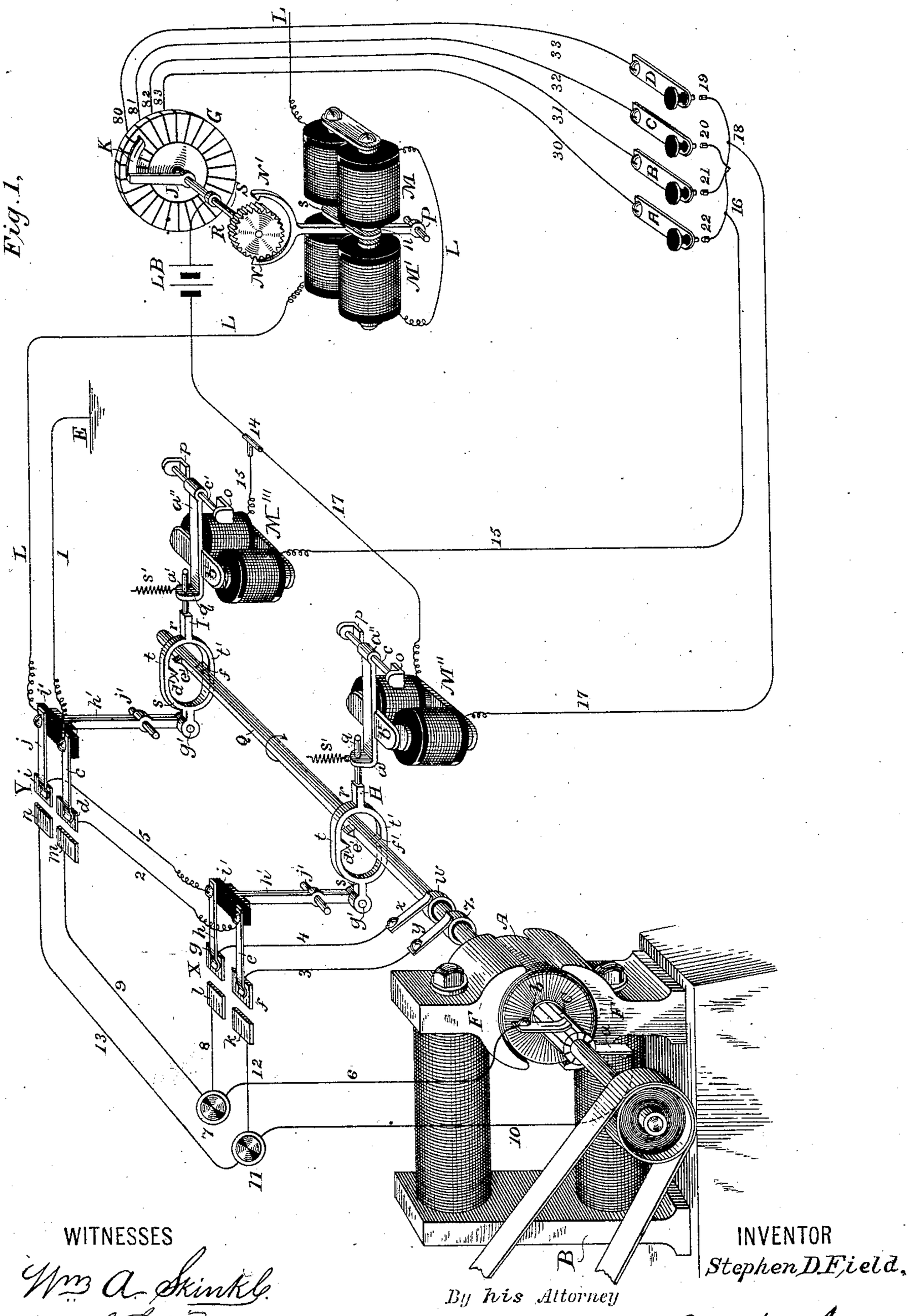
(No Model.) 2 Sheets—Sheet 1.

S. D. FIELD.

DYNAMO ELECTRIC MACHINE FOR PRINTING TELEGRAPHS.

No. 282,297. Patented July 31, 1883.

Fig. 1.



WITNESSES

Wm A. Skinkle

Jos. S. Palmer

INVENTOR

Stephen D. Field.

By his Attorney

C. L. Buckingham

(No Model.) 2 Sheets—Sheet 2.

S. D. FIELD.

DYNAMO ELECTRIC MACHINE FOR PRINTING TELEGRAPHS.

No. 282,297. Patented July 31, 1883.

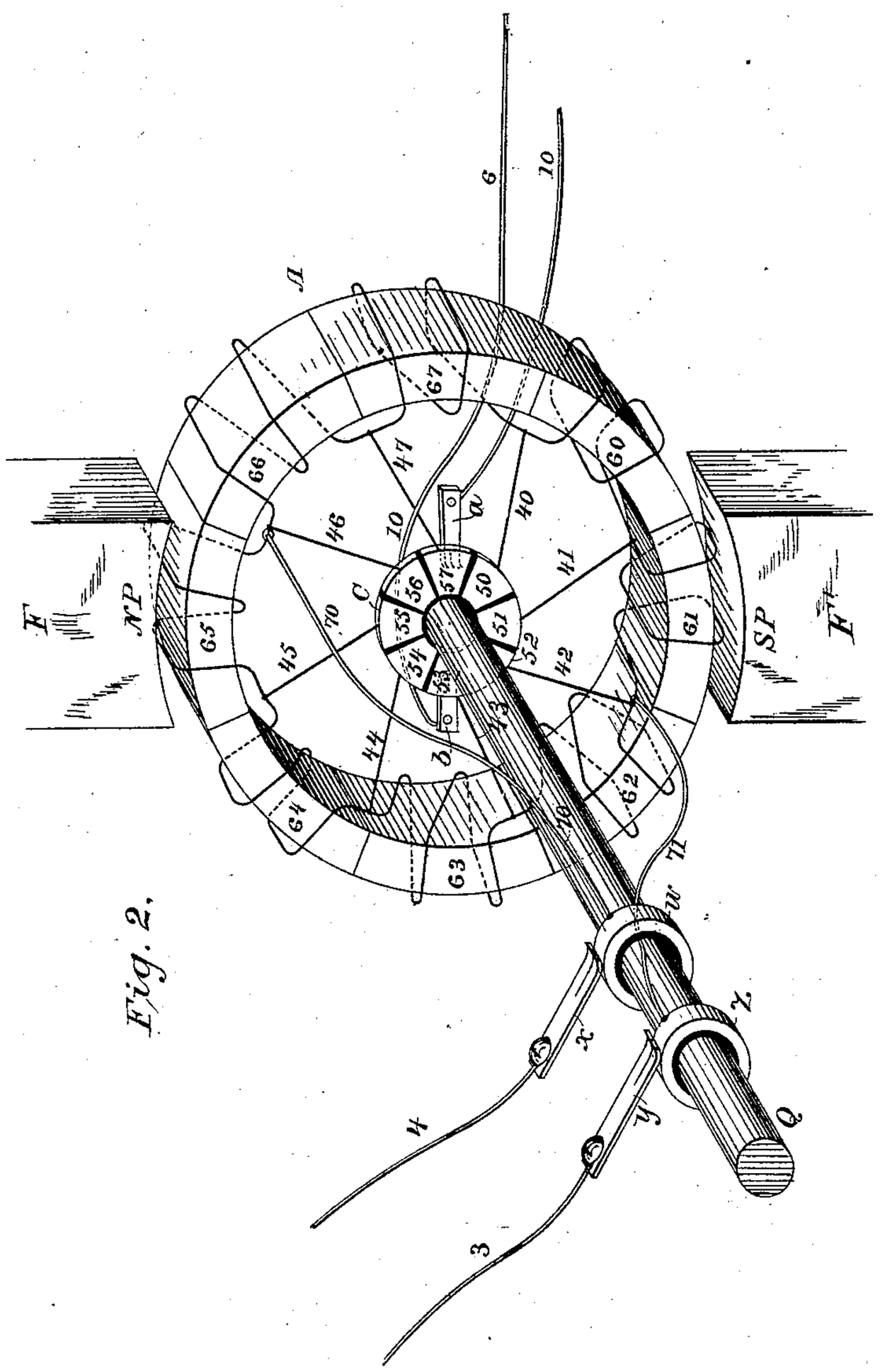


Fig. 2.

WITNESSES

Wm A. Skinkle

Jos. S. Latimer

INVENTOR

Stephen D. Field,

By his Attorney

C. L. Buckingham

UNITED STATES PATENT OFFICE.

STEPHEN D. FIELD, OF NEW YORK, N. Y., ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY, OF SAME PLACE.

DYNAMO-ELECTRIC MACHINE FOR PRINTING-TELEGRAPHS.

SPECIFICATION forming part of Letters Patent No. 282,297, dated July 31, 1883.

Application filed February 9, 1883. (No model.)

To all whom it may concern:

Be it known that I, STEPHEN D. FIELD, of the city, county, and State of New York, and a citizen of the United States, have invented a new and useful improvement relating to the application of dynamo-electric machines for actuating stock-quotation instruments upon a single main line whose type-wheels are moved step by step by to-and-fro currents of short duration, said type-wheels being held or locked in a position for printing by prolonging into a continuous current the pulsation, whether of positive or negative polarity, last sent to line, while at the same time the prolonged pulsation or continuous current of either polarity serves to raise or actuate the printing-pad to print the desired character.

To the end of procuring a series of electrical pulsations of alternately positive and negative polarity, and of obtaining a continuous current of the same polarity as the pulsation last generated, I employ what is commonly known as a "continuous-current" dynamo or magneto electric machine—such, for example, as is described in United States patent of d'Ivernois and Gramme, No. 120,057, of 1871, or the machine set forth in Siemens' English patent, No. 2,006 of 1873. In these forms of dynamo-electric machines it is customary, for the purpose of procuring continuous currents in one direction, to wind the armature with an even number of coils of insulated conducting-wire which are all electrically connected together, and to employ a commutator having a series of metallic strips insulated from one another, of a number equal to the number of coil-sections upon the armature. From each wire connecting the terminal of one coil-section of the armature to the beginning of the succeeding coil-section an electric conductor is carried to a corresponding commutator-strip. Thus the commutator-strips, respectively, are all separately connected with the coils of the armature at points between adjacent coils or sections. In connection with this commutator two conducting-brushes are employed, which simultaneously connect with diametrically-opposite commutator-strips and those strips which are connected, respectively, with those coils or sections of coils upon the armature that in their course of rotation happen to be in a plane or line at right angles to the line or plane joining the poles of the field-magnets of the dynamo-machine. By means of such an arrangement a continuous current only will be produced. However, if, from any two diametrically-opposite strips of the commutator, conducting-wires be carried to two insulated and independent metallic rings upon the same shaft, and such metallic rings be rotated in contact with electrical conducting brushes or strips forming the extremities of an exterior electrical conductor, it is obvious that as the armature is rotated a maximum current of one polarity will be set up when the coil-sections of the armature immediately joining the commutator-strips, which are connected with said metallic rings, are in the plane at right angles to that joining the magnetic poles of the field-magnets, and that upon further rotation of the armature of ninety degrees such maximum current will fall to zero, and from that point of rotation the polarity of current will be reversed, and will increase in strength to a maximum of opposite polarity after a further rotation of ninety degrees, from which point the current will decrease to zero upon rotating ninety degrees farther, and from this point the current will be re-reversed, and will attain a maximum at the end of a complete rotation of the armature. Thus the current generated will be of one polarity during one-half of a rotation of the armature and of the opposite polarity during the second half of the rotation of said armature, and during a complete rotation the current will be reversed and re-reversed. Under normal conditions, when no transmitting-key is depressed, one of the conducting-strips in contact with one of the two metallic rings upon the armature-shaft is connected to earth, while the other of said rings is connected to the main line. Under these conditions, as the armature of the dynamo-electric machine rotates, short pulsations of positive and negative electricity will be established throughout the main-line circuit. The armature-shaft of the dynamo-electric machine is prolonged and provided with two cam projections, which serve to actuate respective main-line electrical

switches. Normally when a finger-key is not depressed, these two electrical switches complete the main-line circuit through the armature devices for giving only reverse currents. However, if a finger-key is depressed, one of the two electrical switches will be moved from its normal position, thereby diverting the main line from a path through the two metallic rings through a second set of electrical brushes, and thereby connecting said main line from earth through the generating-coils of the armature by way of the commutator-brushes for giving a current in one direction. Alternate keys upon the key-board of the transmitter invariably actuate one of the electrical switches, which so connects the main line to the commutator-brushes for giving continuous currents as to always cause a continuous current of, say, positive polarity, to flow to the line. By depressing any one of the other set of alternate keys of the transmitter the other of the two electrical switches will be actuated, and will cause a continuous current of negative polarity to flow through the main line. The respective keys of the transmitter are connected with corresponding strips of what is technically known as the "sunflower" of a printing-telegraph transmitter. In combination with the sunflower, a rotating arm having a conducting-spring attached to a rotating shaft is employed, which is actuated step by step by a pallet-yoke. The pallet-yoke is given a reciprocating movement by reverse pulsations of electricity passing through a main-line polarized electro-magnet. Branch conductors joining the transmitting-keys and the sections of the sunflower form a part successively of a local circuit. The anvils of alternate keys forming one set are all electrically connected, and by means of one electrical conductor are connected with one pole of a local battery. The anvils of the second alternate set of transmitting-keys are also electrically connected together by means of a single conductor, and are likewise connected with the same pole of the local battery. The opposite pole of the local battery is connected with the shaft of the sunflower-arm. Normally, therefore, the local circuit is broken both at the transmitting-keys and at the sunflower. While no one of the transmitting-keys is depressed reverse currents are traversing the main line, thereby actuating the polarized electro-magnet and causing a step-by-step rotation of the sunflower-arm. However, if any one of the transmitting-keys is depressed, the sunflower-arm will continue rotating until it has arrived at that one of the sunflower-sections electrically connected with the key depressed. Upon depressing any one of the transmitting-keys, therefore, the local circuit will be closed through either of two branches forming a part of the local circuit and a current will be set up in one of such branches. These two local branches are each provided with electro-magnets which attract armatures that respectively are mechanically connected with two electrical switches, either of which serves to switch the main line from the reverse-current devices of the dynamo-machine to the commutator-connections, from which only currents of one polarity, either positive or negative, may be directed to line. When the armature of one of the electro-magnets in one branch of the local or sunflower circuit is attracted, a sliding arm is depressed which is provided with two stops, one above and the other below the shaft of the dynamo-electric machine. When the armature is depressed a lug upon the shaft of the dynamo-machine strikes a projection connected with the switch-arm, thereby moving the switch, so as to prevent reverse currents from being sent to line and into position to cause a continuous current—say of positive polarity—to be transmitted. If the transmitting-key is released and the armature of the electro-magnet in this local branch is retracted, the same stop upon the armature-shaft of the dynamo-machine will in its rotation strike a lug which will throw the electrical switch back to its original position—that is, in a position to cause reverse currents to be sent over the line. On the other hand, if any one of the other set of alternate transmitting-keys be depressed, the electro-magnet in the other of the two local branches of the transmitter will cause the second electrical switch to be thrown, so as to prevent reverse currents from being sent to line, and to cause only a continuous current of negative polarity to be sent. Primarily, therefore, a reverse and re-reverse current causes a rotating arm of a sunflower to move two steps during one rotation of the armature of the dynamo-machine. The depression of a finger-key brings apparatus into such a position that the rotation of the armature of the dynamo-machine mechanically moves either of two electrical switches, whereby reverse currents upon the line are suspended, and a continuous current, either of positive or negative polarity, according to the switch moved, is placed to line. The act of depressing a transmitting-key, accordingly, in the first place causes a suspension of reverse currents upon the main line, which in turn causes the armature of the polarized electro-magnet to be held in one position, thereby locking the rotating arm of the sunflower in a fixed position during the depression of the transmitting-key. While the sunflower-arm is arrested and a corresponding key is depressed, the local magnet of the switch will render a return movement of the switch impossible, and only a continuous current can be sent to line.

To fully explain my invention, I will now refer to the accompanying drawings.

Figure 1 represents a complete diagram of the transmitting apparatus. Fig. 2 is a diagrammatic view of a Gramme armature having a commutator from which currents of one polarity may be obtained, and also metallic rings, which are respectively connected with

diametrically-opposite sections of the commutator, whereby reverse currents may be procured, which I term "reverse-current" devices.

In Fig. 1, F F′ represent the poles of field-magnets of the dynamo-machine mounted upon base B. A is a cylindrical or ring armature, as will be more fully hereinafter described, and armature A is rigidly fixed to a shaft, Q. Upon shaft Q is placed commutator C, consisting of a series of metallic strips parallel to the axis of shaft Q, which are insulated from one another, and which are connected, respectively, with wires of the armature joining adjacent coil-sections thereof. Electrical brushes *a* and *b* are pressed in contact with commutator C, and are so positioned that they are in electrical contact with those strips of the commutator which are electrically connected with those coils of the armature which occur to be in a plane at right angles to the plane joining the poles of the field-magnets. Thus, as the armature A is given a continuous rotation a continuous current of electricity will be set up from the brush *b* through the wire 6 and the common external conductor, back to wire 10, through brush *a*, and through the coils of the armature. Upon the same shaft, Q, are placed two metallic rings, *w* and *z*, which are insulated from one another, and which are electrically connected, respectively, with two diametrically-opposite metallic strips of the commutator C. Conducting strips or brushes *x* and *y* are employed, whereby alternating currents of electricity may be passed from the armature through brush *x*, line 4, and any external conductor back to line 3 and brush *y* to the armature.

For convenience of illustration, I have shown in Fig. 2 a Gramme armature, whose sectional bobbins 60 to 67 are connected by wires 40 to 47. These wires, which join the sectional coils of the armature, are connected, respectively, with the insulated strips of the commutator 50 to 57 by separate wires, and the stationary brushes *a* and *b* are set in a line at right angles to the line joining the field-poles F and F′. From point 46—that is, from commutator-strip 56—a wire, 70, is carried to the electrical conducting-spring *w*, and from the diametrically-opposite commutator-strip, 52, or from point 42, a wire, 71, is carried to conducting-spring *z*. Upon rotating the shaft Q from the position shown in Fig. 2, the ring-armature A being rigidly fixed therewith, a maximum current of one polarity will be set up through the wires 70 and 71, their respective contact-brushes *x* and *y*, and through an external conductor, 3 4, when the points 46 and 42 have been brought into a line at right angles to the line joining the field-magnets. When the armature has been moved to such a position that wires 42 and 46 are in the line or plane joining the field-poles, the current will have diminished to zero, where its polarity will change, and the current will increase to a maximum of opposite polarity after a further rotation of ninety degrees, or after three-fourths of a rotation. Upon a still further quarter-rotation the current will have diminished until the armature has received a complete rotation, at which point the current will re-reverse its polarity. It is thus seen that upon one rotation of the armature a pulsation of one polarity will be produced, that the polarity of this current will be reversed, and that a re-reversal will occur.

A single main telegraph-line in which a series of printing-instruments is placed, said single line embracing the magnetizing-coils both of the type-wheel and printing-magnets is so arranged by means of suitable electric switches that normally said line is connected through the armature of the dynamo-machine and through brushes *x* and *y*, whereby reverse currents are produced. However, by means of proper automatic switches, whenever it is desired to print a character, the main line is removed from the wires 3 and 4, connecting with the reverse-current brushes *x* and *y*, and is connected with the wires 6 and 10, whereby straight currents may be sent to line. The means for switching the main line from one set of brushes, *x* and *y*, to the commutator-brushes *b* and *a* is effected by means of the apparatus now to be described.

X and Y represent two electrical main-line switches, one of which, say X, will disconnect the main line from the brushes *x* and *y*, and so connect it with the commutator-brushes *b* and *a* that a straight current—say of positive polarity—will be passed over the line, and of the same polarity as that one of the reverse pulsations last sent, while Y is an electrical switch, whereby the main line is disconnected from the brushes *x* and *y*, and is so connected with the commutator-brushes *b* and *a* that a continuous current of negative polarity will be sent over the main line, the polarity of the last pulsation sent to line having been of negative polarity. The switches X and Y, respectively, will be called into action, according to which of the two sets of keys the one depressed belongs. For instance, if any one of the keys A C E, &c., is depressed, reverse currents upon the main line will be suspended and a continuous negative current will be transmitted. If B, D, or F be depressed, the alternate currents will be suspended and only a continuous positive current will be transmitted.

L B is a local battery whose circuit is completed from point 14, through either of two branch wires, 15 or 17, according as the key of one alternate set or the other is depressed, to points 16 and 18, and thence to one of the anvils 19 and 21, &c., or to one of the anvils 20 and 22, &c. The transmitting-keys A B C D, &c., are connected separately by means of branch conductors 30 31 32 33, &c., as shown, with the sections 80 81 82 83, &c., of the sunflower G, thence through the revolving spring K and arm J and the shaft S to the opposite pole of the local battery.

It will be seen that the local circuit may be closed through either the branches 15 or 17

upon depressing any one of either of the two sets of transmitting-keys, providing the revolving spring K is upon that one of the sunflower-sections corresponding to the key depressed. The spring K is given a step-by-step movement upon each reversal of the main-line current—that is, upon a reversal from positive to negative of the main-line current the polarized magnets M M′ move the pallets N N′ in one direction, thereby rotating the ratchet-wheels R one step, and thereby carrying the spring K from one section of the sunflower to an adjoining one; and upon a re-reversal of the main-line current the spring K will be moved the further distance of one sunflower-section. The main line proceeding from the distant station passes through coils M M′ of the polarized magnet, thence by L to spring *j′*, metallic block *i*, wire 5, spring *h*, conducting-block *g*, wire 4, brush *x*, metallic ring *w*, through coils of the armature of the dynamo-machine to metallic ring *z*, brush *y*, conductor 3, metallic block *f*, spring *e*, wire 2, metallic block *d*, spring *c*, and wire 1 to earth.

As shown in the drawings, if key B or D be depressed, the sunflower-arm will rotate until spring K reaches either section 80 or 82, in which event the local circuit of L B will be closed through the electro-magnet M″, when armature *b′*, attached to lever *a″*, which is pivoted at *c′*, will be attracted, thereby depressing a sliding bar, H, which, between points *r* and *s*, consists of two parts, *t* and *t′*, between which passes the shaft of the dynamo-electric machine. The link-bar H is pivoted at point *g′* to *h′*. Armature-lever *a″* is provided with an elbow, *a′*, having an opening, through which slides the stem *q* of bar H. Armature-lever *a″* is also provided with a retracting-spring, *s′*. Upon the lever *h′* is mounted a horizontal bar of insulating material, *i′*, upon which is mounted conducting-springs *e* and *h*, which normally rest upon conducting-blocks *f* and *g*, but which, upon a backward movement of the arm *h′*, will be carried to rest separately upon the conducting-blocks *k* and *l*. The part *t* of the link-bar H is provided upon its under side with a tooth, *d′*, while the part *t′* is provided with a tooth, *f′*, and in the same plane the shaft Q of the dynamo-machine has affixed thereto a tooth, *e′*.

The two limbs of the link-bar *t* and *t′*, with their respective projections *d′* and *f′*, are so arranged in respect to the tooth *e′* that when the armature of M″ is attracted the projection *d′* will be so far depressed that in the rotation of *e′* it will strike *d′*, driving the spindle *q* through the opening in *a′*, thereby moving the lower end of arm *h′* toward shaft Q, and thereby moving the springs *e* and *h* from blocks *f* and *g* over to blocks *k* and *l*. However, if either a key, B or D, be released after being depressed, the armature of M″ will be retracted by its spring *s′*, when the tooth *d′* will be raised out of the path of rotation of tooth *e′*, and the link-bar H will be given a backward movement, thus returning the spring *h* and *e* from the blocks *l* and *k* to *g* and *f*; and projections *d′* and *f′* are so arranged that when either is moved into the path of *e′* it will be driven to a point just without the arc of revolution of point *e′*, so that the rotation of the shaft Q may continue, and the link-bar H will be held in the same position until the armature-bar *a′* is again attracted or retracted, as the case may be. In the same manner, if either of the alternate keys A or C be depressed, the sunflower-arm will continue to rotate until spring K arrives at section 83 or 81, when the local circuit will be closed through branch 15. Electro magnet M‴ in the branch 15 serves in the same manner as electro-magnet M″ to actuate an armature-lever, thereby raising or lowering link-bar I, which is similar to link-bar H, and which is given a to-and-fro longitudinal movement, according as the armature is attracted or retracted, whereby lever *h′*, of the switch Y throws the springs *c* and *j* from conducting-blocks *d* and *i* to the conducting-blocks *m* and *n*. Thus, if key A or C of the alternate series be depressed, the main line will be disconnected from the brushes *x* and *y*, and will be so connected with commutator brushes *a* and *b* as to direct upon the main line a continuous current of one polarity, but of a polarity opposite to that which would be sent by depressing one of the keys B or D.

For convenience of description, I designate electro-magnets M″ and M‴ and their armatures as "switch-controlling devices," while bars H and I and shaft Q, having lugs thereon, I term "switch-actuating devices." The operation of the switch-controlling devices enables the actuating apparatus to be brought into action.

The commutators for affording a continuous current upon the main line in one direction or the other are connected by wires 6, 8, 9, 10, 12, and 13, with the metallic blocks *k l* and *m m*, respectively. It will be seen, therefore, that if the conducting-strips *e* and *h* of the switch X be moved into contact with blocks *k* and *l*, the conducting-brush *a* will be connected directly to earth through wire 10, 12, 2, and 1, while conducting-brush *b* will be conducted through wire 6, 8, and 5 to the main lines. Again, if the brushes *e* and *h* of switch X remain in their normal position upon *f* and *g* and the brushes *c* and *j* of switch Y be moved upon the conducting-blocks *m* and *n*, the brush *b* will be connected to earth through wires 6 9 *m c* and wire 1, while the brush *a* will be connected to line through wire 10, 13, *n*, and *j′*.

The revolving arm of the sunflower, as it is carried over the metallic sections thereof, is carried into contact with one half of the sunflower-sections by the transmission over the main line of impulses of one polarity, and the arm is carried upon the other half of the alternate sunflower-sections by impulses of an opposite polarity. It is therefore apparent that to bring the sunflower-arm in contact with any particular section a pulsation of pre-determined polarity must be sent over the line

as a condition precedent. It will also be observed that as condition precedent to the operation of either one of the electro-magnets M″ or M‴ in the branches of the local circuit, the sunflower-arm must be arrested upon any one of that series of sunflower-sections through which the electro-magnet M″ or M‴, as the case may be, is connected. If a positive impulse has last been sent to line, the armature of the polarized electro-magnet M M′ will be so moved as to throw the sunflower-arm upon some one of its sections which will connect the local battery through, say, local electro-magnet M″, and, according as the last impulse sent is positive or negative, either electro-magnet M″ or M‴ will be operated. If, upon depressing any particular finger-key of one series, a positive pulsation is the last one sent to line, and M″ is operated, the positive pulsation will always be prolonged or continued into a current of positive polarity. Again, if any particular finger-key of the second alternate set is depressed, so that the last pulsation sent to line is negative, and M‴ is operated, under all such circumstances will the negative pulsation sent to line be prolonged into a continuous negative current. The positive and negative pulsations are normally upon the main line, and they, by the polarized main-line electro-magnet, serve to control or actuate the movement of the sunflower-arm, which is a switch for the local circuit. By depressing any one of the finger-keys one of the two main-line switches X or Y is placed in a condition to be operated by a continued rotation of the shaft Q of the armature of the dynamo-electric machine, and in either event the reverse pulsations upon the main line are suspended, and a continuous current is sent to line, whereby the sunflower-arm is arrested. The depression of a finger-key first enables the sunflower-arm to close a local circuit, and this act, through the agency of M″ or M‴, effects conditions whereby, upon the continued rotation of the armature-shaft, the main-line switch is operated, which in turn, by suspending reversals of current and by developing a continuous current, immediately causes the arrest of the sunflower-arm. Upon releasing the depressed key, and thereby the main-line switch, reverse currents are re-established in the main line, which causes the sunflower-arm to again be given a continued step-by-step movement.

For convenience of illustration, I have herein described a Gramme armature in preference to the cylindrical armature described in Siemens' English patent, No. 2,006 of 1873. However, it is apparent that one can be substituted for the other; or, in fact, any well-known form of dynamo-electric machine can be used for the purpose herein specified which is capable of giving a continuous current. It is also obvious that, instead of employing a commutator for taking continuous currents from the machine and the reverse-current devices herein shown, a commutator may be employed which, when continuous currents are required, shall be held stationary, while said commutator, when it is desired to produce reverse currents, shall be permitted to rotate with the shaft of the dynamo-electric machine; but I desire to disclaim such feature from this case, as it is made the subject of another application.

I desire to disclaim from this application the subject-matter hereinafter claimed when in combination with specific devices adapting the same to a printing-telegraph system, as such subject-matter is embodied in another application filed by me August 5, 1882, No. 68,567.

What I claim, and desire to secure by Letters Patent, is—

1. The combination of an armature of a dynamo-electric machine whose series of coils are electrically connected together, a series of insulated commutator-sections mounted upon the shaft of said armature, which are respectively connected between the coil-sections of the armature, two insulated rings or hubs, also mounted upon said armature-shaft, which are connected with said armature-coils, and two sets of collecting-brushes, whereby from one commutator continuous currents are procured and from the other reversed currents, a main line, and means for connecting said main line either with the straight-current commutator-brushes or devices for collecting reverse currents.

2. The combination of a dynamo-electric machine, a commutator therefor mounted upon the shaft of the armature, for deriving therefrom a continuous current, reverse-current-collecting devices mounted on the shaft of said armature, for deriving from said machine reversed currents, two sets of collecting-brushes, a main line, and means for disconnecting the main line from the reverse-current-collecting devices and for connecting said main line with the continuous-current commutator, and also serving to prolong the last pulsation into a continuous current, whereby reverse currents upon the main line may be suspended and the last pulsation sent may be prolonged into a continuous current of the same polarity.

3. The combination, in a dynamo-electric machine, of an armature whose series of coils or bobbins are electrically connected together, and which, at their junctions, are respectively connected with a series of insulated commutator-strips, conducting-brushes for said commutator, means for deriving from said armature reverse pulsatory currents, consisting of two insulated metallic hubs which are electrically connected with said armature-coils, substantially as described, and conducting-brushes therefor.

STEPHEN D. FIELD.

Witnesses:
WM. B. VANSIZE,
WM. ARNOUX.