(No Model.) 2 Sheets—Sheet 1.

J. C. LUDWIG.

POLARIZED TELEGRAPHIC RELAY.

No. 337,272. Patented Mar. 2, 1886.

Fig. 1.

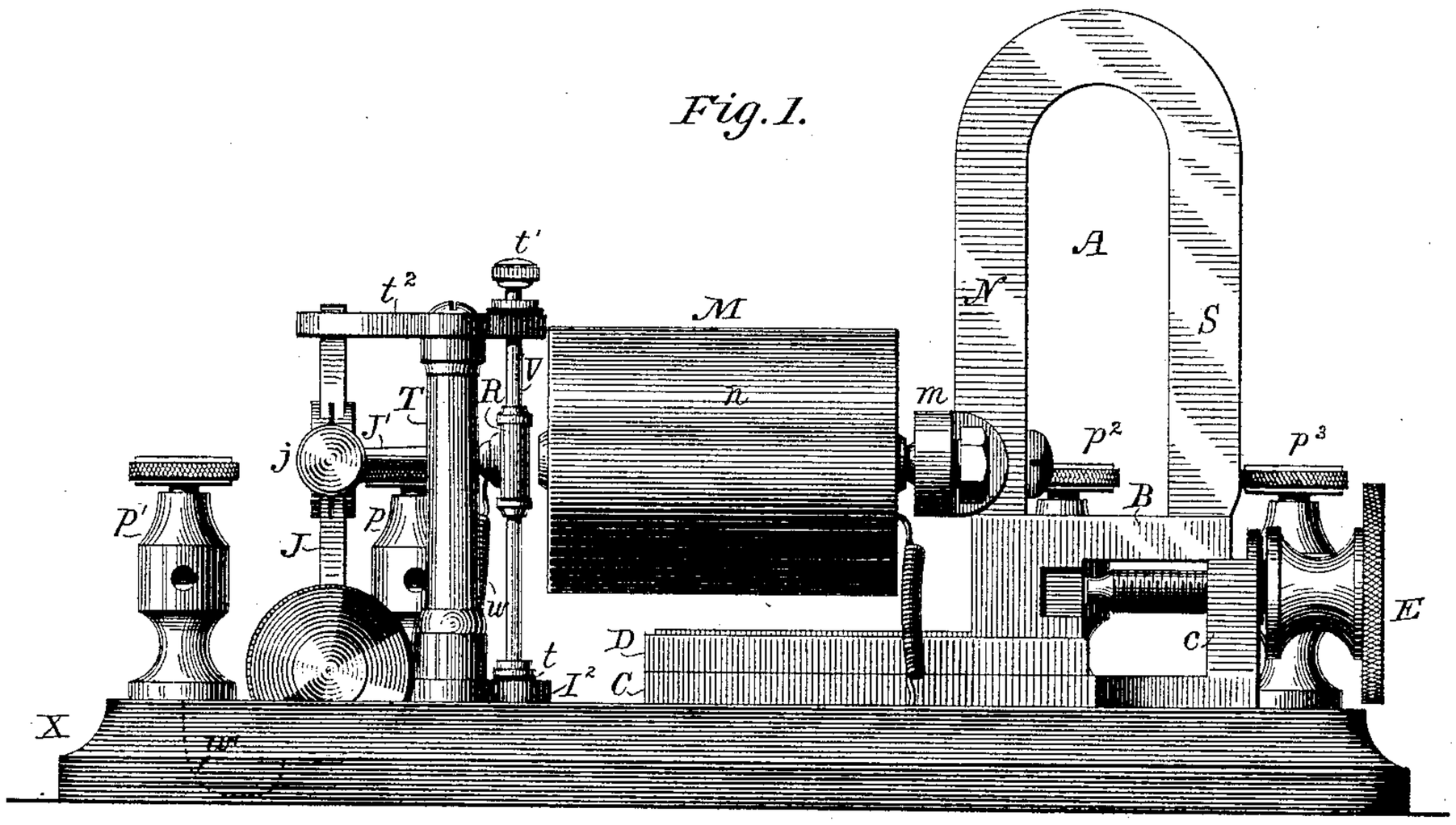
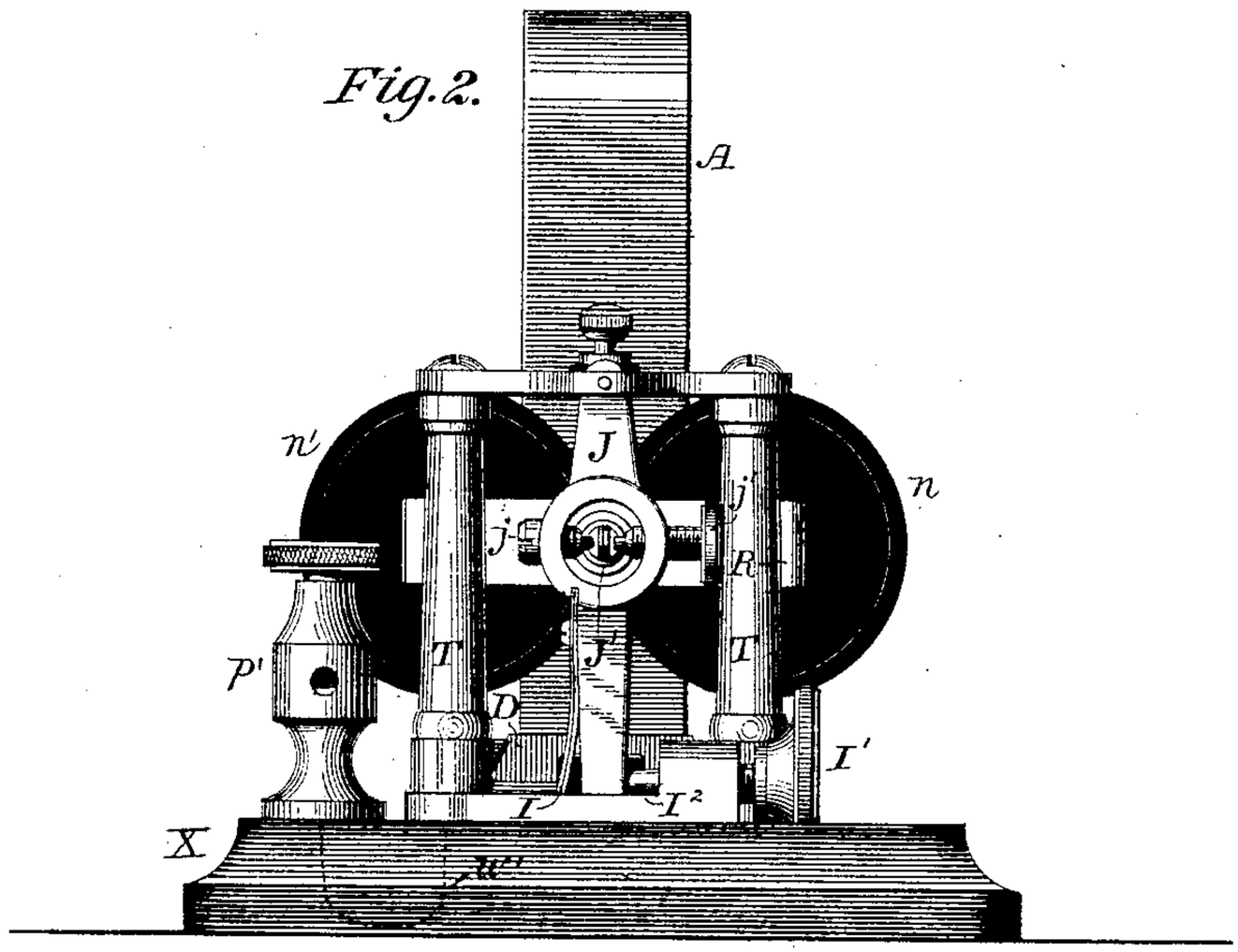


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

J. C. LUDWIG.

POLARIZED TELEGRAPHIC RELAY.

No. 337,272. Patented Mar. 2, 1886.

Fig. 3.

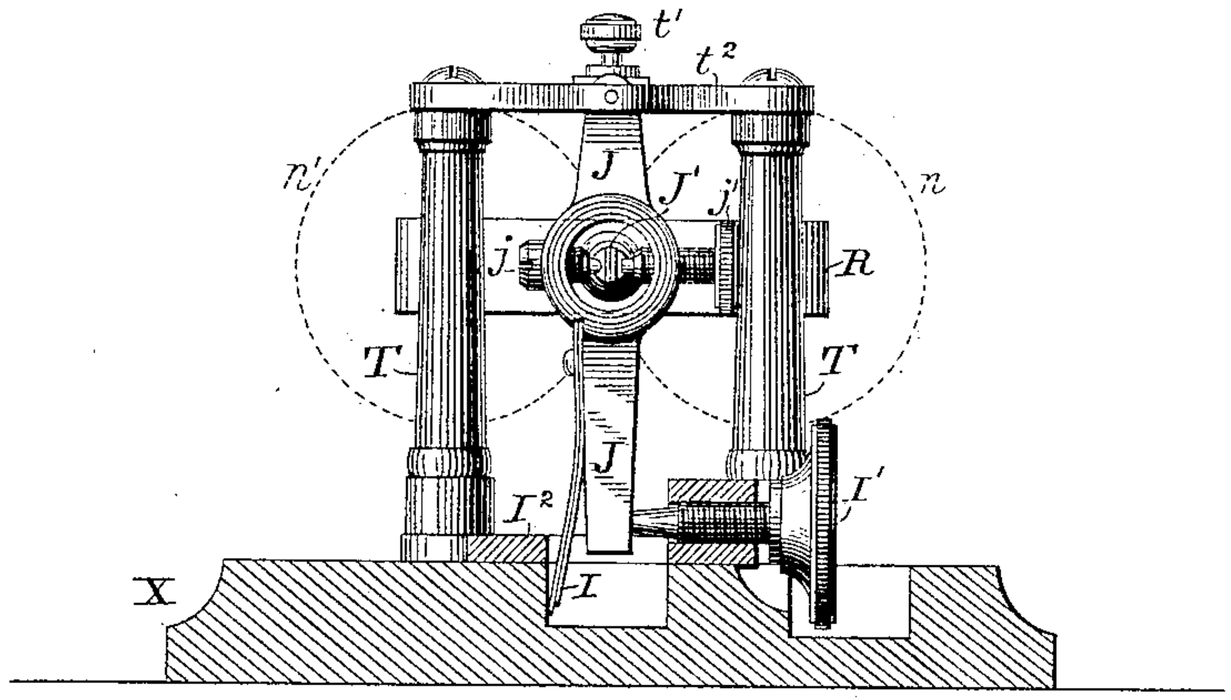


Fig. 4.

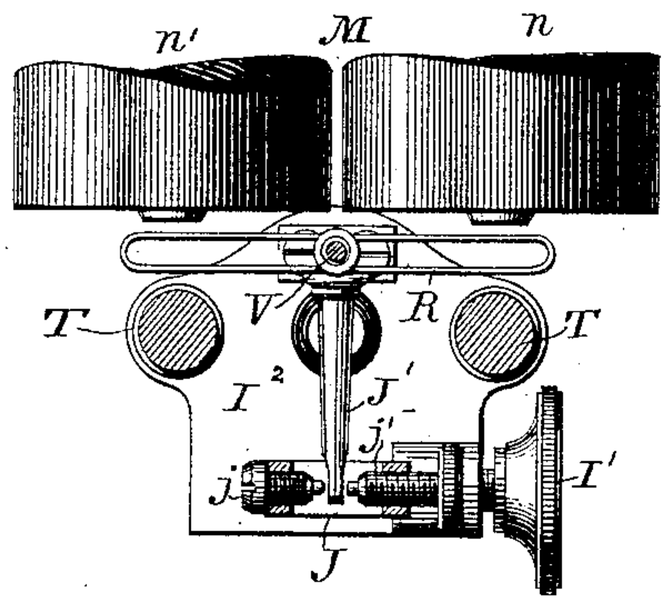
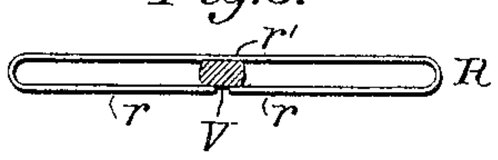


Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN C. LUDWIG, OF SAN FRANCISCO, CALIFORNIA.

POLARIZED TELEGRAPHIC RELAY.

SPECIFICATION forming part of Letters Patent No. 337,272, dated March 2, 1886.

Application filed June 4, 1885. Serial No. 167,619. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. LUDWIG, a citizen of the United States, and a resident of San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Telegraphic Receiving-Instruments, of which the following is a specification.

My invention relates to a telegraphic receiving-instrument which may be used as a main-line receiver or as a relay for opening and closing a local circuit, including a receiving-instrument.

The special object of my present invention is to improve an instrument shown and described in Letters Patent No. 315,427, granted to me on the 7th day of April, 1885, and its general object is the same as that of my said previously-patented instrument—namely, to provide a receiving-instrument which will respond promptly and vigorously to induced electric currents which flow only instantly in alternately opposite directions, and by which this class of currents may be used for telegraphing the Morse code of characters or signals, or other systems in which elemental signals or characters are differentiated in respect to extent or duration.

In my present improved instrument, as in my said previously-patented instrument, I utilize directly but one pole of a permanent magnet, which pole communicates a similar polarity to the two cores of an electro-magnet, and in front of these two cores I pivot a balanced neutral armature, the opposite ends of which are attached with equal force by the two cores when no current traverses their coils. When, however, an instantaneous current traverses the coils in one direction, one of the cores will be strengthened and the other weakened in its attractive power. The strengthened core will then attract the adjacent end of the armature toward it, throwing the other end outward from the weakened pole. The armature being thus attracted will remain under the control of the attracting core, by reason of being closer to it, until a reverse current is sent through the coils. Then the operation will be reversed, and the other core will have the overpowering attraction. It will thus be seen that although the effect of the currents themselves is but momentary, they may be utilized for producing movement of the armature at any desired intervals.

My present special improvements consist in a novel construction of the neutral armature and combination thereof with the electro-magnet having cores of normally similar polarity, whereby the practical neutrality of said armature in its normal relation to the electro-magnet poles is preserved, although its mass might become somewhat polarized by residual magnetism resulting from the inductive influences to which it is subjected; in a novel arrangement of the permanent magnet with relation to the electro-magnet and neutral armature, whereby the unused pole of said permanent magnet is prevented from having any influence upon the armature, and in certain novel devices for adjusting the armature with relation to the electro-magnet poles.

My invention will be readily understood from the following particular description, in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of my improved telegraphic receiving-instrument. Fig. 2 is an end view thereof. Fig. 3 is a detached view of the armature, its supports and adjusting devices. Fig. 4 is a top view of the same with the supports in horizontal section. Fig. 5 is a detached edgewise view of the armature, with its arbor shown in cross-section.

Referring to the drawings, A designates a permanent magnet of horseshoe shape in an upright position, with its poles turned downward and resting upon a horizontal bracket, B, which is mounted upon a sliding plate or carriage, D, having its longitudinal edges dovetailed into a guide-plate, C, upon which it can move lengthwise. The guide-plate is secured to a base, X. In a stationary lug, *c*, is arranged a horizontal screw, E, which extends under the bracket B, and has its tip in swivel connection therewith. It will be readily seen that by turning the screw E the sliding plate D, bracket B, and magnet A may be adjusted to different positions on the guide-plate.

To the outer side of one pole of the permanent magnet A is secured the yoke-piece *m* of an electro-magnet, M, the coils *n n'* of which have soft-iron cores, to which, of course, is

communicated a magnetic polarity, the same as that of the permanent magnet-pole to which their yoke-piece is attached. In front of the poles of this electro-magnet is an equal-armed oscillating armature, R, the middle of which is fastened to a vertical arbor, V, which is stepped in a bearing, *t*, at its foot, and has a top bearing in the end of a screw, *t'*, arranged vertically through a metal plate, t^2, supported by two posts, T T.

The special construction of the armature will be presently described. The plate t^2 projects outwardly beyond the posts T T, and in a slot in this outwardly-projecting portion is pivoted a depending arm, J, the intermediate portion of which has a circular opening, into which extends the tip of a horizontal metallic arm, J', projecting from the arbor of the armature. Through opposite side walls of this opening are arranged adjustable screws *j j'*, the tips of which serve as contacts for the tip of the arm J'. To one side of the depending arm J is secured a spring, I, the lower portion of which curves away from the arm and bears against the wall of a recess formed in the base-board, so as to force the arm J against the tip of an adjusting-screw, I', arranged in a lug on a metallic plate, I^2, upon which stand the posts T T. By turning the screw I' in or out the position of the arm J may be adjusted, as when it is turned out the spring will cause the arm to snugly follow the screw, and the spring will yield to the pressure of the screw upon the arm.

The screw *j* has an insulated tip, while the screw *j'* is a metallic contact for the tip of arm J'. The metallic step-bearing *t* and top bearing, *t'*, of the arbor V are insulated, and the arm J' is connected with a binding-post, *p*, by a wire, *w*, which passes under the base-board, while the arm J is connected electrically with a binding-post, *p'*, by plate t^2, posts T T, plate I^2, and a short wire, *w'*, passing from plate I^2 under the base-board to the post. One coil-terminal of the electro-magnet is connected to a binding-post, p^2, and the other to a similar post, p^3. One of the posts p^2 or p^3 is to be connected with a line-wire, and the other to the earth, or with a switch which may be used to connect it either directly to earth or to earth through a generator, as shown and described in Letters Patent No. 315,425, granted to me on the 7th day of April, 1885.

The armature R, as has been already stated, is entirely neutral so far as its operation is concerned, and it should be made of soft iron. It is arranged quite close to the poles of the electro-magnet M, and when no current traverses the coils of said magnet it will be attracted equally at both ends, and if either end is pressed closer to its adjacent pole than the other is to the opposite pole of the magnet the armature will remain in such position as long as no current passes, and also while a current in a given direction is passing, as will be understood from the further description of the operation of the instrument.

Now, we will suppose that in the construction of the instrument the electro-magnet M is attached to the north pole of the permanent magnet A, and a north polarity is consequently communicated to the soft-iron cores of said electro-magnet. Suppose, further, that the induced current generated and sent on the line flows in such direction through the coils of the electro-magnet that, were the cores of said magnet neutral, the current would give to core of spool *n* a north polarity and to core of spool *n'* a south polarity. Now, it is obvious that, as the cores already have a north polarity, the effect of the current will be to make stronger the north polarity of core, and weaken, if not altogether neutralize, that of core of coil *n'*, so that the core of coil *n* will have the strongest attraction for the armature R, and will draw the adjacent end of said armature toward it, throwing the tip of the arm J' against the contact-screw *j'*, and thus closing a local circuit if the instrument is used as a relay. Although the magnetizing effect of the current may cease almost instantly, the armature will remain attracted by the pole to which it is nearest until a reverse current passes, and by partially turning arbor V will bring the tip of arm J' against the screw *j'*, and will keep the local circuit closed meantime if the instrument is used as a relay. A reverse current will obviously cause the arm J' to leave contact-screw *j'* and strike the screw *j*, which is equivalent to a back-stop, and the local circuit will be opened or simply a back-stroke made.

In the instrument shown and described in my Patent No. 315,427 the oscillating armature is simply a solid oblong plate of soft iron, which is liable to become partially polarized, and in the event of such polarization the instrument loses its delicacy and becomes practically inoperative. To provide against the deleterious effect of polarization of the armature, I have formed it of a long thin strip, with its end portions bent back, as shown at *r r*, Fig. 5, and approached close to each other, without touching behind the intermediate portion, *r'*, which stands between the tips and the magnet. Now, if such a strip becomes polarized, its poles will be at its tips and away from the magnet-cores, which will face the intermediate and neutral portion, *r'*. The polarization of the armature, therefore, should it occur, will have practically no effect so far as its neutral relation to the magnet-cores is concerned, and especially as the intermediate portion forms a metallic screen to intercept any inductive influence of the armature-poles toward the magnet-cores.

In my former patent the permanent magnet was arranged with both its poles toward the armature, and was not adjustable. The unused pole in that form is so near to the armature that it may have some inductive influence thereupon and interfere with its action to such an extent as to prevent it from responding promptly to reversals of current if the current be weak, as it may be on long lines.

In my present improvement I have taken care to remove the unused pole to the greatest practicable distance from the armature, and have arranged it behind the utilized pole, so that the latter acts to intercept the inductive influence of the said unused pole, and prevent any deleterious influence of the same upon the armature.

In my former patented instrument I did not provide means for regulating the distance between the armature and the magnet-cores. Such means have been supplied in my present improvement by mounting the permanent magnet upon the adjustable sliding plate, and while the pendent arm J, its adjusting-screw I′, and the adjustable screws *j j′* serve to bring the armature to an exact magnetic balance with respect to the magnet-cores, the said screws *j* and *j′* are for the special purpose of regulating the amplitude of the oscillations of the armature, so that neither end of the same can ever swing outward beyond the efficient field of the respective magnet-cores.

I prefer to make the armature of soft sheet-iron, commonly known as "Russia" iron, though of course other iron, either cast or wrought, might be used. The arm J′ may be connected with the binding-post *p* by any suitable means which will not interfere with its vibration.

Having now described my invention and explained the operation thereof, I claim—

1. In a telegraphic receiving-instrument of the class described, the combination, with the electro-magnet having cores of normally similar polarity, of the oscillating armature having its end portions bent back away from the magnet-cores, essentially as and for the purpose set forth.

2. The neutral armature formed of a soft-iron strip bent back at both ends, as described.

3. In a telegraphic receiving-instrument of the kind described, the combination, with the neutral oscillating armature and electro-magnet, of the permanent magnet having one end attached to the yoke-piece of said electro-magnet, and its other end arranged behind said attached end and on the opposite side thereof from the neutral armature, substantially as and for the purpose set forth.

4. The combination, with the electro-magnet and its oscillating neutral armature mounted upon a vertical arbor, of the arm J′, projecting from said arbor, the pendent pivoted adjustable arm J, and the adjustable stops upon said arm, substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 25th day of May, 1885.

JOHN C. LUDWIG.

Witnesses:
GEO. T. KNOX,
H. LANG.