

(No Model.)

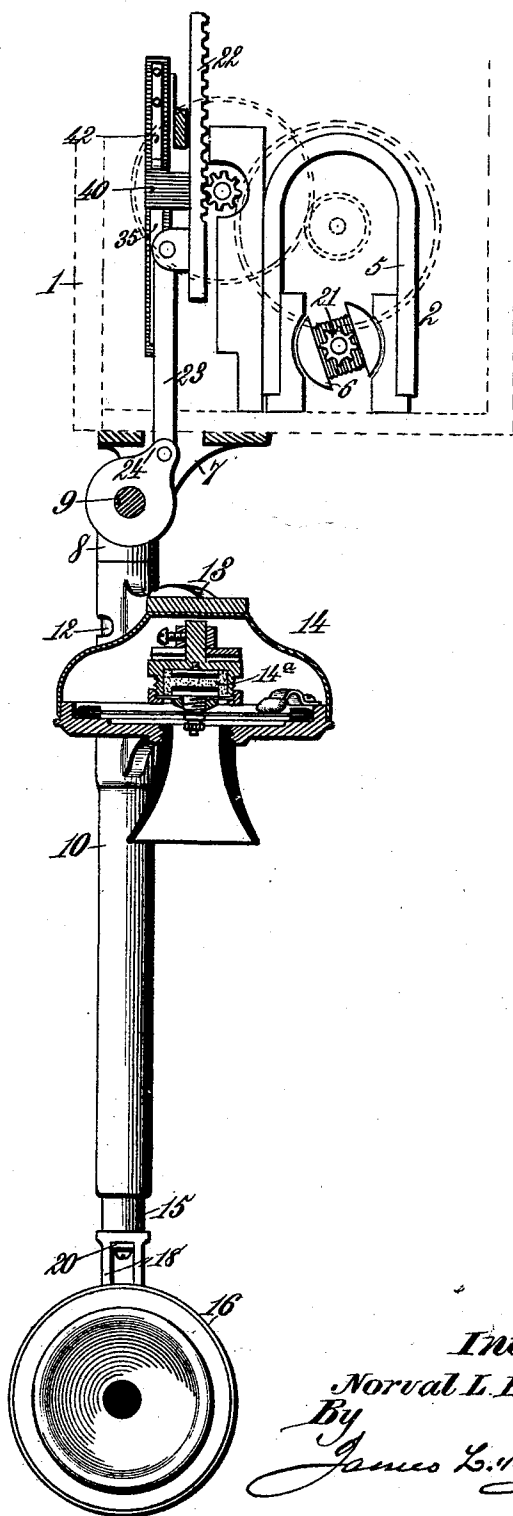
3 Sheets—Sheet 1.

N. L. BURCHELL.
TELEPHONE.

No. 543,798.

Patented July 30, 1895.

Fig. 1.



Witnesses.
Robert G. Smith
Thos. A. Green

Inventor.
Norval L. Burchell
By
James L. Norris
Atty.

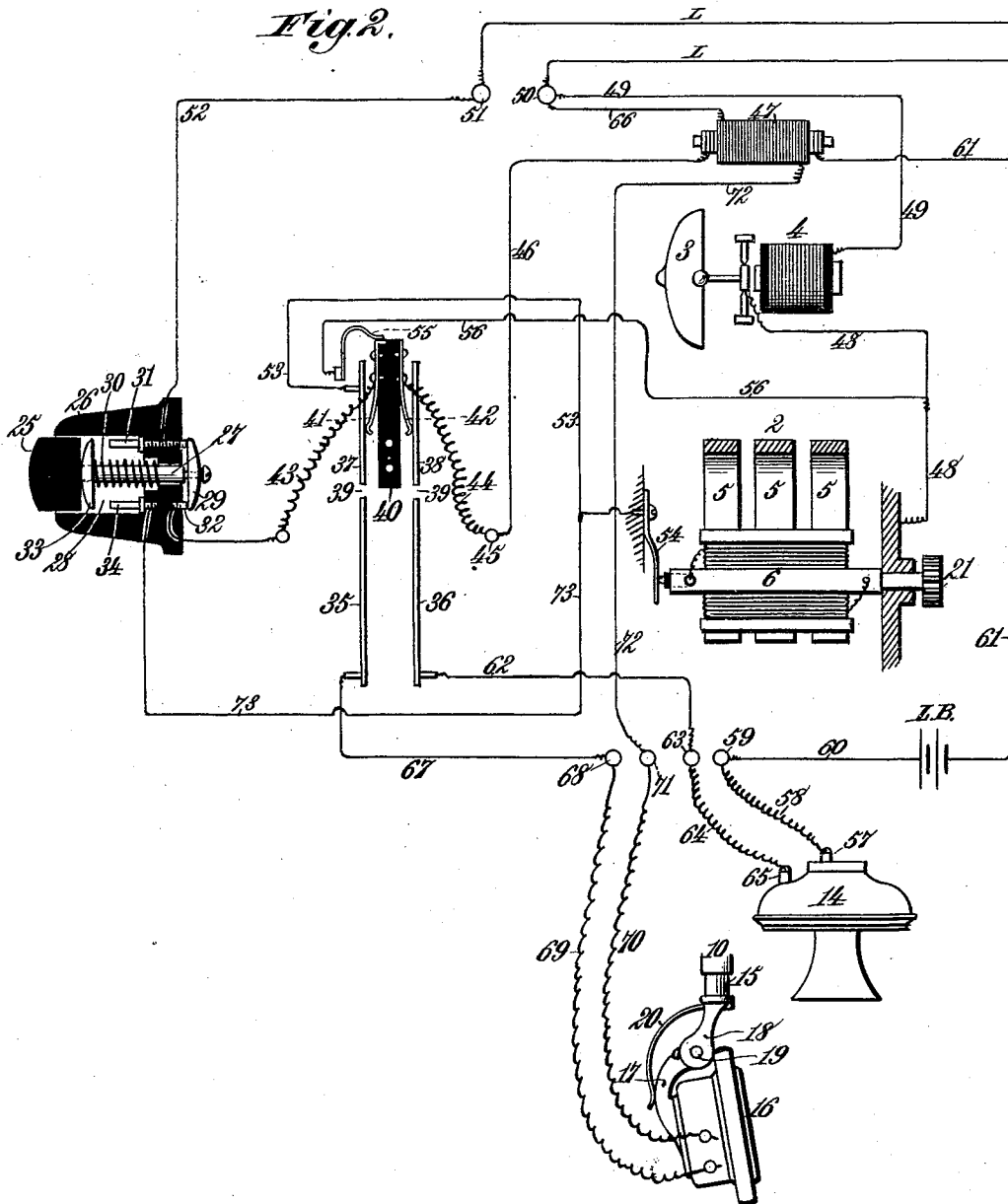
(No Model.)

N. L. BURCHELL.
TELEPHONE.

3 Sheets—Sheet 2.

No. 543,798.

Patented July 30, 1895.



Witnesses.
Robert Smith
Thos. A. Green

Inventor.
Norval L. Burchell.
By *James L. Norris*
Att'y.

(No Model.)

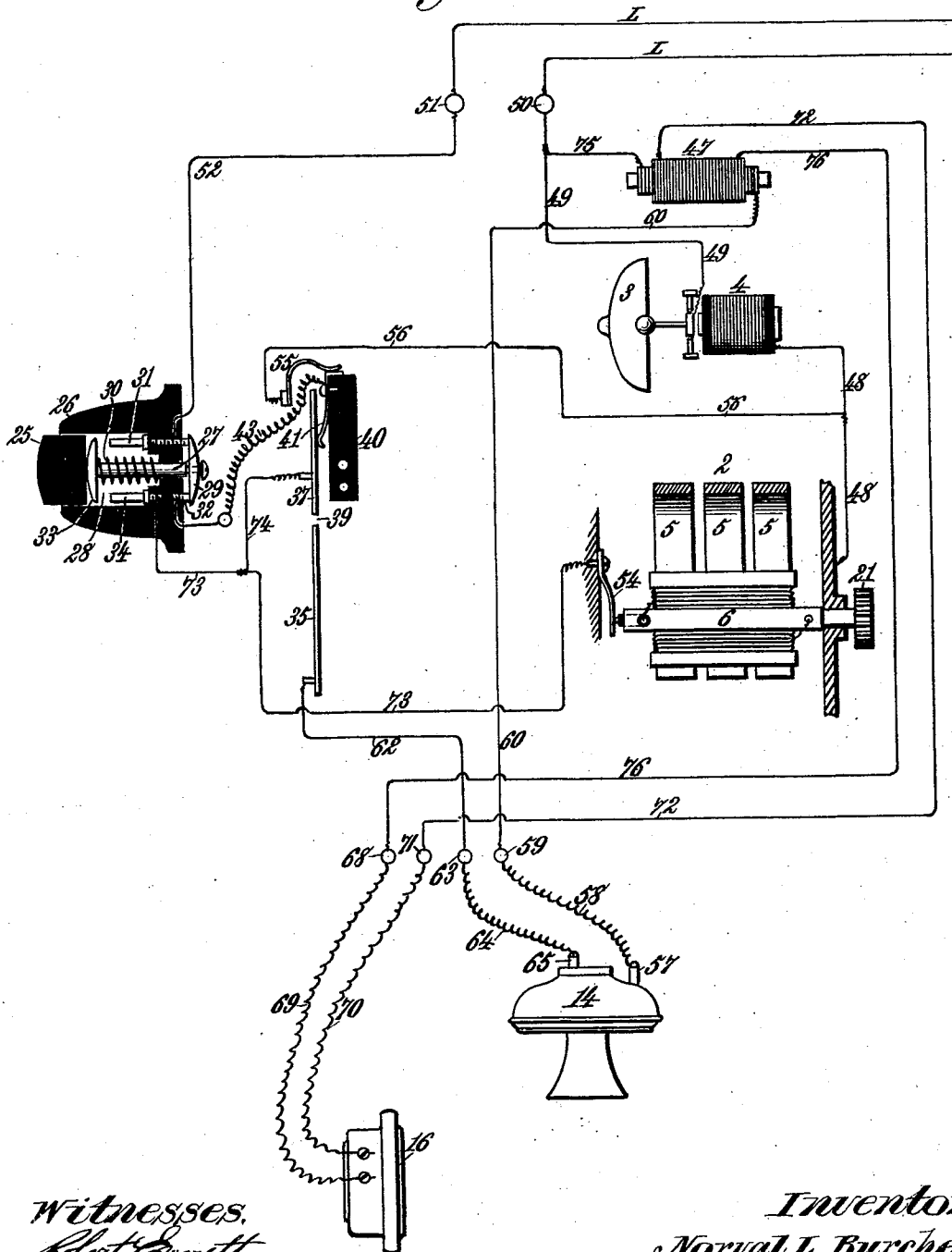
3 Sheets—Sheet 3.

N. L. BURCHELL.
TELEPHONE.

No. 543,798.

Patented July 30, 1895.

Fig. 3.



Witnesses.
Robert E. Smith,
Thos. A. Green

Inventor.
Norval L. Burchell.
By James L. Norris.
Atty.

UNITED STATES PATENT OFFICE.

NORVAL LANDON BURCHELL, OF WASHINGTON, DISTRICT OF COLUMBIA.

TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 543,798, dated July 30, 1895.

Application filed October 29, 1894. Serial No. 527,295. (No model.)

To all whom it may concern:

Be it known that I, NORVAL LANDON BURCHELL, a citizen of the United States, residing at Washington, in the District of Columbia, have invented new and useful Improvements in Telephones, of which the following is a specification.

My invention relates to certain improvements in electric telephones which are closely allied, in certain respects, to the invention for which I filed an application for Letters Patent upon the 20th day of September, 1894, Serial No. 523,636.

It is my present purpose to improve the invention contained in said application and provide a telephone having any type of transmitter in which a granular conducting material is employed for its variable-resistance medium which will retain its efficiency unimpaired for an indefinite period. It is my desire, in other words, to provide a telephone having any suitable form of variable-contact transmitter in which finely-divided or granulated conducting material is employed as a variable-resistance medium, and to mount such transmitter upon a pivotally-supported arm, which must be moved or turned upon its pivotal point whenever the telephone is used, by which movement the receiver and transmitter are brought into proper relations to the speaker for use. The purpose of this arrangement is to cause by such movements of the pivoted arm a frequent change in position of the transmitter and in the gravital relations of the granular particles of its variable-resistance medium, which prevents the latter from packing in its chamber and constantly maintains the vitality and sensitiveness of the transmitter at their maximum and avoids the imperfect transmission caused by either mechanical adhesion or by the settling of the particles due to long disuse. Moreover, the revolution of the armature of the magneto-call generator, which may be, and preferably is, produced by the movement of the pivoted arm, and the resistance to its revolution, which reaches its maximum when the armature-coils cut the maximum lines of force in the magnetic field, produces a vibration which is communicated through the arm to the transmitter-box, by which a mechanical agitation of the granulated material is

caused, whereby it is made to assume different positions and is more or less violently shaken or disturbed, so that its gradual settling or packing and the consequent imperfect action of the transmitter are effectually avoided.

It is my object, also, to simplify and improve the arrangement of circuits in such manner that the bell-coils shall always be in the main-line circuit when the telephone is not in use and the magneto or generator-supplying current to call the central or other station shall be on a short circuit. In this connection it is my further purpose to so arrange and connect a movable switch with the arm supporting the receiver and transmitter, or either of the same, that the short circuit for the magneto or generator shall be interrupted the moment the arm is moved to bring the parts supported by it into position for use, thereby making the main-line circuit operative for the purpose of calling the central or other station. It is my further purpose, in the same connection, to enable the movable switch, which is moved by the vibration of said arm, to automatically cut the magneto or generator out of the main line and switch the transmitter and receiver in as the arm approaches operative position, while its return to the position it occupies when the telephone is not in use cuts out the transmitter and receiver, restores the short circuit of the magneto or generator, and switches the bell-coils into the main line, all being effected without the employment of gravity or other forms of switches heretofore in use.

It is my further purpose to combine with a telephone a novel form of switch, whereby the several circuits may be automatically made operative, or opened and closed at pleasure.

It is my further purpose to provide a telephone with means whereby the circuit, including the main-line and magneto-call generator, may be maintained throughout the whole sweep or range of movement of the pivoted arm, or during a fractional part of the sweep of said arm, thus limiting the sound of the call-bell to a short call, or increasing the same to a continuous peal coextensive with the movement of the pivoted arm, and by which also the bell-coils may be wholly deprived of

current at any moment, thus silencing the call-bell entirely, should this be desirable.

It is my object also to provide a telephone system in which there shall be no necessity of employing local batteries and in which the primary of the induction-coil in each telephone shall be included in the main line and supplied with current from one or more batteries or generators located at the central station, or at any other suitable point, with the secondary of the induction-coil in each instrument in a local receiving-circuit.

The invention consists, to these ends, in the several novel features of construction and in the parts, the combination of parts, and the arrangements of circuits hereinafter fully described and then particularly pointed out and defined in the claims which conclude this specification.

To enable those skilled in the art to which my invention pertains to clearly understand and to practice said invention, I will now describe the same in detail, reference being had for such purpose to the accompanying drawings, in which—

Figure 1 is a vertical section of the telephone box and transmitter, the pivoted arm being shown in side elevation. Fig. 2 is a diagram showing the arrangement of circuits and the circuit-controller, the latter being central section. Fig. 3 is a diagram showing the adaption of the invention to telephone systems in which the line is supplied with current from a single source.

The reference-numeral 1 in said drawings indicates the telephone box or casing, which is equipped with a magneto or generator 2, a bell 3, and bell-coils 4. These parts, however, are merely shown to make up an operative instrument, as they form no part of my present invention, and the generator may be varied in form to suit the requirements of any telephone system. I prefer, however, to use the ordinary magneto-call generator having a magnetic field derived from permanent magnets 5 and an "H" armature 6 of the Siemens type. These parts and the bell and bell-coils are similar to corresponding features in my application filed upon the 20th day of September, 1894, Serial No. 523,636, and it is unnecessary to again describe the same specifically.

Upon the telephone box or casing 1 is mounted a bracket 7, to which is pivoted an arm 8, which is adapted to turn upon its pivot 9 in a plane at right angles with the armature 6 of the magneto-machine. Upon the pivoted arm 8 is slipped the tubular end of an extension-arm 10, which is secured by a pin or screw projecting from the arm 8 and lying in a slot 12, cut transversely in the tubular part of the arm, whereby a limited rotary movement of the latter upon the pivoted arm 8 is permitted. A rigid bracket-arm 13 extends laterally from the extension-arm 10, and upon said bracket-arm is mounted the transmitter 14. This device is one of that type of "long-

distance" transmitters in which a finely divided or granulated conducting material is used as a variable resistance medium.

The instrument shown in the accompanying drawings is substantially similar to that shown in Letters Patent to Anthony C. White, dated November 1, 1892, No. 485,311, and, being well known, a detailed explanation is unnecessary. Moreover, this special form of transmitter is shown merely to illustrate the type or class of instrument, without indicating a preference for any individual construction in said class of instruments, as I may use any transmitter having a granular or finely-divided conducting material as a variable-resistance medium.

The extension-arm 10, of which the tubular portion forms part, is of any suitable length, so that when the ear is at the end of said arm or thereabout the mouth will be at the proper point with relation to the transmitter, but to provide for such variations as may be desired I provide a second extension-arm 15, so connected with or mounted upon the arm 10 that it may form a longitudinal extension or prolongation of the same. I have shown this second arm 15 as being telescoped within the extension-arm 10, but it may be mounted thereon in any other convenient manner by which it can be extended in the same or in a plane parallel to the axis of the arm 10. Upon the end of the arm 15 which is normally close to the end of the arm 10 is the receiver 16, which has a lug 17 projecting from its casing. This lug is inserted between two parallel lugs 18 on the end of the arm 12, and a pivot-pin 19 is inserted through all three. The receiver thus has a capacity for rocking or vibrating in such manner as to form different angles with the vertical plane in which the arm 10 vibrates. A spring 20, mounted at one end on the arm 12, presses with the other end on the back of the casing of the receiver and holds the latter in the position shown in Fig. 2. In use the ear is pressed lightly against the receiver, which yields when the pressure exceeds the force of the spring. One function of the latter is to prevent the person who uses the telephone from exerting too great pressure, thereby incurring the danger of bending or breaking the pivoted bearings, and to enable the receiver to conform in position to the natural and involuntary movements of the body without impairing the contact with the ear. Moreover, this construction permits the user of the telephone to vary the distance between the transmitter and the mouth of the speaker within ordinary limits and may in this manner avoid the necessity of using the extension-arm 12.

The armature-shaft of the magneto-call generator is provided with a pinion 21, which is driven by a rack of teeth upon a bar 22, arranged to move in a right line. A pitman or connecting-rod 23 connects said bar with a forked projection 24 upon the pivotally-mounted end of the arm 8, as seen in Fig. 1.

By vibrating said arm upon its axis 9 the rack-bar 22 will be reciprocated and the armature 6 will receive revolution, sufficient current being generated thereby to magnetize the bell-coils at the central or other station on the line. I will now proceed to describe the several circuits and the circuit-controller and switch, both the latter being so connected that an explanation will be more readily understood when given in running the circuits.

The circuit-controller consists of a push-button 25, arranged within a non-conducting housing 26 and mounted on a spindle 27, which extends through a chamber 28 in the housing and projects through the wall, closing the end of said chamber. Upon the projected end of the spindle is mounted a washer 29 of conducting material. A spring 30, coiled around the spindle 27, within the chamber 28, projects the push-button 25 from the open end of said chamber and draws the washer 29 against two insulated contact-posts 31 and 32, arranged on opposite sides of the spindle. The contact-post 31 extends within the chamber 28 to such a point that when the button 25 is pushed into said chamber far enough a washer 33, lying next said button, will make contact with the end of said post. Upon the other side of the spindle 27 is a contact-post 34, lying wholly within the chamber 28 and electrically isolated from all other parts of the circuit-controller. The end of this contact-post lies in the same plane with the end of the contact-post 31, so that the washer 33 will engage both simultaneously. The spindle 27 being a non-conductor, the sole path for the electric current is by way of the washers 29 or 33. When the former is resting upon the contact-posts 31 and 32, the washer 33 is off both contact-posts, and when the latter is brought upon the contact-posts 31 and 34 the washer 29 is removed from electrical contact.

The switch consists of two parallel contact-strips 35 and 36, arranged at a suitable interval of separation and in line, respectively, with two shorter parallel strips 37 and 38, from which they are separated by a narrow break 39. Between said strips lies a non-conducting bracket 40, carrying two brushes 41 and 42, extending laterally and bearing against the adjacent faces of the contact-strips. The bracket 40 is mounted on or so connected with the rack-bar 22 that it partakes of the reciprocating movement of the latter. The contact-post 32 is permanently connected to the bracket 40 by a flexible cord or other suitable conductor 43. A similar conductor 44 connects said bracket to a binding-post 45, and thence by a wire 46 to one terminal of the primary of the induction-coil 47.

The circuit for the magneto-call generator is as follows: From the positive pole of the armature over a wire 48 to one terminal of the bell-coils, from the other terminal by a wire 49 to a binding-post 50, thence over the line-wires L and back to a second binding-post 51;

thence by a wire 52 to the contact-post 31, then through washer 29, contact-post 32, and flexible cord 43 to the bracket 40; thence through the brush 41 and contact-strip 37 to a wire 53, and over said wire to a brush 54 and to the negative pole of the armature 6. When the bracket 40 is at or near its extreme limit of movement between the contact-strips 37 and 38, which is the point at which it stands when the arm 8 is in the position it occupies when the telephone is not in use, the end of the brush 41 bears against a spring-contact 55, which is connected by a wire 56 to the wire 48. When this is the case the magneto or generator is on a short circuit consisting of the wire 48, wire 56, spring-contact 55, brush 41, contact-strip 37, wire 53, and brush 54. The moment the arm is vibrated to operate the magneto-call generator or to bring the transmitter and receiver into position for use, the short circuit is broken and the only path for the generated current is then through the bell-coils and over the line-wire to the bell-coils at the station called, as already explained. It will be noted that when the magneto is on the short circuit described, the bell-coils 4 are in the circuit which includes the line-wire. This circuit is over the line-wire to binding-post 51, wire 52, contact-post 31, washer 29, contact-post 32, flexible cord 43, brush 41, spring-contact 55, wire 56, wire 48, bell-coils 4, wire 49, binding-post 50, and line-wire L. This circuit excludes the magneto-call generator entirely.

In describing the transmitting-circuit it should be remembered that when the telephone is in use the pivoted arm 8 is swung upon its axis 9 to such a point as to bring the receiver and transmitter into position for use, and that when in this position the bracket 40 will be between the contact-strips 35 and 36, with its brushes 41 and 42 resting upon said strips. The circuit will then be as follows: Starting from the positive pole the current of a local battery L B follows a wire 60 to a binding-post 59, thence by wire 58 to one electrode 57 of the transmitter, from the other electrode 65, by wire 64, binding-posts 63, and wire 62 to contact-strip 36; then by brush 42, flexible cord 44, binding-post 45, and wire 46 to one terminal of the primary of the induction-coil, and from the other terminal by wire 61 back to the other pole of the local battery. The secondary circuit is from one terminal of the secondary of the induction-coil over a wire 66 to the binding-post 50, line-wires L L, binding-post 51, wire 52, contact-post 31, washer 29, contact-post 32, flexible cord 43, brush 41, and contact-strip 35; thence by a wire 67 to a binding-post 68 and wire 69 to one of the electrodes of the receiver. The circuit is completed by a wire 70, leading from the second electrode of the receiver to a binding-post 71, and thence by a wire 72 to the second terminal of the secondary coil of the induction-coil. The receiving-circuit is the same as that last described, but may be read, in Fig. 2, from

the line-wire and binding-post 51 over wire 52, contact-posts 31 and 32, washer 29, flexible cord 43, brush 41, contact-strip 35, wires 67 69 70, binding-posts 71, wire 72, to the secondary of the induction-coil, and thence by wire 66 to the binding-post 50 and line-wire.

It will be observed that when the brushes 41 and 42 are upon the contact-strips 35 and 36 the magneto-call generator and the bell-coils are cut out, their circuits being interrupted by the removal of the brush 41 from the spring-contact 55. On the other hand, when the telephone is not in use, the brushes 41 and 42 being upon the contact-strips 37 and 38, the transmitter and receiver are both cut out, the bell-coils are in the circuit including the line-wires, and the magneto is upon a short circuit, as already described.

The armature 6 being the "H" form, of the Siemens type, it is plain that at two opposite points in each revolution its coils must cut the maximum lines of force of the magnetic field. As the resistance to its rotation will be greatest at these points, and at a minimum half-way between the same, the action of the armature in generating a current will communicate a vibration which will be felt more distinctly in the arm 8 and its attachments, this being due to the fact that said arm is connected through the pitman to the rack-bar 22, which drives the armature-shaft. This vibration being communicated to the transmitter it produces a frequent agitation of the finely-divided particles of conducting material used as a variable resistance medium 14.

The functions of the circuit-controller are as follows: A wire 73 being led from the contact-post 34 to the brush 54, by pushing the button 25 into the chamber 28, the bridge-washer 29 is drawn off the contact-posts 31 and 32, and by moving the button far enough the bridge-washer 33 is seated upon the contact-posts 31 and 34. When the push-button 25 is in normal position, with the bridge-washer 29 on the contact-posts 31 and 32, the circuit of the magneto-call generator, including the line-wires, is broken the instant the brushes 41 and 42 pass the interruptions 39 between the ends of the contact-strips 35 36 and 37 38. The bell at the station called will ring, therefore, during a part only of the whole stroke of the pivoted arm 8 in either direction. When the button is pushed in far enough to seat the bridge-washer 33 on the contact-posts 31 and 34, the circuit of the magneto will still remain the same as before until the contact-post 31 is reached. At this point, instead of passing over the bridge-washer 29, the current traverses the bridge-washer 33, contact-post 34, and wire 73 to the brush 54. The bracket 40 and contact-strips 35 36 37 38 being cut out, the bell at the called station will ring throughout the entire stroke of the arm 8 in either direction. By pushing the button 25 into the chamber 28 far enough to remove the bridge-washer 29 from the contact posts 31 and 32, but not far enough to

seat the bridge-washer 33 on the contact-posts 31 and 34, the main line is broken and the bell-coils 4 may in this manner be wholly deprived of current at any moment. When long continued, loud ringing of the call-bell takes place, its clamor may be instantly silenced in this manner.

My invention is capable of use upon systems in which the primary of the induction-coil in each individual transmitter-circuit is included in the main line, the local batteries being replaced by a single source of electric energy arranged at any suitable point—as, for example, in the central office—in contradistinction to the arrangement shown in Fig. 2, in which a battery is placed in a local circuit, including the primary of the induction-coil, at each subscriber's station. I have shown in Fig. 3 such slight modification as will adapt my invention to a system of this character, the essential features in said figure which correspond with those already described being indicated by the same numerals heretofore employed. Beside the removal of the battery L B (shown in Fig. 2) and the change in the transmitting and receiving circuits the contact-strips 36 and 38 and the brush 42 of the movable switch may be omitted. The wire 53 is removed and the contact-strip 37 is connected by a wire 74 to the contact-post 34. The circuit for the magneto-call generator is the same as that heretofore described until the movable switch 40 is reached. From this point the circuit is completed by contact-strip 37, wires 74 and 73, and brush 54. This gives the short ring of the bell at the station called. For the long ringing throughout the full stroke of the fixed arm 8 the circuit is the same as that already described. The transmitter-circuit, starting from the positive electrode, is from binding-post 57, by wire 58, binding-post 59, and wire 60 to the first terminal of the primary of the induction-coil 47. From the second terminal a wire 75 leads to the binding-post 50 and line-wire. The circuit is completed by the second line-wire, binding-post 51, wire 52, contact-posts 31 32, bridge-washer 29, flexible cord 43, brush 41, contact-strip 35, wire 62, binding-post 63, and wire 64 to binding-post 65. The local receiving-circuit, which includes the secondary of the induction-coil 47, is from one terminal of said secondary by a wire 76 to the binding-post 68, and then by wire 69 to one electrode of the receiver. From the other electrode the circuit is completed by wire 70 to binding-post 71, and thence by wire 72 to the other terminal of the secondary.

It should be noted that by my present invention the telephone becomes practically automatic, the bell-circuit being normally in the main line and being cut out at the moment the pivoted arm is brought to place to present the transmitter and receiver in position for use, both the latter being brought into their respective circuits at the same moment that the bell-circuit is broken, while the

call-bell is sounded at the called station by the adjustment of the pivoted arm. It should be remembered, however, that the signal-circuit controller, although an accessory, is not a strictly essential part of my invention. It enables me to control the ringing of the bell and to silence the latter entirely at my own or at any local station at any moment, and in these particulars it is highly useful. Nevertheless the other important results attained by my invention are independent of this element, as I may make a permanent connection from the main line through the movable switch to the bell-coils and to the receiver and transmitter circuits.

It will be noted that each time the telephone is used the pivoted arm carrying the transmitter must be moved from the position shown in Fig. 1 to a position approximating a horizontal plane passing through the pivotal axis, and as the extent or range of movement depends somewhat upon the height of the user the average movement will be over ninety degrees of arc, or thereabout. Moreover, as the magneto-call generator is operated by the arm the latter will usually receive a plurality of oscillations, since it is customary to sound a very audible call at the central station and is frequently necessary to repeat the call. These movements necessarily agitate and shake up the transmitter and its granular material, thereby preventing the latter from packing. This change of position alone, without the actual vibration produced by the magneto-call generator, will so change the gravital relation of the granular material as to prevent any tendency to pack or to settle, whereby the vitality and sensitiveness of the transmitter would be seriously impaired. Thus all occasion for frequently renewing the transmitter for maintaining it at all times in a fixed position or for rapping the box or casing to remedy the tendency to pack are effectually removed. The shifting of the transmitter, also, from one side of the arm to the other inverts it completely and reverses the action of gravity upon the granular particles, and these frequent changes of position without actual vibration will maintain the sensitiveness and vitality of the transmitter.

It will be noted that in Fig. 3 the contact 35 is shown as having electrical connection by wire 62 with one electrode of the transmitter, the contact 36 being omitted. In other words, the contact 35 is simply substituted for the strip 36 by connecting the wire 62 to the former instead of the latter. It will be perceived that inasmuch as the contact-strip 38 in Fig. 2 is practically a "dead element," electrically speaking, the substitution referred to, which consists in connecting the wire 62 to the contact 35 and dispensing with the contact 36, will make the latter a common medium of electrical communication for the wire 62, leading to one electrode of the transmitter, and for the wire 67, leading from said

contact 35 to one electrode of the receiver. It is obvious that this arrangement is entirely compatible with the circuits illustrated in Fig. 2 by merely connecting the wire 46 to the movable switch on the same side that the contact 35 is placed—as, for example, to the flexible electric connection 43.

What I claim is—

1. In a telephone, the combination with a pivoted arm and with a switch connected to and operated by said arm to complete the telephonic circuit, of a transmitter carried by an arm projecting laterally from the pivoted arm and adapted to turn thereon to bring the transmitter upon either side thereof, said transmitter having a granulated conducting material for its variable resistance medium, whereby said transmitter is necessarily changed in position when the telephone is used and may be inverted, thus changing or reversing, the gravital relations of the granular material, substantially as described.

2. In a telephone, the combination with a main line and with the local telephonic circuits, of a switch consisting of a movable bracket, or carrier, having a single brush, and elongated and continuous contact-strips having a narrow interval of electric separation and so arranged that said brush may have continuous movement thereon one strip being connected in the main line and to one pole of the dynamo, and the other strip being connected through the transmitter to one terminal of the primary of the induction coil, said brush being permanently connected in the main line, substantially as described.

3. In a telephone, the combination with a main line and with the local telephonic circuits, of a switch consisting of a movable bracket, or carrier, having a single brush which is permanently connected with the main line, elongated, continuous contact-strips, having a narrow interval of electric separation, one strip being connected in the main line and to one pole of the dynamo, and the other strip being connected through the transmitter to one terminal of the primary of the induction coil, an arm to operate the magneto call-generator, and means for connecting said arm to the bracket, or carrier, to enable it to operate the switch simultaneously with the operation of the magneto call-generator, substantially as described.

4. In a telephone, the combination with a main line and with the local telephonic circuits, of a switch consisting of a movable bracket, or carrier, of insulating material, a single brush mounted thereon and having a permanent electrical connection with the main line, elongated contacts having a narrow interval of electric separation, one strip being connected in the main line and to one pole of the dynamo, and the other strip being connected through the transmitter to one terminal of the primary of the induction coil, a magneto-call-generator, and an electrically isolated arm or lever, by which said generator

is operated said arm being mechanically connected to the bracket, or carrier of the switch, substantially as described.

5. In a telephone, the combination with a pivoted arm of a transmitter mounted on said arm, having a granular conducting material for its variable resistance medium, and a magneto-call generator, operated by said pivoted arm whereby the transmitter and its granular material is shaken at each use of the telephone, substantially as described.

6. In a telephone, the combination with a pivoted arm of a transmitter mounted on said arm and having a granular conducting material for its variable resistance-medium, and a magneto-call generator having an armature which is revolved by a rack-bar geared with a pinion on the armature-shaft and connected to the pivoted arm, whereby the transmitter and its granular material is shaken at each use of the telephone, substantially as described.

7. In a telephone, the combination with a pivoted arm of a transmitter mounted thereon and having a granular conducting material for its variable resistance medium, a magneto-call generator, a rack-bar meshing with a pinion on the end of the armature-shaft, and a pitman connecting said rack-bar to the pivoted arm, whereby the transmitter and its granular material is shaken at each use of the telephone, substantially as described.

8. In a telephone, the combination with a pivoted arm of a transmitter and receiver, the former carried by a laterally projecting arm and the latter by a pivot at the end of the pivoted arm, and a spring normally rocking the receiver toward the side on which the transmitter lies, substantially as described.

9. In a telephone, the combination with a pivoted arm of a transmitter supported upon a laterally projecting bracket-arm, a supporting arm forming part of said bracket-arm and having a tubular portion receiving and capable of turning upon the pivoted arm, an extension-arm adapted to be drawn out and in, in the line of the pivoted arm, and turning with the supporting-arm, and a receiver pivoted on the end of the extension-arm and having a spring which tilts it toward the side on which the transmitter lies, substantially as described.

10. In a telephone, a circuit controller consisting of a non-conducting spindle having a push-button, bridge-washers mounted on different parts of said spindle, two contact-posts lying on opposite sides of said spindle, a spring drawing one of the bridge-washers against said posts, a third contact-post having an end in line with one of the two, whereby the second bridge-washer may seat on both when the button is pushed to compress the spring, a movable switch connected by a flexible cord to one of the two contact-posts, and interrupted contact-strips on which the movable switch slides, substantially as described.

11. In a telephone system, the combination with a source of electrical energy, of a main

line adapted to conduct current when the circuit is closed, a series of induction-coils having their primaries included in the main line and in the transmitters at the several local stations, a series of local receiving circuits including the secondaries of the induction-coils and the telephonic receivers, and a movable switch which makes and breaks the telephonic circuits and simultaneously breaks and makes the operative circuit of the magneto-call-generator, substantially as described.

12. In a telephone, the combination with a magneto-call-generator, of a movable switch having a single brush, elongated contact-strips electrically separated by a narrow interval over which said brush moves with continuous contact, a circuit for the magneto-call-generator including one of said contact-strips, a circuit for the transmitter including another of said contact-strips, and a short circuit for the magneto-call-generator including the first of said contacts and the movable switch, the latter having a permanent connection with the main line, substantially as described.

13. In a telephone, a movable switch consisting of a bracket, or carrier, having a single brush having permanent electrical connection with the line-wire, elongated, electrically interrupted contact-strips with which said brush has continuous contact throughout each movement of the switch, one of which is connected to one pole of the magneto-call-generator and another to one electrode of the transmitter, a circuit for the bell coils including the other pole of the magneto-call-generator, and a transmitting circuit including the second electrode of the telephonic transmitter, the primary of the induction coil and the main line, substantially as described.

14. In a telephone, a switch consisting of a movable bracket having a single brush suitably connected in the main line, electrically isolated, elongated contact-strips over which said brush moves, one of said strips being permanently connected in the circuit of the magneto-call-generator, and another in the circuit including the transmitter, the primary of the induction coil, and the main line, a separate contact located in the line of movement of the bracket and forming part of a short circuit for the magneto-call-generator, said circuit being completed when the bracket or carrier reaches its limit of movement in one direction, and means for operating the armature of the magneto-call-generator and simultaneously moving the brush of the switch over the elongated contact strips, substantially as described.

15. In a telephone, the combination with a magneto-call generator, and with a transmitter, a receiver, and an induction coil of a switch consisting of a movable bracket permanently connected in the main line circuit, isolated contact-strips over which a brush on the bracket moves, a separate contact lying

in the line of movement, a short circuit for the magneto-call generator, including said separate contact, the brush on the movable bracket, and one of the contact-strips, a local receiving circuit including the secondary of the induction-coil and the telephonic receiver and a transmitting circuit including another of the contact-strips, the brush on the movable bracket, the main line, the primary of the induction-coil, and the telephonic transmitter, substantially as described.

16. In a telephone, the combination with a magneto-call generator, of a pivoted arm connected to and operating the armature of said generator, a transmitter and receiver, a switch consisting of a movable bracket having a brush having permanently electrical connection in the main line, the bracket being con-

nected to said pivoted arm in such manner as to receive motion therefrom, electrically isolated contact strips over which the brush moves, a separate contact lying in the line of movement of the brush, a short circuit for the magneto-call generator including said separate contact, the brush on the bracket, and one of the contact-strips, and a transmitting circuit including the other contact-strip, the brush and the telephonic transmitter, substantially as described.

In testimony whereof I have hereunto set my hand and affixed my seal in presence of two subscribing witnesses.

NORVAL LANDON BURCHELL. [L. S.]

Witnesses:

JAMES L. NORRIS,
THOS. A. GREEN.