(No Model.) 4 Sheets—Sheet 1.

J. E. SMITH.

ELECTRO MAGNETIC POLE CHANGER.

No. 307,498. Patented Nov. 4, 1884.

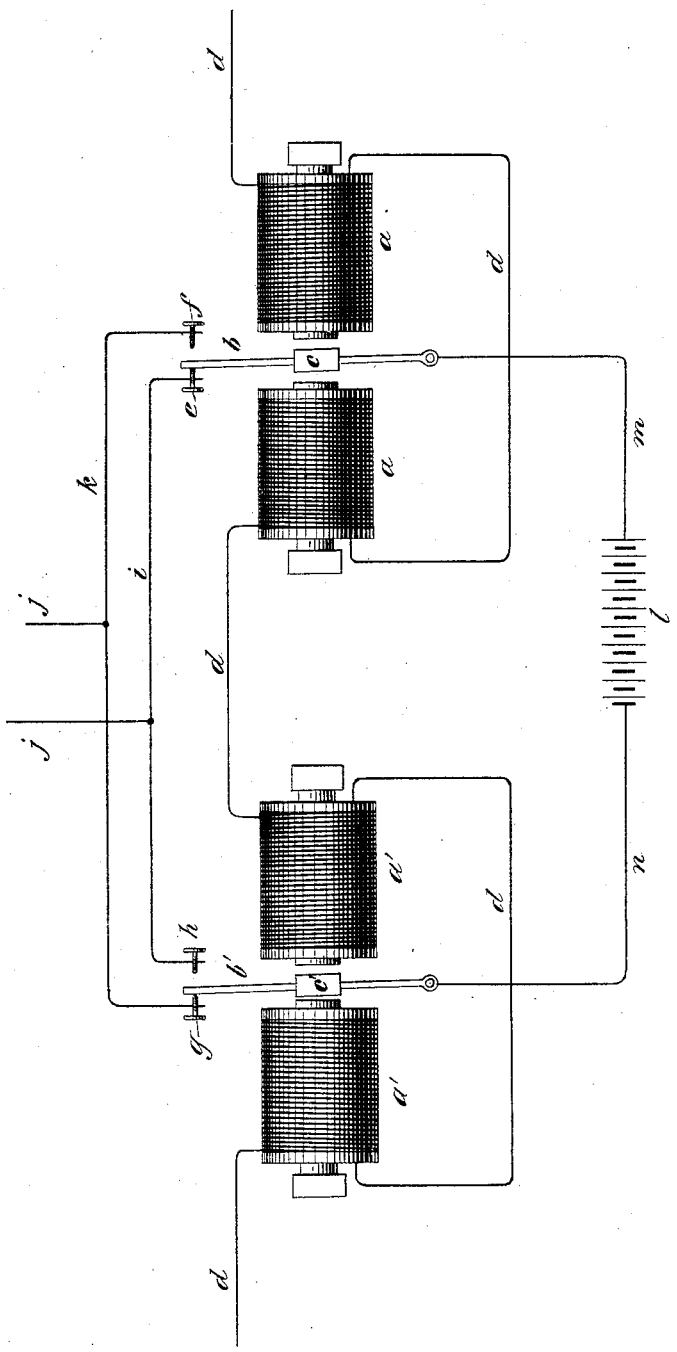

Fig. 1

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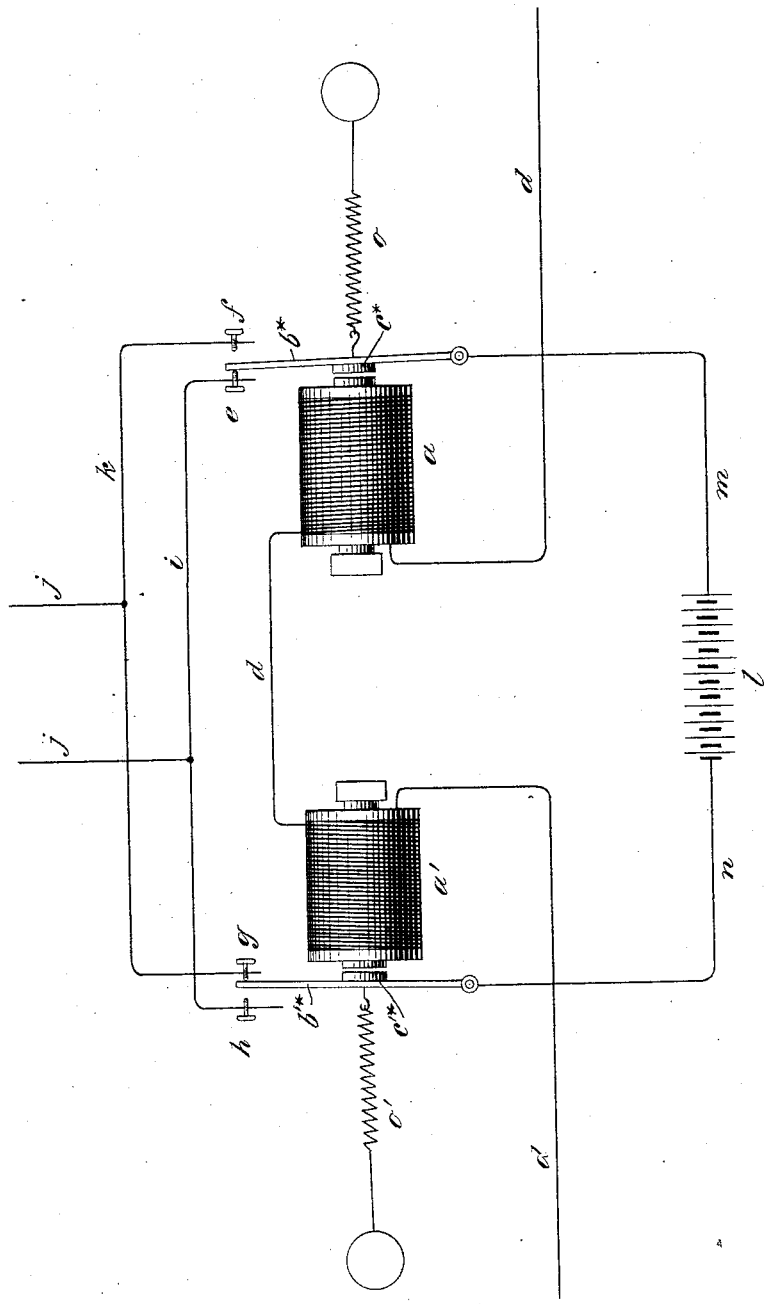

Fig. 2.

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ELECTRO MAGNETIC POLE CHANGER.

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Fig. 4.

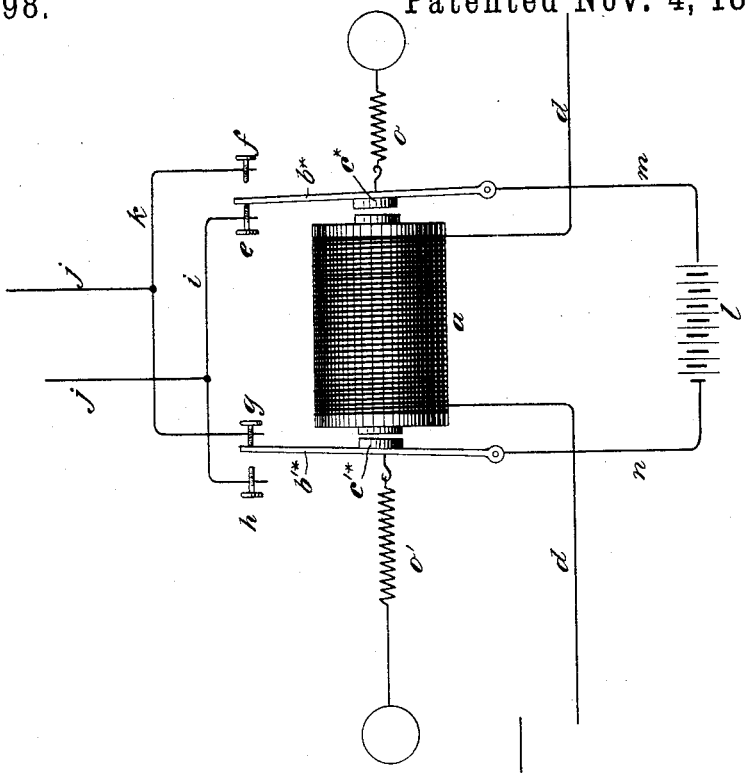
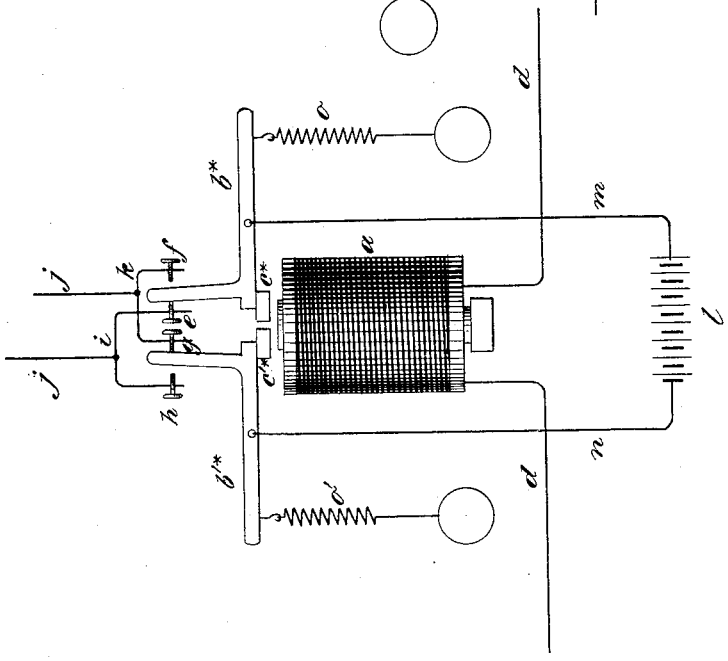


Fig. 3.



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(No Model.) 4 Sheets—Sheet 4.

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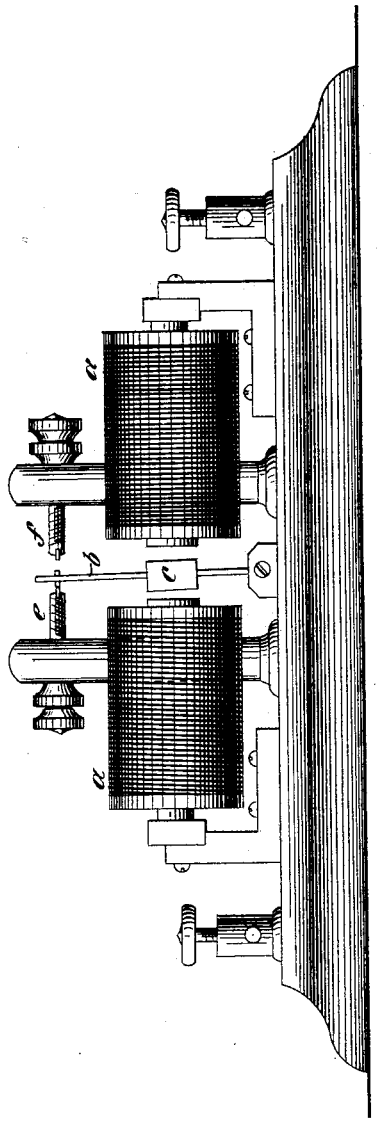
ELECTRO MAGNETIC POLE CHANGER.

No. 307,498. Patented Nov. 4, 1884.

Fig. 5.



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UNITED STATES PATENT OFFICE.

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ELECTRO-MAGNETIC POLE-CHANGER.

SPECIFICATION forming part of Letters Patent No. 307,498, dated November 4, 1884.

Application filed March 30, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOHN E. SMITH, of the city and county of New York, in the State of New York, have invented a new and useful Improvement in Electrical Pole-Changers, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to pole-changers for reversing the current of a single galvanic battery or other electric generator by the action of electro-magnets. Instruments of this description have two circuit-breaking devices, or a double circuit-breaking device, for opening and closing the circuit on each side of the battery or generator. In some instruments of this kind hitherto made the two circuit-breaking levers, tongues, or equivalent parts have been joined together so as to move as one piece, and therefore parts of such devices have necessarily been flexible in order to insure the closing of the circuit on both sides of the battery. It is difficult, if not impossible, to adjust the two parts of such circuit breakers or closers so that both will close the circuit the same length of time, and they cannot be relied on to hold the circuit closed when a current is not passing through the magnet or magnets operating them because of the tendency of the flexible part to cause the inflexible or comparatively inflexible lever to break circuit. There is the same difficulty if all the circuit-breaking levers and connections are flexible. In another form of electrical pole-changer a single lever with an armature actuated directly by an electro-magnet makes electrical contact alternately with two other levers without armatures, which two levers are caused to alternately oscillate by the first-named lever. Such an instrument is very unreliable, because the momentum of the armatureless levers carries them too far and causes them to break contract with the first-mentioned lever when the circuit should remain closed. In order to overcome these defects I use two separate and independently but simultaneously moving circuit-breaking levers or tongues which are preferably inflexible, or, at least, as much so as the armature-lever of the Morse relay, for example. Each of these circuit-breaking levers is attached to an armature, and the points or parts with which said levers make electrical contact are rigid instead of being springs or oscillating levers. The armatures to which said levers are attached may be of soft iron actuated by one or more magnets and currents of either polarity, or they may be of polarized steel and actuated by one or more magnets and currents alternately positive and negative. The magnet or magnets and the armature-levers are arranged in two circuits, the magnet or magnets being located in one circuit, and the armature-levers in the other circuit.

The invention is capable of several modifications, some of which I have illustrated in the accompanying drawings, in which—

Figure 1 is a diagram showing the elements of a pole-changer having two separate polarized circuit-breaking levers operated by two sets of electro-magnets and currents of alternately opposite polarity. Fig. 2 is a diagram showing the essential parts of a pole-changer having two separate circuit-breaking levers with soft-iron armatures actuated by electro-magnets and currents of either polarity. Figs. 3 and 4 show different forms of pole-changers, each with two separate levers operated by a single magnet and currents of either polarity. Fig. 5 shows a method of mounting the several parts of such electrical apparatus.

Similar letters of reference indicate corresponding parts in the several figures.

In Fig. 1, *a a* are two ordinary U-shaped electro-magnets with their poles facing each other. A circuit-breaking tongue or lever, *b*, supporting a polarized steel armature, *c*, is arranged to vibrate between the poles of said magnets by their combined attraction and repulsion, according to the direction of the current energizing them. Magnets *a' a'*, lever *b'*, and armature *c'* are respectively like and arranged like magnets *a a*, lever *b*, and armature *c*. Lever *b* when vibrated by magnets *a a* makes electrical contact alternately with screws *e f*, and lever *b'* in like manner makes electrical contact with screws *g h*. A wire, *i*, connects screw *e* with screw *h*, and screw *f* is connected with screw *g* by a wire, *k*.

The four magnets *a a a' a'* are so connected with one another, and with such reference to the polarity of armatures *c c'*, that a current of a certain polarity acting on them through a circuit, *d*, in which the said magnets may be placed, will cause lever *b* to make contact with screw *f* and lever *b'* to connect with screw *h*,

while a current of the opposite polarity will move said levers against screw *e* and *g*, respectively. The last-named position of the levers is the one shown in the drawings. If now a battery, *l*, be connected by wires *m n* to levers *b b'*, respectively, and one end of a circuit, *j*, be connected by a wire, *k*, with screws *f g*, and the other end of the same circuit be connected with screws *e h* by a wire, *i*, reversed currents through circuit *d* will cause levers *b b'* to alternately connect with opposite ends of circuit *j*, and thus reverse the current of battery *l* over the circuit last named.

The magnets *a a*, with lever *b* and screws *e f*, also magnets *a' a'*, lever *b'*, and screws *g h*, may be fastened to a base, as shown in Fig. 5, and then the two instruments connected in accordance with the diagram in Fig. 1; or all the said parts may in a similar manner be attached to one larger base.

Instead of being placed between two magnets, as shown in Fig. 1, each polarized armature carried by one of the circuit-breaking tongues or levers *b b* may be placed between the poles of a single magnet, and thereby actuated in the same way as when placed between the two magnets *a a* or *a' a'*.

Fig. 2 shows a form of pole-changer in which soft-iron armatures *c* c'** take the place of the polarized armatures in Fig. 1, and a retracting-spring, *o*, is substituted for one of the magnets *a a*, and a retracting-spring, *o'*, takes the place of one of the magnets *a' a'*. Hence, the levers *b* b'** in Fig. 2 are vibrated by a simple opening and closing of the circuit *d*. In all other respects the other parts, their arrangement, connections, and operation, are the same as described in connection with Fig. 1. Magnet *a*, lever *b**, spring *o*, and screws *e f*, as well as like parts in the other half of this pole-changer, may be attached to a base precisely as the different parts of a Morse relay are mounted. In fact, this form of pole-changer can be made by simply taking two Morse relays, adding the connections *f h*, and then connecting the two relays together by wires *d*, *i*, and *k*.

Fig. 3 shows a form of pole-changer in which both soft-iron armatures *c* c'** are arranged near and operated by the same poles of a single magnet, *a*. The levers *b* b'** are bent instead of being straight; but the different parts connect and operate the same as the instrument shown in Fig. 2.

In Fig. 4 the magnet *a* is straight instead of U-shaped, and has a soft-iron armature at each end. The connections and operation of this pole-changer are like those in Figs. 2 and 3. In all these forms of the pole-changer the contact screws or points *e f g h* are to be rigidly supported by metallic posts *p p*, as shown in Fig. 5, or so supported in any other well-known manner. The two separate levers, moved simultaneously by electro-magnets, and the rigid contact-points make the pole-changer perfectly reliable. If battery *l* be connected with wires *i k*, and circuit *j* connect with levers *b b'*, these pole-changers will reverse the current equally well and in substantially the manner herein described.

I would remark that the pole-changer shown in Fig. 1 is a desirable one for use in synchronizing clocks on a system of circuits primarily used for other purposes in accordance with an invention for which I have on the 29th day of March, 1883, filed an application for Letters Patent, Serial No. 89,786. Some or all of these forms may be found useful in stock-reporting printing-telegraphs actuated by reversed currents from a central station. In such use there will be a pole-changer for each line of printers. The printers will be placed in circuit *j* and be actuated by battery *l*. Circuit *d* will be a local circuit, and in it will be situated the magnets of all the pole-changers and the initial or controlling transmitting-instrument.

I am aware that two separate and independently moving armature-levers are shown in Woodfill's United States Patent No. 255,373, of March 21, 1882, and in English Patent No. 2,941 of 1876. In the first-named patent each lever is in a circuit with the other magnet, the whole combination acting as a repeater. In said English patent the two levers are connected in multiple arc, and each lever makes electric contact on only one side. Neither of these two devices can act as a pole-changer. My invention differs from them in having the two armature-levers in series in the same circuit and on opposite sides of an electric generator, and not in circuit with the magnets which vibrate said levers. I therefore restrict myself to the combination herein described, whereby the two armature-levers are enabled to reverse a current over the circuit in which they are located.

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

1. In an electric pole-changer, the combination, with two electric circuits, of two separate and independently moving circuit-breaking armature-levers, and rigid contact-pieces on opposite sides of each of said levers, all arranged in one of said circuits, and electro-magnetic apparatus serving to vibrate said levers, and arranged in the other of said circuits, substantially as herein described.

2. In an electric pole-changer, the combination, with two electric circuits, of electro-magnets in one circuit, with polarized armatures arranged between the poles of said magnets, circuit-breaking levers carrying said armatures, and rigid contact-pieces on opposite sides of said levers, all arranged in the other electric circuit, said levers being connected in series and on opposite sides of an electric generator, substantially as herein described.

JOHN E. SMITH.

Witnesses:
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