

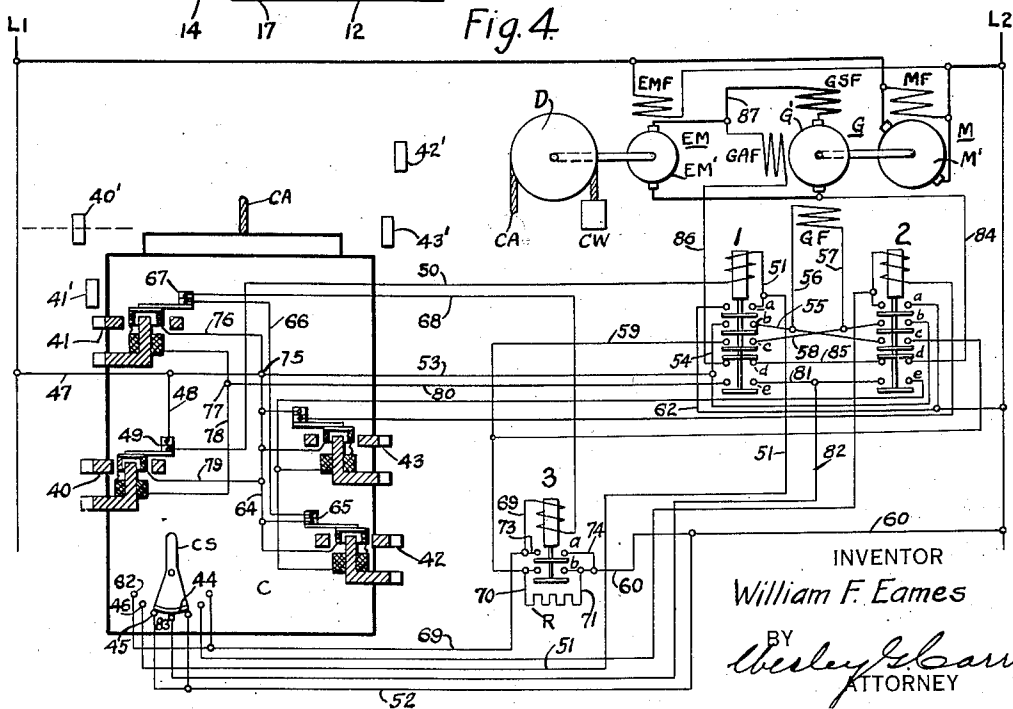
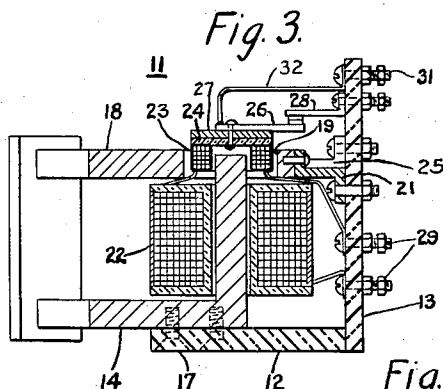
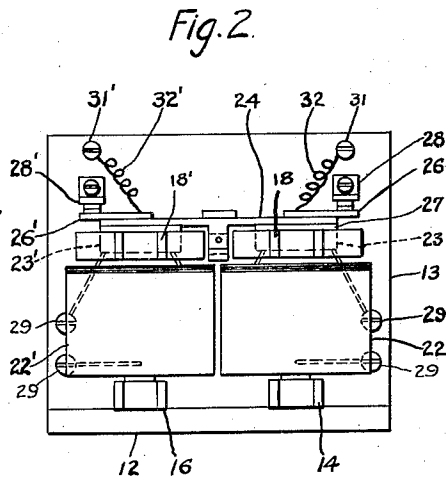
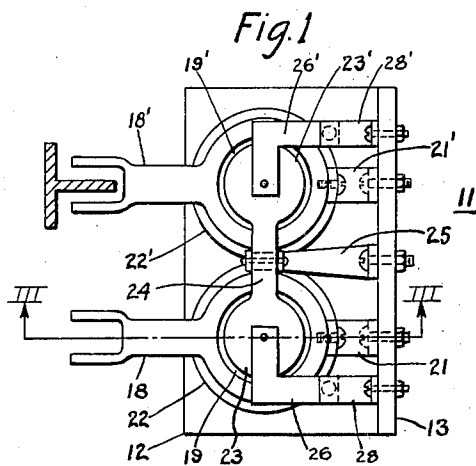
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W. F. EAMES

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DOUBLE COIL INDUCTOR RELAY

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DOUBLE-COIL INDUCTOR RELAY

Application filed June 18, 1929. Serial No. 371,754.

My invention relates to elevators and particularly to inductor relays used in elevator control systems.

5 An object of my invention is to provide a relatively simple, compact and easily manufactured and installed inductor relay.

Another object of my invention is to provide a double inductor relay embodying a plurality of coils and contacts.

10 A still further object of my invention is to provide an inductor-relay structure which shall be so constructed that variations in the supply-circuit voltage will not adversely affect its operation.

15 In practicing my invention, I provide a plurality of magnetizable plural-part yokes, each of substantially C-shape and each having a fixed and a movable coil operatively associated therewith. Contact members are
20 operatively associated with each movable coil to control a circuit.

In the drawing;

Figure 1 is a top plan view of a relay embodying my invention.

25 Fig. 2 is a view thereof, in front elevation, and

Fig. 3 is a view, in vertical section, taken on the line III—III of Fig. 1.

30 Fig. 4 is a diagram of connections of a simplified form of elevator-control system in which the inductor relay embodying my invention is to be used.

35 An inductor-relay structure 11 comprises a base plate 12 and an upright plate 13 which are preferably made of electric-insulating material and may be secured together in any suitable manner.

40 A pair of magnetizable yoke elements 14 and 16 are secured at the forward edge of the base plate 12, as by screws or bolts 17. Each of the members 14 and 16 is of substantially L-shape, and the horizontal portion thereof has a bifurcated end, substantially as shown in Fig. 1 of the drawing.

45 Members 18 and 18', also of magnetizable material, cooperate with the members 14 and 16, respectively, and have their forward ends also bifurcated while their rear ends are enlarged and provided with substantially circular openings 19 and 19', into which the

upper ends of the vertical legs of members 14 and 16 respectively extend. The members 18 and 18' are held in proper operative positions by brackets 21 and 21', respectively, which are preferably made of non-magnetic material and are suitably bolted against the vertical plate 13.

Members 14 and 16, respectively, have coils 22 and 22' mounted thereon and secured thereto in such manner that they will not move relative to the vertical legs of these members.

Movable coils 23 and 23' are secured to opposite ends of an arm 24 in such positions as to extend into the openings 19 and 19', respectively. Arm 24 is pivotally mounted, intermediate its ends, on a supporting bracket 25 also secured to the plate 13, in such position that the weights of coils 23 and 23' will be normally balanced.

70 A suitable contact member 26 is attached to coil 23 by insulating washer 27 to cooperate with a fixed contact member 28, secured to the upstanding plate 13. Similar contact members 26' and 28' are disposed to cooperate with coil 23'. The contact members 28 and 28' may be substantially rigid, and the contact members or arms 26 and 26' may be resilient, the relative location of these cooperating pairs of contact members or arms being such as to maintain the coils 23 and the arm 24 in balanced condition, substantially as shown in Fig. 2 of the drawing, in which position both pairs of contact members 26, 28 and 26', 28' are in operative engagement.

85 The coils 22 and 23 associated with member 14 are connected together in series-circuit relation and are also connected to contact terminals 29 mounted on the plate 13. Contact terminals 31 and 31' are provided at the upper end of the plate 13 to which the contact members or arms 26 and 26' are respectively connected, as by wire shunts 32 and 32'.

90 An inductor relay of this kind is adapted for use in a control system of the kind which is disclosed and claimed in patent application Serial No. 731,921, filed August 14, 1924, by E. M. Bouton and assigned to Westinghouse Electric & Manufacturing Company.

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Fig. 4 of the drawing illustrates a simplified diagram of connections of a system of control embodying inductor relays of the character shown in the preceding figures.

- Referring more particularly, therefore, to Fig. 4 of the drawing, an elevator car designated by C is to be moved upwardly and downwardly and is suspended by a cable CA running over a drum D and having a counterweight CW secured to its other end. The drum D is rotated by a motor EM having an armature EM' preferably directly secured to, or connected with, the drum.

- Means for energizing the motor EM comprises an individual power plant embodying a motor M having an armature M' driving the armature G' of a generator G. The generator G is also provided with a series field winding GSF and an auxiliary demagnetizing field winding GAF wound in opposition to winding GSF. The motor is provided with a shunt field winding MF, and the armatures M' and G' may be mechanically connected to each other.

- The generator G is provided also with a separately excited field winding GF which is adapted to be selectively energized to vary the direction and value of the voltage output of the generator armature G', the terminals of G' being connected directly to the terminals of the armature EM, the series field GSF being, of course, included in this circuit. A combination of this kind is usually known as a Ward-Leonard system of control.

- The motor EM is provided also with a separately and continuously excited field winding EMF.

- The direction and speed of movement of the elevator car C is illustrated as controlled by an up-direction switch 1 and a down-direction switch 2 operable to determine the direction of voltage output of the generator G, and a speed relay 3 for controlling the value of the voltage output of the generator.

- Up-direction switch 1, down-direction switch 2 and speed relay 3 are, in turn, controlled by means of a car switch CS mounted upon the car for manipulation by an attendant.

- For initiating deceleration and stopping of the car, as it approaches the various floors which it serves, I have illustrated an up stopping inductor relay 40 and an up slow-down inductor relay 41 for initiating deceleration of the elevator and for stopping the same, when the car successively passes inductor plate 41' cooperating with up slow-down relay 41 and another inductor plate 40' cooperating with up stopping inductor relay 40, as the car successively approaches each of the floors. In like manner, I have provided a down slow-down relay 42 and a down stopping inductor relay 43 cooperating with inductor plates 42' and 43' as the car approaches the floor, when travelling downwardly.

While, for purposes of simplicity of illustration, I have shown, in Fig. 4, the up stopping inductor relay 40 and the up slow-down inductor relay 41 as being entirely separate, it is to be understood that these relays will be combined into a single unit, such as is illustrated in Figs. 1 to 3, the stopping inductor relay 40 representing the arms 14 and 18, coils 22 and 23 and, in fact, all of the structure on one side of the pivotal suspension of the arm 24, whereas the up slow-down relay 41 represents members 16 and 18', coils 22' and 23' and all of the structure located on the opposite side of the pivotal suspension of arm 24. In like manner, the down slow-down inductor relay 42 and down stopping inductor relay 43, illustrated as separate relays, will, in fact, comprise portions of another relay unit, such as is illustrated in Figs. 1 to 3.

It will be observed that the two portions of relay structure 11, each constituting, in effect, a single relay, are disposed in different vertical planes so that, by arranging inductor plates 40' and 41' for operating up slow-down inductor relay 41 and up stopping inductor relay 40 in corresponding different vertical planes, the forked ends of the members 18 and 18', respectively, may be brought into operative relation to the corresponding inductor plates 41' and 40' without the possibility of the slow-down inductor plate operating the stopping relay and vice versa.

Let it be assumed that the operator wishes to cause the car to ascend. He will operate the lever of the car switch CS to the right so that the arcuate segment 44 thereof will engage contact members 45 and 46. This will establish a circuit which may be traced as follows: from supply-circuit conductor L1, shown at the left-hand side of Fig. 4 of the drawing, through conductors 47 and 48, to the contact members 49 controlled by the stop inductor relay 40 (which may be contact members 26 and 28 of a relay 11, as shown in Figs. 1, 2 and 3), through conductor 50, the coil of up-direction switch 1, conductor 51, contact members 46, 44 and 45 of car switch CS and, through conductor 52 and 60 to supply-circuit conductor L2.

This energizes the coil of up-direction switch 1 which operates to cause certain of the contact members thereof to be brought into operative engagement with each other. A circuit through the field winding GF is energized as follows: from conductor L1 through conductors 47, 53 and 54, the contact members b on up-direction switch 1, conductors 55 and 56, field winding GF, conductors 57 and 58, contact members c on up-direction switch 1, conductor 59, resistor R and conductor 60 to supply-circuit conductor L2. This energizes the field winding GF of the generator to a predetermined de-

gree, and a predetermined voltage is thereby generated in the armature G' and supplied to the armature EM' which will, therefore, rotate in a predetermined direction at a predetermined speed. In this case, the direction is such as to cause the car C to move upwardly.

Up-direction switch 1, when energized, completes a holding circuit for the coil of this switch which extends from supply-circuit conductor $L1$, through conductors 47 and 48, contact members 49 of stopping inductor relay 40, conductor 50, coil of up-direction switch 1, conductor 51, contact members a on up-direction switch 1 and conductor 62, to supply conductor $L2$.

If the operator desires to cause the car to move at a higher speed, he moves the car switch CS further to the right so that the conducting segment 44 thereof will engage contact members 45 and 62. A circuit for speed relay 3 is thereby established which extends from conductor $L1$, through conductors 47 and 64, the contact members 65 of down slow-down inductor relay 42, conductor 66, the contact members 67 of up slow-down inductor relay 41, and conductor 68, to the coil of speed relay 3, through conductor 69, contact members 62, 44 and 45 of car switches and conductors 52 and 60, to supply conductor $L2$. Speed relay 3, when energized, short-circuits resistance R through conductors 70 and 71 and contact members b on relay 3, to thereby cause the car to travel at high speed.

Speed relay 3, when energized, also completes a self-holding circuit which extends from line conductor $L1$, through conductors 47 and 64, contact members 65 of down slow-down inductor relay 42, conductor 66, the contact members 67 of up slow-down inductor relay 41, conductor 68, the coil of relay 3, conductors 69 and 73, contact members a of speed relay 3 and conductors 74 and 60, to supply conductor $L2$.

If the operator desires to cause the car to stop at a predetermined floor, he will move the car switch to its substantially central position, as shown in Fig. 4 of the drawing, whereby an energizing circuit for the coils of relays 40 and 41 is established which extends from line conductor $L1$, through conductor 47, to a junction point 75, where one branch extends through conductor 76, the two coils of inductor relay 41, in series relation, to a junction point 77 on conductor 78, while the other branch extends from junction point 75, through conductors 64 and 79, the two coils of relay 40 and conductor 78, to junction point 77 whence the reunited circuit extends, by way of conductor 80, to the contact members c on up-direction switch 1, conductors 81 and 82, contact members 83, 44 and 45 of car switch CS and conductors 52 and 60 to line conductor $L2$.

Referring again to Figs. 1, 2 and 3, it will be observed that energization of the coils 22' and 23' of the relay 41 will cause a magnetic flux to flow from coil 22', through the leg 16 of the core, the air gap between leg 16 and member 18' and coil 23', to the upstanding portion of core member 16. At the same time, a magnetic flux, produced by coil 22, embraces the horizontal leg of core member 14, the air gap between core 14 and member 18, coil 23 and back to coil 22.

It will, therefore, be apparent that the pull on coils 23 and 23' will balance each other, and the arm 24 will not be moved. However, as car C approaches the floor at which it is desired to stop, an up slow-down inductor plate 41' enters the forked ends of members 16' and 18' and thereby reduces the reluctance of the magnetic path for coils 22' and 23', since the flux now passes through a small air gap from member 16' to the inductor plate 41' and through another small air gap to member 18' while the magnetic circuit for coils 22 and 23 will not be changed. Hence, the increased pull on coil 23' overbalances that of coil 23 and coil 23' will be moved downwardly, thereby separating contact members 26' and 28'.

It will be remembered that contact members 26' and 28' represent the contact members 67 of the relay 41 shown in Fig. 4, and opening of these contact members breaks the holding circuit for speed relay 3 to thereby initiate deceleration of the car by reinserting resistor R in the circuit for generator field winding GF .

In like manner, when the inductor plate 40' comes into operative relation to the inductor relay 40, the holding circuit hereinbefore described for the coil of up-direction switch 1 is interrupted, so that the energization of field winding GF is interrupted and the elevator motor is deenergized.

Means for quickly stopping the motor is provided to include normally-closed contact members d on direction switches 1 and 2, closing a circuit which may be traced as follows: from one terminal of the armature G' , through conductor 84, contact members d on down-direction switch 2, conductor 85, contact members d on up-direction switch 1, conductor 86, field winding GAF and conductor 87 and field winding GSF to the other terminal of armature G' . Any current produced by generator G will, therefore, flow through the field winding GAF , creating a flux opposing that which caused the current, and the generator voltage will be reduced to zero.

When the operator desires to have the car move downwardly, he moves the handle of the car switch CS to the left, and the same cycles of operations will follow this time, however, through down-direction switch 2 instead of the up-direction switch 1.

It is, therefore, considered unnecessary to describe all of these circuits in detail.

The inductor-relay structure embodying my invention thus provides a relatively simple double-inductor relay embodying a minimum number of parts which cooperate for the desired purpose, in the manner hereinbefore set forth. It is obvious that, as the contact arms 26, insulatedly mounted on the balanced lever arm 24, will permit of the operation hereinbefore set forth, the contact members 26 and 28 at the one end of the arm remain closed when that end of the arm moves upwardly, while the contact members 26' and 28' on the other end of the arm will be disengaged as that end moves downwardly.

Slight mis-alignment of the inductor plates 40' and 41' relative to the forked ends of the arms 14, 16 and 18 will not affect the operation of the relays for the reason that any increase in the length of air gap on one side will be compensated for by the decrease in length of the air gap on the other side, so that the total reluctance of the magnetic circuit will not be varied appreciably.

It is also evident that, as the two coils 23 and 23' are normally balanced, any variation in the voltage of the supply circuit energizing the inductor-relay coils will not adversely affect the operation of the moving parts of these relays for the reason that any variation in the voltage affects both sets of coils simultaneously.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof and I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or are set forth in the appended claims.

I claim as my invention:

1. An inductor-relay structure cooperating with an inductor plate including a magnetic yoke, a plurality of relatively movable coils operatively associated with said yoke and normally energized and a switch actuated by the relative movement of said coils.
2. An inductor-relay structure including a normally open-circuit magnetic yoke, a pivotally mounted energizable coil and a fixed energizable coil on said yoke, a switch disposed for actuation by the pivotally mounted coil, and an inductor plate movable relatively to the yoke to complete the magnetic circuit thereof.
3. An inductor relay including a normally open-circuit magnetic yoke, a normally energized pivotally mounted coil and a normally energized fixed coil on said yoke, a normally closed switch disposed for actuation by the pivotally mounted coil, and an inductor plate movable relatively to the yoke to complete the magnetic circuit thereof to effect an opening movement of the switch.
4. An inductor relay including a normally

open-circuit magnetic yoke, an energizable pivotally mounted coil and an energizable fixed coil on said yoke, a normally closed switch resiliently supported on the pivotally mounted coil and an inductor plate movable relatively to the yoke to complete the magnetic circuit thereof to effect movement of the pivotally mounted coil and of the switch.

5. An inductor relay including a plurality of normally open-circuit magnetic yokes located in spaced relation to each other, a stationary energizable coil on each yoke, a movable energizable coil operatively associated with each yoke, means pivotally supporting said movable coils in balanced relation, circuit-controlling switches operatively associated with each movable coil, and a plurality of inductor plates movable relatively to the yokes to selectively effect the closing of the magnetic circuit of a yoke, the movement of a pivotally mounted coil, and the operation of a switch.

6. An inductor relay including a plurality of normally open-circuit magnetic yokes located in spaced relation to each other, a stationary energizable coil on each yoke, a movable energizable coil operatively associated with each yoke, means pivotally supporting said movable coils in balanced relation, a plurality of circuit-controlling switches each individually operable by movement of a corresponding movable coil, and a plurality of inductor plates movable relatively to the several yokes to effect selective closing of the magnetic circuit of a yoke, the movement of a pivotally mounted coil and the operation of a cooperating switch.

7. An inductor relay including a pair of spaced magnetic yokes, each of substantially U-shape, a stationary energizable coil on the intermediate portion of each yoke, a movable energizable coil adjacent each stationary coil, means for pivotally supporting said pair of movable coils in balanced relation, a switch for each of said movable coils operable by movement thereof, and a plurality of inductor plates movable relatively to the several yokes to effect selective closing of the magnetic circuit of a yoke, the movement of the movable coil associated therewith, and the operation of the associated switch.

8. In an inductor-relay, a normally open-circuit magnetic yoke, a plurality of energizable relatively movable coils associated with said yoke, a switch operable by relative movement of said coils, and an inductor plate relatively movable with respect to said yoke for completing the magnetic circuit thereof, for effecting the relative movement of said coils, and for effecting the operation of said switch.

9. In an inductor-relay, a normally open-circuit magnetic yoke, a stationary energizable coil on said yoke, a movable energizable coil disposed adjacent to said stationary coil, a switch operable by movement of said mov-

able coil, and an inductor plate movable relatively to the yoke for completing the magnetic circuit thereof, for effecting movement of the movable coil, and for effecting the operation
5 of said switch.

In testimony whereof, I have hereunto subscribed my name this 14th day of June, 1929.

WILLIAM F. EAMES.

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