Sept. 10, 1940. H. W. WILLIAMS ET AL 2,214,599

INDUCTOR RELAY

Filed March 19, 1938 3 Sheets-Sheet 1

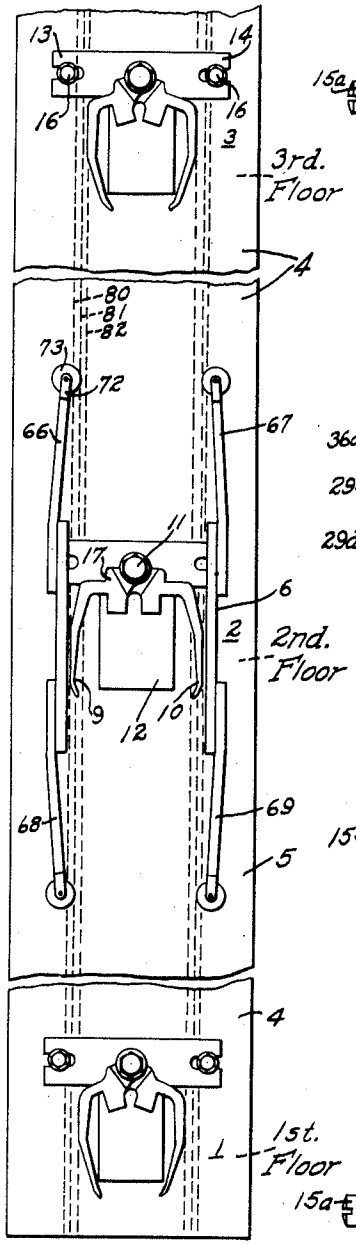


Fig. 1.

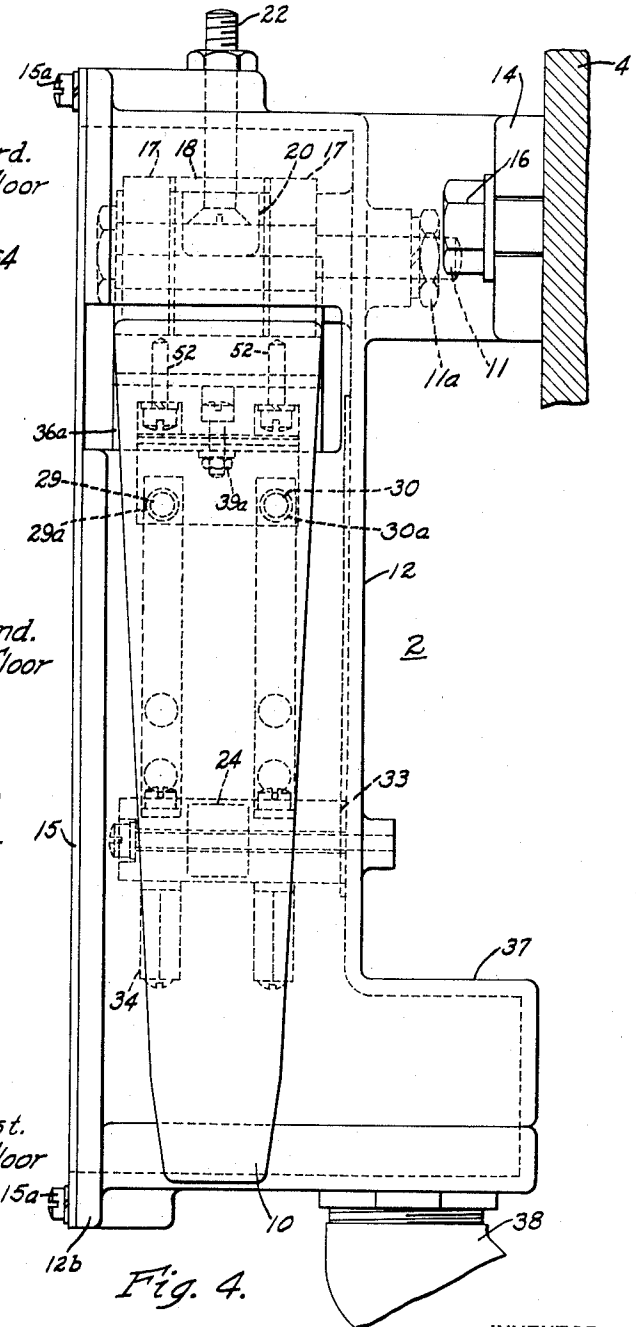


Fig. 4.

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INDUCTOR RELAY

Filed March 19, 1938 3 Sheets-Sheet 2

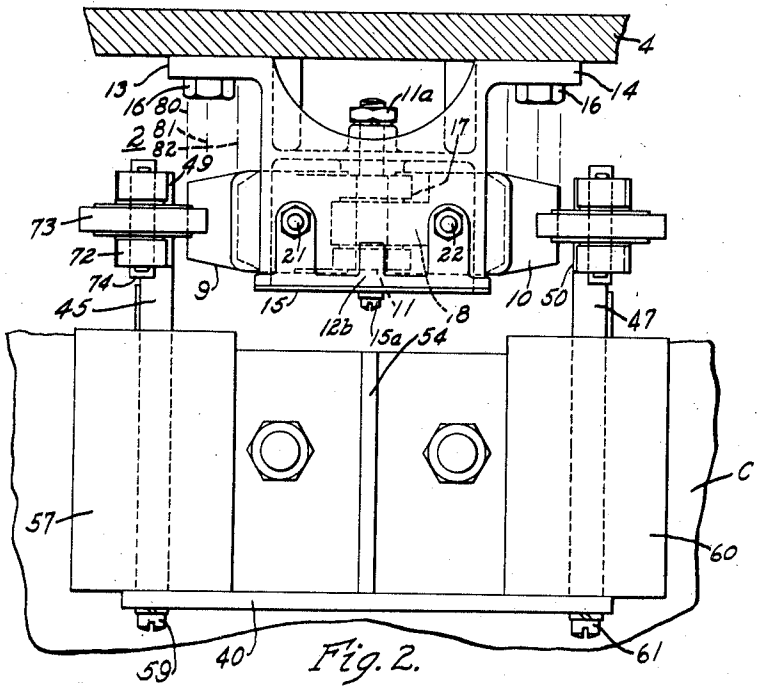


Fig. 2.

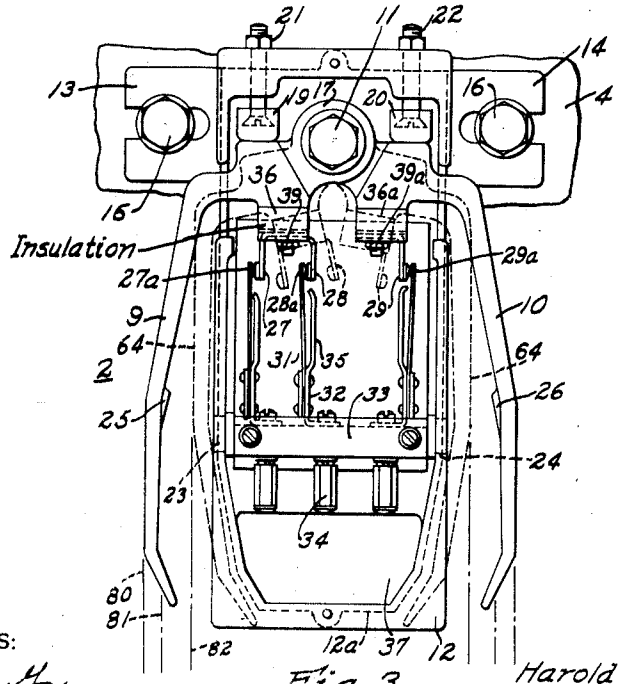


Fig. 3.

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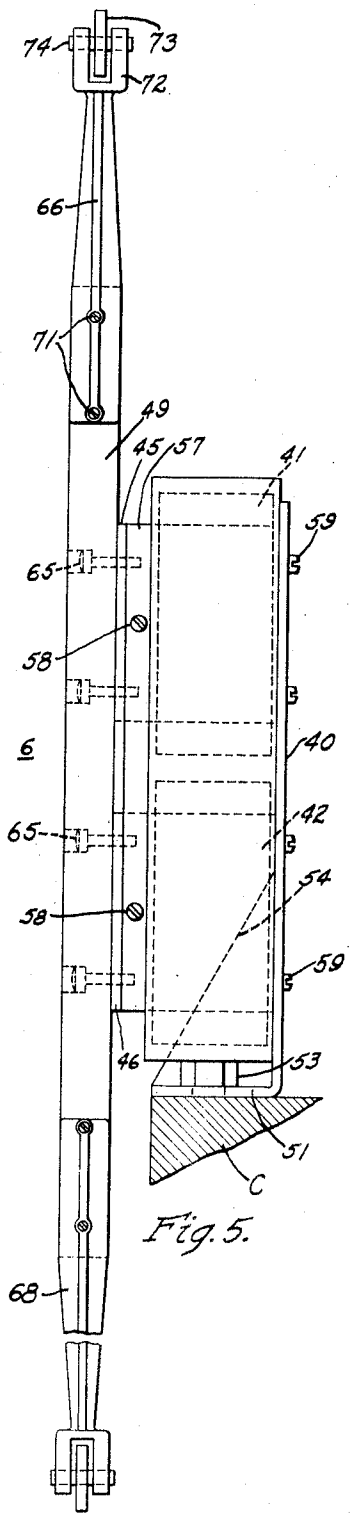


Fig. 5.

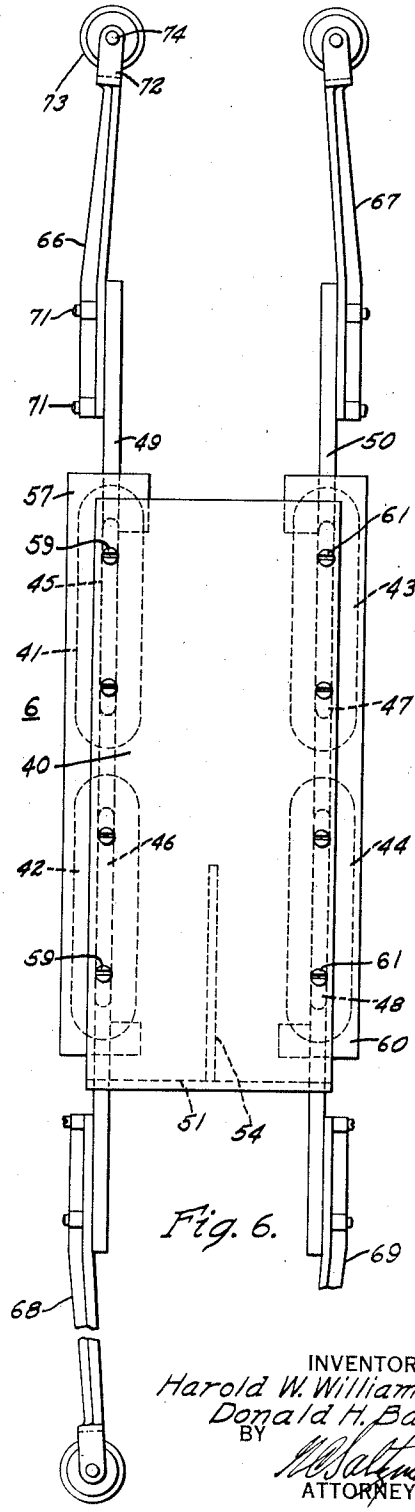


Fig. 6.

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UNITED STATES PATENT OFFICE

2,214,599

INDUCTOR RELAY

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Application March 19, 1938, Serial No. 196,938

10 Claims. (Cl. 200—87)

Our invention relates to inductor relays such as are frequently utilized in elevator systems for controlling the operation of their cars, hatchway doors, etc.

Where inductor relays of this kind are used for controlling the circuits of the hatchway door motors, one relay is usually mounted on the hatchway wall at each hatchway door and in position to be actuated by an energizer carried on the car when the car makes a stop at that door. Each relay comprises a plurality of contact members and a pair of magnetizable switching arms for opening and closing the contact members. The arms are pivotally mounted so the force of gravity will cause them to open the contact members when they are not under the influence of the energizer on the car. The energizer comprises a magnetizable member and a coil for energizing it. When the car makes a stop at a floor with the energizer adjacent to the relay, the coil is energized to induce a magnetic circuit through the energizer and the switching arms to magnetically move the arms into their operated position, thereby closing the contact members.

When the coil is deenergized or the energizing member is moved away from the switching arms, gravity or biasing springs cause the switching arms to return the contact members to their normal open position.

In actual practice, it is found that the contact members of an inductor relay will "freeze" or stick at times and remain closed or the arms will fail to return to their unoperated position after the car moves the energizer away from the relay. When this happens, it causes trouble in the control circuit with which the contact members of the relay are connected.

Hence, it is an object of our invention to provide means for positively freeing and opening the closed contact members of inductor relays after their energizers are deenergized and moved away from their switching arms to thereby insure accurate operation of the control circuits in which the relays are connected.

It is also an object of our invention to provide inductor relays and energizers therefor of more simple and durable construction than have been produced heretofore.

Other objects will be apparent from the following description taken in conjunction with the accompanying drawings, in which:

Figure 1 is an illustration of a plurality of inductor relays with their switching parts mounted on the wall of an elevator hatchway and a portion of an energizer to be moved past them by a car, as constructed in accordance with our invention;

Fig. 2 is a view in top elevation of the inductor relay shown at the second floor in Fig. 1;

Fig. 3 is a view in front elevation of the switching part of the inductor relay shown in Fig. 2 with the switching arms in their actuated position, broken lines being used to show them in their closed position and with the cover plate removed;

Fig. 4 is a view in side elevation on a slightly enlarged scale of the relay shown in Fig. 3;

Fig. 5 is a view in side elevation of the energizer for actuating the switching arms of the relay shown in Fig. 3; and

Fig. 6 is a view in rear elevation of the energizer shown in Fig. 5.

Referring more particularly to the drawings, the relay and energizer therefor are of the kind in which a plurality of relays 1, 2 and 3 are mounted on a hatchway wall 4 of an elevator hatchway to be operated by an energizer 6 mounted on the elevator car C as the car moves up and down the hatchway. When the car brings the energizer adjacent to a relay while it is energized for action, that relay is operated to control a circuit (not shown) for the car. The relays illustrated herein are such as are utilized for controlling the motors for operating the hatchway doors (not shown) at the landings and there will be one inductor relay mounted on the wall at or near each landing. In other cases, the relays may be utilized in systems for decelerating and stopping the car at floors. In such cases, the relays may be mounted on the car and have arms biased to unoperated positions by springs and the operators for the arms may be mounted on the walls of the hatchway. An inductor relay system in which the relays are mounted on the car and the operators on the wall of the hatchway is described in Patent 1,884,446, issued October 25, 1932 to Westinghouse Electric Elevator Company and reference may be had to that patent if more information regarding such a system is desired.

As shown in Figs. 2, 3 and 4, each of the inductor relays comprises a pair of magnetizable arms 9 and 10 pivotally mounted and supported by a bolt or pin 11 in a housing casting 12. The bolt is retained in position by a nut 11*a*. The housing is approximately rectangular in shape as indicated by the dotted line 12*a* and is provided with flanged front face portion 12*b* (Fig. 3) upon which a cover plate 15 may be mounted by means of screws 15*a* to protect the working parts of the

relay. A pair of slotted projections or brackets 13 and 14 provide a means by which the housing may be securely fastened by a pair of bolts 15 to the hatchway wall 4 at the point where the relay is to be located. The upper hinged portion 17 of the arm 9 is bifurcated with its divided parts supported upon the pin 11 and the arm 10 is provided with a single hinged portion 18 that is mounted on the pin 11 and between the bifurcated ends of the arm 9, in order to secure a rigid construction which will permit the arms to move outwardly easily but prevent them from moving sideways when they are being operated.

A pair of rubber bumpers 19 and 20 are mounted upon adjustable screws 21 and 22 supported in the topmost portion of the casting 12 in such manner that they extend downwardly into position to be engaged by the upper shoulders on the arms 9 and 10 when they are moved to their open position. The rubber bumpers may be adjusted to the desired height by rotating the screws 21 and 22 on which they are mounted. A pair of rubber bumpers 23 and 24 are mounted upon the sides of the casting 12 in position to be engaged by projections 25 and 26 on the arms 9 and 10 when the arms are released to move into their normal unoperated position. The provision of the rubber bumpers for limiting the movements of the arms reduces the noise usually inherent to the operation of inductor relays of this character, thus reducing the amount of noise usually produced by the operation of an elevator system.

As shown in Fig. 3, the switching arm 9 is provided with an insulating block 36 upon which a pair of contact members 27 and 28 are mounted by a screw 39 to be closed against cooperating contact members 27*a* and 28*a* by movement of that arm to its operated position, as shown in full lines in this figure. The operating arm 10 is provided with an insulating block 36*a* secured by a pair of screws 52. A pair of contact members 29 and 30 are mounted on the block 36*a* by a bolt to be closed against cooperating contact members 29*a* and 30*a* (Fig. 4) by movement of that arm to its operated position, as shown by the full lines. The broken lines represent the unoperated positions of the arms and the open positions of the contact members when the arms are in their normal unoperated positions.

The cooperating contact member 28*a* is mounted upon a spring arm 31 in a mounting block 32 supported by a cross member 33 that is secured to the interior of the casting frame 12. A terminal post 34 is provided for connecting any suitable circuit to the spring arm 31. The supporting block 32 is provided with a stop arm 35 for limiting the movement of the spring arm when the contact members 28 and 28*a* are opened. Each of the contact members 27*a*, 28*a*, 29*a* and 30*a* are mounted and supported by a spring arm in the same manner as the contact member 28*a*.

The casting 12 is provided with a lower outwardly extending chamber 37 with the underside of which a pipe connection 38 is joined to provide an entrance for such conductors as are to be secured to the connecting posts 34 and the contact members 27, 28 and 29.

The energizer for operating the arms 9 and 10 is shown in Figs. 5 and 6 as comprising a base or supporting plate 40, a plurality of coils 41, 42, 43 and 44, a plurality of cores 45, 46, 47 and 48, and a pair of inductor plates or fins 49 and 50. The supporting plate 40 is provided with a horizontally bent portion 51 at its lower end that is adapted to be seated on the top portion of the elevator car C, only a small portion of which is shown. A plurality of bolts 53 may be used to hold the base plate in position. A bracing web 54 connects the base portion 51 of the supporting plate with its vertical portion for the purpose of giving it a greater degree of strength and solidity. The coil 41 is mounted upon the core 45 and the coil 42 is mounted on the core 46, then a cover 57 is placed over them and secured to the cores by means of a plurality of screws 58. The two coils, their cores and the cover are then secured in vertical alinement on the front face and at one side of the supporting plate 40 by means of a plurality of screws 59. The coils 43 and 44, respectively, are mounted upon the cores 47 and 48; a cover 60 is then placed over them and they are mounted on the same side of the plate 40 as the other coils but close to its opposite edge by means of a plurality of screws 61 in the same manner as the coils 41 and 42 are secured to the plate. The cores and the plate are made of magnetizable material so that the coils are, in effect, mounted on the legs of a substantially U-shaped magnetizable structure. The outer ends of the cores 45 and 46 are connected vertically by the energizing fin 49 of magnetizable material and the magnetizable fin 50 is mounted on the free ends of the cores 47 and 48. A plurality of machine screws 65 are used to hold the fins in position on the ends of the cores.

The inductor relays mounted upon the hatchway wall by means of the bracket 14 and the energizer 6 mounted on the roof of the car at the edge adjacent the wall on which the inductor relays are mounted are disposed in such position that the fins 49 and 50 will embrace, but not touch, the switching arms 9 and 10 as the car moves up and down the hatchway, as shown in the top plan view of Fig. 2. When the coils are energized as the energizer is brought adjacent to the relay, a magnetic circuit passes through the cores 45 and 46, the supporting plate 40, the cores 47 and 48, the fin 50, the arm 10, the arm 9 and the fin 49 to the cores 45 and 46. This magnetic circuit causes the magnetizable arms 9 and 10 to move outwardly from their normal unoperated position as shown by the broken lines 66 to their operated position as shown in full lines toward the energizing fins 49 and 50 as shown in Figs. 2 and 3. The outward action of the arms 9 and 10 closes the contact members 27, 28 and 29 for operating the control circuit (not shown) in the manner for which the system may be designed.

In practice, it has been found that there are times when the contact members operated by the arms 9 and 10 will "freeze" or stick and thus remain closed after the energizer has been deenergized and moved away from the relay. In elevator systems, this is a serious matter. For instance, if an inductor relay is being used for controlling the opening and closing of a hatchway door and the contact members "freeze" in a closed position, the hatchway door associated therewith may not close but remain open when the car bearing the energizer leaves the floor at which the hatchway door is located. It may result in a sericus accident to some passenger. Of course, contact members on relays of this character do not stick or "freeze" very often to such an extent that the biasing weight or spring tension on the operating arms fails to open them. However, it is obvious that it is dangerous to take any risk in this direction. It is for this reason that we have provided a means for causing the operating arms

to break the contact members loose from each other if they should happen to "freeze" or stick when the car leaves the floor. In order to accomplish this desirable result, we mount a plurality of non-magnetizable fingers **66**, **67**, **68** and **69** upon the free ends of the magnetizable fins to trail behind the fins and knock the arms toward their unoperated position if they remain in their operated position after the energizer is withdrawn from them.

The finger **66** comprises a body portion of nonmagnetizable metal such as bronze, that is secured by a plurality of screws **71** to the upper end of the fin **49**. The upper end of the finger is bifurcated to provide a fork **72** in which a rubber tired wheel **73** is rotatably mounted by means of a pin **74**. It is obvious that, in elevator service, the fingers must not touch the relay arms when they pass unless the arms are in their operated position and even then must merely free them from their operated position when they stick in that position. For this reason, the finger **66** is bent or curved slightly inwardly so that the inner periphery of the wheel **73** travels in a plane **80** which overrides the plane **81** of the arm in its operated position but does not touch the plane **82** of the arm in its unoperated position. These plane lines are indicated in Fig. 2. With the wheel mounted as described, it will impinge against the outer face of the arm **9** as the car leaves the floor, if the arm **9** is still in its full operated position with its contact members **27** and **28** in their closed position. When the arm is in its full operated position and the wheel **73** strikes it, it causes the arm to start toward its unoperated position, thus breaking open the contact members **27** and **28**. Once the contact members are freed, the force of gravity on the arm **9** will cause it to move in toward the body of the relay into its normal unoperated position. The position of the trailing finger **66** is designed to cause the wheel **73** to start the arm **9** toward its normal unoperated position if it sticks in its operating position, but not to press the arm all the way into its unoperated position and not to touch the arm if the arm is in its unoperated position while the energizer is moved past it. The trailing arm **67** mounted on the upper end of the fin **50** is a duplicate of the arm **66** and is mounted to free the arm **10** if its contact members **29** stick in their closed position. The trailing fingers **66** and **67** are disposed on the upper ends of the fins for preventing the contact members on the relay from remaining closed after the car moves away from a floor while traveling in the down direction The trailing fingers **68** and **69** are mounted on the lower ends of the fins to prevent the contact members on the relay from remaining closed when the car moves away from a floor while traveling in the up direction.

It will be obvious that the contact members such as **27**, **28** and **29** on the relay may be so mounted that they will be in either a closed position or an open position when the relay is energized. In some cases, it is desirable to have a portion of a control circuit closed when the relay is energized but in another case it may be desirable to have a portion of a control circuit energized by the closing of the contact members on the relay when the relay is deenergized. In either case, the trailing fingers will cause the arms **9** and **10** to move out of their operated position as the car leaves the floor and will thereby provide for a safe operation of the contact members.

From the foregoing, it will be seen that we have provided an inductor relay and an energizer therefor, in which any tendency of the contact members to "freeze" or stick will be eliminated and every contact member will be operated positively when the relay is deenergized and will thereby prevent any accidents due to the circuits being controlled in a wrong manner by a relay when the car leaves the floor at which that relay is located.

It will also be obvious that the mounting of the cores and the coils on the magnetizable plate in the energizer provides a substantially U-shaped magnetic structure easily manufactured and assembled and very efficient in operation for causing the switch arms **9** and **10** to move outwardly. This simple construction also provides an energizer in which a plurality of coils may be used on the legs of the U-shaped magnets and then the U-shaped magnets may be connected vertically by the energizing fins and by the mounting plate which is also the main supporting element for the entire unit to provide a simple yet rugged construction.

We claim as our invention:

1. An energizer for an inductor relay comprising a magnetizable plate for magnetically operating a movable member to an operated position, a non-magnetizable trailing finger, and means for supporting the magnetizable member and the non-magnetizable finger, with the finger extending beyond the working face of the magnetizable member.

2. An energizer for an inductor relay comprising a magnetizable fin of greater length than width, a non-magnetizable finger mounted on one end of the magnetizable fin with its free end extending into a plane beyond the plane of the side surface of the magnetizable fin, and a mounting plate for supporting the fin.

3. An energizer for an inductor relay comprising a supporting plate of magnetizable material having a substantially flat portion, a pair of magnetizable cores disposed on one side of the plate and near opposite edges thereof, a magnetizable fin disposed on the outer free end of each core, and an electrical coil disposed on each core for inducing a magnetic field between the magnetizable fins.

4. An energizer for an inductor relay comprising a supporting plate of magnetizable material having a substantially flat portion, a pair of magnetizable cores disposed on one side of the plate and near opposite edges thereof, a magnetizable fin disposed on the outer free end of each core, an electrical coil disposed on each core for inducing a magnetic field between the magnetizable fins, and a trailing finger of non-magnetizable material disposed on each end of each fin.

5. An energizer for an inductor relay comprising a supporting plate of magnetizable material, two pairs of magnetizable cores mounted on one side of the plate, one pair of cores being disposed apart from each other near one edge of the plate and the other pair of cores being disposed apart from each other but near the opposite edge of the plate, a magnetizable fin mounted on and bridging the free ends of the two cores disposed near one edge of the plate, a second magnetizable fin mounted on and bridging the free ends of the two cores disposed near said opposite edge of the plate, and an electrical coil

disposed on each core for causing a magnetic field to be induced between the fins.

6. An energizer for an inductor relay comprising a supporting plate of magnetizable material, two pairs of magnetizable cores mounted on one side of the plate, one pair of cores being disposed apart from each other near one edge of the plate and the other pair of cores being disposed apart from each other, but near the opposite edge of the plate, a magnetizable fin mounted on and bridging the free ends of the two cores disposed near one edge of the plate, a second magnetizable fin mounted on and bridging the free ends of the two cores disposed near the opposite edge of the plate, an electrical coil disposed on each core for causing a magnetic field to be induced between the fins, and a trailing finger of non-magnetizable material disposed on each end of each fin with their free ends extending within the planes defined by the adjacent faces of the fins.

7. An electric relay comprising a pair of magnetizable arms, a pin for pivotally supporting the upper portions of the arms to permit their lower portions to close toward each other by gravity when no force is applied to move them outwardly, a plurality of contact members associated with the upper portions of the arms to be opened and closed by movement of the arms, and an energizer for magnetically moving said arms outwardly, said energizer comprising a U-shaped member of magnetizable material, a magnetizable fin disposed on the outer end of each leg of the U-shaped member to position the arms between them when the energizer is brought into cooperative position with the switching arms, and an electrical coil mounted on each leg of the U-shaped member for inducing a magnetic circuit through the U-shaped member, the fins and the arms to magnetically move the arms outwardly and thereby operate the contact members.

8. An electric relay comprising a pair of magnetizable arms, a pin for pivotally supporting the upper portions of the arms to permit their lower portions to close toward each other by gravity when no force is applied to move them outwardly, a plurality of contact members associated with the upper portions of the arms to be opened and closed by movement of the arms, and an energizer for magnetically moving said arms outwardly, said energizer comprising a U-shaped member of magnetizable material, a magnetizable fin disposed on the outer end of each leg of the U-shaped member to position the arms between them when the energizer is brought into cooperative position with the arms, an electric coil mounted on each leg of the U-shaped member for inducing a magnetic circuit through the U-shaped member, the fins and the arms to magnetically move the arms outwardly and thereby operate the contact members, and a non-magnetizable finger mounted on the end of each fin in position to physically engage and knock the arm associated with that fin if that arm remains in its operated position upon removal of the energizer from its operative position adjacent to the arms.

9. An inductor relay for an elevator car operating in a hatchway comprising a magnetizable arm, means for pivotally mounting the arm on the wall of the hatchway, a plurality of contact members associated with the arm to be opened and closed thereby, an energizer comprising a magnetizable member, means for mounting the magnetizable member on the car whereby movement of the car past the arm will move the energizer into position adjacent to the arm, an electrical coil for inducting a magnetic circuit in the magnetizable member and the arm when they are adjacent to each other for magnetically moving the arm into an operated position, and a non-magnetizable finger connected to one end of the magnetizable member and extending into a plane passing through the arm in its operated position whereby movement of the car and the magnetizable member away from the arm will cause the finger to knock the arm out of its operated position if it remains therein when the energizer leaves its position adjacent to the arm.

10. An inductor relay for an elevator car operating in a hatchway comprising a pair of contact members and a movable magnetizable arm for operating the contact members, an inductor plate, an electrical coil for causing a magnetic circuit through the arm and the plate when they are adjacent to each other to cause the arm to move from an unoperated position to an operated position, means for mounting the arm and the plate on the wall of the hatchway and the car whereby movement of the car in the hatchway will cause relative movement between the arm and the plate to bring them adjacent to each other when the car is at a predetermined position in the hatchway, and a non-magnetizable finger associated with the plate for starting the arm from its operated position to its unoperated position when there is a relative movement of the arm and the plate causing one to move away from the other.

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