W. M. BRUCE, Jr.

TELEGRAPHY.

APPLICATION FILED OCT. 23, 1915.

1,240,306.

Patented Sept. 18, 1917.

4 SHEETS—SHEET 1.

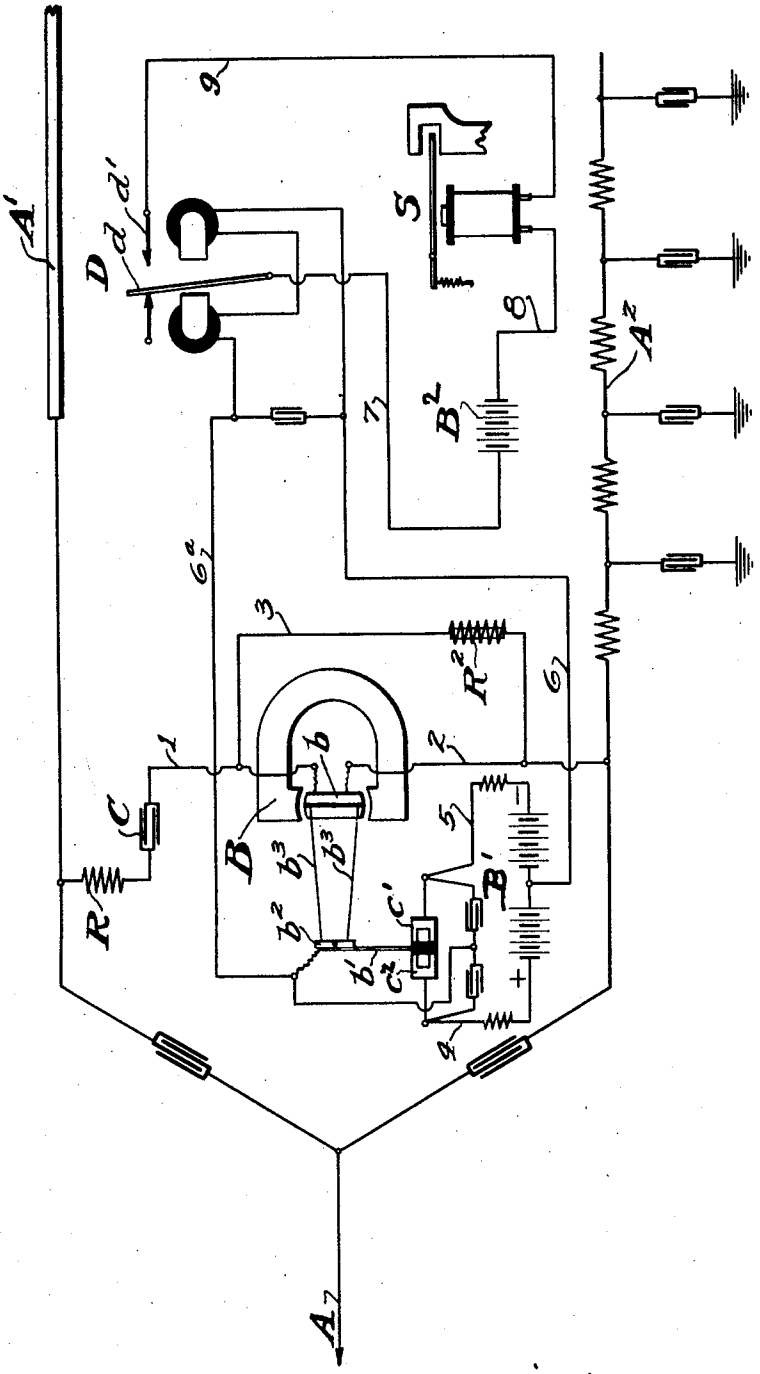


Fig 1

Witnesses

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TELEGRAPHY.

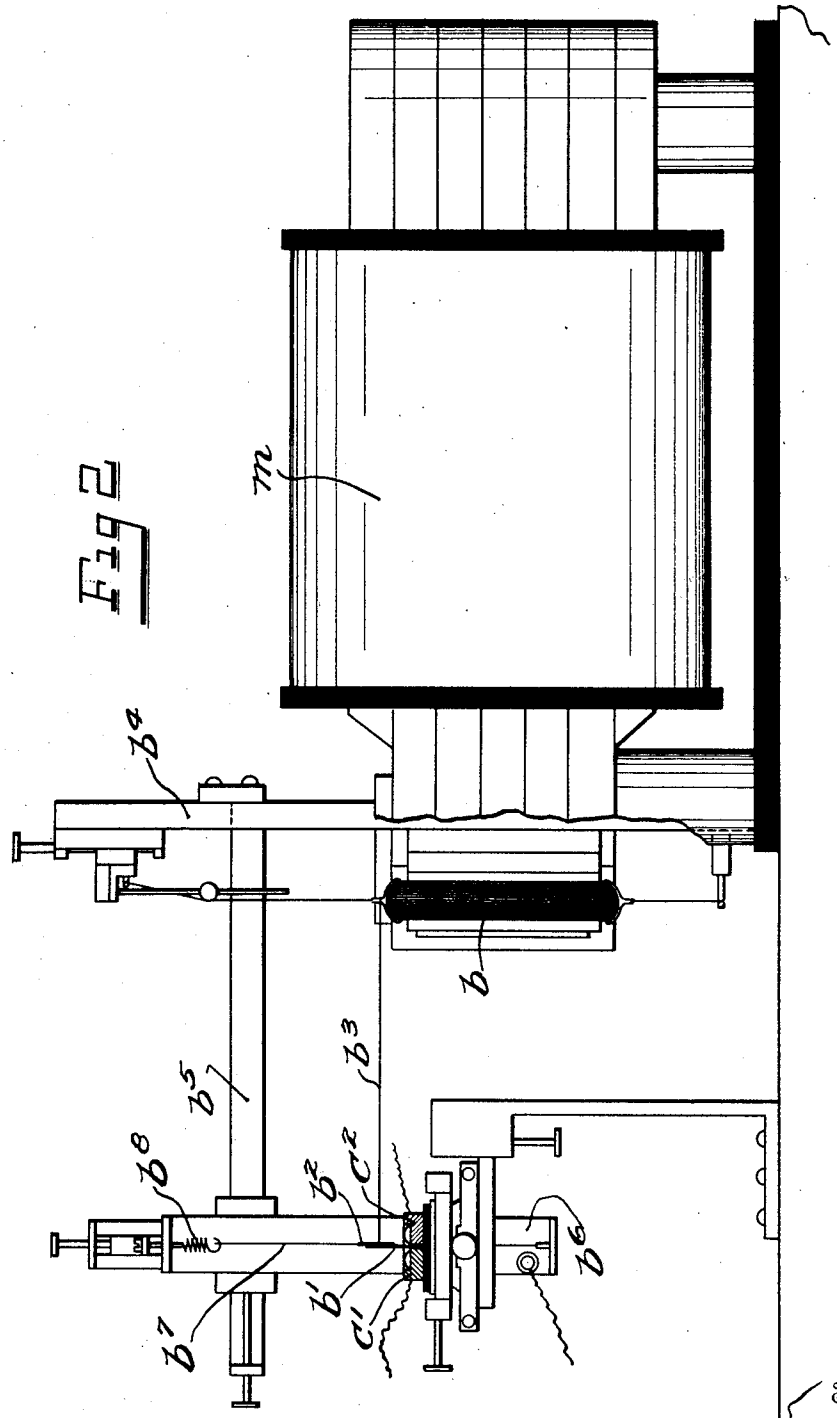
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4 SHEETS—SHEET 2.

Fig 2



Witnesses

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4 SHEETS—SHEET 3.

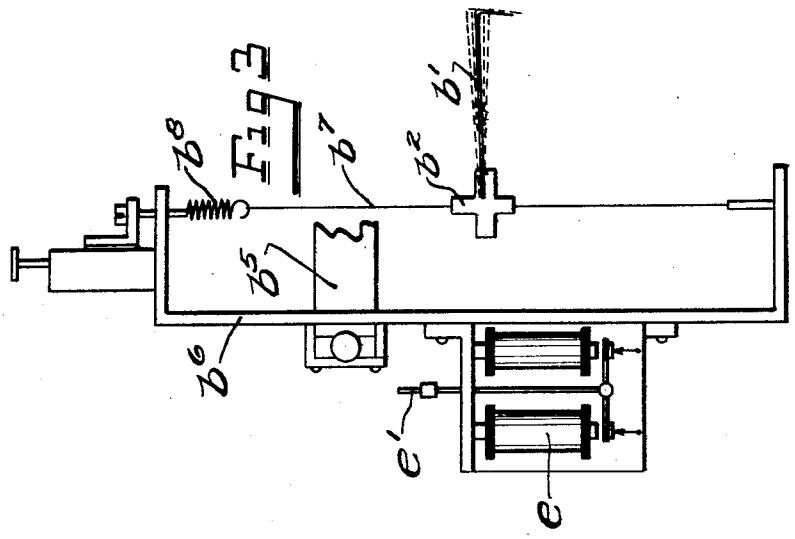


Fig 3

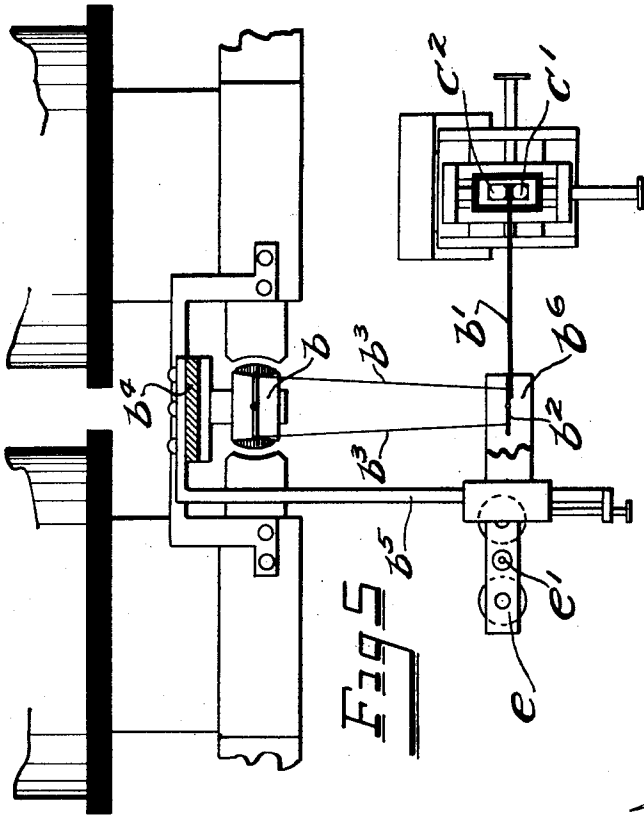


Fig 5

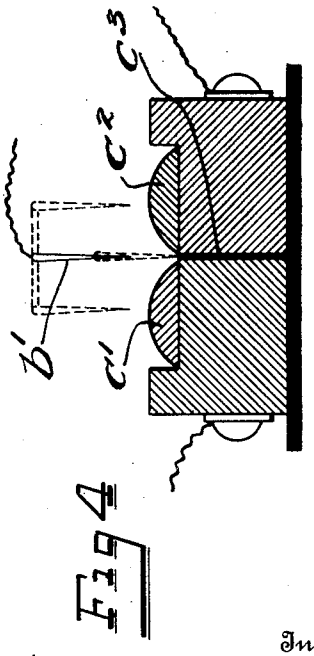


Fig 4

Witnesses

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4 SHEETS—SHEET 4.

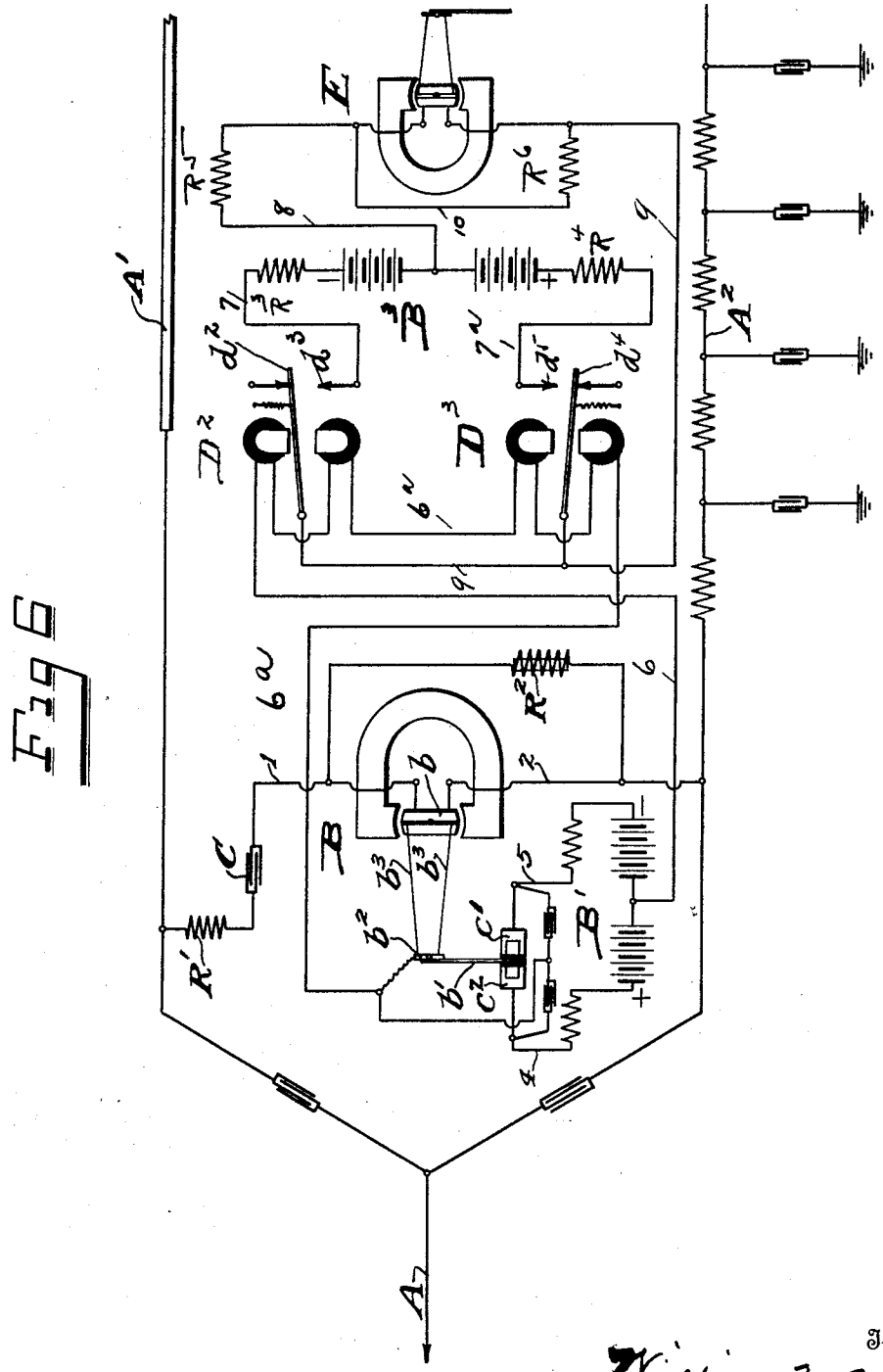


Fig 6

Witnesses

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UNITED STATES PATENT OFFICE.

WILLIAM M. BRUCE, JR., OF SPRINGFIELD, OHIO, ASSIGNOR TO THE UNITED TELEGRAPH & CABLE COMPANY, OF SPRINGFIELD, OHIO, A CORPORATION OF OHIO.

TELEGRAPHY.

1,240,306. Specification of Letters Patent. Patented Sept. 18, 1917.

Application filed October 23, 1915. Serial No. 57,442.

To all whom it may concern:

Be it known that I, WILLIAM M. BRUCE, Jr., a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Telegraphy, of which the following is a specification.

My invention relates to improvements in telegraphy and particularly to that class of telegraphy in which there is used high resistance and capacity lines, such as submarine telegraphy.

My invention consists in the construction and combination of parts hereinafter described and set forth in the claims.

In the embodiment of my invention which I have herein set forth in the drawings and description, I have made the application of my improvement particularly to circuits and apparatus for the use of ordinary Morse signals transmitted by the usual Morse key and received on an ordinary sounder, the invention, however, or parts thereof are equally adapted to the transmission of other forms of signals.

In the accompanying drawings:

Figure 1 is a diagram of the circuits and apparatus embodying the invention.

Fig. 2 is an elevation of the receiving relay which performs an important part of the apparatus.

Figs. 3, 4 and 5 are detail views of the same, Fig. 3 being a partial front elevation, Fig. 4 a partial sectional view of the contacts and Fig. 5 a partial plan view.

Fig. 6 is a diagram showing modifications.

Like parts are represented by similar letters of reference in the several views.

In the accompanying drawings, I have shown only such apparatus as is used at the receiving end of the line, this receiving apparatus being especially adapted for use with the sending apparatus which is described in my Patent No. 1,146,234, although capable of use with other systems of sending.

Referring to Fig. 1, A would represent the sending station of the ordinary duplex submarine telegraph. A′ the cable or conductor and A^2 the artificial lines.

The sending apparatus is attached to the apex of the cable in the usual way and the receiving apparatus in which this invention particularly resides is also placed across the lines in the usual way. Referring to Fig. 1 the circuits and apparatus of the receiving end may be described as follows:

B is my improved relay which is connected between the cable A′ and the artificial A^2 through resistance R, condenser C, by line 1 to the relay coil b, thence by line 2 to the other side of the line or the artificial A^2, the usual shunt 3 with inductive resistance R^2 may also be employed. The movable contact b' is not secured directly to the coil b but is supported on a suspended bridle b^2 which is connected to the coil b by fine thread-like connections b^3 by means of which the movements of the coil are transmitted to the bridle and thus to the contact b'. The movable contact b' thus moves laterally as the relay coil b moves. This movable contact b' is also made to vibrate vertically by means separate from and independent of the coil, the end of the movable contact being preferably turned at right angles and provided with a fine metallic contacting point to engage the stationary contacts c' and c^2. These stationary contacts are connected with wires 4 and 5 to the opposite poles of a divided battery B′, the center of which is connected by wire 6 to a polarized relay D, the circuit being completed by wire 6^a to the movable contact b'. The armature d of the relay D is connected by wire 7 to battery B^2 thence by wire 8 to a translating instrument, such as a sounder s, and by wire 9 to contact d'. The result being that as the movable contact b' of relay B engages the stationary contact c' negative battery is sent to the polarized relay D which holds its armature against the back contact; when the movable contact b' of the relay B contacts with the stationary contact c^2, positive battery is transmitted to the polarized relay D and it is moved against its forward contact d' which closes the circuit for the sounder or translating device and causes it to operate from the battery B^2. As the relay D is polarized this circuit will remain closed until the armature d of the polarized relay D is moved away by a negative im-

pulse which only takes place when the movable contact b' of relay B engages the contact c'.

Shunts with condensers therein are provided around each of the contacts c' and c^2 in the usual manner to prevent sparking. Referring to Fig. 2 my improved receiving relay is shown in elevation and on a larger scale. In this view m represents the magnets, the poles of which are extended on each side of the coil b, which coil is suspended and provided with the usual means for adjustment which adjustment means are preferably carried on a vertical bar b^4. Extending forwardly from this bar b^4 is a horizontal supporting bar b^5 upon which there is adjustably supported a U-shaped frame b^6 between the upper and lower extremities of which is suspended the bridle b^2 which carries the movable and vibrating contact b'. On the side of the vertical part of the U-shaped bar b^6 there is mounted a vibrator which preferably consists of an ordinary vibrating coil e, having a weighted armature e' and connected in a local battery circuit to cause the armature like a pendulum to vibrate. The parts being adjusted so that the vibration can be adjusted to coincide with the natural period of the movable contact b' and cause it to vibrate vertically in unison with the vibrations of pendulum e'. The bridle b^2 is suspended on a thread-like support b^7 and is preferably provided with a spring b^8 and with usual means for adjusting the tension through properly screw-threaded parts mounted on the frame b^6 so that the contact b' is given a vertical and rapid vibration independent of any lateral movement thereof. So long as the coil b of the armature remains stationary this contact b' will vibrate up and down at the zero point between the stationary contacts c' and c^2. Any movement of the coil b however, will, through the suspended bridle b^2, cause a corresponding lateral movement of the movable contact b' which will cause it to rapidly vibrate against the contact c' or c^2 depending upon whether the coil is moved in one direction or the other.

In the circuits herein described, the relay B is a polarized relay and the suspended coil b is moved in one direction by a positive impulse and in the other direction by a negative impulse and in my system of sending Morse signals I employ an impulse of one polarity at the beginning of the impulse and an impulse of opposite polarity at the end of the impulse as fully set forth in my patent referred to, the result being that the movable contact b' is moved to one of the stationary contacts at the beginning of each character and the other at the end of a character so that the polarized relay D is positively moved in one direction at the beginning and in the opposite direction at the end of the character and thus the characters such as dots and dashes may be of any desired length and the sounder will be held up and a dash continued until its circuit is positively broken by the wiping out impulse which moves the armature d in the opposite direction.

For the stationary contacts c' and c^2 I preferably employ mercury as it permits the contact to penetrate to a sufficient depth therein to make the contact without having any influence upon the vibrations. When mercury, however, is independently supported in separate supporting receptacles, the tendency of the mercury to form in globules results in producing, at the edges of the receptacle, depressions or recesses and if these mercury globules are separated by a wall in the usual way the vibrating contact as it moves from side to side will play in these depressions or recesses and a contact may not be obtained. To obviate this I employ for the supports for the contacts c' and c^2 a material preferably having an affinity for mercury and I employ a single cavity which is preferably made up of two blocks of metal; silver being found to be satisfactory, and I separate these blocks by an insulating strip c^3 which preferably extends only to the bottom of the recess in which the mercury is deposited. This insulating strip may be of mica which has no affinity for mercury and a mercury globule will form on each side of this strip. The result is that there is a depression formed immediately over the insulating strip at which point there is no mercury and a mercurial wall of rounded form extends upwardly in the receptacle on each side of this strip as shown in Fig. 4.

When the coil b is stationary the movable contact b' will vibrate vertically at the zero point immediately over this insulating strip or bridge c^3 but the slightest movement in either direction of the coil b will produce a corresponding movement of the pointer or movable contact b' causing it by its vibrations to rapidly penetrate into the mercurial globule which forms the contact on that particular side and this succession of contacts keeps the current of that polarity flowing through the polarized relay and causes it to positively hold up until the movable contact is moved to the opposite globule of mercury when its vibrations therein will send impulses of opposite polarity and cause the relay to be held up in the other direction.

I have demonstrated in practice that this form of contact and this method of operating the same will respond to the most delicate currents passing through submarine cables and as the movable contact can be made in any reasonable length, the movement of the suspended coil b can be multiplied to any desired degree and as there is

no friction in the contacts with the mercury and as the rapidity of vertical vibrations of the contact can be varied to almost any extent, a perfect contact for the local circuit from the receiving relay b to the polarized relay D is secured and perfect operation of the relays is obtained without the use of magnifiers and other apparatus than the relay B which can be placed directly in the receiving circuit of the cable if so desired.

In Fig. 6 I have shown a diagram of circuits for applying this system to recorder style of receiving. In this drawing the circuits for the receiving relay B are the same as in Fig. 1, but two polarized relays D^2 and D^3 are employed and these polarized relays operate to send opposite polarity of current from a divided battery B^3 to a recorder E. Since in recorder style of receiving the recorder moves in one direction for a dot and in the other for a dash, impulses from the battery B^3 are sent to the recorder only when the contact b' of relay b is engaging one or the other of its contacts c' or c^2 and this impulse is wiped out by the movable contact b' coming to the neutral or zero point at which time both of the relays D^2 and D^3 will be in their normal or inoperative position such as shown in Fig. 6. If the movable contact b' of the relay b engages the stationary contact c' negative battery is sent through the polarized relays D^2 and D^3. This negative battery will operate the polarized relay D^2 whose armature d^2 will be caused to engage a contact d^3, connected to the negative side of the divided battery B^3 and send a negative impulse to the recorder E through the circuit from contact d^3, wire 7, negative side of battery B^3, wire 8, recorder E, thence by wire 9 to armature d^2 which will cause the stylus or marking device of recorder E to move in one direction. If the movable contact b' of relay B comes to the zero point, the relay D^2 will drop back to normal and the recorder will come to normal. If this should be followed by another negative impulse the operation will be repeated. If, however, the contact b' moves to the contact c^2 a positive impulse will be sent through the polarized relays D^2 and D^3 which will cause the relay D^3 to operate, bringing its armature d^4 into engagement with contact d^5 sending a positive impulse to recorder E, through circuit from contact d^5, wire 7^a, positive battery B^3, wire 8, recorder E, wire 9 to armature d^4 thus moving its stylus or marking device in opposite direction.

The usual shunt 10 may be employed around the recorder E having the customary resistance R^6 therein, also resistances R^3, R^4 and R^5 in the circuit may be provided in the usual way to adjust the amount of current passing to the recorder E.

While I have shown these relays and circuits arranged to receive Morse on an ordinary sounder by a system set forth in my former patent referred to and also by recorder style, it is obvious that they may be used in various other ways and systems.

The arrangement of the receiving relays and polarized relays shown in Fig. 6 could be used for repeating between different cables by having the relays D^2 and D^3 sending their impulses to a cable instead of a recorder.

Having thus described the invention, I claim:

1. In a relay such as described, having a movable arm, means for rapidly vibrating said arm in one direction, and means such as a movable coil for moving the arm in another direction, mercurial contacts arranged on each side of a zero point, said mercurial contacts being supported so as to form globules with a recess between the same, the recess forming a neutral or zero point, and the globules forming contacting surfaces for securing electrical contact with said movable arm.

2. In a relay such as described, a movable arm and contacts with which it may be caused to engage, means such as a movable coil for moving said arm to different positions adjacent to said contacts, but not in engagement therewith and separate means for causing said arm to vibrate into engagement with said contacts when moved to proper position.

3. In a relay such as described, having a movable arm to form an electrical contact, mercurial globules arranged on opposite sides of a neutral point and adjacent to said arm, said mercurial globules forming contacting devices and separated from each other by a depression formed by the mercurial globules themselves, and electrically separated from each other by means which end below the contact walls of said mercurial globules, and separate means for vibrating said arm to cause it to contact with the mercurial globules when said arm is moved to different positions.

4. In a relay such as described, liquid contacts formed in globules, said globules separated by insulating material, the surface of which is below the top of the liquid globules, in combination with a movable contacting device to engage said liquid globule and form an electrical connection therewith.

5. In a movable coil relay, a contact arm having simultaneous vertical and horizontal movement, contacts located adjacent to said contact arm to form and complete local electrical circuits through the vertical and horizontal movement of said contact arm.

6. In a relay such as described, contacts formed by mercurial globules, separated by insulating material, said globules being pre-

vented from flowing together by the natural law which causes it to form in globules in connection with the metal base on which it rests, in combination with a movable contacting device to form electrical contact therewith.

7. A polarized relay having a movable coil adapted to oscillate within the magnetic field of said relay when current impulses are impressed on the windings of said coil, a contact arm connected to said coil and adapted to oscillate through one plane in unison with said coil and separate means to vibrate said contact arm through a different plane, an electrical contact supported out of the plane of oscillation of said arm by said coil, but within the plane of vibration of said arm, whereby an electrical connection will be established between said arm and said contact by the vibration of said arm when moved by said coil.

In testimony whereof, I have hereunto set my hand this 13th day of October, 1915.

WILLIAM M. BRUCE, JR.

Witness:

CHAS. I. WELCH.