No. 799,585. PATENTED SEPT. 12, 1905.

E. B. WILLIX & J. YOUNG.

ELECTRIC GENERATOR FOR TELEPHONE SYSTEMS.

APPLICATION FILED FEB. 25, 1905.

2 SHEETS—SHEET 1.

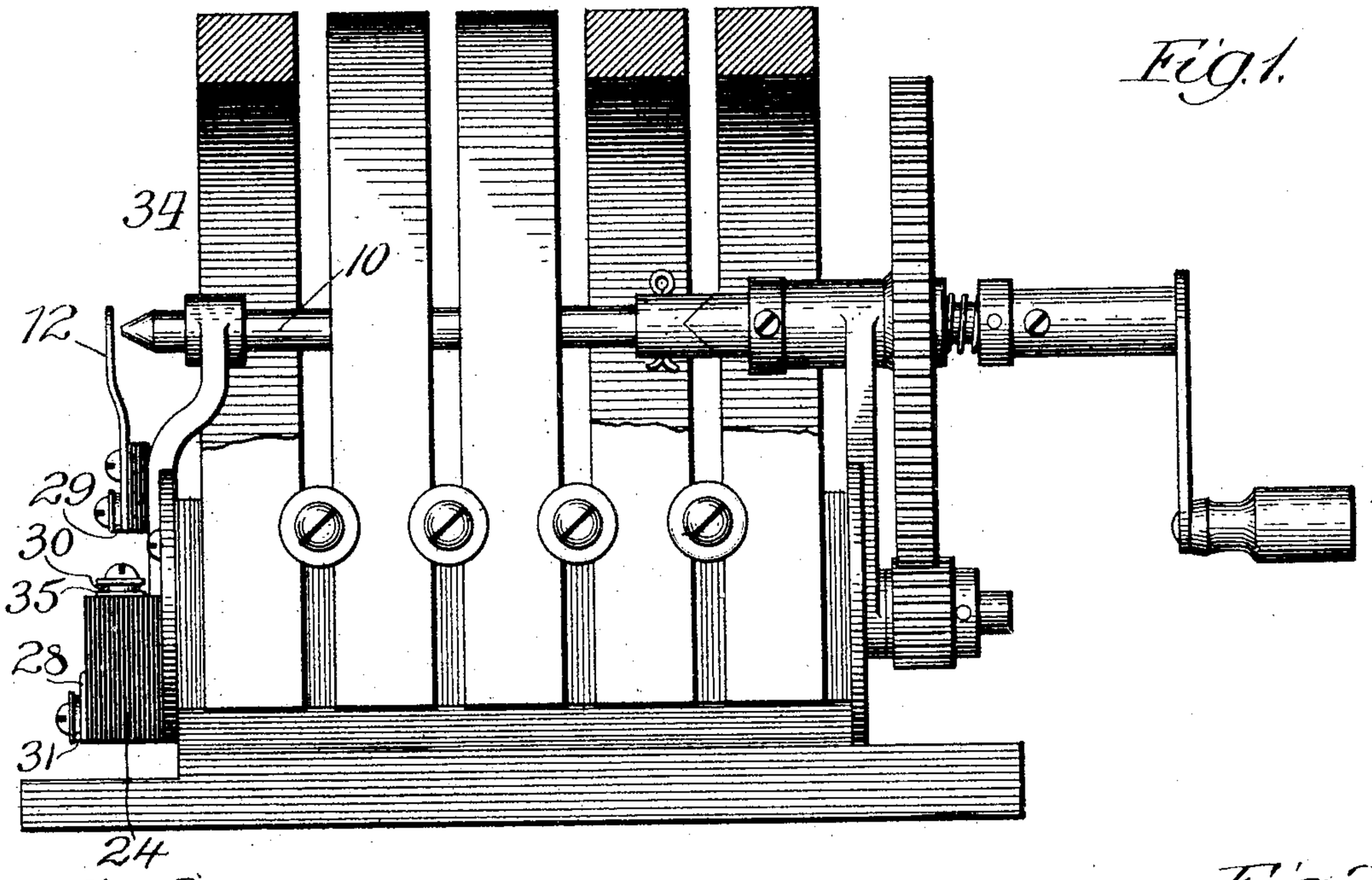


Fig. 1.

Fig. 3.

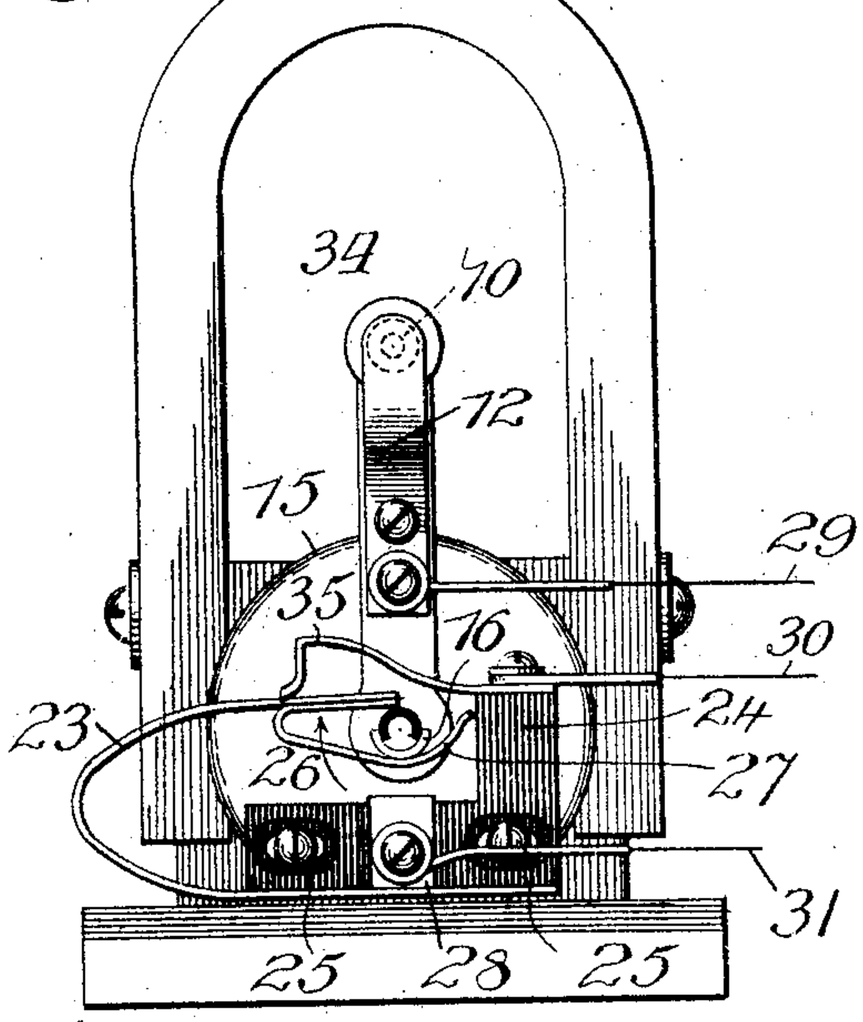
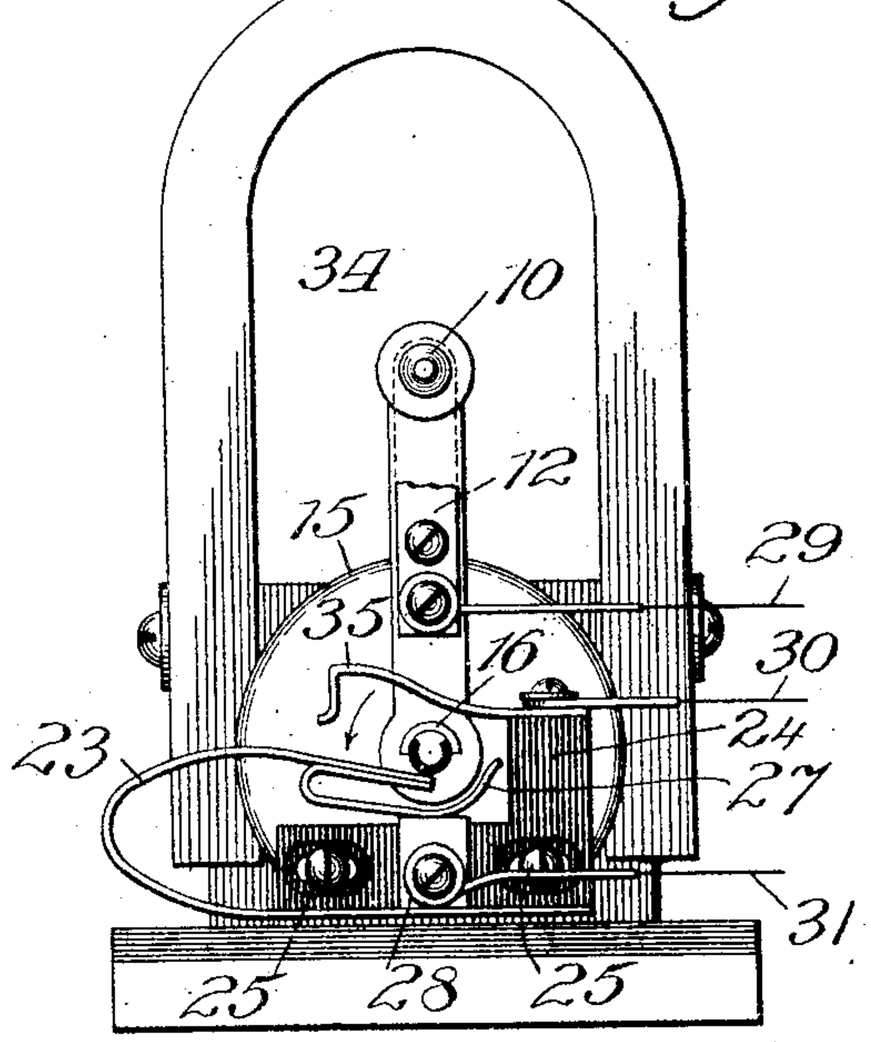


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 4.

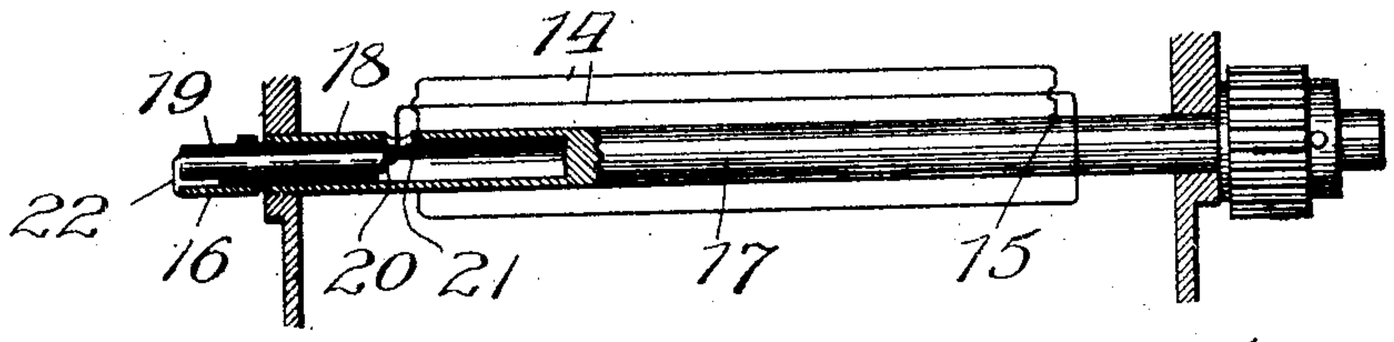


Fig. 5

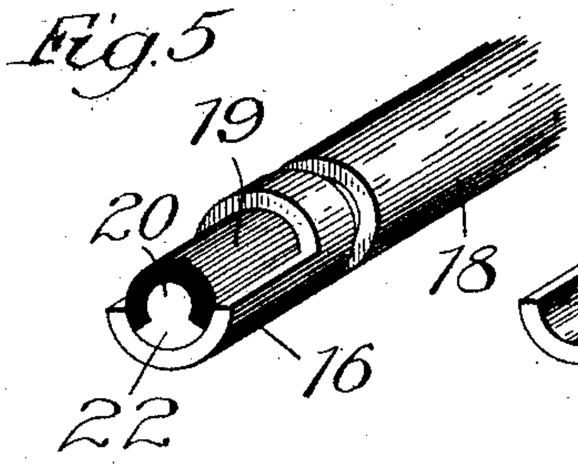


Fig. 6.

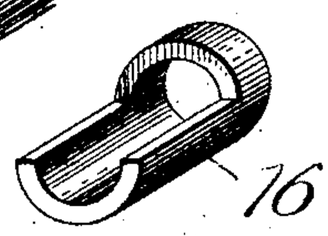


Fig. 7.

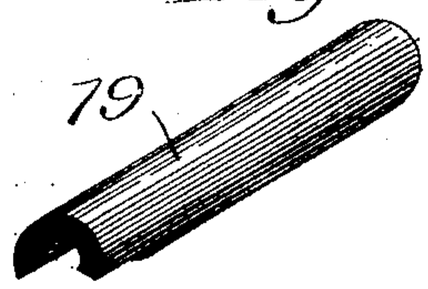


Fig. 8.

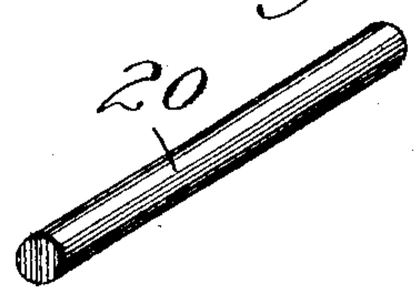


Fig. 9.

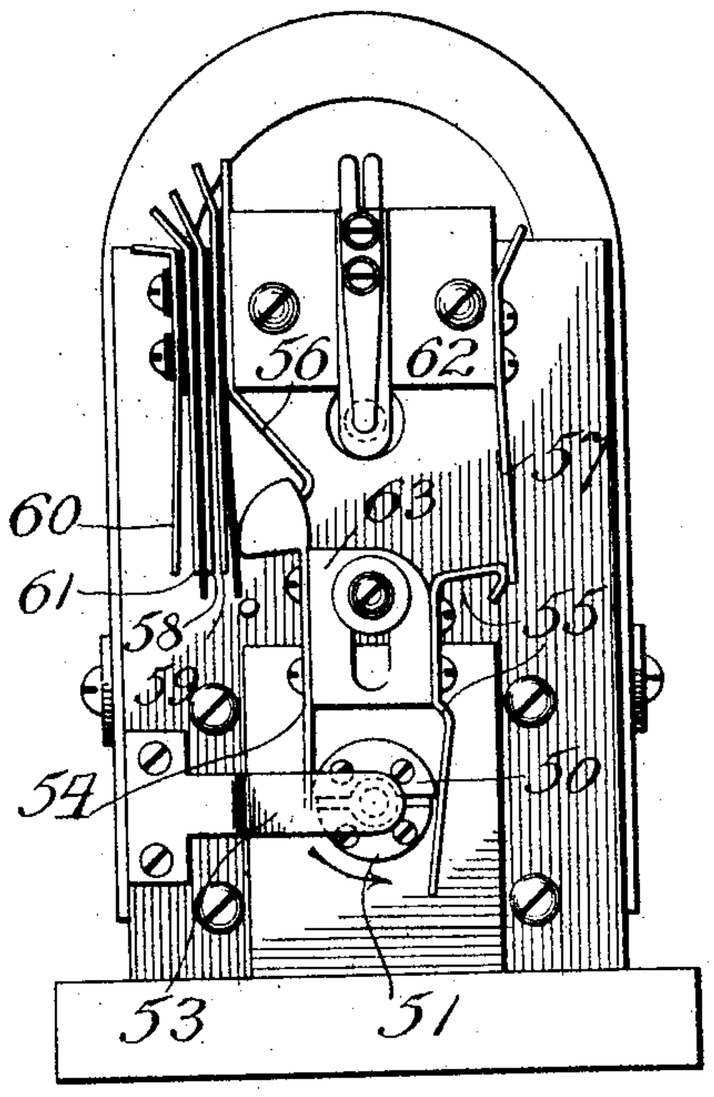
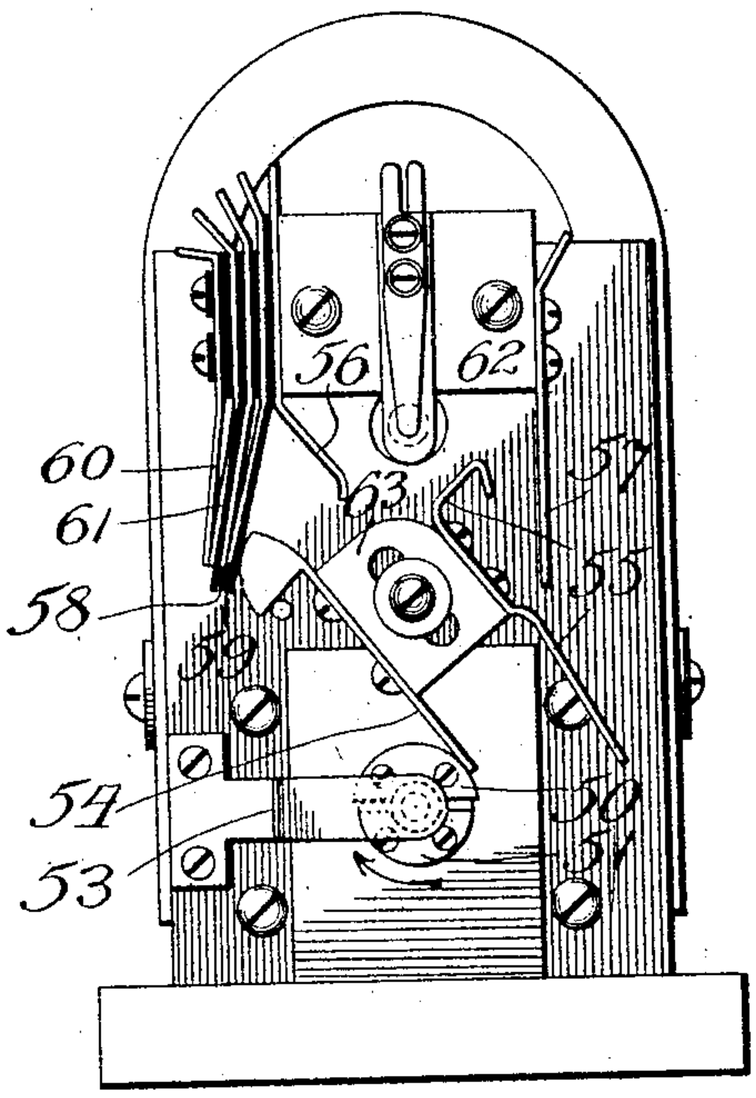


Fig. 10.



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UNITED STATES PATENT OFFICE.

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ELECTRIC GENERATOR FOR TELEPHONE SYSTEMS.

No. 799,585. Specification of Letters Patent. Patented Sept. 12, 1905.

Application filed February 25, 1905. Serial No. 247,278.

To all whom it may concern:

Be it known that we, ENOS B. WILLIX and JOHN YOUNG, citizens of the United States of America, residing in Mount Vernon, county of Linn, and State of Iowa, have invented a new and useful Improvement in Electric Generators for Telephone Systems, of which the following is a specification.

Our invention pertains to electric generators as used in telephone-work and upon party-lines and similar circuits wherein it is required at different times to send forth from a generator-station currents of different natures.

In the signaling of stations upon party-lines when signaling is in any way selective it is required to send from the central office currents of varying natures differing among themselves either in strength, direction, or frequency, or to send signaling-currents over different paths, or both of these conditions in varying combinations. It has been the custom in telephone-work to provide at the central office a generator with a plurality of terminals, from which terminals might be taken currents of varying natures, or to install a plurality of generators giving currents of varying natures. The connection of these sources of potential to a telephone-line for the signaling of a selective telephone-station upon that line in any combination desired has been performed by means of manually-operated keys. In further development of private-line and party-line equipment circuits and systems have been devised in which it has been made necessary that the telephone-substation should send forth electric currents varying in nature in accordance with the purpose for which the current is intended. For instance, in a party-line connected to a telephone central office each substation upon that party-line may be provided with facilities for ringing the central office without ringing the bell of any other station upon that line and also with facilities for ringing the bells of all stations or any other station upon that line without calling the attention of the central office. The methods by which this has been accomplished have been the combination of a generator with manually-operated keys or the combination of a generator with a plurality of terminals with said manually-operated keys. A further condition developed in telephone working which requires alternative natures of current to be supplied from a telephone-substation is the divided central office or, as it is commonly called, the "divided multiple." In this system each telephone-line is provided with two or more central-office signals, and it is the option of the telephoner user so to operate his substation equipment as to actuate selectively a required central-office signal.

It is quite within the scope of our invention to be used in connection with a central office signaling selective stations upon party-lines, with a party-line substation signaling alternatively the central office or other substations, with a private line signaling other stations selectively, or with a substation connected to a divided central office, or other uses.

Our invention consists of means for producing two distinct currents of differing natures from the same electric generator, the respective currents being generated alternatively, as the armature of the electric generator may be driven in alternative directions. The currents delivered by the electric generator may differ in their electromotive-force curves or in the circuit-terminals by which they leave the generator, or both.

The form of our invention herein chosen for descriptive illustration is that of an automatically-reversible collector-brush or brush-holder which in its reversible feature is controlled by the direction of revolution of the armature and which in turn may control switching devices, although a reversible brush without switching contact devices may in many instances be sufficient.

In the drawings, Figure 1 shows a side elevation of a magneto-generator designed to be operated by hand-power and equipped with a simple form of our invention. Fig. 2 shows an end elevation of the generator shown in Fig. 1. Fig. 3 shows an end elevation involving the reversal of the position of the collector-brush shown in the elevation Fig. 2. Fig. 4 shows a detail of armature-circuit and commutator connections of the generator shown in Fig. 1. Figs. 5, 6, 7, and 8 show perspective detail of parts going to make up the commutator and connections of Figs. 1, 2, 3, and 4. Fig. 9 shows a reversible brush-holder as an alternative form of our invention. Fig. 10 shows detail of Fig. 9 with the reversible brush-holder in its alternative position.

In Fig. 1 is shown a hand-generator in which an automatic switch 34, operated by the turning of the generator-crank, is composed of two switching parts 10 12 and in which one end of the armature-conductor 14 is attached to the frame of the generator at 15

and the other end is attached to an insulated collector-ring or commutator-segment 16. When the handle of the generator is turned in either direction, the shaft 10 moves toward the insulated electrical contact-spring 12 and makes electrical connection between the spring 12 and the shaft 10, and therefore between the part 12 and the frame of the generator and with one end of the armature-conductor, this connection being broken automatically when the handle is released, all in a manner well known in the art.

In Fig. 4 a detail of the commutator is shown, the armature-shaft 17 being drilled out to form a tube at 18, into which is driven a tube of insulating material 19, this tube of insulating material supporting a conducting-rod 20. An opening 21 transversely through the wall of the tube 18 permits one end of the armature-conductor 14 to be attached to the conducting-rod 20 and remain insulated from the shaft 17, and therefore from the body of the generator. The insulating-tube 19 projects from the end of the tube 18 and supports upon its projecting portion the collector-ring or commutator-segment 16. A short conductor 22 makes electrical connection between the conducting-rod 20 and the commutator-segment 16.

In Fig. 2 is shown a simple reversible collector-brush consisting of a sheet-metal spring 23, mounted upon the insulating-block 24. The insulating-block 24 is mounted upon the frame of the generator by two screws 25 passing through slots in block 24 to permit of an adjustment of that block, and consequently of the position of the collector-brush 23 with reference to the frame of the machine and the commutator, (designated as a whole as 26.) The free end of the collector-brush 23 approaches the commutator 26 in a direction approximately parallel to the adjustment-slots in the mounting-block 24. The free end of the brush 23 has a spring tendency to press against the commutator 26, and the end of the brush lies tangent to the surface of the commutator, and therefore opposite to the center of the commutator-shaft. By the adjustment-slots in the mounting-block 24 the collector-brush 23 may be so set that the commutator makes contact with the face of the brush at the extreme end rather than at some other point distant from the end. A branch brush 27, electrically and mechanically attached to the collector-brush 23, passes in hook-like shape beyond the end of the collector-brush 23. This brush is of spring metal and normally has a clearance between itself and the free end of brush 23 equal to less than the diameter of the commutator 26. Upon the mounting-block 24 is an electrical contact 28, adapted to make electrical connection with collector-brush extension 27 when said extension is in one of its alternative positions. Upon the block 24 is mounted also an electrical contact-spring 35, adapted to make electrical connection with collector-brush 23 when that brush is in one of its alternative positions.

In Fig. 3 the collector-brush 23 is shown in its alternative position, and the electrical connection between branch brush 27 and contact 28 is therefore broken, while the electrical connection between brush 23 and contact-spring 35 is closed.

In Figs. 2 and 3 are shown also the electrical circuits of the generator in Fig. 1. The frame of the generator is indicated as 15, and three terminals are shown at 29 30 31. The operation of the generator in connection with these circuits is as follows: When the handle of the generator is turned in such direction that the commutator turns, as shown by the arrow in Fig. 2, the collector-brush 23 being in the position shown in Fig. 2, the automatic switch (designated as a whole 34) is actuated to close and a pulsating potential is delivered between terminals 29 and 31 through a circuit within the generator consisting of elements 29 12 10 15 14 20 22 16 23 27 28 31. As the brush is in contact with the commutator-segment 16 during one-half of each revolution of the armature, the potential received by that brush will be pulsating in nature, and the commutator 16 may be so constructed and adjusted with reference to the direction of winding of the armature and the polarity of the magnetic field as to give this pulsating potential in either desired direction, but always in the same direction. A pulsating potential, therefore, is delivered between the terminals 29 and 31. If the direction of the motion of the handle be reversed, the direction of the commutator also will be reversed from that shown by the arrow in Fig. 2 to that shown by the arrow in Fig. 3, and within the first revolution of the commutator the edge of the commutator-segment 16, which forms, as shown, a shoulder upon the commutator 26, will engage the free end of the collector-brush 23 and carry the end of the brush with it into the position taken by the brush in Fig. 3. The branch brush 27 thus is lifted from connection with the electrical contact 28, and as the distance between the brushes 23 and 27 is less than the diameter of the commutator 26 the brush 27 bears upon that commutator opposite to the point of contact of brush 23. The form of curve of branch brush 27 may be adjusted to bring its bearing-point opposite to brush 23, and owing to the diminished diameter of the insulating portion of the commutator as compared with the conducting-segment 16 the segment 16 will make contact with the branch brush 27 before breaking contact from the brush 23, and vice versa. A continuous contact is made, therefore, between brush 23 and commutator-segment 16 through the coöperation of branch brush 27. Also the shifting of brush 23 to its alternative position has brought it into connection

with electrical contact-spring 35. Referring now to Fig. 3, the brush 23 is shown in its shifted position, which is the position always assumed when the direction of rotation of the armature is as shown by the arrow in Fig. 3. With the armature revolving in that direction and with the automatic switch 34 closed, an alternating potential is delivered between the terminals 29 and 30 through a circuit within the generator consisting of elements 29 12 10 15 14 20 22 16 23 35 30, the brush 23 being so supplemented by the branch brush 27 that the compound brush makes continuous contact with the commutator-segment 16, thus connecting terminal 30 continuously with one end of the armature-conductor, while terminal 29 is connected through switch 34 and the frame of the machine continuously with the other end of the armature. Terminal 31 has been insolated by the lifting of the brush 23 and branch brush 27. It is seen, therefore, that by turning the armature of the electrical generator in one direction a current of definite nature may be given from definite terminals to a connected circuit, while by turning the armature in the opposite direction brush connections and switch connections are so shifted as to give a current of definite but different nature to definite but different terminals, and thence to a connected circuit which may be the same or a different circuit from the former one. The two currents thus alternatively produced may be used for any purpose, as set forth in the preliminary statements of this specification.

In Figs. 9 and 10 we have shown an alternative form of our invention, these figures showing details of a model constructed and used by us. In this model the reversible brush has the form rather of a reversible brush-holder to which the brush or brushes are rigidly affixed, and in connection with the reversible brush-holder are divers switches operated automatically incident to the reversal of the brush-holder. In Fig. 9 two commutator-segments are shown. Commutator-segment 50 is insulated and is connected to one end of the armature-conductor by the method illustrated in Fig. 4. Commutator-segment 51 is connected to the armature-shaft 17 electrically, and thus to the other end of the armature-conductor, as illustrated in Fig. 4. Fixed brush 53 bears upon the projecting end of the conducting-rod, (illustrated at 20 in Fig. 4.) Brush 54 bears upon one side of the commutator and brush 55 upon the other. Brush 54 is in electrical connection with contact-spring 56, and brush 55 is in electrical connection with contact-spring 57. In addition to this contact pair 58 59 is open and contact pair 60 61 is open; but both pairs are in position to be closed by the reversal of the brush-holder, which reversal also interrupts the connection between 54 56 and 55 57. At 62 is indicated an automatic switch operated by crank-shaft movement, as illustrated at 34 in Fig. 1. In Fig. 9 the direction of motion of the armature is that shown by the arrow, and upon reversal of the direction of armature motion the end of brush 54 is caught in the groove between the edge of the commutator-segments and the brush is lifted, carrying the brush-holder 63 into the position shown in Fig. 10. The connections of the external circuits for Figs. 9 and 10 are not shown. It is seen that in Fig. 9 a rectified sine-curve potential is delivered between terminal of contact 57 and terminal of contact 56; also that a pulsating potential will be delivered between terminal of contact 57 and terminal of brush 53 and during the intervals between the pulsations the two terminals will be connected together; also that between terminal of contact 56 and terminal of brush 53 a pulsating potential with short-circuited intervals, but of reversed direction of polarity, will be delivered. Any one of these three potentials may be used by selecting with manual keys external to the generator or by connecting an operating-circuit with the desired terminals on the generator. In Fig. 10 the sole terminal connections with the armature-conductor consist of brush 53 and the frame of the machine, and an alternating potential, therefore, will be delivered. The switches 58 59 and 60 61 are designed to connect the alternating terminals 53 and frame to a circuit upon which alternating current is to be delivered when the reversible brush-holder is in the position shown in Fig. 10, in which case the circuit served may be connected to springs 61 and 58, spring 60 to brush 53, and spring 59 to the metal framework of the generator. Terminals 56 57 are designed to deliver rectified sine-curve current to an operating-circuit connected therewith when the reversible brush-holder is in the position shown in Fig. 9, the connection between those terminals and the brushes being broken when the brush-holder is reversed. It is seen, however, that the switches as constructed in the model and shown as 55 57, 54 56, 58 59, and 60 61 might be of almost infinite variation, and also the automatic switch 62 might be of any desired combination of springs and contacts and that our invention consists not in the particular form of springs, switches, brushes, and contact connections, but in the control of switching and collecting devices by the direction of armature revolution. Neither do we wish to limit ourselves to an electrical generator having commutator-segments for reversing brushes or brush-holders, nor to a collector-ring with recess for engaging the brush. A collector-ring or commutator without provision for engaging the brush upon reversal of direction may have auxiliary devices in connection with the armature-shaft or drive-shaft to ef-

fect the change in the nature of the potential delivered to the terminals or the change in the selection of terminals to which potential is delivered.

Having thus described our invention, what we claim as new, and desire to secure by United States Letters Patent, is—

1. In an electric generator, a revolving armature, a commutator or collector-ring in connection with said armature, a reversible collector-brush bearing upon said commutator or ring, an auxilary brush adapted to bear upon said commutator or ring when said collector-brush is in one of its alternative positions, substantially as described.

2. In an electric generator, a revolving armature, a commutator in connection with said armature, a reversible brush always in contact with said commutator, a branch brush adapted to be in contact with said commutator when said brush is in one of its alternative positions, and electrical contact members adapted to be in connection with said brush or branch brush when said brush or branch brush is in one of its alternative positions, substantially as described.

3. In an electric generator, a revolving armature, a commutator in connection with said armature, a reversible collector-brush bearing upon said commutator, and a projecting shoulder upon said commutator to engage said reversible brush, substantially as described.

4. In an electric generator, a revolving armature, a commutator in connection with said armature, a reversible collector-brush bearing upon said commutator, a projecting shoulder upon said commutator to engage said reversible brush, and circuit connections adapted to be changed by the reversal of said brush to effect the delivery of potential from said armature to different terminals of said electric generator in consequence of the reversal of the direction of revolution of said armature, substantially as described.

5. In an electric generator, a revolving armature, a commutator, a reversible collector-brush, an auxiliary collector-brush, and means for causing said auxiliary collector-brush to bear upon said commutator dependent upon the direction of revolution of said commutator, substantially as described.

6. In an electric generator, a revolving armature, a commutator, a reversible brush, terminals for the connection of external circuit-conductors, and switches controlled by the reversal of said brush whereby potential is delivered to alternative sets of terminals in consequence of the alternative position of said reversible brush, substantially as described.

7. In an electric generator, a revolving armature, a commutator, a reversible collector-brush, terminals for the connection of external conductors, an auxiliary collector-brush bearing upon said commutator in one of its alternative positions, means for reversing said collector-brush consequent upon reversal of direction of revolution of said armature, and circuit connections whereby the reversal of said collector-brush will cause the delivery of potential from said armature to alternative terminals, substantially as described.

8. In an electric generator, a reversible brush, terminals adapted for the connection of external conductors, switching contacts in connection with said reversible brush, and circuits whereby the reversal of said brush and consequent operation of said switches will change the connections existing between said brushes and said terminals, substantially as described.

9. In an electric generator, a reversible brush, circuit-changing devices in connection with said brush, terminals for connection of two external circuits, and circuits by which said brush will deliver potential alternatively to the two external circuits as said brush may be in one or the other of its two alternative positions, substantially as described.

10. In an electric generator, a revolving armature, a commutator or collecting-ring in connection with, said armature, a reversible collector-brush or brush-holder, an auxiliary brush adapted to bear upon said commutator or ring when said collector-brush or brush-holder is in one of its alternative positions, substantially as described.

11. In an electric generator, a revolving armature, a commutator in connection with said armature, a reversible brush or brush-holder having a main conductor-point always in connection with said commutator, an auxiliary brush adapted to be in contact with said commutator when said brush or brush-holder is in one of its alternative positions, and electrical contact elements adapted to be in electrical connection with said brush or said auxiliary brush when said brush or brush-holder is in one of its alternative positions, substantially as described.

12. In an electric generator, a revolving armature, a commutator in connection with said armature a reversible brush or brush-holder, and a shoulder upon said commutator adapted to engage a contacting projection of said brush or brush-holder, substantially as described.

13. In an electric generator, a revolving armature, a commutator in connection with said armature, a reversible brush or brush-holder, a projecting shoulder upon said commutator to engage said reversible brush or brush-holder, and circuit connections adapted to be changed by the reversal of said reversible brush or brush-holder to effect the delivery of potential from said armature to different terminals of said electric generator in consequence of the reversal of the direction of revolution of said armature, substantially as described.

14. In an electric generator, a revolving

armature, a commutator or collector-ring, a reversible brush or brush-holder, electric circuits controlled by the reversal of said brush or brush-holder, and means in connection with said revolving armature for reversing said brush or brush-holder consequent upon a reversal of the direction of revolution of said armature, substantially as described.

15. In an electric generator, a revolving armature, a commutator, a reversible brush or brush-holder, an auxiliary brush, and means for causing said auxiliary brush to bear upon said commutator dependent upon the direction of revolution of said commutator, substantially as described.

16. In an electric generator, a revolving armature, a commutator, a reversible brush or brush-holder, terminals for the connection of external circuit-conductors, and switches controlled by the reversal of said brush or brush-holder whereby potential is delivered to alternative sets of terminals in consequence of the alternative position held by said reversible brush or brush-holder, substantially as described.

17. In an electric generator, a reversible brush or brush-holder, terminals adapted for the connection of external conductors, switching elements in connection with said reversible brush or brush-holder, and circuits whereby the reversal of said reversible brush or brush-holder and consequent operation of said switching elements will change the connections existing between said terminals and other parts of said generator, substantially as described.

18. In an electric generator, a reversible brush or brush-holder, circuit-changing devices in connection with said brush or brush-holder, terminals for connection of two external circuits, and circuits whereby said electric generator will deliver potential alternatively to the two external circuits according as said reversible brush or brush-holder may be in one or the other of its two alternative positions, substantially as described.

19. In an electric generator, a revolving armature, giving alternating potential, a brush for collecting alternating potential from said armature, a brush for collecting pulsating potential from said armature, means for revolving the armature in either direction, and means for delivering to the terminals of said generator alternating or pulsating current alternatively and dependent upon the direction in which the armature is revolved, substantially as described.

20. In an electric generator, a revolving armature, means for revolving said armature in either direction, means for delivering an electric potential to given terminals of said generator when said armature is revolved in a given direction, means for delivering an electric potential to alternative terminals in said generator when said armature is revolved in its alternative direction, and means for changing the delivery of electric potential from said given terminals to said alternative terminals and operative consequent upon a reversal of the direction of armature revolution, substantially as described.

21. In an electric generator, a revolving armature, means for revolving said armature in either direction, means for delivering to terminals 29 31 pulsating potential when said armature is revolved in a given direction, and means for delivering to terminals 29 30 alternating potential when said armature is revolved in its alternative direction, substantially as described.

22. In an electric generator, a revolving armature, means for revolving said armature in either direction, means for collecting from said armature potential of a definite nature and for carrying said potential to definite terminals on said generator, and means rendered operative by a reversal of the direction of armature revolution whereby potential of an alternative nature is collected and is delivered to alternative terminals, substantially as described.

23. In an electric generator, a revolving armature, means for revolving said armature in either direction, means for delivering to given terminals electric potential when said armature is revolved in a given direction, and means for delivering to alternative terminals electric potential when said armature is revolving in its alternative direction, substantially as described.

Signed by us at Mount Vernon, county of Linn and State of Iowa, in the presence of two witnesses.

ENOS B. WILLIX.
JOHN YOUNG.

Witnesses:
E. A. JOHNSON,
D. S. BOYN.