No. 749,775. PATENTED JAN. 19, 1904.

D. LA COUR.

ELECTROSTATIC RELAY.

APPLICATION FILED FEB. 7, 1903.

NO MODEL.

Fig. 1.

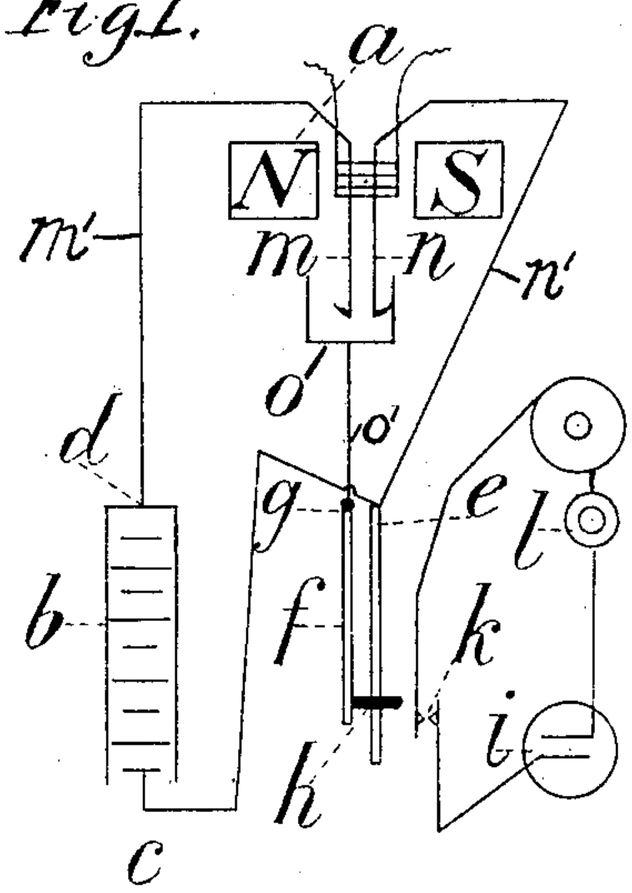


Fig. 2.

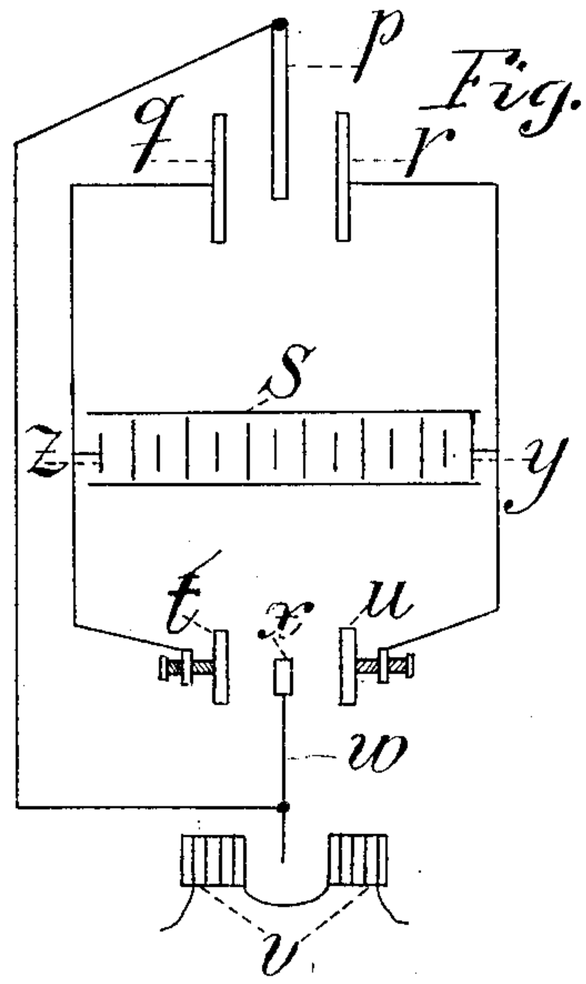


Fig. 3

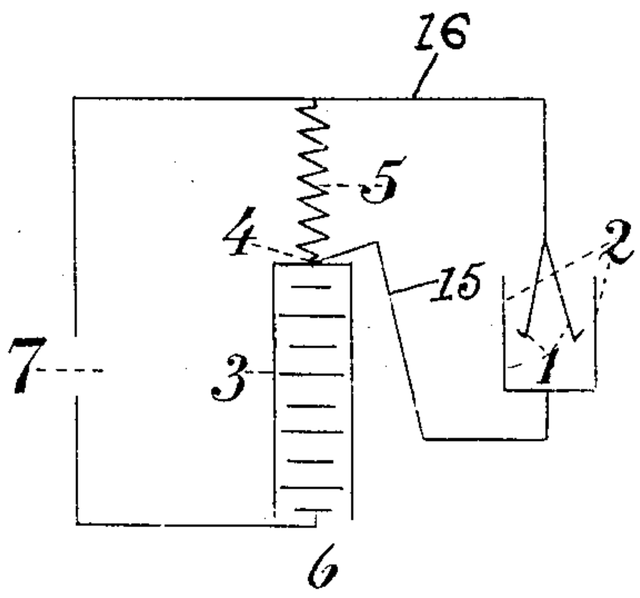
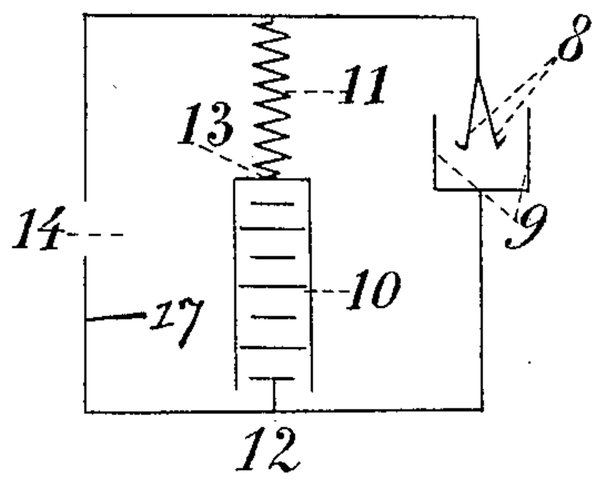


Fig. 4



Witnesses:

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No. 749,775. Patented January 19, 1904.

UNITED STATES PATENT OFFICE.

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ELECTROSTATIC RELAY.

SPECIFICATION forming part of Letters Patent No. 749,775, dated January 19, 1904.

Application filed February 7, 1903. Serial No. 142,403. (No model.)

To all whom it may concern:

Be it known that I, DAN LA COUR, a citizen of the Kingdom of Denmark, residing at Copenhagen, Denmark, have invented certain new and useful Improvements in Electrostatic Relays, of which the following is a specification.

The object of the present invention is to release work from a powerful source of energy by means of extremely weak forces, movements, or other causes. An arrangement according to this invention may, for instance, be used as secondary relay for telegraphing where the relay operated upon by the circuit-current is not able to produce a sufficiently secure contact to insure the closing of a local current of electricity. The invention may also be employed for other purposes.

The principle of my invention is as follows: An electroscope charged from a local source of electricity effects by its movement or oscillation the closing or interruption of an electric current or the performance of other work. The movement or oscillation results from the charging or discharging, which may be effected in different ways, of the coverings or electrodes of the electroscope.

In the accompanying drawings, Figure 1 is a diagrammatic illustration of an arrangement of circuits and apparatus embodying my invention, and Figs. 2, 3, and 4 are similar illustrations of other embodiments thereof.

Referring to Fig. 1, *a* is a relay which may, for example, receive a current of insufficient strength to close an ordinary contact, but still strong enough to be effective in conjunction with an electroscope which, as is well known, responds to the weakest electrical influences. *b* is a battery or other suitable local source of electricity, the pole *c* of which is connected to one covering or electrode, *e*, of the electroscope, said electrode being in this case fixed. The other covering or electrode, *f*, is suspended at point *g* so as to be free to oscillate. It carries a point or projection *h* of insulating material which protrudes through an opening in the fixed electrode. When the two electrodes attract each other and are drawn together, point *h* acts upon contact *k* to close a local circuit, including a battery *i* and a working apparatus *l*—a Morse telegraphic instrument, for example. The relay *a* carries two arms or contacts *m n*, insulated from each other, one, *m*, connected by wire *m'* with pole *d* of battery *b* and the other, *n*, connected by conductors *n'* with pole *c* of said battery. Conductor *n'* also leads to electrode *e* of the electroscope. *o* is a fork connected to oscillatory electrode *f* by conductor *o'*. It follows that when the parts are in the position of rest, (shown in Fig. 1,) with the arm *n* touching the right-hand prong of fork *o*, both electrodes will be charged with current from the same pole *c* (the negative pole, for example) of the battery, and will therefore repel each other; but when current passes over the main line through the relay the arm *n* will be moved out of contact with the right-hand prong of fork *o* and the arm *m* into contact with the left-hand prong of said fork, breaking the connection from pole *c* to electrode *f* and establishing connection from pole *d* (the positive pole, for example) to said electrode by way of wire *m'*, arm *m*, fork *o*, and conductor *o'*. It follows that electrodes *e* and *f* will be charged from opposite poles of the battery and will therefore attract each other, oscillating electrode *f* and causing projection *h* to close the local circuit at *k* and actuate the working apparatus. Upon cessation of the current on the main line the parts will return to the positions shown in Fig. 1, the electrodes *e* and *f* again acquiring the same potential and electrode *f* moving away from electrode *e* and withdrawing projection *h* from engagement with circuit-closer *k*. As will be appreciated, a relatively weak current from battery *b* will be sufficient to effect the operation above described.

Referring to the embodiment of the invention shown in Fig. 2, the oscillating plate *p* is suspended between the fixed plates or electrodes *q* and *r* of an electroscope, which plates are connected, respectively, with poles *z* and *y* of the electricity source *s* and with metallic plates *t* and *u*, which latter may be placed at various distances from each other by adjustment-screws or otherwise. The polarized relay *v* has here only a single arm or tongue *w*, which is electrically connected with a mov-

able electrode or covering *p* of the electroscope. Tongue *w* is at its point supplied with a small plate or the like *x* of a certain capacity. This arrangement has the advantage that the source of energy *s* participates in the work assigned to the relay *v*, as will be apparent from the following explanation of its operation:

Assuming that tongue *w* is in contact with plate *u*, the movable electrode *p* will be charged with the same potential as the pole *y* of the electricity source *s*, and the electrode *p* will be attracted toward fixed electrode *q*. The electricity accumulated in the plate *x* will now cause said plate to be attracted by the plate *t*, which has the same potential as the other pole *z* of the electricity source, and it is possible to adjust the distance, &c., in a manner that will render this power of attraction very nearly able to overcome the friction and other resistances in the relay *v* that prevent the tongue *w* from moving toward the plate *t*. There is now required but a very small impulse of the relay *v* to procure this movement, and as soon as the necessary current passes from the line through the relay the tongue *w* will move, placing electrode *x* against the plate *t*. The tongue *w*, and with it the plate *p*, will receive a potential corresponding to that of the pole *z* of the electricity source, and the electrode *p* will be attracted by electrode *r* and assume a second position of balance. The charged plate *x* is now attracted by the plate *u*, but will only move over to it when aided by an impulse of the relay. The movement of the plate *p* may be here, as in the former case, utilized for various purposes.

In the above-described arrangements I have made small and weak movements or forces give different potentials to the movable part or electrode of the electroscope. The same effect may, however, be obtained in a still simpler manner, it being only necessary to let a galvanometer-needle or some other organ effect a distraction of electricity from the movable part or electrode of the electroscope by which its potential is changed, while this when the distraction ceases immediately recovers its original potential. Such an arrangement is shown in Fig. 3. The electroscope, as here diagrammatically shown, consists of a pair of blades or wings 1, adapted to spread apart, and two fixed coverings or electrodes 2, the blades or wings 1 being adapted to spread apart and close a local circuit or the like—as, for example, in the manner illustrated in Fig. 1; but any other form of electroscope may be employed that will answer the intended purpose. A conductor 15 connects fixed coverings or electrodes 1 with one pole 4 of the battery 3 and also with one end of a high resistance 5. A conductor 16 leads from the movable electrodes 2 to the other end of said resistance and thence to the pole 6 of the battery through a galvanometer-needle at 7 or other suitable means, which normally opens the circuit.

When the galvanometer at 7 closes the circuit between the pole 6 and the electrodes or wings 1, the latter will acquire approximately the same potential as this pole, while the coverings or fixed electrodes 2 will have the same potential as the pole 4. The current which passes from pole 4 to 6 through the resistance 5 is on account of the magnitude of the latter—for example, one hundred million ohms, or more—infinitesimally small. The electrodes or wings 1 will move apart. This movement may be utilized in any desirable manner. When the connection at 7 is interrupted, the coverings 1 will receive the same potential as the pole 4 and electrodes 2 and will fall together. It will easily be seen that a short closing at 7 is not required, but that it will be sufficient for producing considerable potential changes in the coverings 1 that the connection be effected through a resistance relatively weak compared to the resistance 5. As it is possible to make the said resistance 5 any size desired, the transition resistance at 7 may be very considerable without diminishing in any perceptible degree the reflex of the movable coverings.

The arrangement shown in Fig. 4 is the same as that of Fig. 2, except that the fixed electrodes or coverings 9 are connected to pole 12 of the battery 10 and the circuit is normally closed at 14 through conductor 17, leading from battery-pole 12 to one end of high resistance 11 and thence to movable electrodes or wings 8. As before, the other end of the resistance is connected to pole 13 of the battery. When the circuit is interrupted at 14, the electrodes 8 and 9 receive the same potential as poles 12 and 13, respectively, while when the circuit is closed at 14 said electrodes receive the potential of pole 12. Corresponding movements of electrodes or wings 8 result.

While the arrangement according to Fig. 3 may be said to work with "working current"—that is to say, the coverings 1 move apart when the current is closed at 7—the arrangement according to Fig. 4 works with "resting-current"—that is to say, the coverings 8 fall together when the current it closed at 14, while they move apart when the current is interrupted at 14. As in the previous case, it may easily be seen that it is not absolutely necessary to have a perfect closing or interruption at 14 to produce the changes in the potential of the coverings, but only a change of the resistance.

As will be apparent, this invention may be applied to a large variety of uses, which it is not necessary to herein detail.

As it is possible to produce as great an effect as desired by weak forces, it is possible to give a signal at any point or place or any movement may be obtained, though such

movement would be quite insufficient to close a common contact or do other work. As only an exceedingly small amount of energy is required according to this invention to effect the operation of an apparatus—for example, a telegraph apparatus—the circuit-current affecting the primary relay need only be very weak or of short duration, and the working speed by telegraphing through submarine cables, for example, may be considerably increased.

The principle of the invention may of course be embodied in other forms than those herein particularly shown and described.

What I claim is—

1. The combination with an electroscope comprising a fixed and a movable electrode; a local source of electricity for charging said electrodes; circuit connections between said source and the electrodes whereby the latter may be charged with the same potential causing them to repel each other or with different potentials causing them to attract each other; and a device or instrument responsive to electrical influences independent of the local circuit for changing the status of the circuit connections and correspondingly the potentials of the electrodes.

2. The combination with an electroscope comprising a fixed and a movable electrode, a local source of electricity for charging said electrodes; circuit connections between said source and the electrodes whereby the latter may both be charged from one pole of the source or separately from the two poles of the source respectively; and a device or instrument responsive to electrical influences independent of the local source for changing the status of the connections to charge the electrodes both from one pole of the source or separately from the respective poles.

3. The combination with an electroscope comprising a fixed and a movable electrode; a local source of electricity for charging said electrodes; a circuit-controlling device or instrument responsive to electrical influences independent of the local source; circuit connections from one pole of the source to one electrode and to the circuit-controlling device, from the other pole of the source to the circuit-controlling device and from the other electrode to said device, whereby the electrodes may be both connected to one pole of the source or respectively to different poles thereof, according to the position of the circuit-changer.

4. The combination with an electroscope comprising a fixed and a movable electrode; a local source of electricity for charging said electrodes; a circuit-controlling relay in a main line and comprising two fixed contacts and two movable contacts adapted to engage the fixed contacts respectively; and circuit connections from one pole of the source of electricity to one of the movable contacts, from the other pole of the source to the other movable contact and to one electrode, and from the other electrode to the fixed contacts.

5. The combination with an electroscope comprising a fixed and a movable electrode; a local source of electricity for charging said electrodes; a circuit-controlling relay in a main line and comprising two fixed contacts and two movable contacts adapted to engage the fixed contacts respectively; circuit connections from one pole of the source of electricity to one of the movable contacts, from the other pole of the source to the other movable contact and to one electrode, and from the other electrode to the fixed contacts; and a local circuit including working apparatus and a circuit-closer operated by movement of the movable electrode of the electroscope.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

DAN LA COUR.

Witnesses:

VILHELM MATHIASSEN,

A. CUMING GREEN ASPUG.