

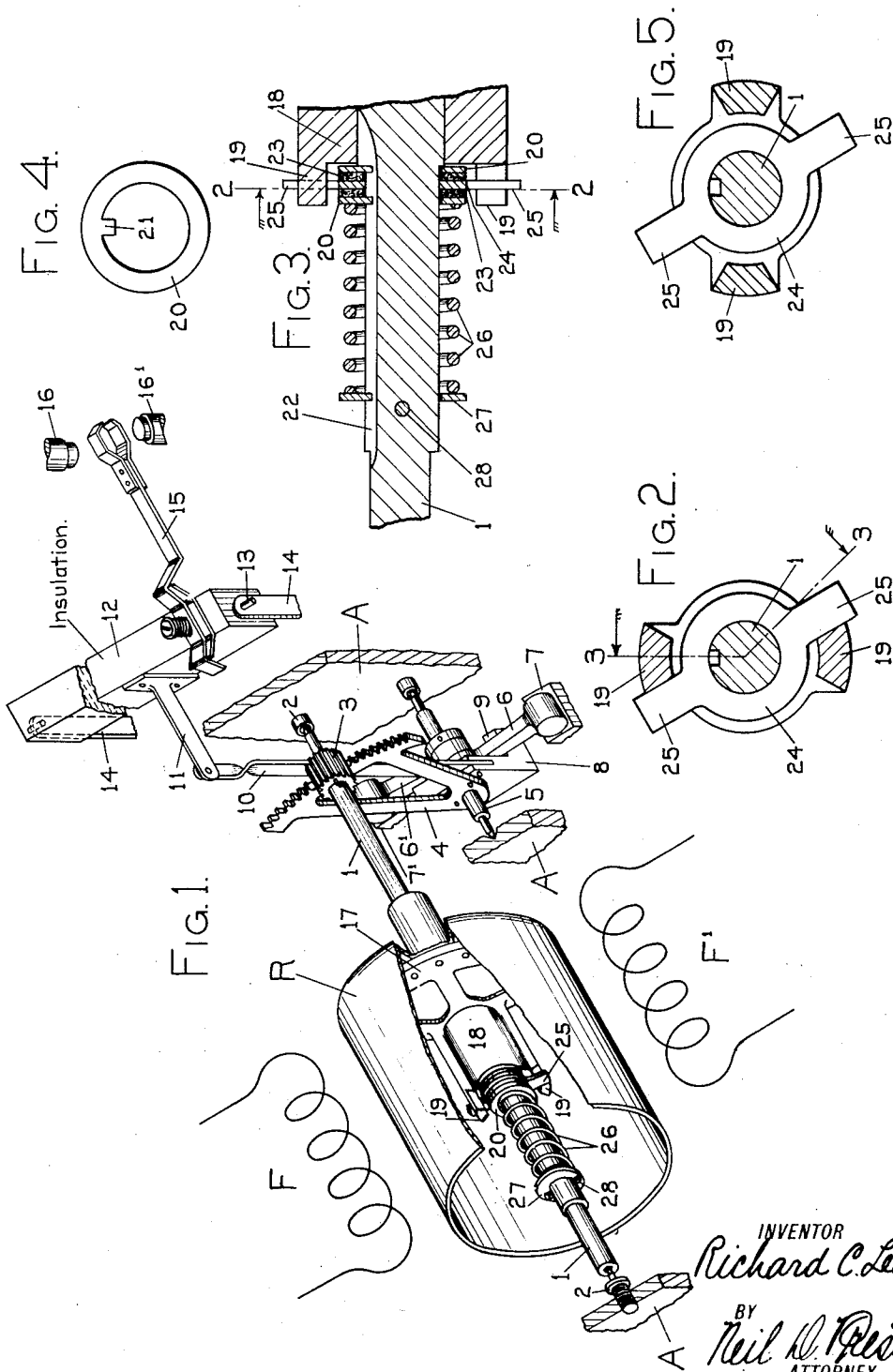
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R. C. LEAKE

RELAY

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INVENTOR
Richard C. Leake,
BY
Neil W. Preston
ATTORNEY

UNITED STATES PATENT OFFICE.

RICHARD C. LEAKE, OF ROCHESTER, NEW YORK, ASSIGNOR TO GENERAL RAILWAY SIGNAL COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

RELAY.

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To whom it may concern:

Be it known that I, RICHARD C. LEAKE, a citizen of the United States, and resident of the city of Rochester, in the county of Monroe and State of New York, have invented a new and useful Improvement in Relays, of which the following is a specification.

This invention relates to an improvement in the construction of relays of the type commonly used in railway signaling systems.

Relays of the construction commonly employed for railway signaling have a tendency, when returning to the biased position upon being deenergized, to oscillate or bob somewhat before the parts of the relay movement come to rest. This action appears to be due to the inertia of the parts which cannot, of course, be immediately brought to rest after having once set into motion by the influence of the counter-weights or other biasing means. In most relays, especially those of the so-called rotor type, I attribute this over-throwing or bobbing action principally to the weight and inertia of the rotor or operating element; and the primary object of my invention is to devise a simple, inexpensive, and efficient construction which will act to gradually bring to rest the rotor or other operating element of the relay without affecting the contact fingers and other connected parts constituting the relay movement.

In the accompanying drawing I have illustrated one embodiment of my invention; and other objects and advantages of the invention will appear hereinafter during the description of the features of construction, functions and mode of operation of this specific embodiment.

In describing the invention in detail, reference will be made to the accompanying drawing, in which like reference characters refer to corresponding parts in the several views, and in which:—

Figure 1 is a perspective view, diagrammatic in its nature, showing a simplified construction of a relay and the preferred embodiment of my invention;

Fig. 2 is an enlarged transverse section through the rotor shaft and hub of the rotor, said section being taken on the line 2—2 in Fig. 3 and looking in the direction indicated by the arrows;

Fig. 3 is a fragmentary enlarged longitudinal section through the rotor shaft and the hub of the rotor, said section being taken on the line 3—3 in Fig. 2 and looking in the direction indicated by the arrows;

Fig. 4 is a detail view of one of the friction washers constituting part of my invention; and

Fig. 5 is a view similar to Fig. 2 showing one of the intermediate positions of the parts such as they may assume during the regular operation.

I have illustrated the preferred embodiment of the invention adapted to a rotor type relay of well known construction. This relay comprises the field elements F and F¹ and a shell type rotor R, this construction being similar to that shown and described in the patent to W. K. Howe, No. 1,094,389, dated April 21, 1914. The rotor R which constitutes the operating element of the relay, is operatively connected to a rotor shaft 1 by a device constructed in accordance with my invention and hereinafter explained. The rotor shaft 1 is supported in the usual way by suitable bearings 2 attached to the frame or supporting casing A of the relay, only parts of this frame A being shown for sake of simplicity. On the rotor shaft 1 is fixed a pinion 3 which meshes with the teeth on a sector 4; and this sector 4 is fastened to a shaft 5 journaled in suitable bearings on the frame A of the relay. Loosely mounted on the shaft 5 are weighted arms 6 and 6¹, constituting the counter-weights of the relay; and the downward movement of the outer weighted ends of these arms 6 and 6¹ is limited by fixed stops, shown diagrammatically and designated 7 and 7¹, these stops in practice being a part of the frame or casing for the relay. The sector 4 is securely fastened to a block 8 which has integral lugs or arms 9, (only one being shown), which extend parallel with shaft 5 on opposite sides thereof and project under the weighted arms 6 and 6¹. A link 10 is pivotally connected at its lower end to the block 8 at one side of the axis of the shaft 5; and the upper end of said link is pivotally connected to the outer end of bracket on arm 11 fixed to a contact block 12. The contact block 12, which is made of suitable insulating material, is provided with trunnion pins 13 which are journaled in the upper

ends of supports 14, fixed to or forming part of the frame or casing A of the relay. A number of contact fingers 15, one being shown, are connected to the contact block 12, and these contact fingers cooperate at their outer ends with fixed upper and lower contacts or binding posts 16 and 16¹, respectively. The construction of this relay movement just described is similar to that shown and described in the patent to W. K. Howe, 1,019,047, dated March 5, 1912; and further explanation of the detail features of this construction may be had by reference to this patent.

This invention relates more particularly to the operative connection between the rotor R and the rotor shaft 1; and according to the invention, this connection is such that the momentum of the rotor, when the relay movement returns to the biased position, will be gradually absorbed. In the specific embodiment of the invention illustrated, the rotor R is provided with a spider 17 at one end having an integral hub 18 loosely mounted on a rotor shaft 1; and said hub 18 has diametrically opposite lugs 19 projecting therefrom parallel with the shaft 1. Between these lugs 19 and the rotor shaft 1 is interposed a friction clutch and lost-motion device, shown in detail in Fig. 3. This device comprises a metal washer 20 on the rotor shaft 1 which bears against a circumferential shoulder on said shaft, as shown in Fig. 3; and the hub 18 of the rotor R being loose on the rotor shaft 1, there is no appreciable friction between said hub and the washer 20. The washer 20 has an inwardly projecting lip 21 integral therewith, (see Fig. 4), which fits in a longitudinal groove or keyway 22 formed in the rotor shaft 1. Bearing against the outer face of the washer 20 is a washer 23 of fiber or similar material; and outside of this fiber washer 23 is the coupling or driving member 24, which is loosely mounted on the rotor shaft 1 and is provided with outwardly extending arms 25 arranged to engage opposite sides of the lugs 19 on the hub 18, as shown in Fig. 2. Outside of the coupling member 24 is another fiber washer 23 and then another metal washer 20; and these various washers and the coupling member 24 are pressed together by a compression spring 26 surrounding the rotor shaft 1 and held at one end by a washer 27, similar to the washer 20, and a small transverse pin 28. It will be observed that this construction provided an operative connection between the rotor R and the rotor shaft 1 which has the characteristics of a friction clutch and a lost motion device.

The parts of the relay are shown in Fig. 1 in the deenergized condition. Upon energization of the field windings F and F¹ with alternating current having the proper phase

displacement, the rotor R is caused to rotate in one direction or the other, depending upon the phase relation of the currents in the windings F and F¹, in accordance with the usual and well-known operation of this type of relay. Assuming the rotor R to be rotated in the counter-clockwise direction, as viewed in Figs. 1 and 2, the lugs 19 on the hub 18 of said rotor drive the arms 25 of the coupling element 24, which in turn causes rotation of the rotor shaft 1, due to the friction between the contacting surfaces of the two metal washers 20, the two fiber washers 23, and the body portion of the coupling member 24. This counterclockwise rotation of the rotor shaft 1 drives the sector 4 in the clockwise direction, pulling down the link 10 and the arm 11 so as to rock the contact block 12 and move the contact finger 15 into contact with the upper contact 16. During this movement the block 8 is rocked and one of its lugs 9 (not shown), raises the counterweight or weighted arm 6¹. The parts of the relay are now in the energized condition. During this operation the movement of the rotor R and the parts operated thereby is comparatively quick in actual practice, and the friction clutch device previously described is employed so as to constitute a yieldable connection between the rotor and its shaft 1, so that as the parts of the relay movement come to rest in the picked-up or energized position, the rotor R may, if necessary, continue its rotation and overrun slightly in opposition to the friction developed by the friction clutch device. This slipping of the friction clutch, when the relay attains its fully energized position, enables the momentum of the rotor R to be gradually absorbed without shock to it or the other parts of the relay movement.

Upon deenergization of the relay, which in practice is usually done by interrupting the supply of alternating current to one of the field windings, while continuing the supply of current to the other field winding, sometimes termed the local winding, the parts of the relay are returned to the biased position by the action of the counterweight 6¹. This return movement drives the rotor shaft 1 and the rotor R in the clockwise direction, as viewed in Figs. 1 and 2. When the sector 4 attains its middle position, as shown in Fig. 1, the outer end of the counterweight 6¹ strikes its stop 7¹ and is instantly brought to rest; and any further movement of the sector 4 beyond this position must raise the opposite counterweight 6.

In practice the parts of the relay movement, consisting of the contact block 12 and its contact fingers, the sector 4, the links 10 and 11, and associated parts, are made of light construction and it is found that the relay movement do not acquire much mo-

mentum during the return movement, at least not sufficient momentum to appreciably overbalance the counterweight 6 and cause these parts to bob or overthrow in the middle position. The rotor R, however, has ordinarily a considerably greater mass, and this mass is distributed at a distance from its shaft 1. Moreover, the rotor R moves much faster during the return movement than the other parts of the relay movement. It would appear, therefore, that the overthrowing or bobbing occurring upon deenergization of relays of the usual construction is due principally to the momentum of the rotor.

According to my invention, the connection between the rotor R and its shaft 1 is such as to permit the rotor, upon deenergization of the relay, to continue its movement after the shaft 1 stops, or in other words, be free to over-run said shaft. To explain more fully, referring to Fig. 2, upon deenergization of the relay, the shaft 1 is caused to rotate by the counterweight 6¹ in the clockwise direction. This shaft in turn drives the coupling member 24 through the friction clutch, and the arms 25 carry with them the rotor; but when the shaft 1, and likewise the coupling member 24, comes to rest in the middle or biased position of the relay movement, the rotor R may continue its clockwise movement. This further movement takes place independently of the shaft 1, and may continue until the other sides of the lugs 19 on the hub 18 of said rotor engage the opposite sides of the arms 25. During such over-running of the rotor R, eddy currents are induced in the rotor due to the influence of the energized local winding, and this results in gradually retarding the movement of the rotor. It is found in practice that this over-run of the rotor R is quickly stopped by the influence of the local winding aided by the friction of the rotor on its shaft, so that the rotor rarely makes much more than a quarter of a revolution before coming to rest. Thus the rotor will be brought to rest at some intermediate point in its over-run, with the parts of the coupling device in the position like that shown in Fig. 5. If desired, one of the lugs 19 and an arm 25 may be omitted, so that the rotor will be able to make a greater free run before being re-coupled to the rotor shaft 1.

If the relay is now reenergized in the same way, as previously assumed, with the same relative phase displacement of the currents in the field windings F and F¹, the rotor R has a free run in the counterclockwise direction before being coupled to its shaft 1.

When the current is reversed in one of the field windings so as to rotate the rotor R in a clockwise direction, opposite to the direction previously assumed, the operation of

the parts is similar to that already described and will be readily apparent without further explanation. Likewise, when the field windings of the relay are supplied with alternating current of one phase relation, resulting in picking up the relay on one side, and then the current is reversed in one field winding so as to pick up the relay on the opposite side, substantially the same movement of parts takes place, there being, however, no appreciable pause in the movement of the parts in the middle or deenergized position, since the rotor R is then being driven under the influence of its field elements and makes its free run quickly.

From the foregoing it will be readily understood that my invention provides a simple and reliable construction permitting the rotor, or other operating element, of a relay to be gradually brought to rest upon deenergization of the relay without causing bobbing or overthrowing. In a sense, it may be said that my invention contemplates the separation of the rotor, or other operating element of the relays from the other moving parts constituting the relay movement, and in absorbing the momentum of said rotor independently of the relay movement. In the case of alternating current relays having normally energized local windings, the momentum of the rotor is absorbed by the braking action of the local winding, aided by the friction between the rotor and its shaft; but obviously, it falls within the scope of my invention to provide other ways of snubbing or braking the rotor. For example, the friction between the rotor and its shaft has been found to be sufficient to reduce the bobbing or overthrowing to a great extent. Also, while I have illustrated my invention applied to a so-called three-position relay, it is evident that the same idea of means may be applied to a two-position relay; and it is further evident that various modifications may be made in the shape and structure of the various parts, according to the type of relay used and the wishes of the designer, without departing from my invention.

What I claim is:—

1. In an alternating current relay of the rotor type, the combination with a rotor shaft connected to the circuit controlling parts of the relay, of a coupling member connected to said shaft by a friction connection and having an arm extending radially from the shaft, and a rotor loosely mounted on said shaft and having a lug arranged to engage said arm, whereby the rotor may move freely relatively to the shaft to a limited extent in either direction and is frictionally connected to said shaft at the limits of its free movement.

2. In a relay, circuit controlling means biased to a middle position, an alternating

- current motor including a field having one element normally energized and a rotor for causing operation of said circuit controlling means from its biased position to an extreme operated position, and means including a lost motion device operatively connecting said rotor and said circuit controlling means and permitting free relative movement thereof to a limited extent in either direction, whereby upon return movement of said circuit controlling means to its biased position, the rotor may over-run and be gradually brought to rest by the influence of the field element.
3. In an alternating current relay of the rotor type, the combination with a rotor shaft positively connected to the circuit controlling parts of the relay, of a coupling member frictionally connected to said shaft and having an arm extending radially therefrom, and a rotor loosely mounted on said shaft and having a lug arranged to engage the arm of said coupling member.
4. In an alternating current relay of the rotor type having a biased relay movement, the combination with a rotor, of means operatively connecting the rotor and the relay movement and capable of permitting a free run of the rotor to a limited extent in either direction.
5. In a relay of the rotor type, the combination with a rotor and its operating shaft, of means operatively connecting said rotor and its shaft and adapted to permit the rotor to move freely relatively to the shaft to a limited extent, whereby the rotor may over-run the shaft upon its return movement, and means whereby the rotor is brought to rest.
6. In a relay of the rotor type, the combination with a rotor and its operating shaft, a biased relay movement positively connected to said shaft, field windings adapted if energized to cause rotation of said rotor, of a friction clutch and lost motion connection between the rotor and the shaft for permitting free movement of the rotor relatively to the shaft to a limited extent, and for producing a frictional connection between the rotor and its shaft at the limits of said free run, whereby the rotor may freely over-run the operating shaft and the relay movement to a limited extent upon deenergization of the relay.
7. In a relay of the rotor type, the combination with the operating parts constituting the relay movement, of a rotor having a lost motion connection thereto which permits the rotor to turn freely with respect to said operating parts, and electro-magnetic means for braking the rotor.
8. In an alternating current relay of the rotor type having two field elements, one of which remains energized when the parts of the relay assume their neutral or deenergized position, the combination with a biased relay movement, of a rotor adapted to freely over-run said relay movement upon return thereof to the biased position, whereby upon a deenergization of the relay, the rotor is gradually brought to rest by the influence of its local field element independently of the relay movement.
9. In a relay, circuit controlling means and associated operating parts constituting a relay movement, means adapted when energized to cause operation of the relay movement and including a movable operating element, and a lost motion connection between said operating element and the relay movement, which permits free movement of said operating element with respect to the other parts of the relay movement, and means for causing electro-magnetic braking of said operating parts, whereby upon deenergization of the relay said operating element may continue its movement by itself and be brought to rest gradually while the parts of the relay movement stop in their biased position.
10. In a relay having biased contact devices and a movable element for operating said devices, the combination with said movable element, of means for bringing said element gradually to rest independently of the device operated thereby upon deenergization of the relay.

RICHARD C. LEAKE.