

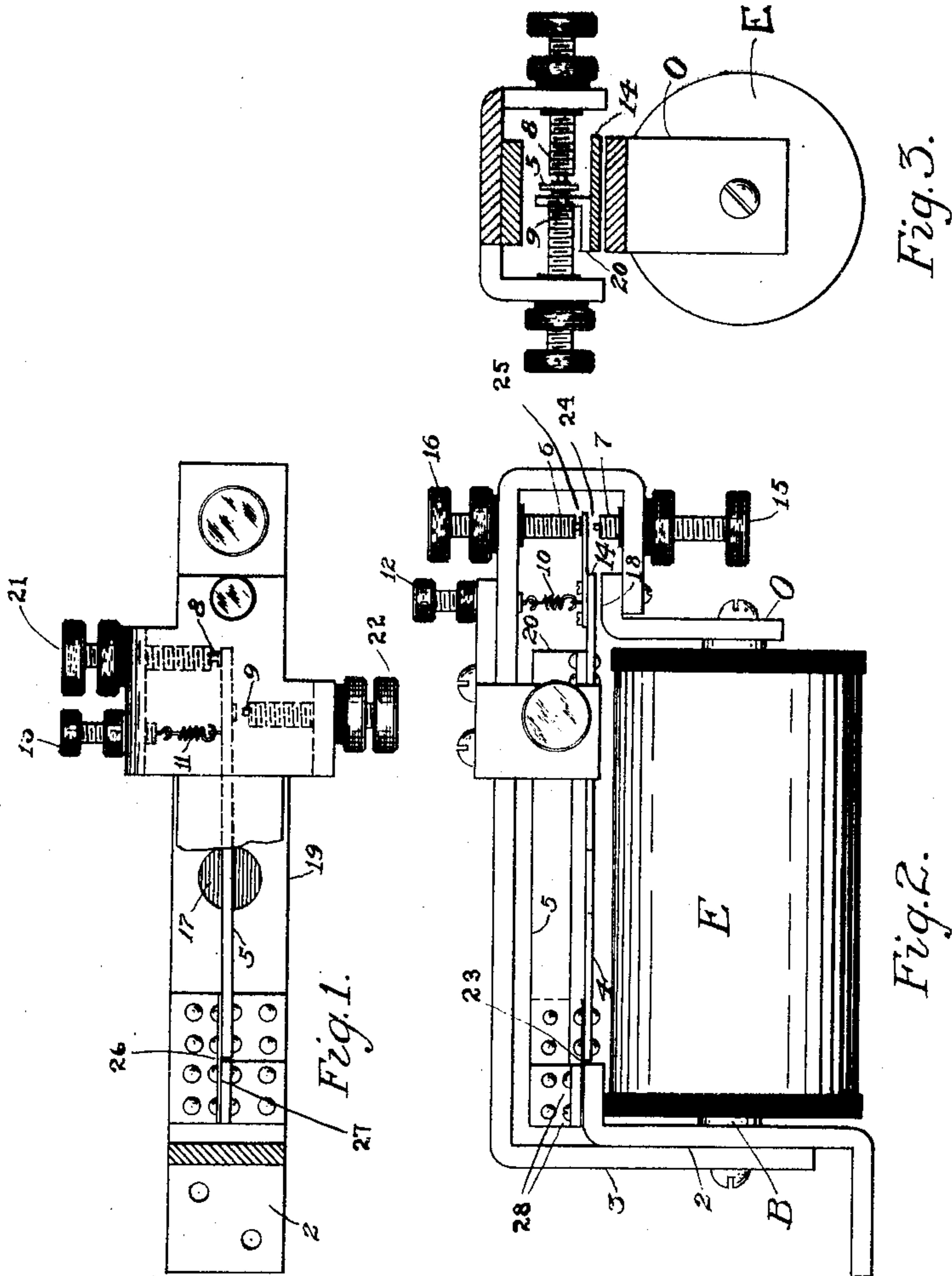
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RELAY.

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INVENTOR

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UNITED STATES PATENT OFFICE.

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RELAY.

Application filed May 19, 1919. Serial No. 298,305.

To all whom it may concern:

Be it known that I, FRANK M. SLOUGH, a citizen of the United States, residing in Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Relays, of which the following is a full, clear, concise, and exact description.

My invention relates to electric relays, and more particularly to that type of relay wherein by electromagnetic effect of the electric current a plurality of armatures is adapted to be successively operated. Such a relay is well known in the art having been previously introduced in the art of telegraphy to control the telegraph repeater circuits, the same being well known as a Ghegan relay.

I find in practice that such a Ghegan relay requires a very careful adjustment in order to secure the desired differences of the periods of operation of the two armatures, and it is an object of this invention to improve upon the said relay to secure a structure wherein greater margins of operation and therefore a more positive operation of the two armatures is to be had, at the same time securing wider margins of time between the actuating periods of the two armatures.

It is also an object of my invention to provide a structure wherein the aforesaid result is realized and which may be readily adjusted to take care of the conditions where the operating current strengths may vary widely, and to provide a structure wherein the parts may be mounted in a small space, and in which the parts to be adjusted are accessible from the front of the relay.

The relay of my invention is particularly applicable to systems, such as the telephone systems where the relays are to be mounted on a rack or on a frame, side by side with other relays, and in which space and accessibility is a prime requisite.

More specifically my invention is an improvement upon the relay disclosed in my pending application, Serial No. 135,636, filed December 7, 1916, and like the relay of that application I aim to produce a relay specially suited for use in telephone switch-

boards and the like, where the space available for the mounting of such relays is limited.

It is an object of my invention to construct a relay that will operate with positiveness and certainty, first one armature and after a certain interval a second armature, whenever an impulse of current of sufficient duration and strength traverses the circuit in which the relay magnet winding is included, and to operate only a single armature whenever a current impulse of relatively short duration, or relatively low strength, or both traverses the said circuit.

These and other objects of my invention as well as the invention itself will be better understood from a description of the embodiment illustrated in the accompanying drawings in which:—

Fig. 1 shows a plan view of a relay constructed in accordance with my invention, except that the electromagnet is not shown in Fig. 1.

Fig. 2 shows a side elevation of the parts shown in Fig. 1, together with the electromagnet E, and other parts not capable of being shown in Fig. 1 on account of being hidden by other illustrated parts.

Fig. 3 shows a front end view of the relay of Figs. 1 and 2, certain parts being shown as broken away and other parts omitted in order to show the arrangement of the contacts and end views of the armatures of the relay.

Referring now to the figures and more particularly to Figure 2 at E, I show an electromagnet, having a core B. Secured to the one end of the core is a pole piece O and to the other end of the core an armature supporting pole piece extension member 2 which is preferably made of magnetic material such as soft iron, and also secured to the same end of the core B, is a non-magnetic support member 3 which at its opposite end is secured to the member O, for the sake of rigidity of mechanical construction. The non-magnetic member 3 carries the contact screws 15, 16, 21 and 22 and also the adjusting screws 12 and 13. An armature 4 is spring mounted by a leaf spring 23 upon the magnetic pole extension 2 and extends

in a direction parallel with the electromagnet E so that its free end, 14, is brought adjacent to an opposing face 18 of the electromagnet core extension O.

5 The armature 4 being made of magnetic material, when the core B is energized by the effect of the winding of the electromagnet E, the free end, 14, of the armature will be mechanically attracted toward the face 10 18 of the pole extension O and is caused to move toward the said face until mechanically stopped by the closure of the contacts 24, one of which contacts is carried by the moving armature 4, the other being mounted 15 on the end of the screw 15.

The contact carried by the screw 15 is adjustable, as are also contacts carried by screws 16, 21 and 22 on account of the provision of threads, as for instance the threads 20 shown at 6 and at 7, for adjusting contact screws 16 and 15.

The threaded screw 15 is so adjusted in practice that the armature end 14 does not quite come in contact with the pole extension 25 face 18 though nearly doing so, this for the purpose of preventing a tendency to "stick" to the pole face. When the electromagnet is deenergized the armature 4 is retracted until the contacts 25 are closed, under the re- 30 tractile power of the spring 10, whose power is made adjustable through the medium of the adjusting screw 12.

The armature 4 is thus adapted to close the set of contacts 24 upon each energiza- 35 tion of the electromagnet E, and to close the set of contacts 25 upon each deenergization of the said electromagnet and in practice the relay is adapted to operate the armature 4 whenever current of operative 40 strength traverses the electromagnet, the armature 4 being a "quick acting" armature.

Also carried by the magnetic pole extension 2 is a second armature 5, which will 45 herein be referred to as a slow acting armature, the same being spring mounted by a spring 26 secured to an L-shaped member 27, rigidly secured by machine screws 28 to the pole extension 2; the spring 26 for 50 the armature 5 is preferably disposed at a right angle to the spring 23 of the armature 4, consequently the armature 5 is adapted to move in a direction at a right angle to the direction of the movement of the arma- 55 ture 4.

The retractile spring 11 normally retracts the armature 5 so that it is normally at rest with the contacts 8 closed, being adapted when in its alternative operative 60 position to close the contacts 9.

The magnetic extension of the armature 4 in the form of an L-shaped member 20, is provided to carry magnetic lines to the free 65 end of the armature 5, the L-shaped member 20 being rigidly secured at its base to

the armature 4 and having its free arm extending parallel to the direction of movement of armature 4 so that the normal air-gap distance between the free end of the L-shaped member 20 and the opposing face of 70 the armature 5 is always substantially the same, whether or not the armature 4, carrying the member 20 is in its operative normal position.

The proportions used and the arrange- 75 ment of the parts is such that when more than a given magnetic potential is exerted by the electromagnet E at the ends of the armature 4 that the said armature will fail to convey all of the generated magnetic 80 lines of force, and this is particularly true due to the fact that the mid-portion of the armature 4 is restricted in cross-sectional area, the hole 17 being drilled at an armature mid-point. Therefore, some of the 85 lines of force under the condition, wherein the restricted portion of the armature 4 approaches the point of magnetic saturation, will take a shunt path around the restricted portion of the armature 4 the said path 90 comprising the member 20, the air-gap between member 20 and the armature 5, the armature 5, to the pole extension 2.

The operation of the device in practice is as follows: Upon normal current strength 95 being passed through the winding of the electromagnet E, the armature 4 will be caused to move first from its normal position, wherein, a relatively large air-gap exists in its magnetic circuit, to its opera- 100 tive position, whereby, the said air-gap is very considerably reduced. The system is so proportioned that the restricted portion of the armature 4 is capable of carrying most of the lines of force induced by the 105 presence of such a magnetic potential as may exist between the ends of the armature 4, when the said armature is retracted and when the current flowing through the winding has not yet had time to completely build 110 up to the substantially maximum strength, the building up being accomplished slowly due to the presence of considerable self-induction in the electromagnet winding.

But when the armature 4 is completely at- 115 tracted, and when the current strength approaches its maximum, the magnetic potential exerted at the ends of the armature 4 is of such a strength that leakage lines of force are caused to follow the shunt mag- 120 netic path above mentioned, the said path including the armature 5 and the air-gap normally existing between said armature 5 and the member 20, causing the armature 5 to be attracted to the arm 20. 125

Therefore, the relay of my invention is particularly well adapted for use in electric systems wherever it is desired to establish a time interval between the operations of two different electric switches, since I have 130

provided in a unitary structure, the fast operating armature, 4, and the slow operating armature 5.

Also the two armatures may be so adjusted that they may operate on different strengths of current, the armature 4 for instance operating when relatively weak current traverses the winding of the magnet E, and the armature 5 only operating when the current of more than a predetermined strength traverses the said winding.

I may also adjust armatures to current impulses of a given strength and frequency so that the armature 4 may respond to the said impulses, the armature 5 being non-responsive thereto, the provision of a relay having a plurality of armatures, capable of such an adjustment, being the principal object of my invention. At the same time, however, I may adjust said armatures so that armature 4 will remain attracted during the sending of current impulses of a given strength and frequency, the armature 5 being free to vibrate, substantially in unison with the said impulses.

In the relay of my invention I have improved upon prior structures designed for the same purpose in that I have so arranged the second or slow operating armature 5 that it is not traversed by lines of force which do not first traverse the first or fast operating armature.

I am aware that numerous and extensive departures may be made from the embodiment of my invention herein illustrated and described, but what I claim as my invention is defined in the following claims:—

1. In a relay, the combination with an energizing electromagnet, of a fast operating armature for the said electromagnet extending in a plane parallel to the long axis of said core of the said electromagnet and adapted to be attracted thereby, a second armature also extending in a plane parallel to the long axis of said core and adapted to be attracted to the first armature by magnetic lines emanating from the said first armature.

2. In a relay, the combination with an energizing electromagnet, of a core for the said electromagnet, a pole extension for each end of the said core each extending in a direction at right angles thereto, a pair of armatures pivoted to one of the said pole extensions, one of the armatures having its free end arranged in proximity to the other pole extension, the other of the said armatures having its free end arranged in proximity to an intermediate point on the said first armature, whereby when the said electromagnet is energized the said first armature is attracted to the last named pole extension and the said second armature is attracted to the said intermediate point on the said first armature.

3. The combination with an energizing electromagnet, of a core for the said electromagnet having an extension, a pair of armatures pivoted to the extension of the said core, one of the said armatures having its free end arranged in proximity to the other core end, the other of the said armatures having its free end arranged in proximity to an intermediate point on the said first armature, whereby when the said electromagnet is energized the free end of the first armature is attracted to the adjacent core end, and the free end of the second armature is attracted to the said first armature at said intermediate point.

4. In a relay, the combination with an energizing electromagnet, of a core for the said electromagnet having an extension, a pair of armatures pivotally supported each at an extension of the said core, and each extending in planes parallel to the long axis of the said core, one of the said armatures being longer than the other armature, said longer armature being adapted to be attracted by the other end of the said core when the said electromagnet is energized, and the shorter armature being adapted to be attracted by a magnetic pole on the said first armature.

5. In a relay, an energizing magnet, a pair of armatures therefore, one of the said armatures being adapted to be attracted by the said electromagnet directly, the other of the said armatures being adapted to be attracted to the said first armature, after the said first armature is operated, and means to maintain a constant air-gap for the flowing of magnetic lines from the said first armature to the said second armature independent of the operative position of the said first armature.

6. In a relay, the combination with an electromagnet; of a core for said magnet; a pair of armatures for said core, said core and said armatures being arranged in a divided magnetic circuit; a common portion for said circuit including said core, a portion of one of said armatures and an air gap between said core and said armature; said magnetic circuit having one branch completed through a second portion of said armature, and a second branch of said magnetic circuit including said second armature and an air gap between said second armature and said first armature.

7. In a relay, the combination with an electromagnet; of a core for said magnet; a pair of armatures for said core, said core and said armatures being arranged in a divided magnetic circuit; a common portion for said circuit including said core, a portion of one of said armatures and an air gap between said core and said armature; said magnetic circuit having one branch completed through a second portion of said

armature; and a second branch of said magnetic circuit including said second armature and an air gap between said second armature and said first armature, the second portion of said first armature being of relatively high magnetic reluctance as compared with the reluctance of the said magnetic core.

8. In a relay, the combination with an energizing electromagnet, of a fast operating armature for said electromagnet, and a second armature adapted to be attracted to said first armature by magnetic lines emanating from said first armature, said armatures operating in planes at right angles to each other.

9. In a relay, the combination with an energizing electromagnet, of a pair of reed armatures for said electromagnet extending in planes parallel to the long axis of said electromagnet, and adapted to be attracted thereby.

10. In a relay, the combination with an electromagnet of a pair of reed armatures mounted in different planes one of which armatures normally shields the other.

11. In a relay, the combination of an electromagnet and a pair of super-imposed reed armatures, one of said armatures having less cross-sectional area at an intermediate point for causing said armatures to operate out of synchronism.

12. In a relay, the combination of an electromagnet and a pair of reed armatures, one of which is mounted at right angles to the other.

13. In a relay, the combination of an electromagnet and a pair of reed armatures, one of which is mounted at right angles to the other, and means for adjusting the range of movement of said armatures.

In witness whereof, I hereunto subscribe my name this 16th day of May, A. D. 1919.

FRANK M. SLOUGH.