

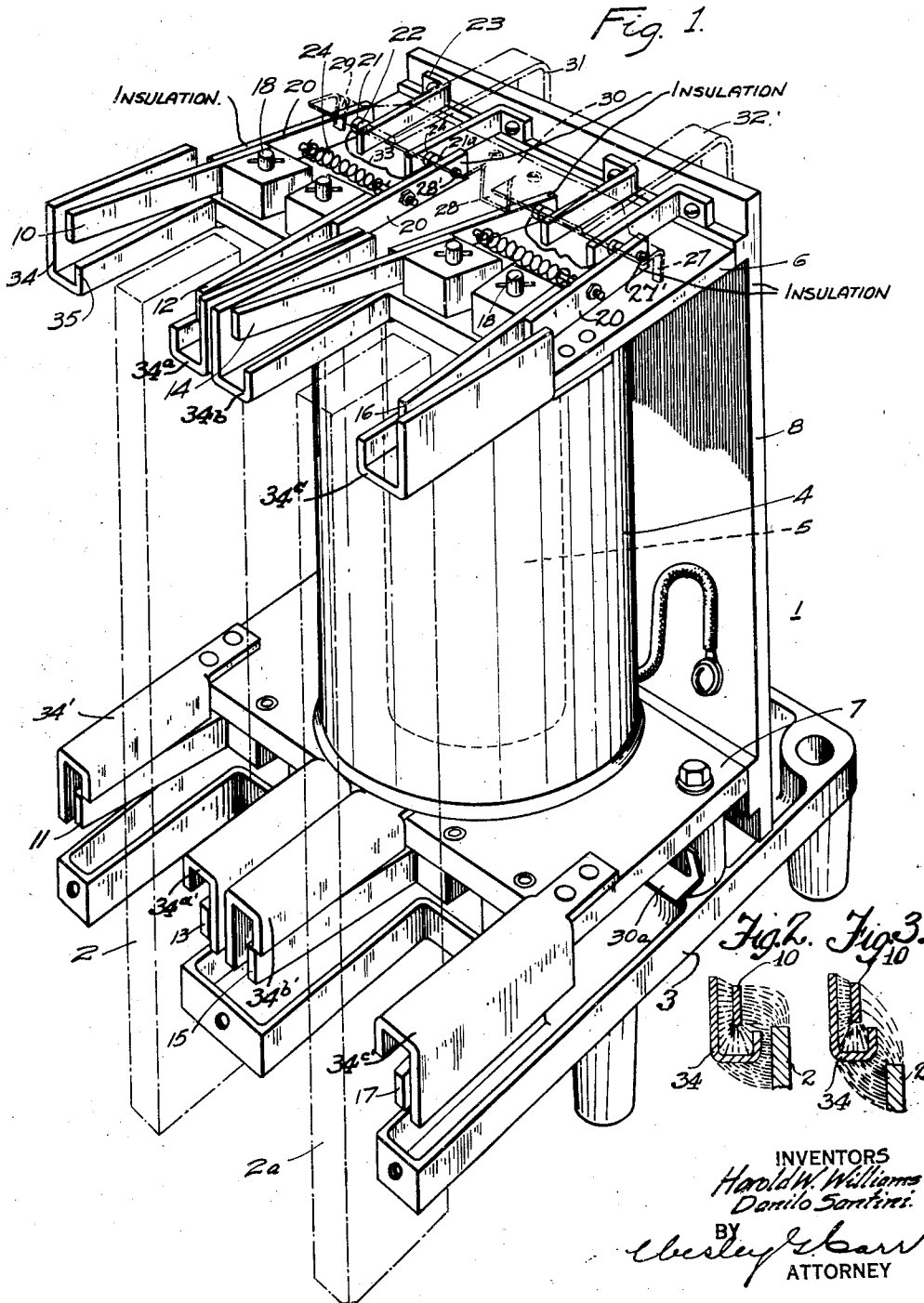
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H. W. WILLIAMS ET AL

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RELAY

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HAROLD W. WILLIAMS AND DANILO SANTINI, OF EAST PITTSBURGH, PENNSYLVANIA,
ASSIGNORS TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A
CORPORATION OF PENNSYLVANIA

RELAY

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Our invention relates to relays and more particularly to inductor relays of the type employed in control systems for controlling the operation of elevators, railway cars and similar vehicles.

The object of the invention, in general, is the provision of an inductor relay that shall be simple and efficient in operation and adapted for ready and economical manufacture and installation.

A more specific object of our invention is to provide a relay of the above mentioned type that will be accurate in operation and which will not open its contact members until it reaches a definite predetermined point in passing a cooperating inductor plate.

Another object of our invention is to provide an inductor relay that shall operate effectively, regardless of variations in the positions of the armatures with reference to the cooperating inductor plates.

It is also an object of our invention to provide magnetic shields for the cooperating parts of an inductor relay that shall insure accurate action of the relay as it passes its cooperating inductor plates.

Other objects of the invention will, in part, be obvious, and will, in part, appear hereinafter.

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

Figure 1 is a view, in perspective, of an inductor relay embodying our invention, and

Figs. 2 and 3 are diagrammatic views illustrating the action of the magnetic field as the inductor plate is brought into active relationship with the armatures of the relay.

We have illustrated, in Fig. 1 of the drawing, an inductor relay 1 adapted to be mounted on one of two relatively movable bodies, in position to cooperate with a pair of inductor plates 2 and 2a, mounted on the other of such bodies.

The relay is mounted upon a suitable base 3 and comprises a coil 4 that is wound on a suitable spool or core 5 which is provided with large rectangular end plates 6 and 7

of suitable magnetic material. A plate 8, of insulating material, is mounted upon the rear edges of the end plates 6 and 7 to brace them in their operating positions and also to provide a terminal board for the electrical connections of the relay.

As shown, the relay is provided with four pairs of cooperating armatures 10 and 12, 11 and 13, 14 and 16 and 15 and 17, that are pivotally supported upon the end plates 6 and 7 by means of pivot pins 18. In order that each armature may be employed to open or close a circuit, it is provided with an arm 20 of insulating material which carries a contact member 21 disposed to engage a cooperating contact member 22 on a stationary conducting arm 23 that extends from the panel board or plate 8. The contact members 21 are biased to a closed position by tensile springs 24 which are mounted between, and attached to, the extending arms 20 of each pair of armatures.

It has been observed, in the operation of elevators, hoists and similar apparatus, that the relative position of the car and the hatchway changes from time to time under the influence of different conditions of loading and changes due to wearing of the guide shoes which normally guide the car, in a fixed path, up and down the hatchway. In elevator systems employing inductor relays as control elements, it is customary to mount one of the cooperating elements of each relay, usually the electro-magnet and armature assembly, on the elevator car, and to mount the other element, or magnetizable plate, in the hatchway. The reverse of this arrangement has also been used, but is the less satisfactory of the two. It is apparent, therefore, that accurate adjustment of the clearance between the relay armatures and the inductor plates must be maintained or the armatures will be brought so close to the inductor plates as to strike them, damaging the armatures, or the armatures will pass the armature plates at such great distances that insufficient magnetic flux will pass between the armatures and the plates to cause actuation of the armatures. In prior forms of inductor relays for elevator work,

this problem has been further complicated in that the relays have been so organized that the change of relative positions of the car and the hatchway caused by "side-sway", wearing of guide rails and shoes and the like have produced variations in the total air gap between the magnetizable-plates and the armatures actuated thereby.

By arranging the armatures as projections between which the inductor plates may pass, movement of the relay, in either of its lateral directions with reference to the plates, does not change the total air gap in the magnetic circuit; that is, should the relay be moved transversely, the plate would pass more closely to one of the armatures, for example, 10, than to the other armature 12, of the pair. At the same time, the plate would also pass more closely to the armature 11 than to the armature 13. Hence, though the total air gap between the armature 12, the plate 2 and the armature 13 would be increased, at the same time, the total air gap between the armature 10, the plate 2 and the armature 11 would be reduced, and such variation as would occur would, therefore, not have any material bearing upon the actuation of the relay. On the other hand, should the relay be moved laterally at right angles with reference to the inductor plate 2; that is, should the plate 2 be projected deeper into the opening between the armatures 10 and 12, the total air gap between the armatures and the inductor plate will not be varied, and such change of relative position will not affect the operation of the relay.

Inasmuch as the contact members 21 and 21a of the armatures 10 and 12 are electrically connected by a conductor 33, and are disposed in series in the circuit to be controlled thereby, the actuation of either one of the armatures from its biased position will effect an opening of the circuit in which they are connected. The armatures 11 and 13 are arranged similarly to the armatures 10 and 12 in order that the operation of either one of them will control the circuit in which they are connected in series.

Inasmuch as the armatures 14, 16, 15 and 17 are mounted and connected like the armatures 10, 12, 11 and 13, they will be operated in the same manner when the relay is moved past the inductor plate 2a.

In elevators of the automatic-landing type, in which inductor relays are employed to initiate the steps of deceleration of the car at such distance from the floor, at which a stop is to be made, as will cause the car to stop at the floor, it is essential that the point at which the deceleration is initiated shall be the same at all times in order to cause the car to stop accurately level with the floor without under-running or over-running the floor, since, the more accurate the

operation of the relay, the more accurate will be the landing. For that reason, we have provided each armature with a shield of magnetizable material, attached to the respective end plates 6 or 7 for preventing the armature from being actuated by the inductor plates until the car has reached a definitely predetermined point in its upward or downward travel. The shields are respectively designated as 34, 34a, 34b, 34c, 34', 34a', 34b', and 34c'.

Referring to Fig. 1, a magnetic circuit, including armatures 10 and 12, and 11 and 13 extends from one pole of the coil 4, through the end plate 6, the armatures 10 and 12, shields 34 and 34a, the inductor plate 2, shields 34' and 34a' the armatures 11 and 13, and the end plate 7, to the opposite pole of the coil. As will be apparent, a second magnetic circuit for the flux of coil 4 includes the armatures 14, 16, and 15 and 17, the shields 34b, 34c, 34b' and 34c', and the inductor plate 2a. The function of the shields, as 34, is to prevent the direct passage of flux from the armatures, as 10, to the inductor plates 2 and 2a until these elements assume predetermined relative positions. As will be apparent from Fig. 1 of the drawing, if the flux is permitted to pass directly from the armatures to the inductor plates, the armatures are subjected to a force tending to cause rotation thereof about the axes 18. This force varies in value in accordance with the relative positions of the armatures and plates and is, of course, a maximum when the two elements are opposite one another, or in the position shown in Fig. 3. By interposing the shields as shown, however, the greater part of this flux is deflected in such a way that only a small force is exerted on the armature tending to cause rotation thereof until the elements assume the position shown in Fig. 2, at which time the armature is suddenly subjected to a substantially maximum force, and is thereby actuated. This feature is graphically illustrated in Figs. 2 and 3, Fig. 3 illustrating the flux path from the inductor plate 2 when it is below the shield 34, at which time, it will be observed, practically all of the flux passes between the plate 2 and the armature 10 by way of the shield 34, and that very little force is applied to the armature 10 to cause it to rotate about the axis 18. However, as the relay 1 is moved downwardly, the upper edge of the plate 2 approaches to a position level with the lower portion of the armature 10, as illustrated in Fig. 2, and considerable flux passes through the armature 10 and the plate 2, the magnetic pull on armature 10 being such as to cause rotation thereof about axis 18. Hence, the armature cannot operate until the inductor plate reaches this position; that is, until the car passes a predetermined

point in the hatchway. It will be observed, therefore, that the point of actuation of the relays, and hence, of initiation of slow-down, may be accurately determined. In practice, the variations in the point at which the relays are operated have not exceeded limits of one-quarter of an inch in either direction.

It will be noted that the shields 34 are disposed below the associated armatures 10, 12, 14 and 16, and that the shields 34' are disposed above the associated armatures 11, 13, 15 and 17. As will be obvious, this alternate arrangement of the shields is appropriate where the armatures of the former group are to be operated when the relay, or the inductor plates, are moved in one direction, and the armatures of the latter group are to be operated during movement of the relay, or the inductor plates, in the other direction. The relative positions of the several armatures and shields may, of course, be arranged in any desired manner to accommodate different operating requirements.

It will be further observed that if, due to shifting of the relative position of the car and the hatchway, the inductor plate 2 is brought closer to one of the armatures of a set than to the other; for example, closer to armature 10 than to armature 12, actuation of armature 10 is positively prevented prior to the time the upper end of the inductor plate 2 is brought level with the lower portion of the armature 10, in spite of the fact that the reduced air gap allows the passage of a greater quantity of flux between the armature and the inductor plate. Hence, the use of the shields 34 not only increases the accuracy when all of the parts are in exact adjustment but also takes care of variations due to inaccuracy of adjustment caused either by wear or by faulty initial installation.

It is frequently desirable that an armature, when actuated, should be maintained in its actuated condition during the entire time the coil 4 is energized. For this purpose, we have provided plates 30 and 30a of magnetizable material suitably mounted upon the end plates 6 and 7, respectively, with magnetic insulation between the plates and the respective end plates. The plate 30 is provided with downwardly bent projections 27, 28 and 29 to engage, respectively, tips of magnetizable material inserted near the extreme ends of the insulating arms 20. These magnetic tips are designated by the reference characters 27' and 28', only two of the tips being shown, but it is to be understood that one tip is provided for each of the armatures 10, 11, etc. on the relay.

The plate 30 is magnetically connected with the plate 30a by means of strips 31 and 32 of magnetizable material, to thereby complete a magnetic circuit between the coil

4 and the plates 30 and 30a. The flux which passes from the coil through the plates 30 and 30a is insufficient to cause actuation of the armature, but, when the armatures are otherwise moved and the tips 27' are brought into physical contact with the projections 27, sufficient flux will pass to maintain the armatures in their new positions. However, as soon as coil 4 is deenergized, this flux will disappear and the armatures will be restored to their original positions under the influence of their respective springs.

In addition to the holding function performed by the plates 30 and 30a, it will be observed that these plates are so shaped as to extend above the contact members operated by the armatures 10, 11, 12, etc., and the flux passing through these plates may be utilized to "blow-out" any arc occurring between the respective sets of contacts.

While we have illustrated and described only one specific embodiment of our invention, we realize that it is susceptible of wide application and we do not desire to be limited to the precise construction illustrated and described.

We claim as our invention:

1. In an inductor relay, a magnetizable coil, an armature, a magnetizable plate for cooperating magnetically with said armature, and a magnetic shield disposed to prevent the passing of magnetic lines of force directly between the armature and the plate until the plate is in a predetermined position relative to the armature.

2. In an inductor relay, a magnetizable coil, a movable armature, a magnetizable plate disposed to be brought adjacent to said armature for cooperating magnetically therewith to cause movement of said armature, and shielding means for accurately determining the position of the plate adjacent to the armature at which the armature will be operated.

3. In an inductor relay, a magnetizable coil, a movable armature, a magnetizable plate disposed to be brought adjacent to said armature for cooperating magnetically therewith to cause movement of said armature and means for controlling the direction of the effective lines of force between the armature and the plate.

4. In an inductor relay, a magnetizable coil, a movable armature associated with said coil, a magnetizable plate movable with reference to said armature for cooperating magnetically therewith to cause movement of said armature and a magnetic shield for preventing the plate and the armature from cooperating magnetically until they are in a predetermined position with reference to each other.

5. In an inductor relay, a magnetizable coil, a movable armature associated with said coil, a magnetizable plate movable with

- reference to said armature for cooperating magnetically therewith to cause movement of said armature and a magnetic shield associated with said armature for preventing the plate and the armature from cooperating magnetically until they are in a predetermined position with reference to each other.
6. In a relay, a magnetizable coil, a movable armature associated with said coil and a magnetic shield disposed in proximity to said armature for preventing effective fringing of lines of force from said armature.
7. An inductor relay comprising a core member, a coil disposed on said core member, a movable armature associated with the upper end of said core member, a cooperating movable armature associated with the lower end of said core member, a magnetizable plate movable with reference to said armatures for cooperating magnetically therewith to cause movement of said armatures, a magnetic shield disposed around the under side of the first named armature and a second magnetic shield disposed around the upper side of the second named armature for accurately determining the position of the plate adjacent to the armatures at which the latter will be operated.
8. An inductor relay comprising a magnetizable coil, a pair of armatures disposed to cooperate magnetically with each other, a second pair of armatures disposed to cooperate magnetically with each other, and a magnetizable plate disposed to pass between said pairs of armatures.
9. An inductor relay comprising a core member, a coil disposed thereon, a plurality of movable armatures associated with said coil and core member and disposed to provide a pair of substantially parallel magnetic fields when the coil is energized, and a magnetizable plate for operating said armatures disposed to pass between those armatures disposed to form the one magnetic field and those armatures disposed to form the other magnetic field.
10. An inductor relay comprising a core member, a magnetizable coil disposed on said core member, a plurality of movable armatures disposed to provide a pair of substantially parallel magnetic fields when said coil is energized, and a magnetizable plate for operating said armatures disposed to pass between those armatures for forming the one magnetic field and those armatures for forming the other magnetic field.
11. An inductor relay comprising a core member, a magnetizable coil disposed on said core member, two pairs of armatures associated with said coil and disposed to provide a pair of substantially parallel magnetic fields when said core is energized, and a magnetizable plate for operating said armatures disposed to pass between the two pairs of armatures, said pairs of armatures being spaced apart such distance as will insure the operation of at least one pair of said armatures as the plate passes between them when the coil is energized.
12. An inductor relay comprising a core, a magnetizable coil disposed on said core, a pair of armatures associated with one end of said core, a pair of armatures associated with the other end of said core, said armatures being arranged to form a pair of substantially parallel magnetic fields when said coil is energized, and a magnetizable plate for operating the armatures, said plate being disposed to pass between the armatures for one magnetic field and the armatures for the other magnetic field.
- In testimony whereof, we have hereunto subscribed our names this 18th day of May, 1928.
- HAROLD W. WILLIAMS.
DANILO SANTINI.

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