No. 814,571. PATENTED MAR. 6, 1906.

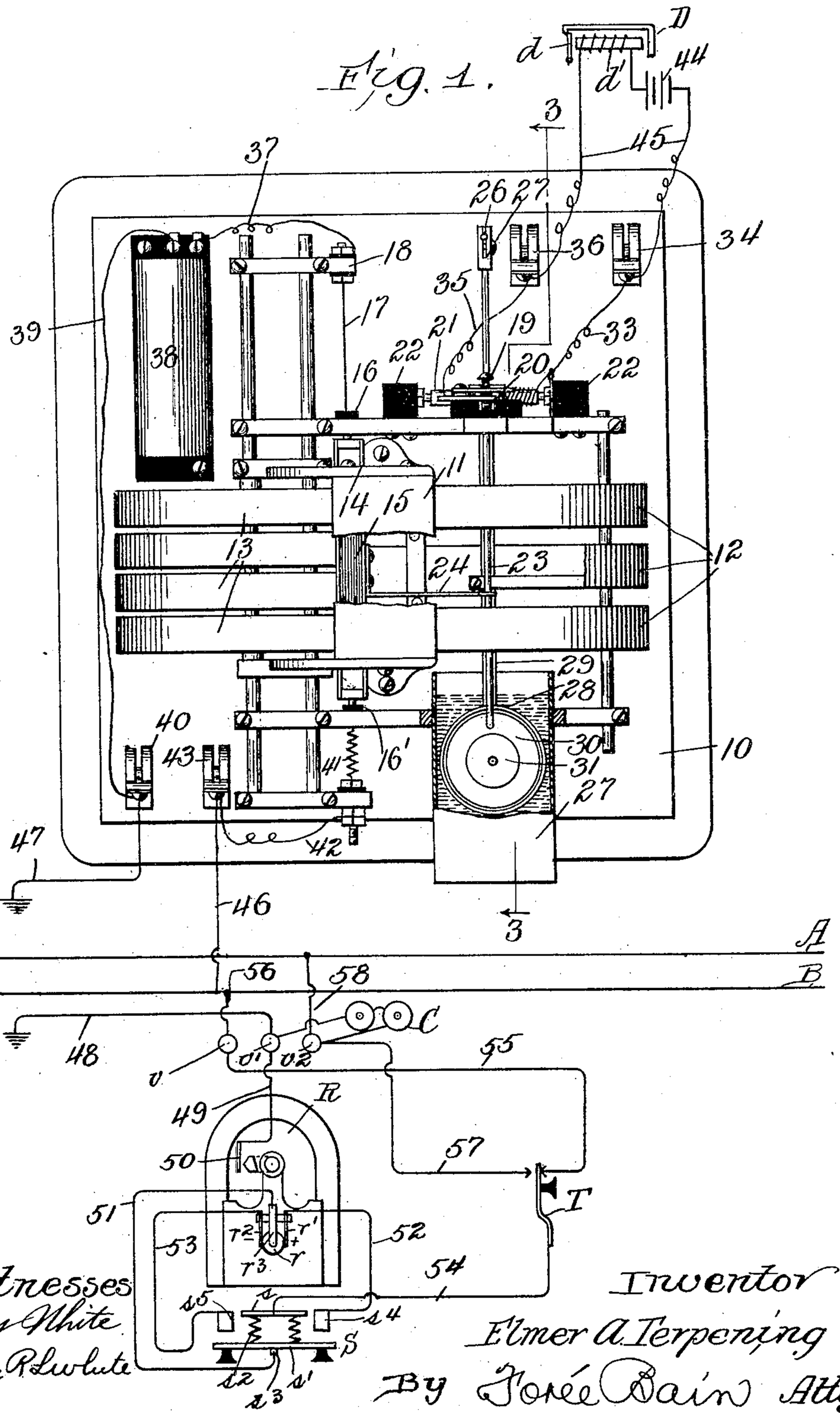
E. A. TERPENING.

TELEPHONE SYSTEM.

APPLICATION FILED SEPT. 6, 1904.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses
Ray White
Harry R Lubcke

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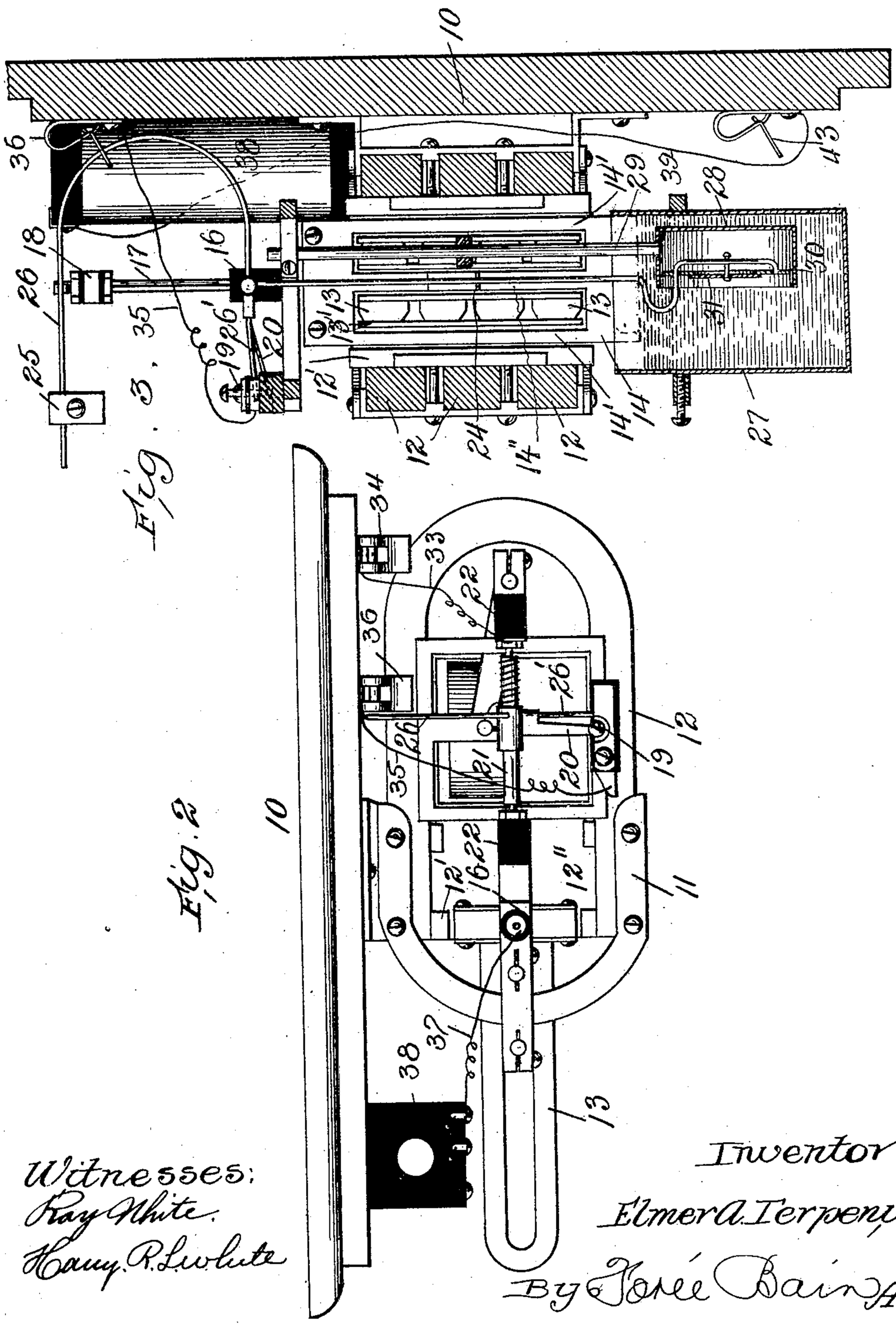
3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

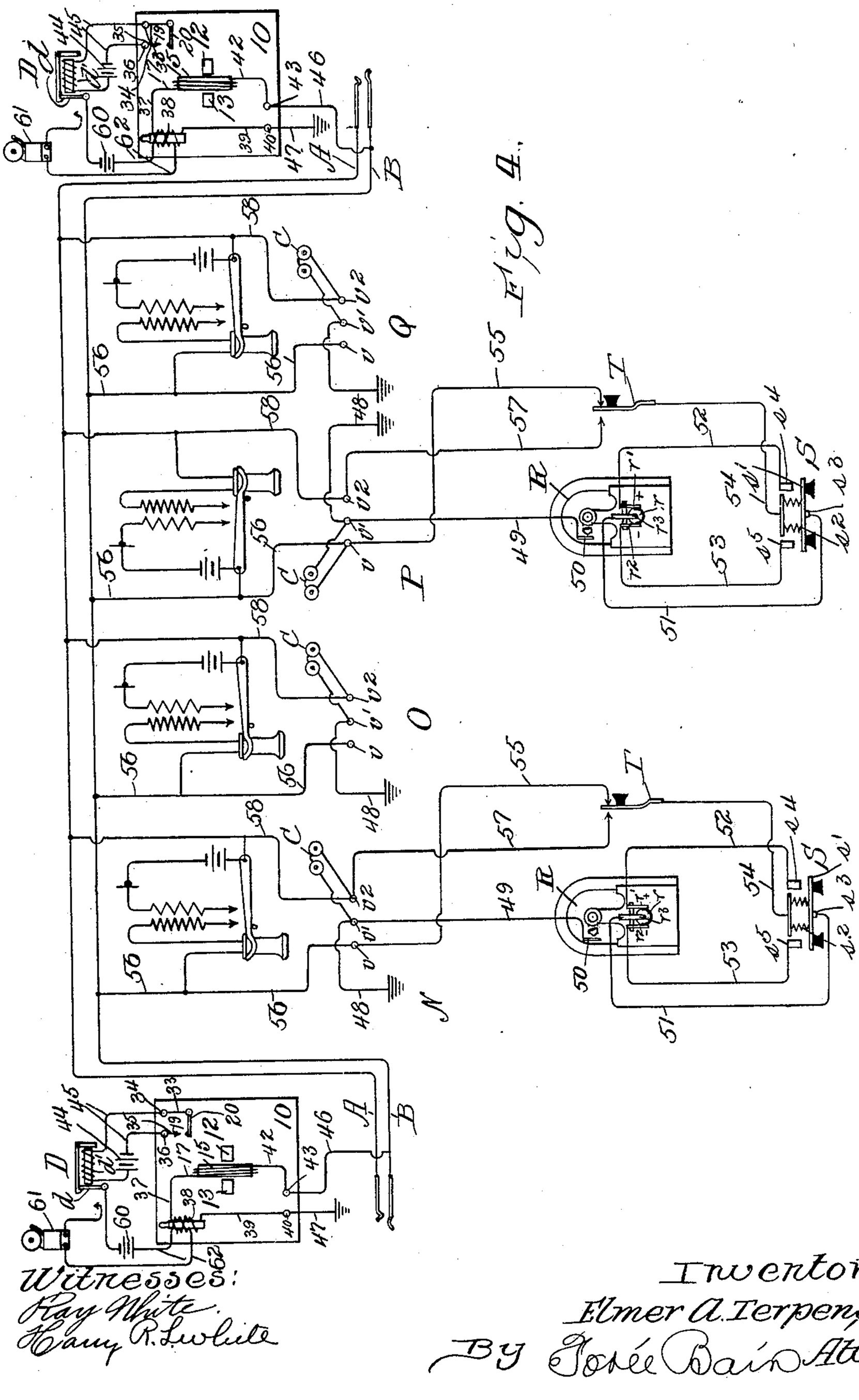

Fig. 4.

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UNITED STATES PATENT OFFICE.

ELMER A. TERPENING, OF GENESEO, ILLINOIS.

TELEPHONE SYSTEM.

No. 814,571. Specification of Letters Patent. Patented March 6, 1906.

Application filed September 6, 1904. Serial No. 223,413.

To all whom it may concern:

Be it known that I, ELMER A. TERPENING, of Geneseo, in the county of Henry and State of Illinois, have invented certain new and useful Improvements in Telephone Systems; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to telephone call systems, and while broadly applicable as to certain features is particularly adapted for party-line systems.

One of the salient objects of my invention is to provide a call system whereby the stations on a party-line are enabled to call each other without actuating the signaling mechanism at central station and to call either of two central stations at will without disturbing the other or the other subscribers' stations.

A further object of my invention is to provide a responsive device at the central station as part of the signaling outfit which will be extremely sensitive to feeble currents and which will therefore act even under very adverse conditions.

Another salient object of my invention is to provide a signaling system for a divided-circuit party-line whereby the parties connected on one side of the line may call the parties connected on the other side of the line.

Other and further objects of my invention will hereinafter become fully apparent from the following description taken in conjunction with the illustrative drawings, wherein—

Figure 1 is a front elevation of a central-station relay of my invention, showing diagrammatically its connection with other devices of a signal system. Fig. 2 is a top plan view of the relay shown in Fig. 1. Fig. 3 is a section on line 3 3 of Fig. 1. Fig. 4 is a diagrammatic view showing the embodiment of my signaling system in a two-central divided-circuit party-line.

Throughout the drawings like characters of reference refer always to like parts.

Referring now to the relay or current responsive device shown in Figs. 1, 2, and 3, 10 indicates a suitable base upon which is mounted in a suitable supporting-frame 11 two sets of permanent magnets 12 12 and 13 13, preferably of horseshoe shape and having their arms spread to different extents, so that the poles of the magnets 13 13 extend between the poles of the magnets 12 12. Any suitable number of magnets 12 12 and 13 13 may be provided, the magnets of like size being arranged in vertical alinement and preferably having their ends connected by pole-pieces 12′ 12′ and 13′ 13′, respectively. The proximate surfaces of the pole-pieces 12′ and 13′ of the magnets are spaced apart a sufficient distance to accommodate the side pieces of an oscillating coil-frame 14, which preferably comprises solid end portions connected by strips 14′ 14′ and a central strip 14″, lying, as described, between the proximate faces of the magnet pole-pieces, and a central strip 14″, lying between the arms of the smaller magnets 13 13. Upon the frame 14 is wound a coil 15 of suitable fine wire for a purpose to be described.

The frame 14 is arranged for oscillation through a small angle between the magnets, and to this end is maintained in vertical position in suitably insulated bearings 16 16′; but it is preferably freely suspended therein from a wire 17, of German silver or other suitable material, at its upper end supported by, but insulated from, any suitable bracket 18 and at its lower end electrically connected to the coil. Suitable contact parts of an electric circuit are associated for operation with the oscillating coil, preferably in such a way that contact is made between said parts only when the coil swings in one predetermined direction, and means are preferably also provided for rendering the action of the coil so sluggish that it will not sufficiently respond to alternating current of ordinary frequencies to actuate the contact parts. Specifically, 19 indicates a stationary contact-point suitably mounted on the framework and insulated therefrom, and 20 indicates a coacting movable contact member, preferably an arm, mounted upon a transverse shaft 21, pivotally supported at its ends in bearing-blocks 22. From the shaft 21 depends a rod 23, the lower end of which is operatively associated with a retarding device to be hereinafter described. Intermediate its ends the rod 23 is spanned by the slotted end of an arm 24, the opposite end of which is secured to the central piece 14″ of the frame of the oscillating coil 15. The movable contact part is preferably adjusted as to balance by a weight 25, mounted for adjustment upon a rod 26, extending at right angles to the axis of the shaft 21. If preferred, one end of the rod 26 may be extended forward, as at 26′, to coact with the stationary contact member and form a

stop to limit the throw of the movable contact member 20 in either direction and take the strain therefrom.

The retarding device, heretofore adverted to, is preferably a dash-pot and in the construction shown comprises a liquid-receptacle 27, containing a casing 28, open on one side and supported, as upon a rod 29, adjustably secured to the framework 11.

30 indicates the movable member or plunger of the dash-pot secured to the rod 23. Preferably the plunger 30 is centrally perforated, and the perforation is covered on one side by a valve 31, so that the member 30 is relatively freely movable in one direction and relatively slow of movement in the other direction. Preferably, also, for the present purpose the direction in which the plunger 30 is freely movable is that which corresponds with movement of the movable contact member away from its stationary contact-point.

Now it will be apparent to those skilled in the art that if current is passed through the coil 15 in one direction it will tend to throw the arm 24 in such direction as to move the movable contact member 20 into contact-making position relative to its stationary member 19, but that in causing such movement of the contact parts the coil has to overcome the maximum resistance of the dash-pot, the valve 31 closing the aperture of plunger 30 when the said plunger is moved to the left, Fig. 3. If current be passed through the coil in the opposite direction, it tends to move the contact part to its utmost limit away from the stationary contact member or until the stop-rod 26′ contacts with the frame, but in so doing has to overcome the minimum resistance of the dash-pot, the valve 31 whereof opens to movement in this direction. The resistance of the dash-pot is sufficient to render the action of the contact devices sluggish enough to prevent an alternating current of any ordinary frequency from ever causing contact to be made between the contact members, and it will also be apparent that the valve arrangement of the dash-pot, making its resistance to movement in opposite directions unequal, causes the plunger to work in the direction which would remove the contact members to their farthest separated position, and so removes the liability of accidental closing of the contact parts.

While I have herein described and for purposes of the present employment of my current-responsive device I prefer to employ the responsive coil as a means for actuating a circuit-closer, it will be apparent that it might be employed to actuate any other mechanically-operable devices of different characters.

For convenience of wiring to the exterior circuits the movable contact member is connected by a wire 33 with the terminal 34, and the stationary contact 19 is connected by a wire 35 to the terminal 36, while the suspension-wire 17, electrically connected with the coil 15, is connected by wire 37 with an impedance-coil 38, the opposite terminal whereof is connected by wire 39 with the terminal 40. The opposite extremity of the coil 15 is connected to a spring-wire 41, which in turn is connected by wire 42 with the terminal 43. All these parts and wires are conveniently upon the board 10.

Referring now to the parts diagrammatically shown in Fig. 1, it will be seen that a signaling device is associated in circuit with the contact parts of the relay to respond to the action of said relay. Specifically, D indicates a drop having a shutter *d* and a coil *d′*. 44 indicates a local drop-battery. Connection is made from terminal 34 by wire 45 to battery, thence to the coil *d′*, and thence back to terminal 36. The oscillating coil 15 is arranged in the calling-circuit, being in the present ground-return call system bridged between a line-wire and the ground. In the drawings, A and B indicate the two line-wires of a metallic circuit. 46 indicates a connection between wire B and terminal 43, and 47 indicates a connection from terminal 40 to ground. The subscriber's station may be equipped with any convenient means for sending current of different qualities, either direct or alternating, and is preferably so arranged that direct current of either positive or negative character or alternating current may be transmitted to the line at pleasure. In the devices illustrated, which I prefer to employ, R indicates a ringer having attached thereto a commutating device comprising a semi-insulated cylinder *r*, on which rest the three brushes *r′*, r^2, and r^3, the first two said brushes bearing upon the peripheral portions of the commutator member to make intermittent electrical contact therewith and the last said brush having constant contact with said commutator at its end. The construction is such that pulsating positive current may be taken from brush *r′*, negative pulsating current from brush r^2, and alternating current from brush *r*. Associated with the ringer is a selective switch S, comprising a stationary plate *s*, a tiltable plate *s′*, springs s^2, interposed between the plates and electrically connecting them, and three contact-blocks s^3, s^4, and s^5, their arrangement being such that tne springs s^2 normally hold the tiltable plate *s′* in contact with the block s^3; but the said plate is capable of being tilted to connect either end with the corresponding contact-block s^4 or s^5 and at the same time break its connection with the block s^3. A two-point spring-switch, as T, is also provided, and three binding-posts *v*, *v′*, and v^2 are shown to receive the connections of the instruments of the call system. The connections are as follows in the ground-return call system shown: From ground extends a wire 48 to the binding-post *v′*, whence extend wires 49 to the

automatic shunt contact-piece 50 of the ringer R. From the alternating brush r^3 of the ringer-commutator a wire 51 extends to the contact-block s^3 of the switch S, and from positive and negative brushes r' and r^2 of said commutator extend wires 52 and 53, respectively, to the respective contact-blocks s^4 and s^5 of the switch S. The plate s of the switch is connected by wire 54 with the blade of the switch T. From the upper contact-point, with which said blade normally contacts, extends wire 55 to binding-post v, which is connected to line-wire B by wire 56. The lower contact of switch T is connected by wire 57 to post v^2, which is connected to one of the line-wires, as A, by wire 58. C indicates a bell bridged between posts v' and v^2. Obviously, however, the devices might be wired in any way to accomplish the results sought, the wiring here shown being, however, convenient for such a system as that illustrated.

Now it will be apparent that when it is desired to call "central" the switch S is operated to connect the switch-plate s' to the brush r' or r^2, supplying current of the quality to which the relay at central is operatively responsive, and (assuming that the relay in question is operable by a positive current to actuate its circuit-closing parts and the plate s' is moved into contact with the block s^4) a circuit is established as follows: from the ground through wires 48 and 49 and contact 50 to the generator, thence by positive brush r' and wire 52 to contact-blocks s^4, through the movable bar s', the spring s^2, and plate s to wire 54, by said wire to the switch-blade T, and thence through wires 55 56, line B, and thence by wire 46 to terminal 43. Within the relay the current flows by wires 42 and 41 to the oscillating coil 15, and thence by 17 and 37 to the coil 38, and thence by wire 39 to terminal 40, the said terminal being connected by wire 47 to ground, completing the circuit. The continued application of the pulsating current to the extent of a few turns of the generator-handle turns the coil 15 strongly enough to overcome the resistance of the dash-pot and press the rod 23 outward, tilting the movable contact member 20 up into contact with the stationary contact member 19, and thereby completing the drop-circuit 45 to actuate the drop D.

In Fig. 4 I have shown the adaptation of my invention to a two-central four-party divided-circuit system. The wiring of the different stations is in general alike for all, and the connections of the transmitter and receiver with the line may be made in any suitable way. To balance the line, however, the bells of the subscribers are alternately bridged from the tip side or the sleeve side of the line, considered with reference to the jack connections on the central board to the ground, but a sufficient preponderance of bells being bridged on one side of the line to compensate for the resistance of the coils 15 and 38 of the relays bridged between the opposite side of the line and ground. Thus in Fig. 4, both relays being bridged from the sleeve side of the line (the wire B) to ground at the four stations N, O, P, and Q, three of the bells are grounded on the tip side, as shown at N O Q, and but a single bell, that at P, being grounded on the sleeve side. When such arrangement is used, the relay should be so wound that the joint resistance of the impedance-coil and the oscillating coil will be equal to the resistance of a bell, while the retarding-coil should offer a retardation equal to that of the bells of the circuit. To this end I prefer that the retardation device 38 be variable, as diagrammatically suggested in Fig. 4.

It will be understood that where the party-line is connected with two centrals, as shown in Fig. 4, the relay at one central is wound or connected to operatively respond to negative current and the other relay made to operatively respond to positive current, the bells on the line being all responsive to alternating current alone. Thus it will be apparent that by properly manipulating the switch S to connect the desired brushes of the generator-commutator to the line the subscriber may signal either central without disturbing the other or without ringing the bells of the other subscribers on the line, or he may call any one of the other subscribers on his line without disturbing the central-station operators. The switch T is provided to enable subscribers whose ringers are connected on one side of the circuit to shift the connections to the opposite side and call those parties so normally connected. In Fig. 1 when the blade of switch T is depressed the ringer is connected between ground and the line-wire A instead of between ground and wire B.

In Fig. 4 I have shown a refinement of the device at the central station which may be omitted or employed, as desired. The shutter of the drop D may be connected in a normally open circuit, so as to act as a circuit-closer, the circuit comprising a battery 60 and a buzzer or bell 61, connected together by wire 62, which includes a few turns about the impedance-coil 38. Thus when the relay is actuated to drop the shutter the circuit 62 is closed and the bell or buzzer caused to sound, the make and break of the circuit at the same time causing impulses in the relay-circuit, which are transmitted to the subscriber's station and may be heard in the subscriber's receiver. Thus a means is provided indicating to the subscriber that the relay at central has responded to his call and an answer will be forthcoming in due time, and at the same time an audible signal is given at central.

While I have described with some particularity the application of certain features of my invention in one system to which they are well adapted, I desire it to be understood

that I appreciate that certain features of my invention are susceptible of wide application, and I do not desire to be understood as limiting myself to the exact features herein shown and described further than are specified in the claims.

It will of course be apparent that the elements of my invention are capable of application in systems employing either metallic or grounded circuits with the instruments bridged or in series by simple changes of connections which can be made by those skilled in the art.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a telephone system, in combination, a party-line circuit connecting a plurality of subscribers' stations and a central station, at each subscriber's station means for producing alternating and direct current in the lines, and a signaling device responsive to alternating current only, and at the central station a relay comprising a coil supported for oscillation in a magnetic field, and means for retarding the oscillation of said coil.

2. In a telephone system in combination, a party-line circuit connecting a plurality of subscribers' stations and a central station, at each subscriber's station means for producing alternating and direct current in the line, and a signaling device responsive to alternating current only; and at the central station a relay comprising a coil supported for oscillation in a magnetic field, means for retarding the oscillation of said coil, and a signaling device operatively connected with said coil.

3. In a telephone system in combination, a party-line circuit connecting a plurality of subscribers' stations in a central station; at each subscriber's station means for producing alternating and direct current in the line, and a signaling device responsive to alternating current alone; and at the central station a relay comprising a light coil supported for oscillation in a magnetic field, means for retarding the oscillation of said coil in one direction, and a signaling device operatively connected with said coil to respond to its prolonged movement in one direction only.

4. In a calling apparatus for telephone systems, in combination, a line-circuit connecting a subscriber's station and a central station, at the subscriber's station means for causing direct current to flow through the line, and at central station a relay comprising permanent magnets arranged with their poles in opposition to form between them strong magnetic fields, a coil electrically connected with the line, supported for oscillation with its windings passing between the adjacent poles of the magnets, contact devices arranged for connection in another circuit, and operative connection between the movable element of said contact devices and the oscillating coil.

5. In a calling apparatus for telephone systems, a central signal responsive apparatus comprising a coil supported for oscillation in a magnetic field and connected in the call-receiving circuit; a normally open local circuit including an indicator, a source of current-supply, and contact devices comprising a movable part and a stationary part, and operative connection between said oscillating coil and the movable contact part, whereby said coil is arranged to actuate said contact devices controlling the local circuit.

6. In a telephone system, a central-station signaling apparatus comprising a coil supported for oscillation in a magnetic field and connected in the calling-circuit, a local circuit comprising a signal device, and contact devices controlling said local circuit, operative connections between a movable member of said contact devices and the coil, whereby said coil actuates the contact device; and means for retarding the oscillation of the coil whereby it is made insensible to alternating currents.

7. In a telephone system, a central-station signal apparatus, comprising a coil supported for oscillation in a magnetic field and connected in circuit with the subscriber's calling device, an impedance-coil in said circuit, a local circuit including a drop and circuit-controlling devices, operative connections between said circuit-controlling devices and the coil; a normally open alarm-circuit arranged to be closed by the shutter of the drop and including an alarm, a source of current-supply, and a winding about the said impedance-coil.

8. In a telephone system, in combination a metallic party-line circuit connecting a plurality of subscribers' stations and a central station; at each subscriber's station a generator for producing alternating or direct current in the line, and a bell responsive to alternating current only, bridged between one side of the line and ground, the bells at different subscribers' stations being bridged from opposite sides of the line; and means for switching the generator for connection with either side of the line; and at the central station a signaling device responsive only to direct current.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

ELMER A. TERPENING.

In presence of—
HARRY A. REHERD,
RUTH J. RICE.