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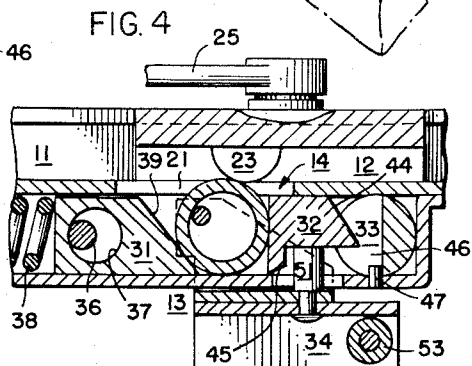
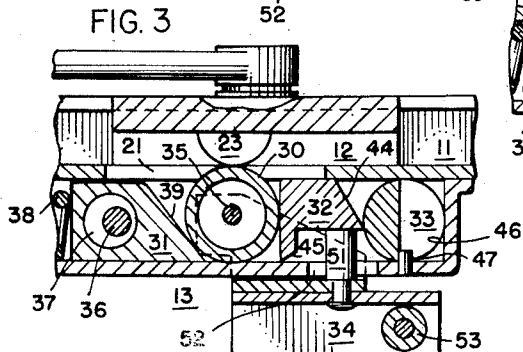
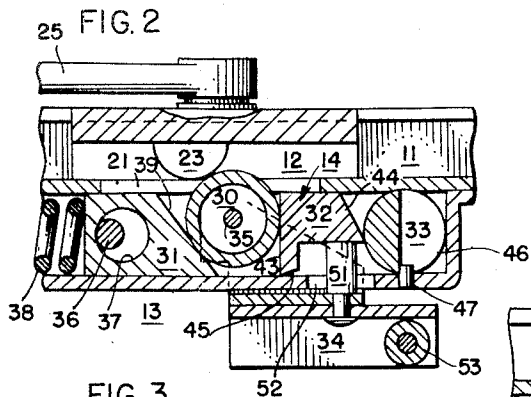
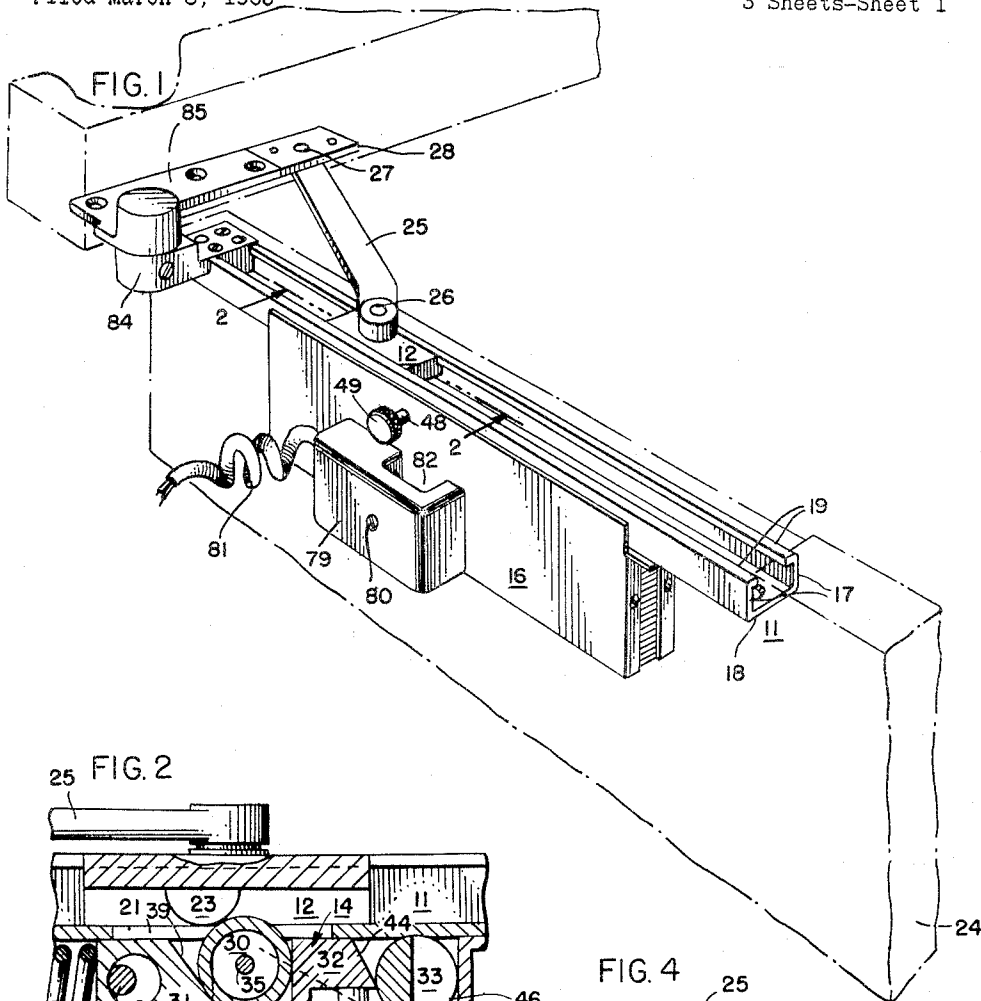
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3,164,404

AUTOMATIC HOLD-OPEN RELEASE

Filed March 8, 1963

3 Sheets-Sheet 1



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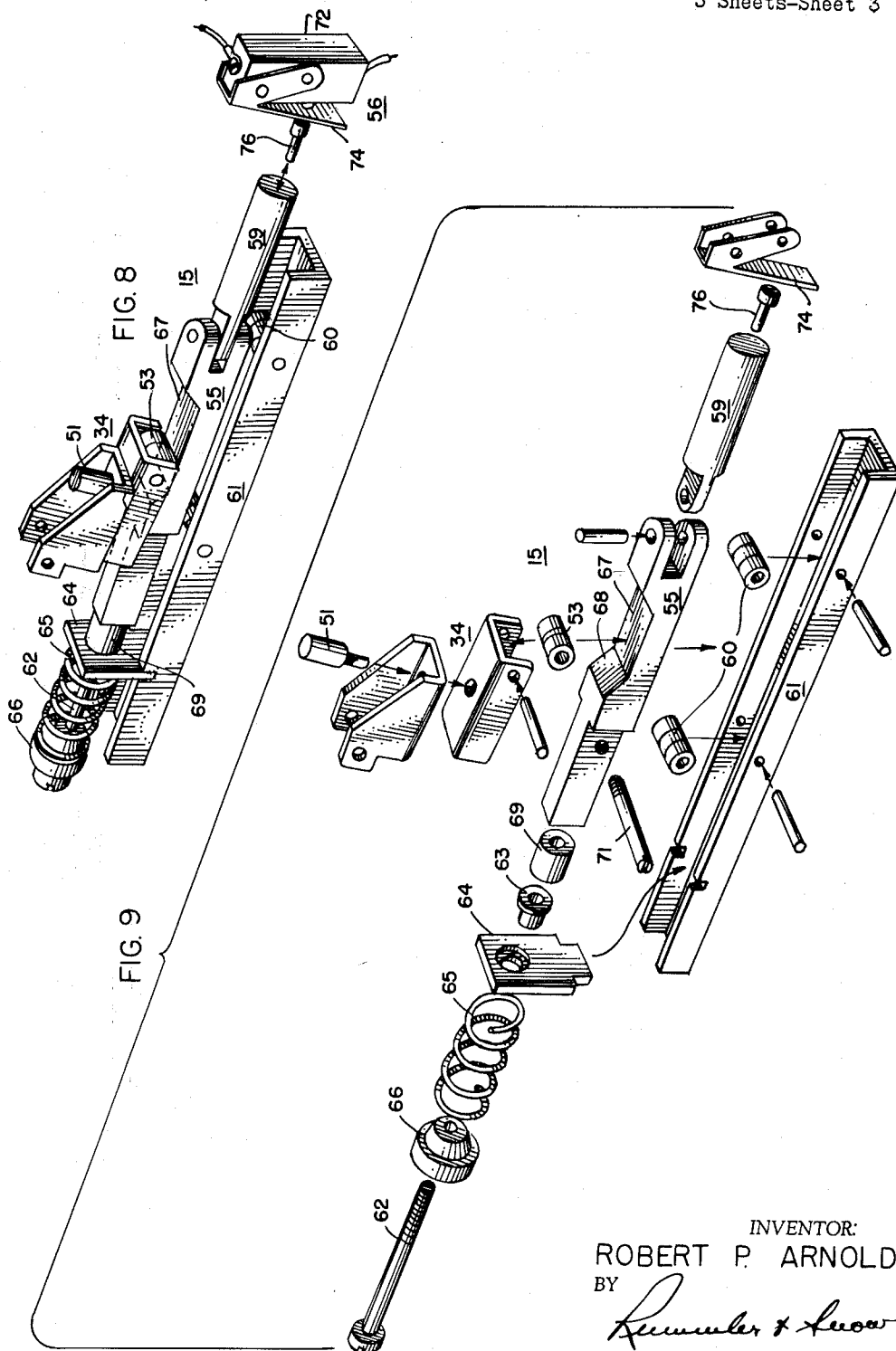
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3 Sheets-Sheet 3



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AUTOMATIC HOLD-OPEN RELEASE

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10 Claims. (Cl. 292-273)

This invention relates to electrically-controlled means for rendering inactive a normally operable door hold-open mechanism.

Public buildings, such as hotel, office, factory and the like, have fire-doors for closing passages connecting the various sections of the building. These doors are usually equipped with automatic devices for closing the doors, one purpose being to lessen the hazard of fire in one part of the building reaching another part through the connecting passages. However, there are times when it is desirable to retain these doors open to promote the circulation of air and/or permit constant traffic between the several sections of the building. Such retention of the door in open position is generally achieved by a manually releasable hold-open means adapted to counteract the influence of the automatic-door closing device which is biased to normally close the door upon the release of the force causing the door to open. However, in the event of fire or other emergency it is desirable to provide for the simultaneous remotely actuated release of all hold-open means that may be in operation.

Thus, the main objects of this invention are: to provide improved electrically-controlled motor means for releasing a hold-open mechanism for an automatically-closed door; to provide an improved means of this kind particularly adapted for controlling a door hold-open latch means which is normally biased to retain in retracted position an element reciprocally movable along a track by a link arm activated by the movement of the door; to provide an improved motor-means for this purpose, including a normally energized solenoid arranged for compact association with a hold-open mechanism recessively mountable either in the door or the door frame; to provide an improved means for preventing the automatic reactivation of the hold-open mechanism following its emergency release by electrical means; to provide improved hold-open release means automatically operated upon electric current failure and requiring manual reactivation of the hold-open mechanism; and to provide an improved electrical hold-open release means of this kind which is so simple in construction as to make very economical its manufacture for inclusion in currently-produced and/or currently-in-use conventional types of door hold-open mechanisms involving a latch-retained, track-mounted reciprocable element.

In the adaptation shown in the accompanying drawings:

FIGURE 1 is a perspective view of a preferred form of door hold-open mechanism equipped with an electric latch-means release constructed in accordance with this invention;

FIG. 2 is an enlarged, fragmentary, longitudinal, sectional view taken on the plane of the line 2-2 of FIG. 1, showing the latch means in "on" position for retaining a door open;

FIG. 3 is a view similar to that of FIG. 2 but showing these parts in the relative position they assume when the door is manually forced into or out of a hold-open position;

FIG. 4 is a view similar to FIG. 2 but showing the relative positions these parts assume when manually adjusted to "off" position to permit the automatic closing of the door under the unrestrained action of an automatic door-closing device;

FIG. 5 is a longitudinal, sectional view of an improved electric motor-means, constructed in accordance with this

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invention, as arranged in a supplemental housing for controlling the latch-means shown in FIGS. 2 and 3, the motor means being shown inactivated to permit the automatic retraction of the latch means from the door hold-open position shown in either FIG. 2 or 3;

FIG. 6 is a transverse, sectional, elevation taken on the plane of the line 6-6 of FIG. 5;

FIG. 7 is a fragmentary, partly broken view similar to FIG. 5 but showing the electric motor-means, when energized by electric current, holding the latch means in the "on" position shown in FIG. 2, subject to automatic release upon failure of current to the motor-means for causing the latch means to assume the position shown in FIG. 5;

FIG. 8 is a perspective view of the assembled electric motor-means and associated hold-open release means; and FIG. 9 is an exploded perspective view of the device shown in FIG. 8.

The essential concept of this invention is to provide an electric motor operated means for retaining a door hold-open mechanism in its activated position to engage and hold a track-supported reciprocable element adapted to control the closing movement of a door, said means being subject to release of the hold-open mechanism in the event of current failure to the motor, and the motor being reactivatable only after a manual operation of the release means to restore it to its operative hold-open position.

An automatically releasable, door hold-open mechanism embodying the foregoing concept comprises a track 11 mounting a reciprocable slide block 12 and on the under side of which track 11 is fixed a guideway 13 enclosing a latch means 14 controlled by a motor-means 15 enclosed in a housing 16 suspended from the track 11 embracively below the guideway 13.

The track 11, as best shown in FIG. 1, is a channel bar the parallel sides 17 of which extend up from a base 18 and terminate in opposed inwardly turned flanges 19. The base 18 has formed therein openings 21 and 22 (see FIG. 5) the purpose of which will be explained presently.

The slide element 12 here is shown as an inverted-channel like, rectangular-shaped slide block dimensioned for reciprocable movement, longitudinally along the track 11 within the sides 17 and flanges 19, across the opening 21 to move a shoulder 23, disposed within the slide block (see FIGS. 2 and 6), into and out of position for engagement with the latch means 14 to hold open a door 24, normally urged toward its closed position by a conventional door-closing device not shown. The reciprocation of the element 12 on the track 11 is effected by a link arm 25 pivoted at one end by a pin 26 to the element 12 and connected at its other end by a pin 27 fixed to a plate 28, the possible locations of which track and plate will be explained later.

The guideway 13 is secured to the under face of the track 11, below the openings 21 and 22, to mount the latch means 14 which is subject to the hereinafter explained activation to engage the shoulder 23 on the slide block 12 for retaining the latter in its retracted position for holding open a door 24, as circumstances may require.

The latch means 14, as herein shown, is the same as that disclosed and claimed in Patent No. 2,887,194, except only for its adaptation for use with the hereinafter described motor means 15 for holding the latch means in its operative position. Such latch means 14 (as shown in FIGS. 2 to 5 inclusive) comprises a catch 30, a cam block 31, a pawl 32, a stop 33 and a rocker arm 34. Under the counteracting forces of a spring 38 and the stop held pawl 32, the catch 30 is held in elevated position where it is engageable with the element shoulder 23 to releasably hold open the door 24 against the action of an automatic door-closing device.

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The catch 30 here is shown in the form of a hollow cylinder in axial width somewhat less than the distance between track sides 17 so as to fit into the open bottom of the slide block 12 between the legs thereof. In diameter, the catch 30 is equal to or slightly less than the vertical distance between the inner face of the base of the guideway 13 and the inner face of the base 18 of the track 11. Also, the catch 30 embraces a pin 35, spanning the guideway 13 adjacently under the track-base opening 21, for retaining the catch 30 in operable position in the guideway 13.

The cam block 31 is slidably supported in the guideway 13 for opposite reciprocation under the influence of a spring 38 to the extent permitted by a fixed pin 36, which extends through a transverse opening 37 in the cam block to limit its back and forth movement. The spring 38 embraces a threaded bolt 40 anchored at 41 to the guideway 13 and on which is mounted a knurled spring tensioning nut 42 exposed through the opening 22, the spring 38 bearing between the nut 42 and the back side of the cam block 31 to normally urge the front side cam face 39 into engagement with the cylindrical surface of the catch element 30.

The pawl 32 is somewhat L-shaped, with the ends of the angled arms tapered as at 44 and 45, and is disposed in the guideway 13 in inverted position, between the catch 30 and the stop 33, with the rear face 43 of the pawl facing the catch cylinder 30. The pawl 32 normally rests on the end 45 of its vertical leg and is normally held in upright position by means of a peg or post 51 which engages the underside of the horizontal leg of the pawl. However the pawl 32 is tiltable forwardly on the edge 45 between the opposite positions as shown in FIGS. 2-4 and in FIG. 5, respectively, by removal of the supporting peg or post 51, as will be explained. In the one position of the pawl 32, the catch cylinder 30 is maintained in elevated position between the cam block 31 and the pawl for engagement with the shoulder 23 to retain the slide element 12 in its retracted position on the track 11, as shown in FIG. 2. In the other position of the pawl 32, the catch cylinder 30 is free from such slide retaining position by reason of the dropping of the pawl support post 51 due to lowering of the bracket 34 as shown in FIG. 5. In this position the pawl falls forwardly, increasing the space between the pawl and the cam surface of the cam block 31, so that the catch 30 falls below the track 11.

The stop 33 here is shown as a cylindrical body with a diametrically transverse slot 46 into which projects a fixed pin 47. A shaft 48 concentrically secured to the stop 33 extends exteriorly of the guideway 13 and mounts a knurled knob 49 whereby the stop member 33 is oppositely turnable through one-half revolution, as limited by the pin 47 in the slot 46, to turn the hold-open means "on" or "off." In one such position of the stop 33 (FIGS. 2 and 3) the solid body of the stop engages the pawl 32 and holds it from horizontal movement in the guideway 13. In this position the hold-open means is "on." In the other position of the stop 33 (FIG. 4) the slot 46, which is made wider axially than the pawl leg 44, faces the pawl and the pawl is shifted horizontally by the catch cylinder, the pawl end 44 entering the slot 46, so as to permit the catch 30 to drop to the base of the guideway 13 and out of the track path of the slide block 12. Thus a manually operated means is provided for making the hold-open operative or inoperative as may be desired.

The rocker arm 34, most clearly shown in FIGS. 8 and 9, comprises a pair of channel-shaped parts mounted together back-to-back, one of which parts straddles the guideway 13 and is hinged on the pin 35 for swinging between an elevated position, in parallel relationship with the under face of the guideway 13 (FIGS. 2-4 and 7), and a lowered or retracted position as shown in FIGS. 5 and 8. A post 51, fixed on the rocker arm 34, extends up through a hole 52 in the bottom of the guideway 13

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to engage the underside of the leg 44 of the pawl 32. This post 51, as before mentioned, normally supports the pawl 32 in operative position in the guideway 13 and by reason of its being carried by the rocker arm 34 this post 51 and its function is under the full control of the motor means 15 acting against a cam roller 53 journaled on the under side of the rocker arm 34 at a point furthest from its hinge on the pin 35.

Generally, and as indicated in FIG. 5, the motor means 15 is an electro-magnetic device and comprises a solenoid 54, a cam bar 55, a microswitch 56 and an actuating spring means 57.

The solenoid device 54 has its frame fixed interiorly in the housing 16 by screws 58, at the end remote from the guideway 13. The armature 59 of the solenoid device is secured to the adjacent end of the cam bar 55.

The cam bar 55 is reciprocally mounted on a pair of spaced rollers 60 journaled in a channel-shaped support 61 which, in turn, is mounted fixedly in the housing 16. A threaded bolt 62 is secured to the end of the bar 55 opposite the armature connection and is slidably supported on a bearing 63 seated in a vertical plate 64 fixed on the channel-shaped support 61. The head end of the bolt 62 extends beyond the plate 64 and is embraced by a compression spring 65 interposed between a bushing 66 on the bolt 62 and the plate 64. The spring 65 normally biases the bar 55 rearwardly and thus opposes the force of the energized solenoid 54 acting on the armature 59. Adjacent its connection to the armature 59 the bar 55 is recessed at 67 and the rearward end surface of the recess is inclined to form an angled cam surface 68 for engagement with the roller 53 on the end of the rocker arm 34 whereby the linear movement of the bar 55, in one direction or the other, raises or lowers the rocker arm 34 relative to the guideway 13, thereby controlling the functioning of the latch means 14.

It will now be apparent that when the solenoid device 54 is energized, the armature 59 will be pulled into the hollow solenoid coil thus shifting the cam bar 55 to the right, as seen in FIG. 7, against the action of the spring means 57. When the solenoid is de-energized, however, the armature is instantly released and the tensioned spring 65 pulls the cam bar rapidly to the left, as seen in FIG. 5. In order to cushion the impact of the spring actuated cam bar at the end of its rearward stroke, a rubber, or comparable composition, collar 69 is positioned on the bolt 62 between the rearward end of the bar 55 and the plate 64. As shown, the bar 55 also mounts a laterally projecting post 71 extending outwardly through a slot in one side of the housing 16 (FIG. 6). This post 71 is for manual resetting of the cam bar 55 of the motor-means 15 after the current failure condition has been corrected, as will be hereinafter explained.

The switch means 56 comprises a conventional, normally-open microswitch 72 mounted on a bracket 73 which in turn is fixed on the end of the frame of the solenoid device 54. A spring arm 74, secured to the microswitch 72 extends across the switch actuating button 75 in position for depression by an axially shiftable pin 76, mounted in the opposed end of the solenoid frame, when the solenoid 54 is activated and the armature 59 is pulled into the solenoid coil. Such movement of the armature 59 causes the inner end of the armature to engage the pin 76 and force it against the spring arm 74 to cause a depression of the button 75 to close the microswitch 72.

Wires 77 lead from the solenoid 54 through the microswitch 72 to a terminal block 78 enclosed in a small box or cover member 79 secured exteriorly on the housing 16 by a screw 80 (FIG. 1). A suitable flexible cable 81 leads from the terminal block 78 to a controlled source of electric current, preferably by way of a wall mounted receptacle, not shown, located adjacent the hinged side of the door. The box 79 also encloses the post 71, access

to which is had through suitable openings 82 in the top and bottom sides of the box 79.

The herein described hold-open device is shown, in FIG. 1, as recessed into the top edge of a door 24, as is quite conventional with door hold-open mechanisms. The door may be mounted on vertically-aligned hinges or pivots 84, such as the one shown in FIG. 1, one part of which is integrated with a mounting plate 85 secured to the door-frame cross piece. Thus, it will be understood that the link-arm pivot-plate 28 may be made as an integral part of the hinge plate 85.

The operation of this improved automatically releasable door hold-open mechanism is as follows:

Upon installation of the mechanism and its connection to a controlled source of current, the parts will normally be in the condition shown in FIG. 5 and to activate the mechanism, a tool, such as a screw driver, has to be inserted through the opening 82 in the box 79 (FIG. 6) to press the post 71 in the direction to shift the cam bar 55, against the action of the spring 65, to the limit of the movement permitted by the retraction of the armature into the coil 57. At the limit of such movement the pin 76 will be depressed by the armature 59 to flex the spring arm 74 and thereby close the circuit through the micro-switch 72. Thereupon the solenoid 54 will become energized and the armature 59 will be retained in such activated position until there is a failure of current to the solenoid 57, either accidentally or intentionally.

The shifting of the cam bar 55 to the activated position will cause the cam surface 68 acting on the roller 53 to elevate the rocker arm 34 into the position shown in FIGS. 2-4 and 7 wherein the post 51 holds the pawl 32 in its upright operative position. Assuming that the stop 33 is in the "on" position, as shown in FIGS. 2, 3 and 5, the raising of the pawl 32, pressing the tapered face 44 against the stop 33, will shift the pawl to the left, as viewed in the drawings, and force catch 30 against the cam face 39 and into the elevated position shown in FIG. 2. Thereupon a manual swinging of the door 24 into open position will cause the slide element 12 to move along the track 11, to the left as seen in the drawings, and bring the shoulder 23 which is semi-circularly rounded, into engagement with the cylindrical catch 30. The force on the door to swing it open will cause the shoulder 23 to depress the catch 30, momentarily retracting the cam block 31 against the spring 38, to permit the shoulder 23 to pass beyond the catch 30, as shown in FIG. 3, to the position shown in FIG. 2. The tension of the spring 38 is such as to hold the catch 30 in elevated position and thereby retain the element 12 in this retracted position, against the normal force of any closing mechanism, and to maintain the door 24 open. However, the door 24 may be swung into closed position merely by applying sufficient manual pressure against the free edge of the door to cause the shoulder 23 to cammingly depress the catch 30 against the cam block 31 so as to retract it against the force of the spring 38. Because of the leverages involved, a relatively small force on the free edge of the door is ample to overcome the hold-open action.

Should the door 24 be held in open position and there be a failure of current, for any reason, to the solenoid 54, the spring 65 will snap the cam bar 55 rearwardly to the position shown in FIG. 5. Thereupon, the rocker arm 34 will be released to retract the pawl support post 51 and the pawl 32 will fall forwardly into the angled position shown in FIG. 5. This will provide space to receive the catch cylinder, out of the path of the slide block 12, and the door 24 will be free to close under the action of its automatic door-closing device.

Upon a restoration of current through the cable 81, the solenoid 57 will not be re-activated automatically, since the switch means 56 still remains open. Thus, in a building having a great number of doors equipped with such electric-release mechanism, restoration of current

will not result in a sudden heavy power surge in the building circuits. Moreover, time will be permitted to inspect each and every door mechanism to see that it is in proper functioning condition. That being determined the motor means 15 for each door is individually re-activated by the manual pressuring of the post 71 to shift the armature 59 back into the coil 57 and to close the holding circuit through the microswitch 72.

If at any time it is deemed necessary to have the door 24 remain closed, subject to opening only as persons pass through the passage way in which the door is located, the stop member 33 may be turned by the knob 49 into the position shown in FIG. 4. Then, the pressure of the spring 38 will push the block 31 only to the limit permitted by the pin 36, and any force on the catch cylinder 30 will cause it to move the pawl 32 into the slot 46 in the stop member 33, as shown in FIG. 4. Whereupon the catch 30 will rest on the bottom of the guideway 13, out of position to engage the shoulder 23 on the slide block element 12.

The main advantages of this invention reside in the fact that the hold-open mechanism is a "fail-safe" device which can function as a hold-open means only so long as an energizing current can be supplied; in the fact that the improved mechanism can be electrically integrated into a master building electrical system so that a current failure, by any remotely located means, will result in the automatic release of every door for closing; in the arrangement whereby the hold-open function can be re-activated only by individual manual adjustment for each door; and in the fact that when the device is activated it will function as a typical mechanical hold-open, allowing manual movement of the door in or out of hold-open position.

Although but one specific embodiment of this invention has been herein shown and described it will be understood that numerous details may be altered or omitted without departing from the spirit of this invention as defined by the following claims.

I claim:

1. An automatically releasable door hold-open mechanism comprising, a slide element adapted for reciprocable movement relative to a door and along a predetermined path, a link arm pivoted at one end to the slide element and having its other end adapted for pivotal connection at a fixed location for effecting the reciprocation of the slide element along said path into and out of a retracted door hold-open position by movement of the door, latch means shiftable into and out of the path of the slide element for normally retaining the slide element in its retracted position, electric motor means for normally holding the latch means in the path of the slide element so long as the motor means is energized, said motor means being adapted to release said latch means upon being de-energized, and resiliently yieldable means normally co-acting with said motor means to support said latch means in the path of said slide element and adapted to yield for retraction of said latch means upon the application of a predetermined force against the latch means by said slide element being urged along said path by said link arm.
2. An electrically-releasable, door hold-open mechanism as set forth in claim 1 wherein a switch connected in series with the motor-means is de-activated upon release of the latch means by the de-energization of the motor means, and the said switch is of the normally open type disposed to be held in closed position by the motor means only upon manual actuation of the motor means to shift the latch means into the path of said slide element.
3. An electrically-releasable, door hold-open mechanism comprising,

(a) a track adapted for mounting on the horizontal edge of a vertically hinged swinging door,

- (b) a slide element mounted for reciprocable movement on the track,
- (c) a link arm pivotally connected at one end to the slide element and adapted for pivotal connection to a fixed location at its other end for effecting the shifting of the slide element along said track and into and out of a retracted position upon movement of the door,
- (d) latch means movable into and out of the path of said slide element for normally retaining the slide element in its retracted position,
- (e) electrically actuated means connectable to a source of current and operable for holding the latch means in the path of said element when energized and to retract the latch means from said path when de-energized, and resiliently yieldable means normally coacting with said electrically actuated means to support said latch means in the path of said slide element and adapted to yield for retraction of said latch means upon the application of a predetermined force against the latch means by said slide element being urged along said path by said link arm upon movement of the door.
4. An electrically-releasable, door hold-open mechanism as defined by claim 3 wherein the motor-means comprises,
- (1) a cam means operable between holding and releasing positions with respect to said latch means,
- (2) means normally urging said cam means toward latch releasing position, and
- (3) a solenoid actuated armature for holding said cam means in latch holding position.
5. An electrically-releasable, door hold-open mechanism as defined by claim 3 wherein the latch means comprises
- (1) a catch normally projecting into the track and spring-biased for movement transversely of the track into the path of the slide element to retain the said element in its retracted position
- (2) a movable pawl normally holding said catch in the path of the slide element and normally biased to release said catch
- (3) a cam bar operable for shifting said pawl between catch holding and catch releasing positions
- (4) means normally biasing the cam bar in the direction to shift the pawl to catch releasing position, and the motor-means comprises a solenoid device operable when energized for holding said cam bar against the action of said cam bar biasing means.
6. An electrically-releasable, door hold-open mechanism as defined in claim 5 wherein a normally open switch is in series with the solenoid device and is mounted for operation by manual shifting of the cam bar to close the circuit to the solenoid device for holding the cam bar against the action of its said biasing means.
7. A door hold-open mechanism comprising
- (a) a channel shaped track adapted to be mounted on

- the top edge of a door and having an opening in its bottom web intermediate its ends,
- (b) a slide block movable along said track,
- (c) means for connecting said slide block to the head rail of a door opening to cause reciprocation of the slide block along said track upon opening and closing movement of the door,
- (d) a latch means on said track movable through said bottom opening into and out of the path of said slide block and operable for engaging and holding the slide block against return from an open-door position along said track,
- (e) resiliently yieldable means normally holding said latch means in the path of said slide block, and
- (f) electrically energized means coacting with said yieldable means to hold said latch means in slide block engaging position on said track,
- (1) said electrically energized means being adapted for releasing said latch means upon being electrically de-energized, and
- (2) said electrically energized means being resiliently biased toward latch means releasing condition.
8. A door hold-open mechanism as defined by claim 7 wherein the said electrically energized means comprises
- (a) a reciprocable cam bar movable between a latch means holding position and latch means releasing position,
- (b) means normally biasing the cam bar toward the latch means releasing position, and
- (c) a solenoid device for holding the cam bar in latch means holding position against the action of the cam bar biasing means.
9. A door hold-open mechanism as defined in claim 8 wherein a spring opened switch is connected electrically in series with the solenoid device and is positioned to be closed mechanically by manual shifting of the cam bar to its latch means holding position.
10. A door hold-open mechanism as defined by claim 9 wherein the solenoid device comprises a helical coil and an armature movable axially into the coil, the armature being connected axially to the cam bar, and the switch is mounted for actuation by the armature to close the circuit to the coil only when the armature has been shifted into the coil by manual shifting of the cam bar to the latch means holding position.

References Cited by the Examiner

UNITED STATES PATENTS

2,171,365	8/39	Harding	292—201
2,298,068	10/42	Pierce	200—87.4
2,887,194	5/59	Noltin et al.	292—273 X

FOREIGN PATENTS

334,095	10/03	France.
5,599	1906	Great Britain.

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