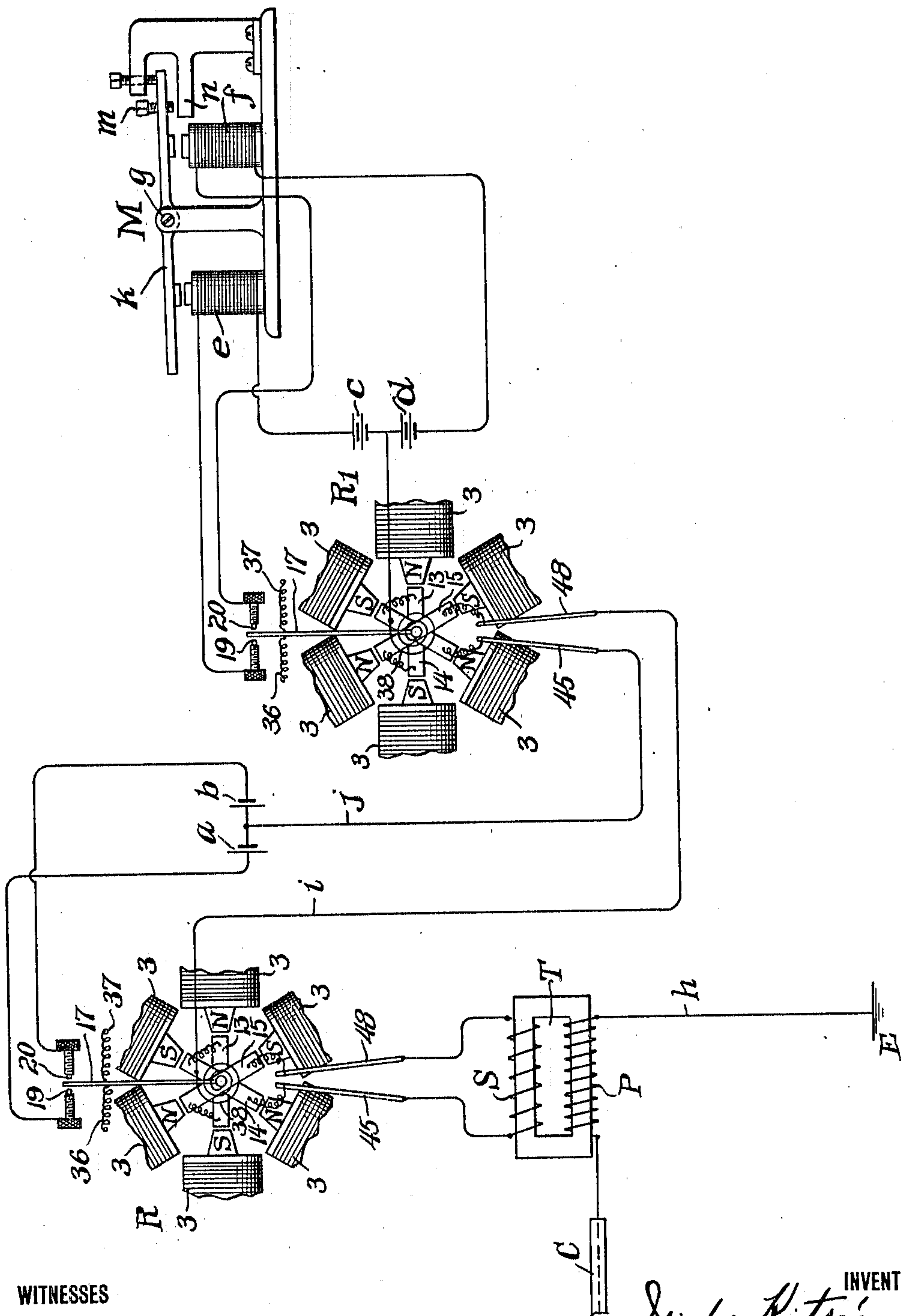


I. KITSEE.
CABLE TELEGRAPH SYSTEM.
APPLICATION FILED FEB. 10, 1909. RENEWED JULY 20, 1912.
1,099,380. Patented June 9, 1914.



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CABLE-TELEGRAPH SYSTEM.

1,099,380.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ISIDOR KITSEE, a citizen of the United States, residing at Philadelphia, county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Cable-Telegraph Systems, of which the following is a specification.

My invention relates to telegraphy, and more particularly to telegraphy over a long line or cable, such as a submarine cable, or over any other line or circuit having relatively great capacity.

My invention resides in the combination with a line or cable, of an extremely sensitive relay which is responsive to the received energy, and in turn controls another relay, the self-induction of the second relay circuit being so small that sticking at the contacts of the sensitive line relay is prevented or does not occur. And the second relay, which may be a more rugged and less sensitive instrument, controls a sounder, or recorder, or other instrument.

It is a further feature of my invention that the extremely sensitive relay in association with the line or cable is of a movable coil type, a plurality of coils secured together to form a single moving system and a separate pair of field poles for each coil, the relay tongue or arm being biased to a position between two contacts, such contacts serving to send currents in one direction or another through the similar moving system of a second and less sensitive relay, which may also have a biased tongue or arm normally between two contacts, such contacts in turn controlling separate windings of the sounder, or recorder, or other instrument. And by preference, in my system the relays described are controlled by the secondary of a transformer whose primary is connected in the line or cable and has a conductive connection to earth.

My invention resides in other features hereinafter described and claimed.

One of the greatest disadvantages in employing very sensitive relays on lines or cables where only a very limited current is available, is the sticking or sparking at the sensitive relay contacts.

I found while using a submarine cable running from New York city, N. Y., to

Canso, Nova Scotia, the cable having a length between 900 and 1,000 miles, that the sparking and sticking of the contacts for a very sensitive relay is not so much due to the making and breaking of the local circuit, which included only one voltaic cell, but is due mostly, and I believe entirely, to the electromagnetic inductive devices included in the local circuit. In some cases, the relay tongue and forward contact were connected with three small secondary cells, the electromotive force being six volts. No sticking or sparking was noticeable when the circuit included a small coil or winding having no magnetic core; but as soon as the magnetic core was inserted, the sparking was noticeable and the sticking commenced. The secondary cells were then taken out of circuit and replaced by only one dry cell, but yet the sparking and sticking continued, thus showing that in very sensitive relays an electro-magnet having any considerable self-induction should not be inserted in the local circuit controlled by the contacts of the sensitive relay.

In a relay such as described, the contact is very light, and if it is taken into consideration that the sensitive relay may be operated by an induced impulse, lasting only a small part of a second, and that the relay tongue, as soon as the impulse has ceased, returns immediately to zero, and so breaking the local circuit, it is obvious that the device controlled by the contacts of the sensitive relay requires a large number of ampere turns, or requires a very large amount of current for sufficiently energizing it. Both of these conditions were found disadvantageous in practice, as causing sparking or sticking and unreliable action.

I found that if the first or very sensitive relay is substantially duplicated in the local circuit by another relay which is less sensitive, so that heavier controlling springs may be employed and more rugged mounting for the movable member, the second or local circuit relay is satisfactorily controlled by the sensitive relay and that the sparking and sticking at the contacts of the sensitive relay is absent.

For an illustration of one of the forms my invention may take, reference is to be had to the accompanying drawing, which is

a diagrammatic view of circuits and apparatus.

At the transmitting station, positive and negative impulses are impressed upon the line or cable C by any suitable means, and at the receiving end the primary P of a transformer T is connected between the cable C and earth E, the connection from earth being a conductive one through the conductor *h*. The transformer is preferably a step-down transformer, that is to say, the secondary S has a fewer number of turns than the primary P.

The terminals of the secondary S are connected to the conducting rods 45 and 48 to which are connected the terminals of the moving coil system of the extremely sensitive relay R, the moving system consisting of the three movable coils 13, 14 and 15 secured together to form a single moving system, and each coil having a pair of poles N S, the field magnetism being derived from the windings 3 of the cores whose poles are N S. In fact, the relay R is such as described in my co-pending application Serial No. 476,849.

The moving system of the relay carries the tongue or arm 17 which is biased to a position between the stationary relay contacts 19 and 20 by the delicate springs 36 and 37, and the spiral conductor 38 makes electrical connection with the tongue or arm 17 and the conductor *i*.

The contact 19 is connected with one pole of the source of energy *a*, as one or more cells of battery, while the contact 20 connects with the opposite pole of a similar source of energy *b*. The conductor *j* leads from a point between the sources *a* and *b* to the conducting bar 45 and the conductor *i* connects with the conducting bar 48 of the second more robust or less sensitive relay R¹, preferably of the same type as R. Here, again, the tongue or arm 17 is biased and in normal position is between the contacts 19 and 20, the controlling springs 36 and 37 being, in this case, much more robust than the corresponding springs 36 and 37 of the relay R. And the moving system of the relay R¹ need not be so delicately pivoted or mounted as that of the relay R, jewels being preferably used in the case of the relay R, while an ordinary metallic pivotal mounting may be used for the relay R¹.

In general, the relay R¹ may be larger and more robust than the relay R, the coils of the moving system may be larger and the field members also may be larger.

Controlled by the relay R¹, is a sounder, recorder, or other instrument M having the two separate windings *e* and *f*, associated with the sources *c* and *d*, respectively and controlled, respectively, by the contacts 19 and 20. Both electro-magnets *e* and *f* operate to alternately attract the armature le-

ver or bar *k* pivoted at *g*, sufficient friction being supplied at the pivot *g*, as by tightening the pivots, to cause the bar *k* to remain in that position to which it was last attracted.

The operation is as follows: Assuming a positive impulse impressed upon the cable C, at the receiving end an impulse is generated in the secondary S which, then, traverses the coils 13, 14 and 15, preferably in series, and causes them to exert a very powerful torque, considering the weak current traversing them, in the intense magnetic field and produce a slight movement bringing the tongue or arm 17 into engagement with the contact 19, for example. This contact is momentary, however, since the springs will return the tongue again to central or normal position. This momentary contact closes a circuit through the source *a* and the coils 13, 14 and 15 of the relay R¹ and the conductor *i*, causing the moving system of the relay R¹ to bring its tongue or arm 17 momentarily into engagement with the contact 19, for example. Immediately, however, the tongue or arm 17 is restored to normal midway between the two contacts. This momentary contact at 19 causes the magnet *e* to be energized and to attract the armature lever or bar *k* to the position shown, where it remains due to the friction at its pivots or mounting. I have found that the sticking of the contacts of the sensitive relay R, that is, the sticking of the tongue or arm 17 to either of the contacts 19 or 20, is not dependent, within wide limits, upon the voltage or strength of the current in the local circuit controlled, but is due to the self-induction of the local circuit. By the arrangement here shown, however, the self-induction of the local circuit is small, the self-induction of the coils 13, 14 and 15 being small since the field they create is a weak one, and since they are always in a constantly maintained intense magnetic field. Because the self-induction of this local circuit is so small, there is no sticking at either of the contacts 19 or 20 of the relay R. Assuming, now a negative impulse to be transmitted over the cable C, an impulse is again generated in the secondary S but in opposite direction to the first impulse. This second impulse causes the moving system of the relay R to move in opposite direction from what it did under the influence of the preceding impulse, and, therefore, the tongue 17 engages contact 20. This closes a circuit through the source *b*, contact 20, tongue 17, conductor 38, conductor *i*, thence through the moving coils of the relay R¹, and thence through conductor *j*. It will be noted that the current through the coils of relay R¹ is opposite to what it was in the previous case when energized by source *a*, and, therefore, the tongue 17 en-

gages contact 20, with the result that the electro-magnet f is energized momentarily, and the armature lever or bar k is attracted until the stop m strikes the member n , causing a click or sound. Thus, it is apparent by sending over the cable alternate positive and negative impulses, the instrument M will respond like an ordinary sounder or recorder to produce dots and dashes depending upon the interval of time between the successive line impulses of opposite polarity. And while I have shown the relay R connected in the secondary of a transformer whose primary is connected in a conductive connection between the cable and earth, no condenser intervening, it is to be understood that the relay R may be connected directly in the cable, or otherwise associated therewith.

What I claim is:

1. The combination with a line or cable having great capacity, of receiving apparatus comprising a sensitive relay associated with said cable, a local circuit controlled by said relay, said relay being biased for normally holding said local circuit open, a less sensitive relay included in said local circuit, a second local circuit including an unbiased signal translating instrument controlled by said second relay, said second relay being biased for normally holding said second local circuit open.

2. The combination with a line or cable having great capacity, of receiving apparatus comprising a transformer, a relay subjected to received energy transmitted through said transformer, a local circuit controlled by said relay, said relay being biased to hold said local circuit normally open, a second relay included in said local circuit, a second local circuit including an unbiased signal translating instrument controlled by said second relay, said second relay being biased to hold said second local circuit being normally open.

3. The combination with a line or cable having great capacity, of receiving apparatus comprising a transformer, a relay energized by received energy transmitted through said transformer, a local circuit controlled by said relay being normally open and including a second relay, and a normally open circuit including an unbiased signal translating instrument controlled by said second relay.

4. The combination with a line or cable having great capacity, of a polarized relay subjected to received energy, said relay being extremely sensitive, the contact member of said relay being biased and resting normally between two stationary contacts, a second polarized relay alternately controlled by said contacts, the contact member of said second relay being biased to normal between two stationary contacts, and a signal re-

producing instrument having independent windings, each controlled by one of the contacts of said second relay.

5. The combination with a line or cable having great capacity, of an extremely sensitive relay subjected to received energy, said relay having relatively fixed and movable contacts, and a local circuit controlled by said contacts, the self-induction of said local circuit being small whereby sticking at said relay contacts is prevented.

6. The combination with a line or cable having great capacity, of an extremely sensitive polarized relay subjected to received energy, said relay comprising means for maintaining an intense magnetic field, and a moving system comprising a plurality of coils secured together, said coils being disposed at an angle with respect to each other, fixed and movable contacts controlled by said moving system, a local circuit, and a movable coil of a polarized relay included in said local circuit, the self-induction of said local circuit being small whereby sticking at the contacts of the extremely sensitive relay is prevented.

7. The combination with a line or cable having great capacity, of an extremely sensitive polarized relay subjected to received energy, contacts controlled by the moving system of said relay, a second relay having its coils connected in circuit controlled by the contacts of said sensitive relay, and a signal translating instrument comprising an unbiased movable member and a plurality of electromagnets for moving said member in different directions controlled by said second relay.

8. The combination with a line or cable having great capacity, of a transformer having its primary connected in said line or cable, an extremely sensitive polarized relay connected in the secondary circuit of said transformer, and a local circuit controlled by said extremely sensitive relay, said local circuit having small self-induction whereby sticking at the contacts of said sensitive relay is prevented.

9. The combination with a line or cable having great capacity, of a transformer having its primary connected in said line or cable, an extremely sensitive relay comprising a plurality of coils secured together and disposed at an angle with respect to each other, said coils being connected in the secondary circuit of said transformer, a local circuit controlled by said relay, a second relay having low self-induction in said local circuit, and an unbiased signal translating instrument controlled by said second relay.

10. The combination with a line or cable having great capacity, of a transformer having its primary connected to said line or cable, an extremely sensitive polarized relay comprising a plurality of coils secured to-

gether and disposed at an angle with respect to each other, said coils connected in the secondary circuit of said transformer, a local circuit controlled by said relay, a second relay of similar type but less sensitive than said first mentioned relay connected in said local circuit, and an instrument controlled by said second relay.

11. The combination with a line or cable having great capacity, of a polarized relay subjected to received energy, said relay responding to positive and negative line impulses to engage one or the other of two contacts, and an instrument controlled by said contacts comprising a winding controlled by each contact, a movable member, said windings operating alternately upon said member, said member remaining in the position to which it was last moved.

12. The combination with a sensitive relay subjected to received energy and having

delicately engaging contacts, of a local circuit controlled by said contacts and including a second relay, said second relay having a winding producing practically negligible self-induction, whereby sticking at the contacts of said sensitive relay is prevented.

13. The combination with a line or cable having great capacity, a relay associated with said line or cable, and a second relay controlled by said first relay and comprising movable coils disposed in an intense magnetic field, said field being practically unaffected by the current passed through said movable coils.

In testimony whereof I have hereunto affixed my signature in the presence of the two subscribing witnesses.

ISIDOR KITSEE.

Witnesses:

ELEANOR T. McCALL,
A. E. STEINBOCK.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."