuit when ringing either call-bell to the exclusion of the other, substantially as described.

23. In a party-line system, the combination of two oppositely-biased call-bells connected with a line-circuit, an alternating-current generator connected with the line-circuit, and a source of steady current connected in multiple with said generator for converting the alternating current generated by said generator into selective signaling-currents, substantially as described.

24. In a party-line system, the combination of two oppositely-biased call-bells connected with a line-circuit, an alternating-current generator and means to connect the same with the line-circuit, a source of steady current bridged with said generator for converting the alternating current generated by said generator into selective signaling-currents, and an impedance in series with the steady-current source, substantially as described.

25. In a selective ringing telephone system, the combination with a metallic line-circuit, of four biased call-bells, two of said bells being oppositely biased and in operative relation with one limb of the metallic circuit, the remaining two bells being oppositely biased and in operative relation with the other limb of the metallic circuit, an alternating-current generator, and a source of steady current bridged with said generator for converting the current generated by said generator into selective signaling alternating currents, and an impedance in series with the steady-current source, and means to connect the selective signaling-current with either limb of the metallic circuit for selectively ringing one of the biased call-bells, substantially as described.

26. In a party-line telephone system, the combination with a line-circuit, of two oppositely-biased call-bells connected in operative relation therewith, one of said bells being organized to respond to a major positive alternation and a minor negative alternation, and the other bell being organized to respond to a major negative alternation and a minor positive alternation, an alternating-current generator, and a source of steady current bridged with said generator for converting the current generated by said generator into major and minor alternations, and an impedance in series with the steady-current source, and means to connect the generator and steady-current source with the line-circuit in the act of selectively ringing either call-bell, substantially as described.

27. In a party-line telephone system, the combination with a line-circuit, of two oppositely-biased call-bells connected in operative relation therewith, a source of positive steady current, and a source of negative steady current, and an alternating-current generator, and means to connect either source of steady current and the alternating-current generator in multiple and with the line-circuit in the act of selectively ringing one bell to the exclusion of the other, substantially as described.

28. In a party-line telephone system, the combination with a line-circuit, of two oppositely-biased call-bells connected in operative relation therewith, one of said bells being organized to respond to a major positive alternation and a minor negative alternation, and the other bell being organized to respond to a major negative alternation and a minor positive alternation, a source of positive steady current, and a source of negative steady current, and means to connect either source with the line-circuit in the act of selectively ringing one of the biased call-bells, and an alternating-current generator bridged with the steady-current source for producing the required major and minor alternations when ringing, and an impedance in series with the steady-current source, substantially as described.

29. In a selective ringing telephone system, the combination with a metallic line-circuit, of four biased call-bells, two of said bells being oppositely biased and in operative relation with one limb of the metallic circuit, the remaining two bells being oppositely biased and in operative relation with the other limb of the metallic circuit, a source of positive steady current, and a source of negative steady current, and means to connect either source with the limbs of the metallic circuit in the act of selectively ringing one of the biased call-bells, and an alternating-current generator bridged with the steady-current source when ringing, and an impedance in series with the steady-current source, substantially as described.

30. In a party-line telephone system, the combination with a metallic line-circuit, of four call-bells, two of said bells being oppositely biased and in operative relation with one limb of the metallic circuit, the remaining two bells being oppositely biased and in operative relation with the other limb of the metallic circuit, all of said bells being organized to ring with major and minor alternations, a source of positive steady current, and a source of negative steady current, and means to connect either source with the limbs of the metallic circuit in the act of selectively ringing one of the bells, and an alternating-current generator bridged with the steady-current source for producing the major and minor alternations when ringing, and an impedance in

series with the steady-current source, substantially as described.

31. In a party-line telephone system, the combination with a metallic line-circuit, of two oppositely-biased call-bells associated with each limb of the line, two of said bells being organized to respond to major positive alternations and minor negative alternations, and the other two bells being organized to respond to major negative alternations and minor positive alternations, a source of positive steady current, and a source of negative steady current, and means to connect either source with either limb of the line in the act of selectively ringing one bell, and a source of alternating current bridged with the steady-current source for producing the major and minor alternations when ringing, and an impedance in series with the steady-current source, substantially as described.

32. In a selective party-line system, the combination with a line-circuit of two oppositely-biased call-bells connected therewith for signaling, the call-bells being organized to require a major alternation to actuate the biased moving element in opposition to the biasing force exerted thereon and a minor alternation to assist the biasing force in the retracting stroke of said biased moving element, means to produce selective signaling-current with major and minor alternations, the means consisting of a source of steady current and a source of alternating current bridged together when signaling, and a resistance-coil in series with the steady-current source, substantially as described.

33. In a selective party-line system, the combination with a line-circuit, of two oppositely-biased call-bells connected therewith for signaling, means to produce selective signaling-current with major positive alternations and minor negative alternations to ring one bell, and major negative alternations and minor positive alternations to ring the other bell, the means consisting of a positive steady-current generator and a negative steady-current generator, and mechanism to engage either steady-current generator with the line-circuit when ringing, and an alternating-current generator bridged with the engaged steady-current generator when ringing, and a resistance-coil in the engaged steady-current generator path, substantially as described.

34. In a party-line telephone system, the combination with a metallic circuit, of two oppositely-biased call-bells connected with each limb of the line for selective signaling, one bell of each limb of the line being organized to require a major positive alternation to actuate the biased moving element in opposition to the biasing force exerted thereon and a minor negative alternation to assist the biasing force in the retracting stroke of said biased moving element, and the oppositely-biased

call-bell on each limb of the line being organized to require a major negative alternation to actuate the biased moving element in opposition to the biasing force exerted thereon and
 5 a minor positive alternation to assist the biasing force in the retracting stroke of said biased moving element, means to produce selective signaling-current with major positive alternations and minor negative alternations
 10 to ring two of said bells, and major negative alternations and minor positive alternations to ring the remaining two bells, the means consisting of a source of positive steady current and a source of negative steady current,
 15 and mechanism to engage either current with either limb of the metallic circuit when ringing one bell to the exclusion of the others, and an alternating-current generator bridged with the engaged steady current when ringing,
 20 and a resistance-coil in the engaged steady-current path, substantially as described.

35. In a party-line telephone system, the combination of two oppositely-biased call-bells associated with a line-circuit for selective
 25 signaling, means to produce an alternating selective signaling-current, the means consisting of a source of positive steady current and a source of negative steady current, and mechanism to engage either source with the line,
 30 and an alternating-current generator bridged with the engaged source of steady current when signaling, and a resistance-coil in series with the engaged steady-current source, substantially as described.

36. In a party-line telephone system, the combination with a line-circuit, of two oppositely-biased call-bells connected therewith for selective signaling, selective signaling apparatus for producing positive alternations of
 40 greater strength than the negative alternations to ring one bell, and negative alternations of greater strength than the positive alternations to ring the oppositely-biased call-

bell, the selective signaling apparatus comprising an alternating-current generator, a positive steady-current generator, and a negative
 45 steady-current generator, means associated with the line-circuit and generators to engage either steady-current generator singly and the alternating-current generator in multiple for
 50 producing selective current for operating either call-bell to the exclusion of the other, and a resistance-coil in the engaged steady-current-generator path to prevent short-circuit of the alternating generator while ringing,
 55 substantially as described.

37. In a party-line telephone system, the combination with two metallic limbs extending from the central station through four substations, of a telephone set at each of said substations connected in a normally open bridge
 60 extending between the two metallic limbs whereby the telephone set at any one of the substations may be individually connected between the metallic limbs, a biased call-bell at
 65 each of said substations connected between one limb and the ground, all of said bells being organized to ring with major and minor alternations, an alternating-current generator, a source of positive steady current, and a source
 70 of negative steady current, mechanism to engage either source of steady current with either metallic limb for selective signaling one bell, the alternating-current generator being connected in multiple with the engaged source
 75 of steady current for producing the required major and minor alternations, and a resistance-coil in series with the engaged steady-current source, substantially as described.

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

THOMAS C. DRAKE.

Witnesses:

A. DURBIN,
 E. J. AVRICK.