Aug. 17, 1965 C. H. HOLDRIDGE 3,200,905

ELEVATOR DOOR INTERLOCK

Filed March 1, 1962 2 Sheets-Sheet 1

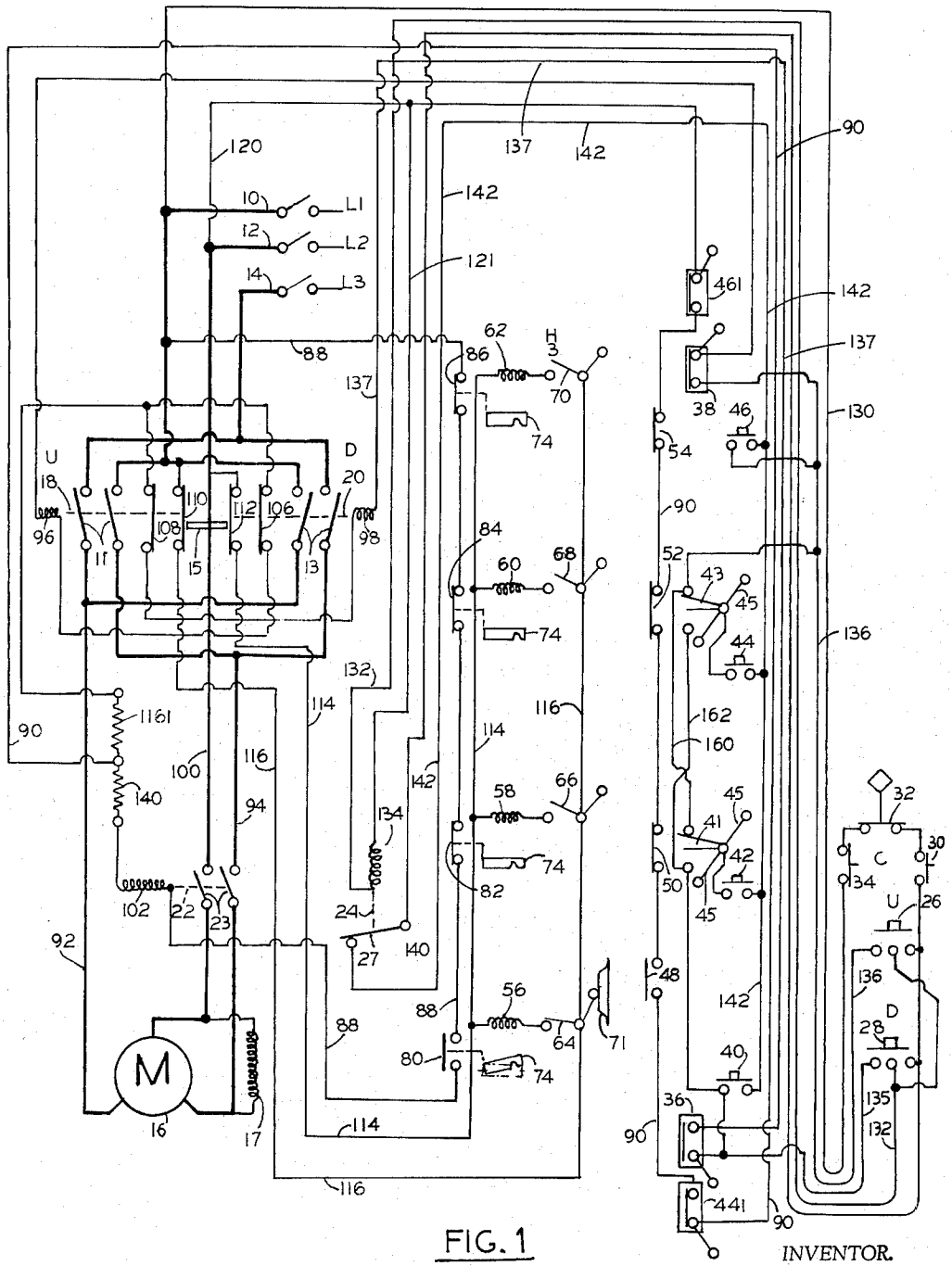

FIG. 1

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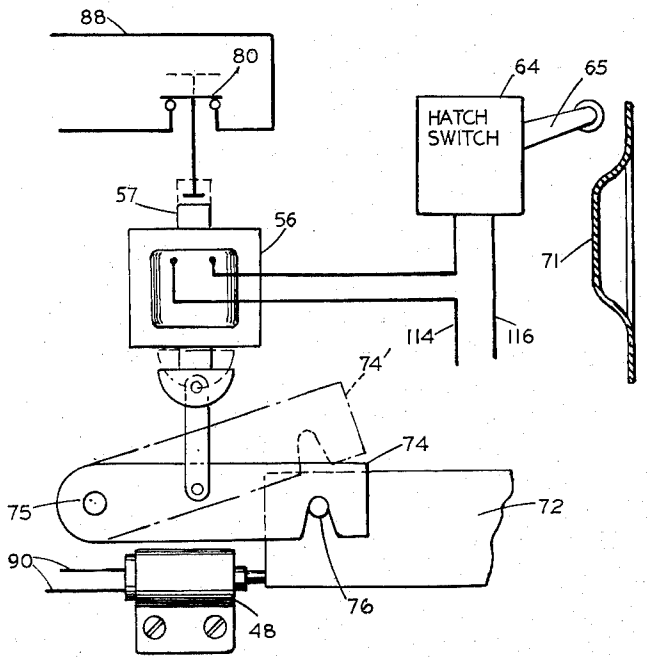

FIG. 2

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ELEVATOR DOOR INTERLOCK

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1 Claim. (Cl. 187—31)

This invention relates to an elevator door interlock circuit employing a car carried cam coacting with hatch switches in circuit with hatch door lock actuating solenoids.

In elevators, provision is made for releasing a hatchway door interlock, when the car reaches the hatchway level. Car carried cams coacting with interlock release cam followers at each hatchway have been proposed. In order to prevent interlock release temporarily while a car is moving past each hatchway a motor operating retiring cam has been proposed, such cam being car carried, and retracted, so as not to engage the interlock cam followers at hatchways while the car is in motion. Such motor operated retiring cams are costly, and further do not protect against failure of the hatchway interlock door releases to relock after each release.

The present invention is directed to interlock circuit wherein the need for a retiring cam is eliminated, by low cost switches of the micro switch type, which are associated with each door interlock release so as to open a circuit so long as the door release remains in unlocked position. Since such door releases are usually actuated by solenoids having moving armatures, the jamming or failure of the armature to return the release to lock position, upon deenergization, may leave a hatchway door free for opening at any time, irrespective of a retiring cam, the only effective purpose of the latter being to eliminate temporary door interlock release upon a car moving past a hatchway.

The circuit of the present invention employs at each hatchway, a switch closed only upon mechanically positioning of the interlock door release in door locked position and closure of all such switches, disposed in a series circuit, is rendered essential by interconnection with the solenoid, of the potential switch controlling the ultimate application of power to the car hoist motor. The invention further has to do with circuitry for deenergizing the hatchway door interlock release solenoids at such times as the direction switch is closed, the closure of the latter being essential to hoist motor energization.

The above and other features of the invention will appear more fully hereinafter from the following detailed description when taken in conjunction with the accompanying drawings. It is expressly understood that the drawings are employed for purposes of illustration only and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claim.

In the drawings wherein like reference characters indicate like parts:

FIGURE 1 is an elevator operating circuit diagram employing the hatchway door interlock of the present invention; and

FIGURE 2 is a diagrammatic illustration of a hatchway door interlock and operative means associated therewith, forming a part of the circuit of FIGURE 1.

In the drawings, there is shown a three phase line comprising conductors 10, 12 and 14, a three phase reversible car operating motor 16, having a magnetic brake 17, solenoid actuated up and down direction switches 18 and 20, a solenoid actuated potential switch 22, and a non-interference relay 24. The elevator car C is provided with up and down control switches 26 and 28, a safety switch 30, a governor switch 32, and a gate contact switch 34.

The elevator shaft is provided with lower and upper limit switches 36 and 38 for the bottom and top floors respectively and intermediate over center second and third floor switches 41 and 43, and over travel switches 441 and 461, all acted upon by a car carried actuating cam as will be understood in the art.

At each floor are control button switches 40, 42, 44 and 46. Additionally at each floor are latch switches 48, 50, 52 and 54, which are closed by the respective hatchway doors, when the doors are in the position assumed when latched, as by the ordinary manually operated door latch or bolt, not shown, but which is well understood in the art. At each hatchway door are interlock safety latch release solenoids 56, 58, 60 and 62, and interlock safety latch release switches 64, 66, 68 and 70, in series circuit with their respective solenoids, the switches being closed by a car carried cam 71, illustratively shown at the first floor level, with switch 64 cammed closed.

In FIGURE 2, there is shown a schematic diagram of the interlocking switches associated with each hatchway door interlock. As shown, the door 72 is in door closed position, as it would be if bolted by the ordinary manually operated door latch or bolt hereinabove referred to. The door, when so positioned is additionally held against opening by an interlock safety latch 74, which may be pivoted as at 75, to the door frame, and engage a door pin 76 when in safety latched position. The door upon being placed in normally closed position engages a latch switch such as 48, and holds the same closed. The latch switches 48, 50, 52 and 54 are disposed in a series circuit 90, which if opened precludes elevator operation.

The interlock latch 74 is adapted to be moved to the unlatched position indicated at 74', to permit opening the door 72, by energization of the solenoid 56, the armature 57 of which lifts the interlock latch 74. The solenoid 56 is in circuit with a hatch switch 64, which has a cam follower actuator 65 that is engaged by the car carried cam 71, to close the switch 64, when the car is in the immediate region of being level with the hatchway door. Upon energization of the solenoid 56 and the raising of the interlock latch 74, the armature 57, opens a potential switch such as 80, which is in a series circuit with potential switches 82, 84 and 86 located at each of the other hatchways in association with the respective interlock latch solenoids, and in a series circuit 88, the completion of which is made essential to elevator car operation. It will be seen from FIGURE 2, that unless switch 48 is closed by the door being in closed position, and unless switch 80 is likewise closed, and the circuits 90 and 88 completed by similar conditions at the other hatchways, movement of the elevator car is prevented. The door 72 may be in the closed position and manually latched, or bolted but unless the interlock latch 74 is in latching engagement with the pin, the armature 57 will not permit switch 80 to close. Thus the switch 80 is held open by positive mechanical action unless interlock latch is in latched position. Thus any failure, or sticking of the solenoid armature in the interlock release position prevents car operation.

Referring to the motor circuit, it will be seen that the source of three phase current lines 10 and 14 are connected to the switch blade contacts 11 and 13 of the up and down direction switches 18 and 20, which contacts 11 and 13 are normally open, and closed only in response to energization of the respective up or down switch operating solenoids 96 or 98. Mechanical interlocking to allow but one of switch contacts 11 or 13 to close at any time is indicated at 15. In addition electrical interlocking is provided for by contacts 106 and 108 of switches 20 and 18, which contacts 106 and 108 are normally closed when the switch contacts 11 and 13 are open. The contacts 106 are in circuit with solenoid 96,

and contacts 108 are in circuit with solenoids 98, so that upon the closure of switch contacts 11, contacts 108 open the circuit to solenoid 98, and upon closure of the switch contacts 13 the contacts 106 open the circuit to solenoid 96, and electrical interlocking is thus provided for. The contacts 11 and 13 are connected to motor leads 92 and 94 and the direction of motor rotation depends on which of contacts 11 and 13 are closed. Line 12, through lead 100, and line 94 lead to the motor 16 through the switch contacts 23 of the potential switch 22, which is closed by energizaion of the solenoid 102.

The up and down directional switches 18 and 20 are provided with additional switch contacts 110 and 112 respectively, which are normally closed when the switch contacts 11 and 13 are open. The contacts 110 and 112 are connected to the lines 10 and 12, and to a parallel circuit 114 and 116 embracing the door interlock solenoids 56, 58, 60 and 62, and their respective car cam actuated switches 64, 66, 68 and 70. It will be seen that unless the up and down switches 18 and 20 are both open as respect motor contacts 11 and 13, the parallel circuit 114 and 116 is deenergized and thus no actuation of any door interlock solenoid to latch release or open position is possible. Switches 11 and 13 must both be open and the car hoist motor deenergized, before a door solenoid can be energized.

Referring to the circuit diagram, it will be seen that closure of the car up switch 26, for example, will complete a circuit from line 10 through lead 130 and 132 to solenoid 134 of non-interference switch 24 to open the contacts 27 thereof, the solenoid being connected to line 12 through lead 121. Opening the contacts of switch 24 opens the circuit from lead 130, lead 140 and lead 142 connected to the hatchway button switches 40, 42, 44 and 46, thereby preventing interference therefrom during operation from the car switch 26. The car switch 26 also completes a circuit through lead 136 through upper limit switch 38 to the up solenoid 96, through down switch contacts 106 through current limiting resistor 116, and thence through series circuit 90, including limit switch 441, hatch door switches 48, 50, 52 and 54, and limit switch 461 (all of which must be closed) to lead 120 connected to line 12. Up switch 18, being energized by solenoid 96 closes contacts 11, and opens contacts 108 and 110, the latter contacts 110 deenergizing door solenoid circut 114 and 116, whereby door interlock latch 74 will be released to drop into position and saftey latch the door at the lower level, permitting switch 80 to close.

The previous circuit established though lead 90 to line 12 energizes potential switch solenoid 102 to close contacts 23, the circuit 88, leading through potential switches 80, 82, 84 and 86 to line 10, being completed. The magnetic brake 17 is energized to brake release position and the hoist motor operates in the up direction.

When the car reaches a desired floor, such as the second floor at hatchway button 42, release of the up button 26, opens the circuit to up switch solenoid 96, opening contacts 11, and stopping the car. The car cam 71 closes solenoid interlock switch 66, releasing interlock latch 74 at solenoid 58, the circuits 114 and 116 being reenergized by closure of up switch contacts 110. Energization of solenoid 58 to open its interlock latch 74, immediately opens potential switch 82, opening circuit 88, and deenergizing solenoid 102 of potential switch 22, and opening the contacts 23 thereof.

Had the operator desired to proceed to the thrid or fourth floor hatchway, and maintained contact of up button 26, the circuit leads 114 and 116 would remain dead during continued closure of contacts 11 due to the open switch 110, so that interlock door latches associated with solenoids 58 and 60 would have remained in safety lock position, except upon stoppage of the car due to opening of contacts 11.

Operation of the car from any one of the hatchway positions results from establishment of the same circuits except interference solenoid 134 is not energized and the circuit to the hatchway buttons 40, 42, 44 and 46 is completed through the contacts 27 of the non-interference switch 24 which completes a circuit between leads 140 and 142. It will be observed that hatchway buttons 42 and 44 are in circuit with over center switches 41 and 43 respectively, which are flipped or thrown from the position shown by passage of the car upward therepast, the car having cam means engaging the arms 45 of the switches for the purpose. Thus if the button switch 42 be closed, and the car is at a higher level, switch 41 has been shifted from the position shown in which a circuit is established between switch 42 and lead 160, to the position establishing a circuit between switch 42 and lead 162. Tracing lead 160, will show it to be connected to lead 135, which was energized by car up button 26, to energize up solenoid 96. Tracing lead 162, will show it to be connected to a corresponding lead 135 from car down button 28 which is in circuit with lower limit switch 36, and lead 137 extending to the down switch solenoid 98.

Thus the car position above or below the intermediate hatchways will automatically respond in correct travel direction in response to actuation of hatch button 42 or 44, by reason of the positions taken by switches 41 and 43, as the car passes by.

From the foregoing it should be readily apparent, that hatchway switch 40, or car down button 28, when closed, will bring the car down, unless the car is at the first floor hatchway, in which case limit switch 36 is open, and the circuit thus broken to solenoid 98. Similarly hatchway switch 46 will bring the car up unless located at the fourth floor hatchway, in which case limit switch 38 is opened and solenoid 96 deenergized.

While in FIGURE 2 a diagrammatic illustration of the mechanical features of the interlock are shown as it might be applied for example to a sliding door, it will be apparent that it is applicable to such doors whether vertically or horizontally sliding, as well as hinged doors. The safety feature requiring that the interlock latch must be mechanically in latch position to close potential switch circuit 88; and that the interlock solenoids 56, 58, 60 and 62 are all deenergized when the car is in motion, assures that no door may be opened without stopping the car at a hatchway level. No car operation can be had unless every door be closed and circuit 90 is thus completed and all safety interlock latches are in latch position, so that circuit 88 is completed. Thus no door may be opened without breaking two control circuits, with the car at a hatchway level. Further the interlock solenoids remain deenergized so long as the car is in motion and no energization of any solenoid can take place, except as the car is brought to rest at a hatchway.

While a single modification of the invention has been illustrated and described, it is to be understood that the invention is not limited thereto. As various changes in the construction and arrangement may be made without departing from the spirit of the invention, as will be apparent to those skilled in the art, reference will be had to the appended claim for a definition of the limits of the invention.

What is claimed is:

An elevator door interlock comprising a hatchway, a hatchway door, latch contacts closed only when said door is in closed position, a safety interlock means comprising a solenoid operated lock member to release and lock said door when in closed position, said solenoid releasing said door only when energized potential switch contacts associated with said solenoid held open when said interlock means is in door release position, an elevator car carried fixed cam, a switch connected in series with said solenoid and associated with said hatchway and having a cam follower for switch actuation to closed position and engaged by said car carried cam whenever the car is at the hatchway level, a hoist motor for said car,

a solenoid actuated directional switch and a solenoid actuated potential switch for energizing said motor, means actuated by said directional switch when in closed circuit position for deenergizing said lock member solenoid, a series circuit including the solenoid of said potential switch and said potential switch contacts to prevent closure of said solenoid potential switch when said potential switch contacts are open, and a circuit in series with the solenoid of said directional switch and said latch switch to prevent closure of said directional switch upon said latch switch being in open circuit.

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