

C. KINSLEY.
 RELAY AND METHOD OF OPERATING SAME.
 APPLICATION FILED JAN. 16, 1913.

1,126,483.

Patented Jan. 26, 1915.
 2 SHEETS—SHEET 1.

Fig. 3.

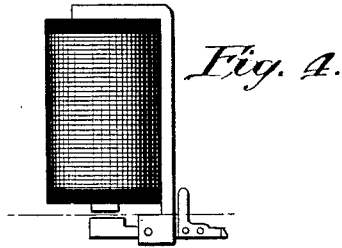
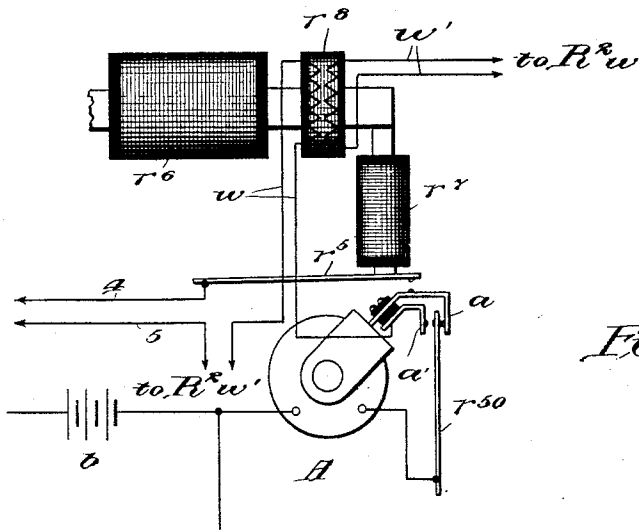


Fig. 5.

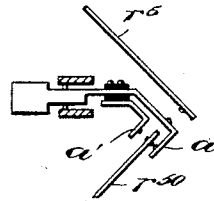


Fig. 6.

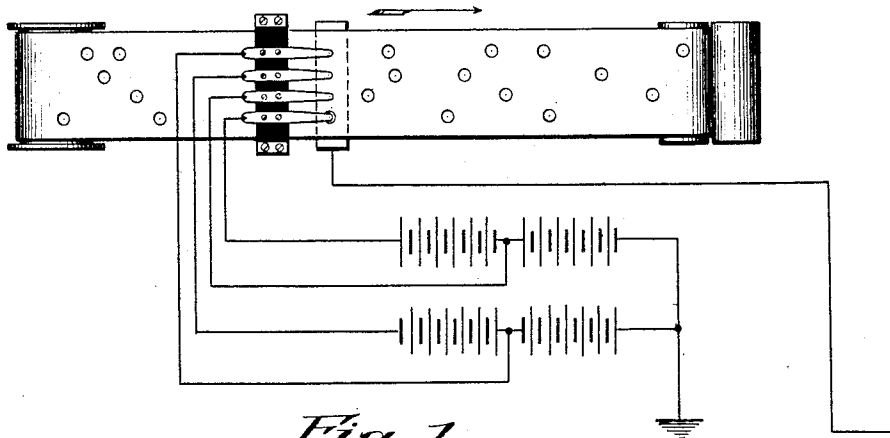
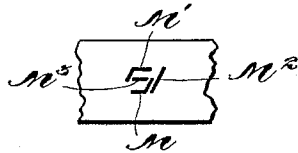


Fig. 1.

Inventor

Carl Kinsley.

Witnesses

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By

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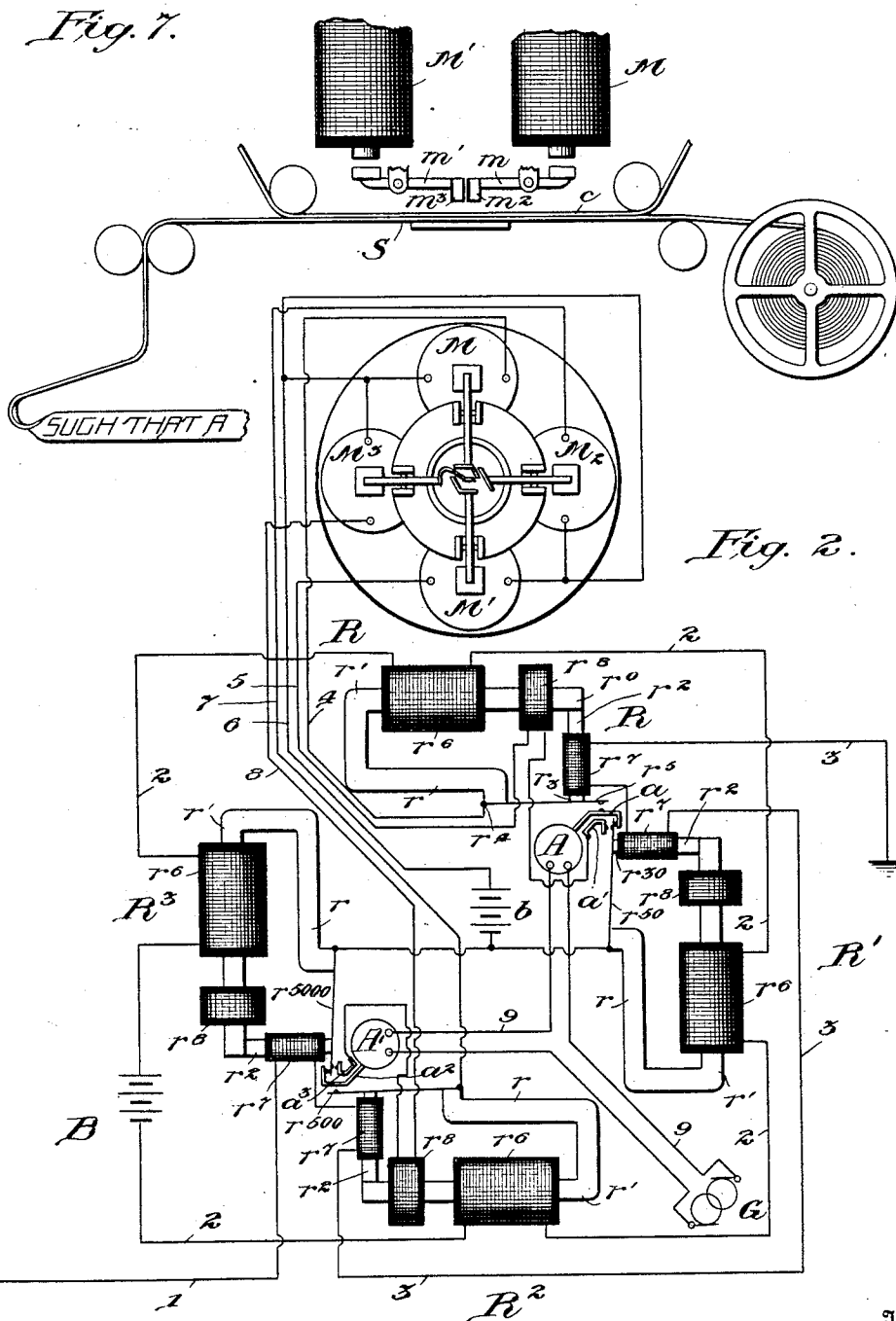
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2 SHEETS—SHEET 2.



Witnesses
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RELAY AND METHOD OF OPERATING SAME.

1,126,483.

Specification of Letters Patent.

Patented Jan. 26, 1915.

Original application filed August 30, 1909. Serial No. 515,318. Renewed June 19, 1912, Serial No. 704,682. Divided and this application filed January 16, 1913. Serial No. 742,504.

To all whom it may concern:

Be it known that I, CARL KINSLEY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Relays and Methods of Operating Same, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to relays and the method of operating the same particularly applicable to service in high speed telegraph systems, but upon full understanding of my invention, it will be apparent that the relay and method of my invention will be found of utility in other fields of electrical service. Furthermore upon an understanding of my invention it will be apparent that the structure of the relay of my invention may be varied widely without departing from the generic method of operation in any way.

In order that the method of operation, and the advantages thereof may be most clearly understood, and fully appreciated, I have chosen to illustrate the relay of my invention and describe its operation in connection with the high speed telegraph system forming the subject of my co-pending application, Serial No. 704,682 filed June 19, 1912 (renewal of Serial No. 515,318, filed Aug. 30, 1909) patented February 11, 1913, No. 1,053,042, of which application the present application is a division.

In the system of the application referred to, I make use of a series of printing elements, preferably four in number, each of which is adapted to impress on a record surface a characteristic fragment or element common to a number of letters of the alphabet. By operating these printing elements in various combinations, either in conjunction or in sequence, I cause the several letters of the alphabet to be formed. Each element is controlled by an electromagnet in a local circuit supplied with current from a local source; and these local circuits are controlled by relays of peculiar construction, the leading characteristic of which is the attenuation of their armatures which are held in such a way as to have a very high natural period. These are the relays of my invention. This type of armature, employed either in a relay or on a printing magnet,

is disclosed in my prior applications filed August 12, 1903, Serial No. 169,228, and February 1, 1908, Serial No. 413,841, the latter patented February 20, 1912, as No. 1,018,115. My present invention is in the nature of an improvement over the inventions disclosed in the said applications.

In the present case I employ two instruments which I may term compound relays, of the aforesaid type, their armatures working in conjunction and in combination with each other to effect the several printing elements. Each relay has an energizing coil or winding, an actuating coil, and a neutralizing coil. The energizing coils are all connected in a local circuit in series with a suitable source of current; the actuating coils are all in series to line; and the neutralizing coils are in series in the respective local circuits containing the printing magnets for purposes to be presently described. Each double relay has also what I may term an electromagnetic agitator for the anvil of its armatures, which are apt to stick thereto. The agitator magnets may be continuously actuated and the anvils continuously moved by means of alternating current separately applied, or by current impulses in the local circuits of the printing magnets.

In operation, I employ current of two strengths, or large and small potential differences, and of plus and minus polarity. Two of the relays respond to positive currents, and two to negative currents; and I differentiate between the relays and their associated printing magnets of each pair, by winding the relays to respond to different current strengths. One relay of each pair responds to currents of small value, but both respond to currents of large value. The armatures are so connected and related to each other that when the second relay of a pair is energized, it not only closes its own local circuit, but simultaneously opens the local circuit of its associated or small current relay.

My invention is illustrated in the accompanying drawings in which—

Figure 1 is a diagram showing the conventional elements at a transmitting station, which may be of any suitable type to produce plus and minus impulses at two different potentials, and all at high frequency. Fig. 2 is a similar diagram showing a re-

ceiving station embodying the present invention. Fig. 3 is a fragmentary diagram showing a modified arrangement of the relays. Figs. 4 and 5 show details of the 5 agitators. Fig. 6 shows the impressions produced by the several printing elements. Fig. 7 is a side view of two of the printing elements with the other two removed.

Referring to the drawings, in Fig. 1 I 10 have shown the conventional type of transmitter comprising a perforated tape, with cooperating means for sending impulses of opposite polarity and two different 15 strengths, or in other words, of impressing electromotive forces upon the line at different potentials and opposite polarities. As this transmitting apparatus forms no part of the present invention, it will not be 20 described in detail and I will remark in passing that it may be replaced by any suitable type other than the one indicated. For different types of transmitters I refer to my prior applications hereinbefore identified.

25 Referring to Fig. 2, 1 indicates the line wire extending from the transmitting to the receiving station. At the latter I provide a group of relays designated by the letters R, R', R² and R³ respectively. Each of 30 these relays has a core designated generically by r⁰, and as to its several limbs by r, r' and r², these limbs being returned at right angles to each other so as to bring the pole piece r³ in proximity to a straight line 35 extending from the end of and parallel to the limb r. Secured upon this limb at r⁴ is a spring strip constituting an armature r⁵. This armature is attenuated and of small mass so that it will have a high natural 40 period, and is made of magnetic material so that it may carry the magnetic flux across the gap between the two pole pieces r³ and r⁴. The entire core r⁰ is maintained magnetized to a predetermined density and with 45 a predetermined polarity by the coil r⁶, which is connected in a local circuit 2 in series with similar coils upon the other relays, and with a suitable source of current B. Upon the limbs r², and contiguous to 50 the pole piece r³ is an actuating winding r⁷. These windings on all the relays are also connected in series with each other, in the wire 3 leading from the line 1 to ground. 55 All the line impulses therefore pass through all of these actuating windings in series and by properly proportioning the windings, as well as by making them direct or reverse, according to the direction of the energizing windings r⁶, they are made effectively 60 responsive to different current strengths and polarities. Thus, by using the expedient of controlling each of two local circuits by a single relay, responsive to large current only, and two other local circuits each controlled by two relays, one responding to

small current for closing and the other to large current for opening, I may selectively control any one of four printing magnets.

In addition to the energizing and actuating relays, I show what I may call neutralizing coils, marked r⁸. The large currents due to large potential differences at the transmitting end, are apt to effect the receiving or actuating windings of the two relays R and R², which are wound to respond 75 to small currents—or rather the cores of the relays R and R² will show either too large a residual magnetization or will be demagnetized, depending on the direction of the current. The effect of these neutralizing 80 windings will be described in detail in connection with the statement of operation. It may be said at this point in passing however that Fig. 3 shows how extra spools or neutralizing windings r⁸ on the relays R and 85 R² may be so wound and connected as to neutralize, by the local printing current, the abnormal effect produced by large signaling current. If only the extra magnetizing effect is to be considered, then Fig. 2 shows 90 how these coils r⁸ need have only one winding. Of course, extra windings might be used on the coils r⁷, but an extra spool is considered best to be shown for clearness.

A and A' represent what I shall term 95 electro-magnetic agitators. The two relays R and R' and the other two R² and R³, are associated in pairs, with one of the agitators for each pair. It is the function of this agitator to move the anvil contacts of the 100 relays to prevent sticking which I have found can be prevented. The details of the agitator are shown more clearly in Figs. 3, 4 and 5, the former showing the same parts 105 as in Fig. 2 but on a larger scale, and the last two showing respectively a side view and a bottom plan view.

As already stated, the relays R—R' constitute a pair, their armatures working in 110 combination with each other. These armatures are normally attracted and touch the pole pieces r³ and r³⁰. When the armature r⁵⁰ is up, and the armature r⁵ is retracted, then a circuit is completed from the local battery b through r⁵⁰ to anvil a, with which 115 it is in contact, thence to r⁵ and so to the wire 4 and its printing magnet. On the other hand, with the armature r⁵⁰ retracted and down, circuit would be from the battery b through r⁵⁰ to the anvil a' and so through 120 neutralizing winding r⁸ of R to the wire 5 and its printing magnet. The wire 6 is a common return from all the printing magnets to the battery b as will be pointed out a little later. The relays R and R' both 125 respond to positive current, coming over the line 1. In each case this current produces its effect through the winding r⁷, which is opposed to the winding r⁶. This winding r⁷ on the relay R is wound and bears such a 130

relation to the winding r^6 for currents of small value as to produce a neutralizing effect; while the winding on relay R' responds only to currents of large value. The same proportions obtain respectively between the windings on relays R^2 and R^3 . Thus, the four printing magnets M , M' , M^2 and M^3 can be selectively affected by impulses over line wire 1 in the following manner: (1) A positive impulse of small value releases armature r^5 and closes wire r to magnet M ; (2) A positive impulse of large value releases both armatures r^5 and r^{50} . The latter closes circuit from battery b to the anvil a' thence through the coil r^8 to wire 5 and magnet M' ; while the former is prevented from closing circuit of wire 4 and magnet M by the fact that the battery feed for this circuit is through the armature r^{50} , which has moved out of contact with the anvil a and into contact with the anvil a' ; (3) A negative impulse of small value releases armature r^{500} of relay R^2 and closes wire 7 to the magnet M^2 ; (4) A negative impulse of large value releases both armatures r^{500} and r^{5000} , the latter connecting battery through windings r^8 and the wire 8 to magnet M^3 , and the former partially closing circuit 7 at the anvil a^2 , but finding no battery there because the controlling armature r^{5000} is out of contact therewith. It will be noted that in the diagram, the coils r^8 of the relay R' and R^3 are not connected.

With the arrangement shown in Fig. 2, the agitator magnets A and A' are fed from an alternating current generator G through the wires 9. Their function is to keep the anvils a and a^2 in motion, so that there will be constant rubbing contact between these anvils and the armatures r^{50} and r^{5000} , which would otherwise be liable to stick. Incidentally this constant movement prevents sticking of the other armatures which however is less liable to occur. Some details of the agitators are shown in Figs. 4 and 5 which are sufficiently clear to be understood without extended description. The armatures of the magnets A and A' carry the contact anvils $a-a'$, and a^2-a^3 , respectively. The anvils a' and a^3 are separated from the others, as indicated in Figs. 3 and 5, by insulation, and if desired, both members may be insulated from the armature.

In Fig. 2 the agitators are shown included in circuit with a generator of alternating current, for continuous operation, but as the electric welding to which the sticking is largely due only takes place when the relays are working, I may include the agitator magnets in the local battery circuits, as indicated in Fig. 3, magnet A for example being included in the feed wire from the battery b to the armature spring r^{50} . In this same figure, I have shown a separate coil r^8 , with two windings, one on

the side w and the other on the side w' . It is an important feature of my invention to use this coil in the local circuit in the correction of the retentiveness of the iron cores. The magnetization above normal as well as the demagnetization by large currents may both be sufficiently disturbing to require correction. It should be borne in mind in examining Fig. 3 that R is the small current relay, and R' is the large current relay. The two wires at w' in the r^8 coil of relay R , are used to meet the case of over-magnetization, and they run to the other circuits, corresponding to the w wires shown in Fig. 3. In other words, there is an interrelation between the R and R^2 relays, of an electrical nature, as well as a definite interrelation between R and R' or R^2 and R^3 . Thus, currents coming over the line 1 which would be too heavy and tend to over-magnetize one of the small current relays R , and would tend to demagnetize the other small current relay R^2 , by virtue of the corrective windings w on R^2 in series with w' on R , and vice versa, would restrain and correct this tendency in each case while properly operating the large current relay R' or R^3 of appropriate and responsive polarity.

Fig. 6 shows the impressions produced by the four printing elements controlled by the four magnets M , M' , M^2 and M^3 respectively. A side view of one pair of these magnets with the others removed is shown in Fig. 7, and it should be stated that for printing purposes I may use either the chemical printing disclosed in my prior applications before referred to, or printing by impact using a typewriter ribbon, carbon paper or the like which is indicated at C in Fig. 7 wherein M and M' are a pair of printing magnets with a pair of pivoted armature levers m and m' carrying the type elements m^2 and m^3 . The record surface is shown at S , and may advantageously be a page or strip of paper, fed by suitable mechanism as the printing progresses.

The alphabet composed of four elements shown in Fig. 6 is not a part of my present invention and therefore I consider it unnecessary to illustrate it in full. However, I have indicated several letters on the end of the paper strip in Fig. 7, from which little difficulty will be experienced in understanding the principle involved.

The operation of my system will be fully understood from the foregoing description. The paper tape in Fig. 1 is punched, preferably by a perforating machine operated on the typewriter principle, it is then inserted in the transmitting machine, and drawn along beneath the springs thereof by a suitable motor. The perforations are in four rows corresponding to the four springs which are connected to the battery

B' so as to send positive and negative impulses of two strengths, or at two different potentials. Each row of perforations represents recurring instances of the same element, and these elements are arranged as shown in Fig. 6, and controlled by the respective magnets M, M', M², and M³, as therein indicated, for the reason that in the usual letter the succession of impulses gives the order of line impulses as M², M, M³ and M'. It is found better to have the weak impulses thus precede the strong ones, and also so far as possible to have the polarities alternate.

It will be evident after reading the foregoing that some changes in detail can be made without departing from the spirit of my invention. For example, instead of having the relay 'R' open the local circuit controlled by the relay R, it might act directly to disable that relay, as by shunting or disconnecting it. I consider the arrangement described to be the best, however, and present it as such, without being limited to the specific details thereof. All non-essential variations are to be considered as within the scope of the appended claims.

I claim—

1. A telegraph receiver comprising a relatively stationary and a relatively movable contact element, an electromagnetic actuating device for the movable element, and means independent of said electromagnetic device carrying said relatively stationary element and adapted to vibrate the same so as to move its contact into and out of the path of travel of the cooperating contact to prevent sticking.

2. In a relay, a pair of contacts, an electromagnet for producing motion of one contact toward the other, and means for producing motion of the other contact into and out of the line of travel of the first contact, whereby sticking is prevented.

3. In a relay, a pair of contacts, an electromagnet and an armature controlled thereby for moving one contact to and from the other, and a second electromagnet with an armature connected to the second contact for moving it into and out of the path of travel of the first, thereby preventing sticking.

4. In a relay, a pair of contact surfaces normally in contact, a pair of independent electromagnets, having armatures each connected to one of said contacts, means to energize and deenergize one electromagnet intermittently to separate and connect the contact surfaces for purposes of signaling, and means to periodically actuate the other electromagnet to periodically vibrate one of the contacts, to prevent sticking.

5. A compound relay selectively controlling a plurality of printing circuits and comprising a pair of electromagnets with separate armatures, and a common anvil for said armatures movably mounted, together with means for vibrating said anvil continuously during operation.

6. A compound relay selectively controlling a plurality of printing circuits, and comprising a pair of electromagnets with separate armatures, and a common anvil for said armatures, together with a third electromagnet having its armature connected to said anvil, to produce continuous vibratory motion thereof with respect to the cooperating armature contacts.

7. A relay comprising a pair of independent electromagnets, independent armatures for the electromagnets, a pair of contacts carried thereby, and means for producing intermittent energization of one of said magnets, and signaling energization of the other, the magnets and their armatures being so related angularly that their movements and the resultant movements of their respective contacts are in different planes, one movement producing contact and the other movement preventing sticking.

8. A relay comprising a spring armature, a magnetic field structure normally acting on said armature to retain the same in a distorted position under stress, means for neutralizing the effect of said magnetic field for a short interval and thereby releasing the said armature from the magnet, a circuit closing contact carried on said armature, an anvil and a cooperating contact carried thereon, and means for vibrating said cooperating contact at an angle to the plane of oscillation or movement of said armature, the period of vibration of the anvil being so related that the release of the armature will produce a signaling contact, and the angular vibration of the anvil contact will prevent sticking without interfering with the said signaling contact.

9. In a relay, an electromagnet, an armature therefor and a contact carried thereby, an anvil and a cooperating contact carried thereby, with means to connect and separate said contacts for signaling purposes, and separate means to produce relatively intermittent vibration of the contacts in divergent planes to prevent sticking.

In testimony whereof I affix my signature in presence of two witnesses.

CARL KINSLEY.

Witnesses:

J. J. BURNS,
A. W. PERKINS.