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ELECTRIC INDUCTOR RELAY

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Fig. 1.

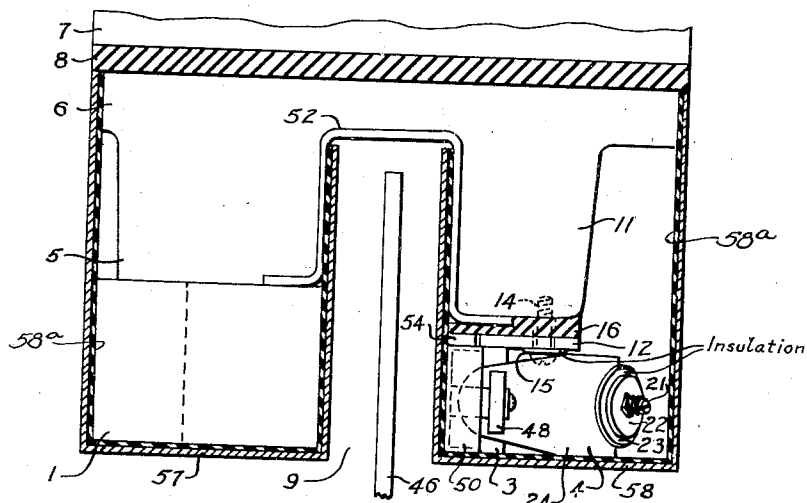
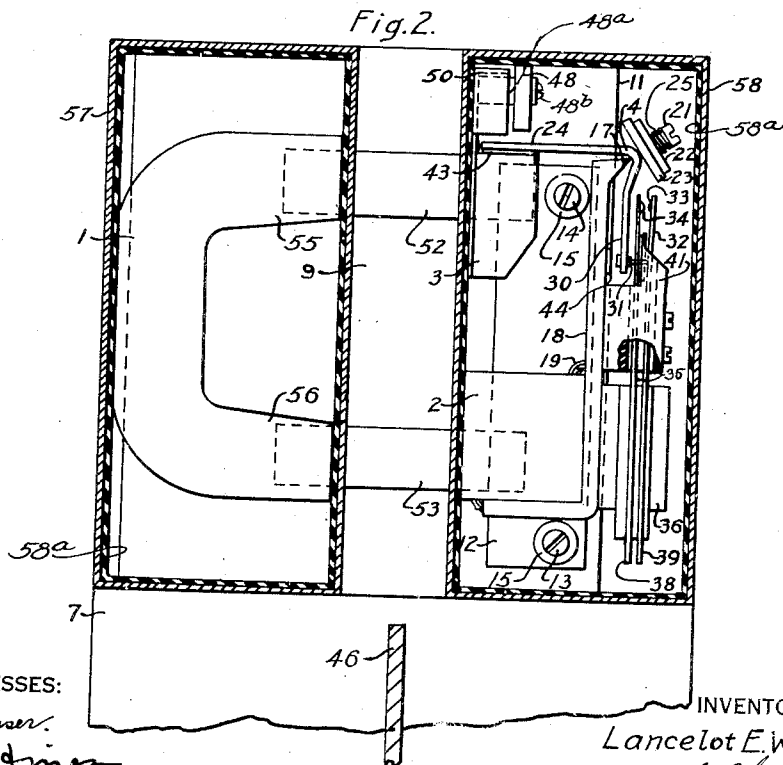


Fig. 2.



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ELECTRIC INDUCTOR RELAY

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My invention relates to electric relays, and more particularly to inductor relays of the kind which are operated by relative movement between a relay body, having relay contacts, and a plate of magnetizable material. Such relays are, as is known, commonly used in electrically operated elevator systems and also in train control systems.

One object of my invention is to provide an inductor relay in which the contact members will open and close positively and rapidly in response to the passage of a magnetizable plate adjacent thereto or successively in response to the passage of a plurality of plates following each other at high speed.

Another object is to provide an inductor relay which shall not be affected by mechanical shocks or by magnetic interference by reason of iron-work in an elevator shaftway, or by other adjacent inductor plates.

It is also an object of the invention to provide an inductor relay which shall be simple in construction, economical to manufacture and maintain in operation and which shall require a minimum amount of adjustment.

According to the present invention in a relay, an armature associated with relay contacts is arranged to be attracted against a biasing force to collector pole pieces by magnetic flux from a magnet, and a cooperating magnetizable means is adapted, on movement relative to said pole pieces, to short circuit the said flux path from the said magnet to the pole pieces and thus effect release of the said armature and hence change the state of the contacts associated with the armature.

Also, in this relay, the collector poles may be spaced apart from the poles, with the magnetizable means disposed to move relatively to the pole pieces and in the space between the magnet and the pole pieces to short circuit the flux from the magnet, and the armature may be arranged to be attracted to one of the collector pole pieces and to form a part of the magnetic circuit between the collector pole pieces.

For a better understanding of the invention, reference may be had to the accompanying drawing, in which:

Figure 1 is a plan view of an inductor relay constructed in accordance with my invention for use in an elevator system; and,

Fig. 2 is a view, in front elevation, of the relay illustrated in Fig. 1.

Referring more particularly to the drawing, I have illustrated an inductor relay comprising a

main magnet 1 of horseshoe shape, a pair of cooperating collector pole pieces 2 and 3 and an armature 4. The magnet 1 may be energized in any desired manner, but is preferably what is known as a magnet of high magnetic remanence usually known as a permanent magnet and is shown as mounted upon an outer extension 5 of a base 6. The base 6 is preferably a casting of non-magnetizable material which is mounted upon a suitable bracket or support 7, a rubber washer 8 being disposed between the base and the bracket to cushion the relay and the base upon the bracket.

The collector pole pieces 2 and 3 are preferably of soft iron of low magnetic remanence and are separated from the magnet 1 by an air gap 9 and are mounted upon another extension 11 on the base 6. The pole pieces 2 and 3 are supported in position by fastening them to a brass plate 12 which is secured to the extension 11 by a pair of screws 13 and 14, each screw being provided with a rubber bushing 15 where it passes through the brass plate to insulate and deaden the noise of operation of the relay. A rubber mat or plate 16 is also disposed between the brass plate 12 and the base extension 11 to provide a noiseless mounting for the active parts of the relay. The armature 4 is mounted upon the knife-edge portion 17 of a magnetizable member 18, which is mounted upon the collector pole piece 2, as by welding 19, or in any other suitable manner.

A screw 21 is passed through the armature 4 and screwed into the knife-edge end of the magnetizable member pole extension 18, and a washer 22, is mounted upon the screw 21 to press against the armature 4 and hold it against the knife-edge 17 so that it will be free to rock upon the knife-edge and thus move its arm 24 into and out of operating position with the pole piece 3. A rubber washer 23 is disposed on the screw 21 in position between the washer 22 and the armature. A spring 25 is mounted upon the screw 21 to bias the metal washer 22 and the rubber washer 23 toward the armature 4 so as to hold it lightly and resiliently in its operative position without permitting it to become noisy on its axis when it is being attracted or being released by the pole pieces.

One end 30 of the armature 4 extends along the pole extension 18 and is provided with a pin 31 disposed to extend outwardly into engagement with a spring 32, upon the free end of which is mounted a contact member 33. The contact member 33 is disposed to cooperate with a con-

tact member 34 mounted upon the free end of a resilient spring 35. The springs 32 and 35 are firmly mounted in a mounting block 36 and are provided with conductor extensions 39 and 38 by means of which the relay may be connected in the electrical circuit to be controlled. A buffer block 41 is provided for limiting the movement of the spring members 32 and 35. As is shown, the spring member 32, by exerting pressure against the pin 31 on the arm 30, biases the other arm 24 of the armature away from the pole piece 3. When the pole piece 3 is energized, it attracts the armature arm 24 against the biasing force of the spring 32 and thus opens the contact members 33 and 34. When the pole piece 3 is deenergized, the spring 32 is released from the force exerted against it and thus closes the contact members.

In order to further decrease the operation noise of the relay, a thin sheet of non-magnetizable material 43, preferably of a resilient shock-absorbing nature, is mounted upon the upper face of the pole piece 3 at the point where the armature arm 24 is attracted to the pole piece when the pole piece is energized. This sheet 43 should be thin enough to provide for good operation between the pole piece and the armature, but of sufficient shock-absorbing qualities as to not only prevent the armature from coming into physical contact with the pole piece, but to deaden the noise which might otherwise be occasioned by the operation of the armature. A sheet of shock-absorbing material 44 is also mounted upon pole extension member 18 where the armature pole arm 30 engages it when the pole pieces and armature are deenergized. This is also provided for preventing physical contact between the members 30 and 18 for the purpose of rendering the relay more quiet in operation.

A vane or sheet 46 of magnetizable material is provided for use as an inductor plate to be disposed in the slot 9 for the purpose of short circuiting the magnetic flux from the main magnet 1 to the collector pole pieces 2 and 3 when it is desired to deenergize those pole pieces for the purpose of releasing the armature 4.

A small magnet 48 is mounted above the upper face of the pole piece 3 for the purpose of imparting snap action to the opening movement of the armature 24 and for assisting in the elimination of any contact bounce of the armature, especially at the moment of first contact between the contact members 33 and 34 on the springs 32 and 35. The auxiliary magnet 48 may be of any suitable permanent magnetic material and of any desired shape, but preferably a permanent horse-shoe magnet, is mounted upon and supported by a shield plate 50 which is mounted upon the upper end of the pole piece 3 for the purpose of preventing leakage of flux from the main magnet 1 directly to the armature arm 24 and also to prevent demagnetization of the pull of magnet 48. The shield 50 is preferably constructed in the form of an open box or hood, of sheet iron of reasonably high permeability or of a non-permanent magnetic alloy such as is sold under the trade-mark "Hypernik" or under the term "stalloy" (an iron silicon alloy). The shield may be secured to the pole piece 3 in any suitable manner as by welding, soldering etc., but I prefer to extend the "floor" of the shield down along the side of the pole piece 3 and secure it thereto by means of suitable counter-sunk screws (not shown). The magnet 48 may be mounted on the

floor of the shield by means of a nonmagnetic spacing block 48^a and a screw 48^b.

The shield is provided for preventing the flux from the main magnet 1 demagnetizing the small magnet 48. Although the shield is to some extent in the magnetic circuit of the small magnet 48, the poles of the latter are disposed so close to the armature 24 that there is very little magnetic leakage and whether or not the shield has any effect upon the latter has not been found to be of any practical importance.

A pair of U-shaped magnetizable members 52 and 53 are mounted against the inner face of the slot 9 in the central portion of the base 6 with their arms extending outwardly into magnetizable engagement with the main magnet and the collector pole pieces. The member 52 extends from the upper part or pole 55 of the magnet 1 around the inner portion of the slot 9 and into magnetic engagement with the pole piece 3. The member 53 extends around the inner portion of the slot 9 with its outer ends disposed in magnetic engagement with the pole 56 of the magnet 1 and the pole piece 2. The members 52 and 53 act as flux diverters to provide a permanent predictable magnetic bias on the switch unit, thus enabling spring 32 to be made stronger than could otherwise be done. It then becomes possible to regulate the effective armature movements by adjusting the position of the small magnet 48 in relation to the armature, and the tension of spring 32 upon the armature. If desired, each of the flux diverters may have a step piece 54 placed between itself and the pole piece it serves for the purpose of reducing the air gap therebetween.

A cover plate 57 is provided for covering the main magnet 1 and that portion of the base 6 upon which it is mounted. A cover plate 58 is provided for covering the collector pole pieces, the parts directly associated therewith and that portion of the base 6 upon which they are mounted. The covers 57 and 58 are lined preferably with a suitable rubber or other sound deadening composition 58^a to reduce the operating noise of the relay and protect its various parts from dust and other deteriorating influences.

The relay may be used in connection with any system in which an efficient and practically noiseless inductor relay is desired. However, its most desirable field of use is probably in connection with the operation of elevator cars in their hatchways. In elevator systems for operating the cars in their hatchways, it is often desirable to have an inductor relay for operating door switches, lock switches or switches for controlling the deceleration and stopping of the car. When the present inductor relay is used in an elevator system, it will be assumed that the relay supported upon the bracket 7 will be mounted on the elevator car (not shown) by attaching the bracket 7 to some suitable part of the car. It will also be assumed that the inductor plate 46 is mounted in the hatchway (not shown) in cooperative position with reference to the relay on the car so that as the car moves up and down the hatchway the inductor plate will pass through the relay slot 8.

Assuming that the main magnet 1 is a permanent magnet, then when the car is in such position in the hatchway that the inductor plate 46 is not in the air gap 9, the flux from the main magnet pole pieces 55 and 56 flows across the air gap 9 and energizes the collector pole pieces 2 and 3. In this condition, the armature arm 24

is attracted to the pole piece 3 and is held against the plate 43. The attraction of the armature 4 causes its arm 30 to move the pin 31 outwardly against the spring arm 32 and thus push it away from the spring arm 35 so that the contact members 33 and 34 are opened and held in their open position.

Assuming now that the car moves along its hatchway until the inductor plate 46 enters the air gap 9, then the inductor plate short circuits the flux from the magnet 1 to the pole pieces 2 and 3 and thereby deenergizes these pole pieces. The deenergization of the collector pole pieces releases the arm 24 of the armature 4 from its attracted position against pole piece 3. The biasing action of the spring 32 against the pin 31 on the arm 30 of the armature tilts the armature so that its arm 24 moves away from the pole piece 3 and toward the auxiliary magnet 48. The attraction of the auxiliary magnet causes the arm 24 of the armature to move toward that magnet with a quick, snap action, and also renders the movement of the armature positive and bounce-free.

Assuming that the car moves on past the inductor plate 46, then as the plate leaves the air gap 9, the flux from the main magnet 1 again flows to the collector pole pieces 2 and 3 and energizes them to attract the arm 24 of the armature 4 into its position in magnetic engagement with the pole piece 3. This operation of the armature causes its arm 30 to move the pin 31 outwardly against the spring 32 and thereby separate the contact members 33 and 34. The opening or closing of the contact members may be used to control a circuit as desired.

Although the contact members 33 and 34 have been illustrated as being closed when the inductor plate 46 is disposed in the air gap, it is obvious that the contact members may be so arranged that they will open when the inductor plate is in the air gap and close when it leaves the air gap.

It will also be apparent that the use of shock-absorbing and sound-deadening material as described contributes to the silent and efficient operation of the relay and that the construction described is in a compact form so that a plurality of relays may be grouped closely together in a common mounting bracket on an elevator car. It will also be obvious that where a plurality of these relays are provided on one car, magnetic shielding means of suitably disposed sheets of magnetizable material may be provided where desirable for each unit whereby the effect of the magnets of adjacent units upon the armatures not served by them will be minimized.

Although I have illustrated and described only one specific embodiment of my invention, it is to be understood that many changes therein and modifications thereof may be made without departing from the spirit and scope of the invention.

I claim as my invention:

1. A relay comprising a pair of collector pole pieces, a permanent magnet provided with a pair of poles disposed to energize the collector pole pieces, means for supporting the collector pole pieces and the magnet with air gaps between the poles of the magnet and the collector pole pieces, an armature disposed to be attracted by one of the collector pole pieces when they are magnetized, and a magnetizable plate for movement through the air gaps between the collector pole pieces and the poles of the magnet to short circuit the flux from the magnet, thereby deener-

gizing the collector pole pieces to release the armature.

2. A relay comprising a pair of collector pole pieces, a permanent magnet provided with a pair of poles disposed to energize the collector pole pieces, means for supporting the collector pole pieces and the magnet with air gaps between the poles of the magnet and the collector pole pieces, an armature disposed to be attracted by one of the collector pole pieces when they are magnetized, a magnetizable plate for movement through the air gaps between the collector pole pieces and the poles of the magnet to short circuit the flux from the magnet, thereby deenergizing the collector pole pieces to release the armature and means for supporting the armature with its body portion providing a part of the magnetic circuit between the collector pole pieces.

3. A relay comprising a pair of collector pole pieces, a permanent magnet provided with a pair of poles disposed to energize the collector pole pieces, means for supporting the collector pole pieces and the magnet with air gaps between the poles of the magnet and the collector pole pieces, an armature disposed to be attracted by one of the collector pole pieces when they are magnetized, a magnetizable plate for movement through the air gaps between the collector pole pieces and the poles of the magnet to short circuit the flux from the magnet, thereby deenergizing the collector pole pieces to release the armature, and flux diverting strips disposed at one side of said air gaps for providing flux paths from the magnet poles to the collector pole pieces around one side of the air gaps to render the armature more effective in operation.

4. A relay comprising a pair of collector pole pieces, a permanent magnet provided with a pair of poles disposed to energize the collector pole pieces, means for supporting the collector pole pieces and the magnet with air gaps between the poles of the magnet and the collector pole pieces, an armature disposed to be attracted by one of the collector pole pieces when they are magnetized, a magnetizable plate for movement through the air gaps between the collector pole pieces and the poles of the magnet to short circuit the flux from the magnet, thereby deenergizing the collector pole pieces to release the armature, and a pair of U-shaped flux diverters disposed around said air gaps to provide flux diverting paths from the magnet poles to the collector pole pieces.

5. A relay comprising a pair of collector pole pieces, a permanent magnet provided with a pair of poles disposed to energize the collector pole pieces, means for supporting the collector pole pieces and the magnet with air gaps between the poles of the magnet and the collector pole pieces, an armature disposed to be attracted by one of the collector pole pieces when they are magnetized, a magnetizable plate for movement through the air gaps between the collector pole pieces and the poles of the magnet to short circuit the flux from the magnet, thereby deenergizing the collector pole pieces to release the armature, and an auxiliary magnet disposed adjacent to the armature for assisting the movement of the armature away from the pole piece by which it is released.

6. A relay comprising a pair of collector pole pieces, a permanent magnet provided with a pair of poles disposed to energize the collector pole pieces, means for supporting the collector pole pieces and the magnet with air gaps between the poles of the magnet and the collector pole pieces,

an armature disposed to be attracted by one of the collector pole pieces when they are magnetized, a magnetizable plate for movement through the air gaps between the collector pole pieces and the poles of the magnet to short circuit the flux from the magnet, thereby deenergizing the collector pole pieces to release the armature, an

auxiliary magnet disposed adjacent to the armature for assisting the movement of the armature away from the pole piece by which it is released, and a magnetic shield disposed to limit leakage of flux from the magnet to the auxiliary magnet or armature.

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