This invention relates to an improved mechanism for operating an elevator hatch door and interlock.

Modern elevator mechanism have a sliding door on the elevator car and a separate sliding door on the hatch at each floor landing, and the hatch door is provided with an interlock. The interlock on the hatch door includes an electric switch which is in the elevator operating control circuit, so that when the interlock is disengaged and the hatchway door is unlocked, the switch is open and the elevator cannot operate.

The elevator car carries a door operating mechanism for opening the sliding door on the car, and the present invention is directed to an electromagnetic clutch mechanism by means of which the interlock is disengaged and the hatch door is opened or closed with the elevator car door.

Thus, the principal object of the present invention is to provide a very simple, positively operating clutch mechanism which not only operates the hatch door in conjunction with the car door but also disengages the hatch door interlock at the beginning of an opening operation to unlock the hatch door and break the operating circuit, and re-engages it as a door closing operation finishes to lock the door and close the circuit.

A further object of the invention is to provide such a mechanism which may be readily adapted to the modernization of existing equipment already in service.

Yet another object of the invention is to provide such a device in which the clutching of the hatch door to the car door is effectuated by means which may be controlled through an electric circuit, so that the entire operation may not really coordinate through electrical means alone, the operation of the elevator car and the leveling of the car at a given floor landing.

The invention is illustrated in a preferred embodiment in the accompanying drawings in which:

FIG. 1 is a fragmentary elevational view of an elevator car door and hatch door as viewed from the elevator car, with parts of the car door broken away;
FIG. 2 is a fragmentary broken elevational view on an enlarged scale of the interlock mechanism and its operating linkage, the parts being shown in full lines in the engaged position of the interlock and in broken lines in a position which the parts occupy with the hatch door partly open;
FIG. 3 is a fragmentary section taken as indicated along the line 3—3 of FIG. 2 with the interlock engaged;
FIG. 4 is a view similar to FIG. 3 with the interlock disengaged;
FIG. 5 is a fragmentary section taken as indicated along the line 5—5 of FIG. 3; and
FIG. 6 is a fragmentary section taken as indicated along the line 6—6 of FIG. 4.

Referring to the drawings in greater detail, an elevator hatchway is provided with a doorway 10 (see FIGS. 3 and 4) which is formed in a wall 12 and has a frame 11 including an upper metal frame member 12. Mounted on the upper frame member 12 are brackets 13 which in turn bear an interlock mechanism, indicated generally at 15 and 15a, which are connected at their upper ends by a bar 16. As seen in FIGS. 2, 3 and 4, each of the door carriages includes a front frame plate 17 in the upper portion of which is journed a grooved carrier roller 18 which rides on an arcuate top surface of the track 14, and in the lower portion of the frame plate 17 is a small guide roller 19 which rests upon the bottom of the track. Brackets 20 at the bottom of the carriages 15 provide mountings for hanger bolts 21 upon which is suspended a door 22. As seen in FIGS. 1 and 2, the door 22 has a safety edge 23 of resilient material which abuts the door frame 11 when the door is closed.

An elevator car, a portion of which is shown fragmentarily as 24 in FIG. 1, is provided with a conventional sliding door 25, which has a resilient safety edge 26 abutting the wall of the elevator car 24 when the door is closed.

Referring particularly to FIGS. 2, 3 and 4, an interlock mechanism, indicated generally at 27, is provided for the hatch door 22. The interlock mechanism has a fixed portion secured to an angle bracket 28 on the track 14 above that portion of the door frame which the safety edge 23 of the hatch door 22 abuts when the door is closed. Surrounding the bracket 28 is a supporting frame 29a for a fixed interlock lug 29 along side of which is a fixed switch block 30 having an inclined forward face 31 on which is mounted a fixed electric switch contact 32. The interlock mechanism 27 also has movable portions which include an interlock arm 33 pivotally mounted on a stud 34 on the door carriage 15. The interlock arm 33 is provided at its forward end with a depending hook-like nose 35 which is adapted to engage behind the latch lug 29 as seen in FIG. 2, while the arm 33 adjacent the nose 35 is a switch block 36 having an inclined face 37 which is complementary to the inclined face 31 of the fixed switch block 30. On said inclined face 37 is a spring loaded switch contact 38 which is so positioned that when the interlock arm swings about pivot 34 the contact 38 slides across the fixed switch contact 32 which tends to keep the contact clean and prevent burning.

The operating mechanism for opening and closing the hatch door 22 and for moving the interlock arm 33 so as to unlock the arm and open or close the hatch door 22 and 38 includes an electromagnetic clutch mechanism indicated generally at 39 which is mounted on the car door 25, and a hatch door and interlock operating mechanism indicated generally at 40 which is mounted on the hatch door 22.

As seen in FIGS. 1 and 6, the electromagnetic clutch mechanism 39 includes a vertically extending channel member 41 provided at its upper and lower end portions with cross spindles 42 on which are mounted a pair of rubber clutch members 43 which are provided with aligned central recesses 44. Between the rubber clutch members 43 is a pair of vertically spaced electromagnets, indicated generally at 45, the pole pieces of which have spaced flanges 46 which project forward of the clutch members 43 flanking a line through the recesses 44 of said members.

The hatch door and interlock operating mechanism 40 includes a horizontal channel bracket 47 on the inside of the hatch door 22 which is mounted for lateral adjustment by a screw and slot connection indicated at 48. The parallel horizontal flanges 47a of the channel bracket 47 afford mountings for an arm pivot pin 49 on which a clutch arm is pivotally mounted. At the front of the clutch arm 50, directly aligned with the recesses 44 in the rubber clutch members 43, is an upright ferrous metal clutch piece 51 which is adapted to be attracted by the electromagnets 45 when the latter are energized. As seen in FIGS. 5 and 6, the clutch arm 59 is provided with a set screw 52 which may be adjusted to press the arm against the wall. The channel bracket 47 to permit adjustment of the normal angular disposition of the arm 50 with respect to
the hatch door 22 and of the space between the clutch piece 51 and the electromagnets 45; and a projecting portion or boss 50 of the arm 52 is engaged with the clutch piece 51 to form a stud 54 for a compression spring 55 which serves normally to urge the arm 50 to the inactivated position seen in FIG. 5. A stud 56 on the brackets 47 serves as a guide for the other end of spring 55.

Exerting pressure on the hatch door 22 from the lower flange 47a of the channel bracket 47 is an angle member 57 which, adjacent the margin of the hatch door 22, is provided with a bushing 58 to receive an axially slidable and pivotable upright interlock operating rod 59 the upper end of which is adjustably secured to the interlock arm 33 immediately forward of its pivot 34. Adja-

cent the bushing 58 on the interlock rod 59 is a clamp 60 in which is a pivot 61 to receive one end of an inclined interlock operating link 62 the other end of which is adjustably secured to a bracket 63 on the clutch arm 50 adjacent the ferrous clutch piece 51. As seen in FIG.

5, when the clutch piece 51 is in its normal position, the interlock actuating link 62 is substantially parallel to the face of the hatch door 22 and, upon actuation of the electromagnet 45 on the car door 25, the movement of the ferrous metal clutch piece 51 swings the arm 52 outwardly on its vertical pivot 49 which pulls the adjacent end of the interlock operating link 62 away from the door, thus axially rotating interlock rod 59. The inclined position of link 62 causes this movement to elevate interlock rod 59 so as to move the interlock arm 33 about its pivot 34 and unhook it from the hatch lug 29, at the same time opening the switch contacts 32 and 38.

Preferably the clutch piece 51 consists of a ferrous metal pipe in the ends of which are wooden end pieces 51a, so that both ends of the clutch piece are positioned in front of the rubber clutch members 43 before the electromagnets act on the clutch piece. This prevents any direct engagement of the clutch piece with the electromagnets, which could cause chattering or slammimg.

The operation of the device is believed to be clear from the foregoing detailed description. The elevator car 24 is provided with conventional driving means and a conventional control system for the driving means which may be either manually operated from the elevator car or automatically by push button. The operating mechanism and its control means cooperate in the usual manner to move the elevator car up and down the hatchway as desired, and to stop the elevator car at a floor landing which is provided with a hatch door such as hatch door 22. The components of the interlock (not shown) including a separate operating motor by means of which the car door 25 may be moved between its closed position as seen in FIG. 1 and an open position. The car door operating mechanism is of conventional design and, accordingly, is not shown; and it is wired into the control circuits for the elevator driving means in a conventional way by which it is assured that the elevator car door will only start to open when the car is stationary at a floor, or nearly so.

Immediately upon stopping of the car at a floor or at a predetermined time in the car leveling operation, the electromagnets 45 are energized to pull the ferrous metal clutch piece 51 from the normal position of FIG. 5 to the engaged position of FIG. 6. The movement of the clutch piece is continued and it is then urged toward the interlock operating rod 62 and operating rod 59, disengages the interlock arm 33 to unlock the hatch door and break the elevator operating circuit, so that the hatch door is free to move to the left along with the car door 25; and substantially simultaneously the door operating motor on top of the elevator car is energized to slide the car door 25 and hatch door 22 to the left, as seen in FIGS. 5 and 6. When the car door returns to its closed position, it carries the hatch door 22 along with it, and upon completion of the door closing movement, the electromagnets 45 are de-energized so as to release the clutch piece 51 and permit the compression spring 55 to return the clutch piece 51 and the idler of parts 49 to the normal positions of FIG. 5, which returns the interlock arm 33 to its engaged position, as seen in FIG. 2 and 3, and closes the interlock switch contacts 32 and 38, thus locking the hatch door 22 and closing the operating circuit. The switch contacts 32 and 38 are in the main control circuit for the elevator driving mechanism, so that as long as the contacts 32 and 38 are open it is not possible to operate the elevator car.

Whether the energization of the electromagnets 45 occurs when the car is absolutely stationary, or during the last of a leveling operation, is immaterial to the functioning of the operating mechanism of the present invention.

The present device is especially advantageous where an existing elevator mechanism is being modernized by the substitution of an automatic hatch door operation for a manual one; because the hatch door tracks often are not parallel to the car door tracks, and the device here disclosed and claimed operates satisfactorily in spite of such inaccuracies.

The foregoing description is given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, for some modifications will be obvious to those skilled in the art.

We claim:

1. In an elevator system having a hatchway with a wall, an elevator car mounted for movement in the hatchway, a sliding car door on said car, means for controlling the movement of said car, and door operating means on the car operable as the car stops at a floor landing, hatch door mechanism at said floor landing comprising: a fixedly mounted hatch door; a movable interlock member on the hatch door releasably engaged with a fixed interlock member on the hatchway wall; electromagnetic clutch means on the car door energizable upon stopping of the car at the floor landing, said clutch means including a rubber clutch member with a recess facing the hatch door; an upright ferrous metal clutch piece movably mounted on the hatch door in front of said recess to be drawn magnetically into clutching engagement with said clutch member upon energization of the electro-magnetc to releasably secure the doors together before there is any movement of the car door; and an interlock actuating linkage connecting said clutch piece to the movable interlock member to disengage said member as the clutch piece is drawn into clutching engagement.

2. In the vacuum of claim 1 the interlock means are provided with end portions of non-magnetic material.

3. In an elevator system having a hatchway with a wall, an elevator car mounted for movement in the hatchway, a sliding car door on said car, means for controlling the movement of said car, and door operating means on the car operable as the car stops at a floor landing, hatch door mechanism at said floor landing comprising: a slidable mounted hatch door; a movable interlock member on the hatch door releasably engaged with a fixed interlock member on the hatchway wall; electromagnetic clutch means on the car door energizable upon stopping of the car at the floor landing; a conveying magnet means on the car door engagingly connected to said arm in front of the clutch means and movable into engagement therewith by swinging of the arm on its pivot upon energization of the electro-magnet; a vertically movable operating rod on the hatch door which is operatively connected with the movable interlock member; an operating link connecting said rod to the clutch piece so that movement of the clutch piece into engagement with the clutch means lifts said rod to unlock said interlock member.

4. In an elevator system having a hatchway with a
wall, an elevator car mounted for movement in the hatchway, a sliding car door on said door, means for controlling the movement of said car, and door operating means on the car operable as the car stops at a floor landing, hatch door mechanism at said floor landing comprising: a slidable mounted hatch door; a movable interlock member on the hatch door releasably engageable with a fixed interlock member on the hatchway wall; electro-magnetic clutch means on the car door energizable upon stopping of the car at the floor landing, said clutch means including a pair of vertically spaced rubber clutch members having vertically aligned recesses facing the hatch door; a clutch arm mounted on an upright pivot on the hatch door; means for adjusting the minimum angle of said arm with respect to the hatch door; spring means urging said arm toward said minimum angle; an upright ferrous metal clutch piece on said arm in front of said recesses and movable into clutching engagement with the rubber clutch members by swinging of the arm on its pivot upon energization of the electromagnet; a vertically movable operating rod on the hatch door which is operatively connected with the movable interlock member; and an operating link connecting said rod to the clutch arm so that movement of the clutch piece into engagement with the clutch means lifts said rod to unlock said interlock member.

5. In an elevator system having a hatchway with a wall, an elevator car mounted for movement in the hatchway, a sliding car door on said car, means for controlling the movement of said car, and door operating means on the car operable as the car stops at a floor landing, hatch door mechanism at said floor landing comprising: a slidable mounted hatch door; a movable interlock member on the hatch door releasably engageable with a fixed interlock member on the hatchway wall; electro-magnetic clutch means on the car door energizable upon stopping of the car at the floor landing; a clutch arm mounted on an upright pivot on the hatch door with its free end opposite the clutch means; means for adjusting the minimum angle of said arm with respect to the hatch door; spring means urging said arm to said minimum angle; a ferrous metal clutch piece on the free end of said arm and confronting the clutch means to be drawn magnetically toward the car door into clutching engagement upon energization of the electromagnet; a vertically movable operating rod on the hatch door which is operatively connected with the movable interlock member; and an inclined operating link connecting the free end of the clutch arm to a point on said rod which is vertically displaced from said arm so that movement of the clutch arm on its vertical pivot as the clutch piece moves into clutching engagement with the clutch means lifts said rod to disengage said interlock member.

6. In an elevator system having a hatchway with a wall, an elevator car mounted for movement in the hatchway, a sliding car door on said car, means for controlling the movement of said car, and door operating means on the car operable as the car stops at a floor landing, hatch door mechanism at said floor landing comprising: a slidable mounted hatch door; a movable interlock member on the hatch door releasably engageable with a fixed interlock member on the hatchway wall; electro-magnetic clutch means on the car door energizable upon stopping of the car at the floor landing; a clutch arm mounted on an upright pivot on the hatch door; means for adjusting the minimum angle of said arm with respect to the hatch door; spring means urging said arm toward said minimum angle; a ferrous metal clutch piece on said arm in front of the clutch means and movable into engagement therewith by swinging of the arm on its pivot upon energization of the electromagnet; and an interlock actuating linkage connecting said clutch arm to the movable interlock member to disengage said member as the clutch piece is drawn into clutching engagement.

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