United States Patent [19]

D'Hooge

[11] **3,926,461**

[45] **Dec. 16, 1975**

[54] **ELECTRICALLY ACTUATED DOOR HOLDER AND RELEASE**

[75] Inventor: **Richard E. D'Hooge,** Wood Dale, Ill.

[73] Assignee: **Rixson-Firemark, Inc.,** Franklin Park, Ill.

[22] Filed: **Aug. 1, 1974**

[21] Appl. No.: **493,685**

[52] **U.S. Cl.** **292/275**

[51] **Int. Cl.²** **E05C 17/04**

[58] **Field of Search** 292/263, 273, 275, 278, 292/305, 306; 16/48.5, 49, 65, 70, 82; 49/1

[56] **References Cited**

UNITED STATES PATENTS

749,318	1/1904	Morris	292/305 X
1,102,859	7/1914	Blackwell	292/273
1,425,271	8/1922	Mukden	16/49
1,711,282	4/1929	Orr	292/275
2,108,891	2/1938	Johnson	292/275
2,268,977	1/1942	Westrope	292/275 X
3,164,404	1/1965	Arnold	292/273
3,415,562	12/1968	Peterson	16/48.5 X
3,630,560	12/1971	Atkins	16/49 X
3,648,326	3/1972	Gaysowski	14/48.5
3,683,450	8/1972	Morrison et al.	292/275 X
3,729,770	5/1973	Lasier	16/48.5
3,796,451	3/1974	Schultz	292/263

FOREIGN PATENTS OR APPLICATIONS

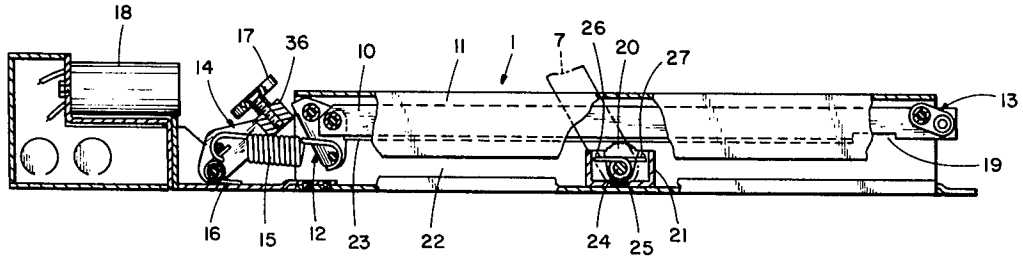
524,406	4/1931	Germany	292/275

Primary Examiner—Roy D. Frazier
Assistant Examiner—Thomas J. Holko

[57] **ABSTRACT**

An electrically actuated door holder and release for the multi-point holding of a pivoted door throughout a range of door open angles, and for the release of a held door either electrically or in response to manual override. The door holder comprises a channel which pivotally supports through linkages an elongated hold-open bar. An elongated friction strip is carried by the hold-open bar. The hold-open bar is normally held in hold-open position under tension by an armature spring coupled to the hold-open bar. The channel is formed with a slot which guides a slide block which moves linearly along the length of the hold-open bar in response to changes in the angle of door opening. The slide block carries a pivotally supported hold-open cam which engages the friction strip to effect door hold open in the event the armature linkage is further placed under tension by energization of an electromagnet. Upon deenergization of the electromagnet, or alternatively upon the application of a manual override door closing force, the hold-open bar is pivoted away from the slide block and the friction strip engaging cam and the door is released.

8 Claims, 16 Drawing Figures



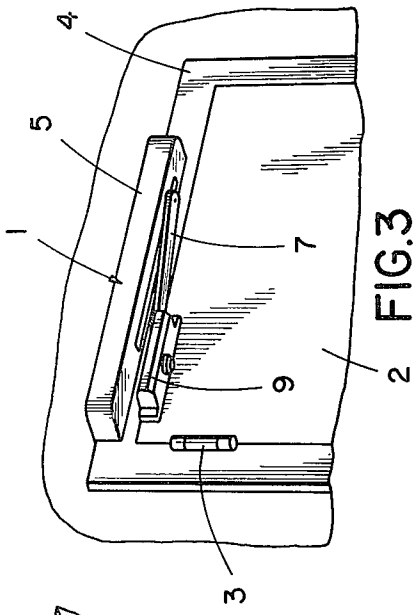


FIG.3

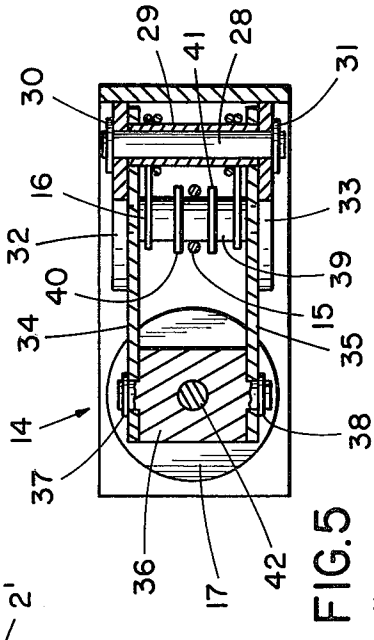


FIG.5

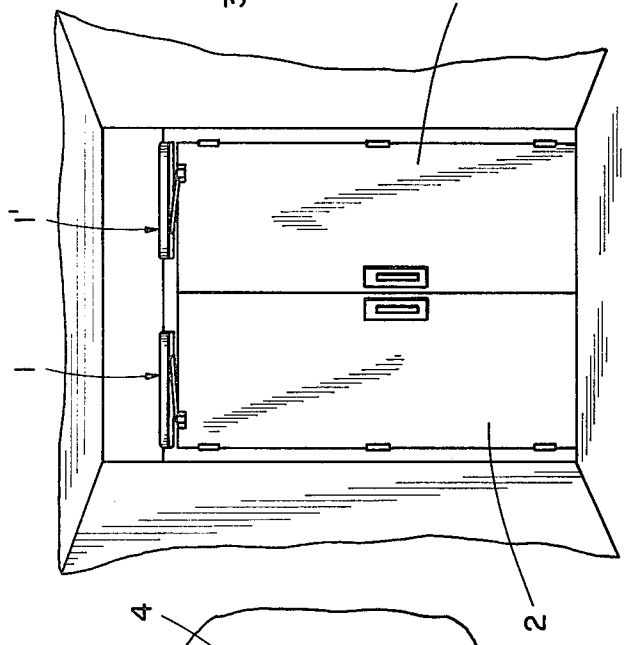


FIG.2

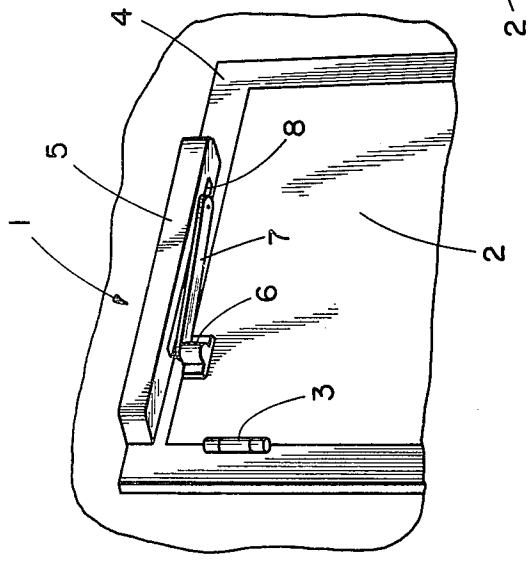


FIG.1

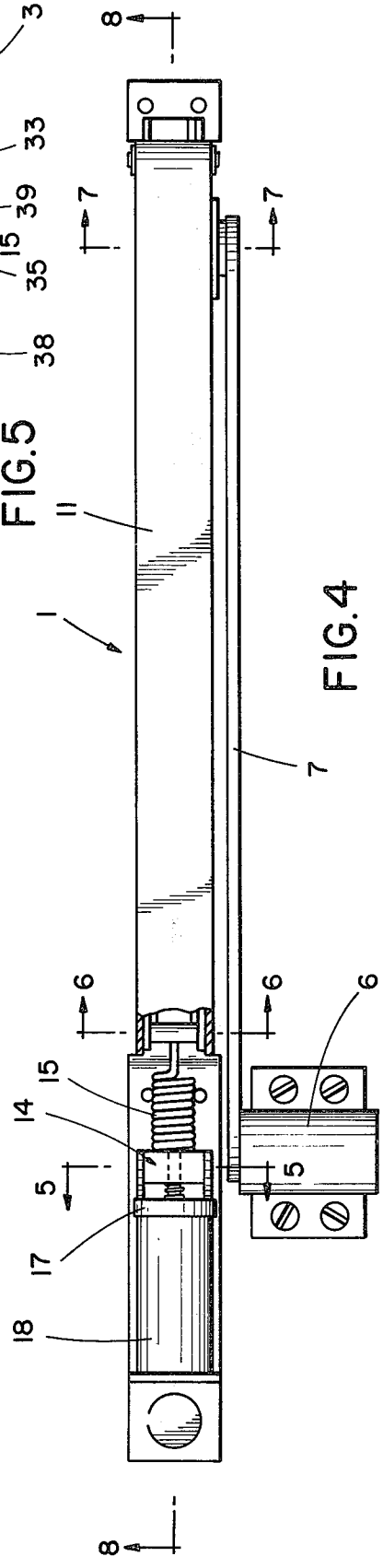


FIG.4

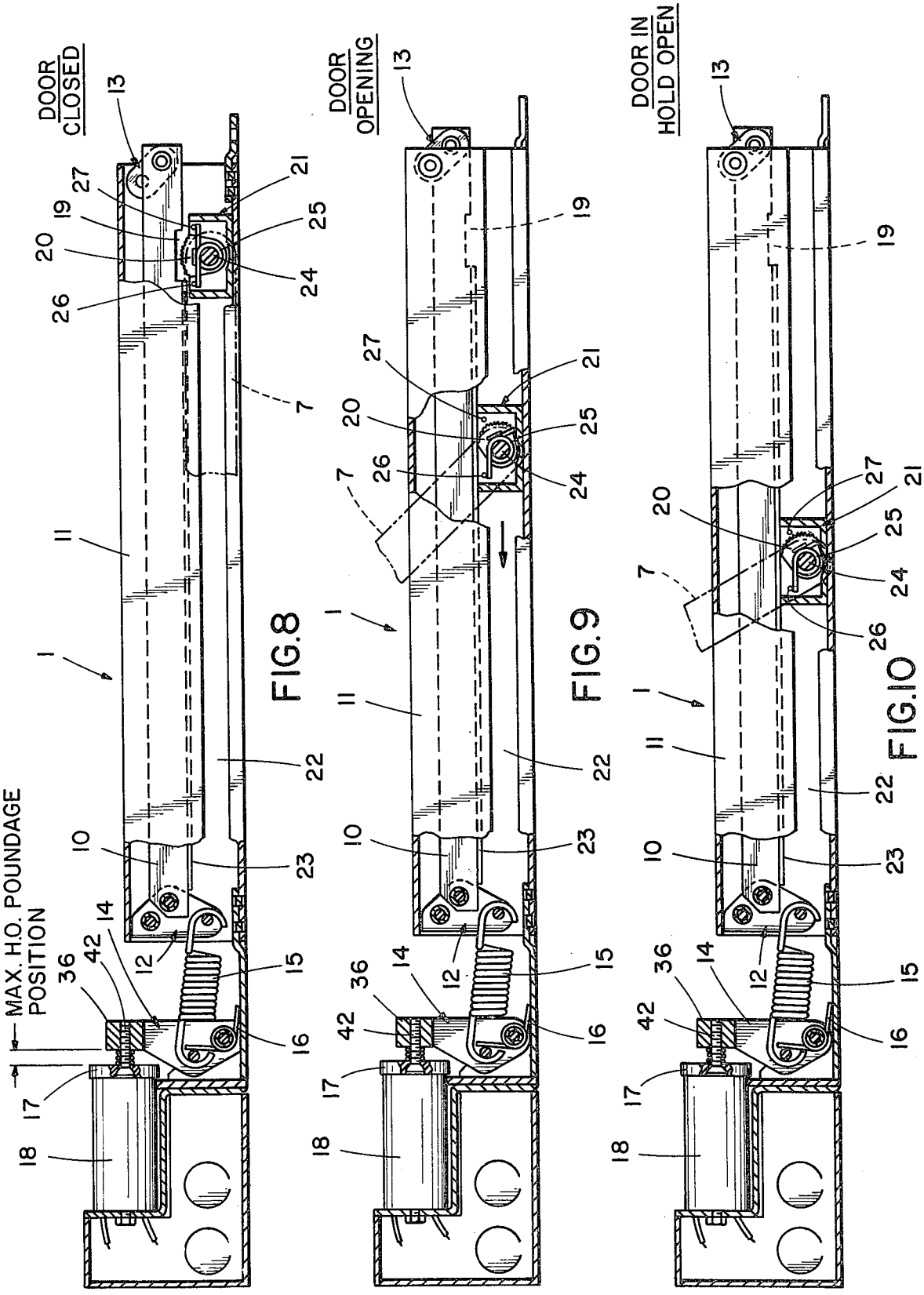


FIG.8 FIG.9 FIG.10

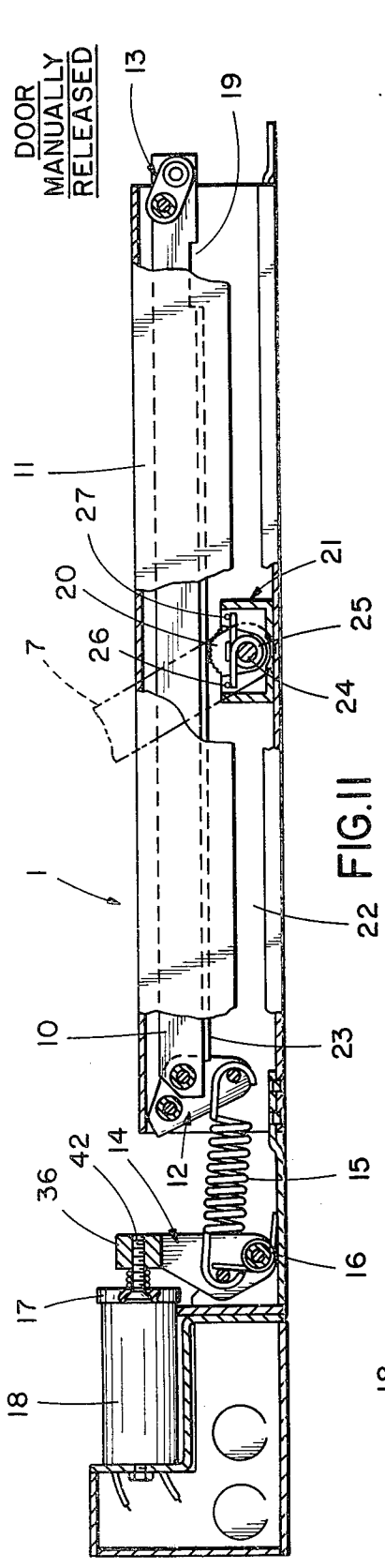


FIG.11

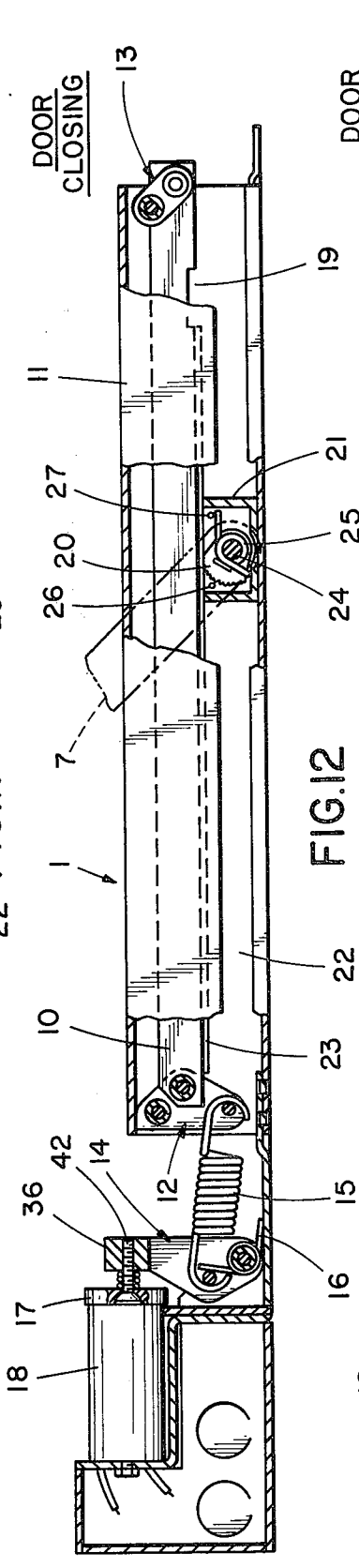


FIG.12

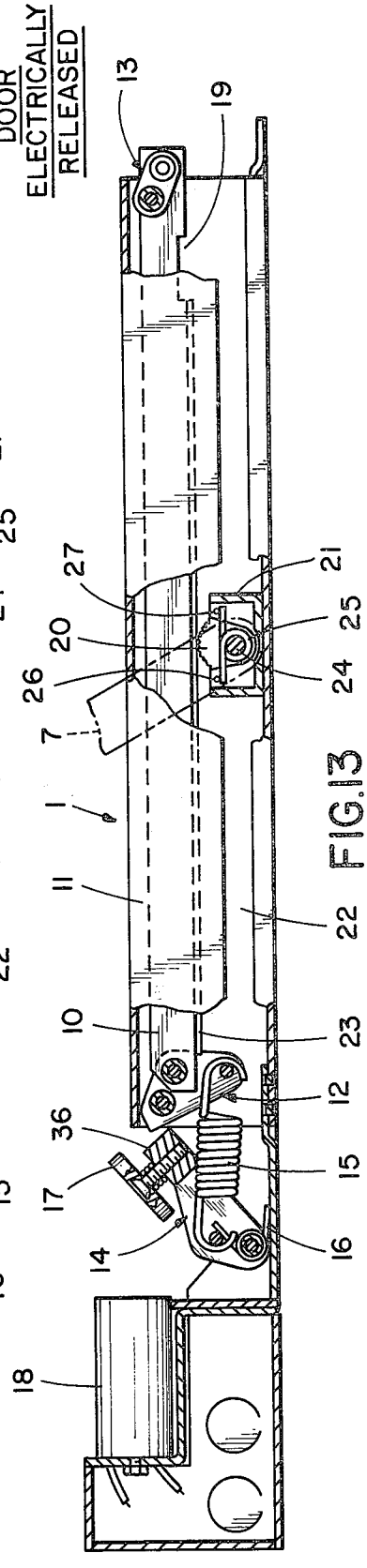


FIG.13

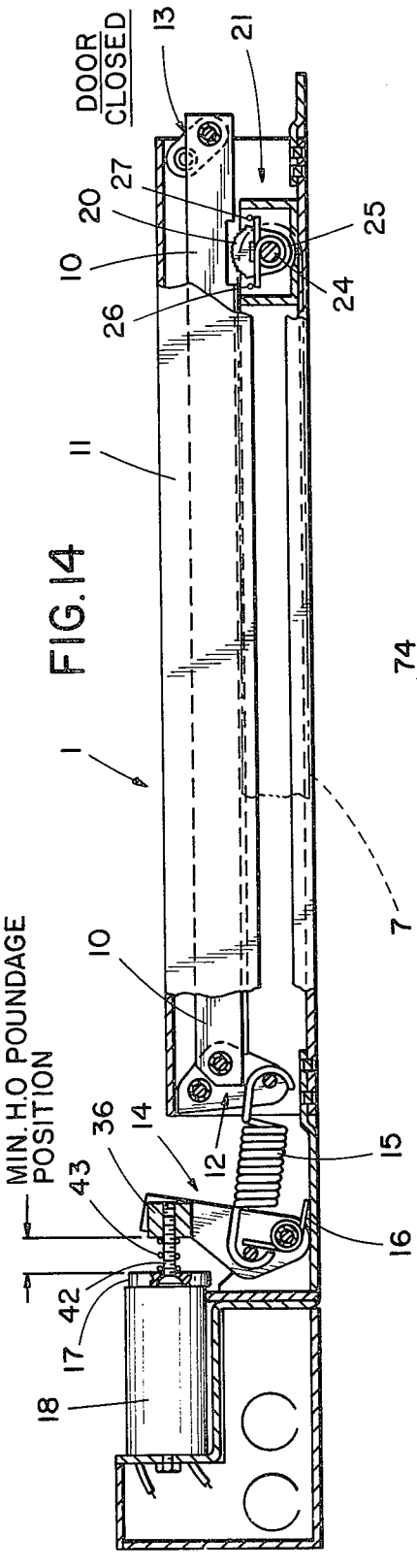


FIG. 14

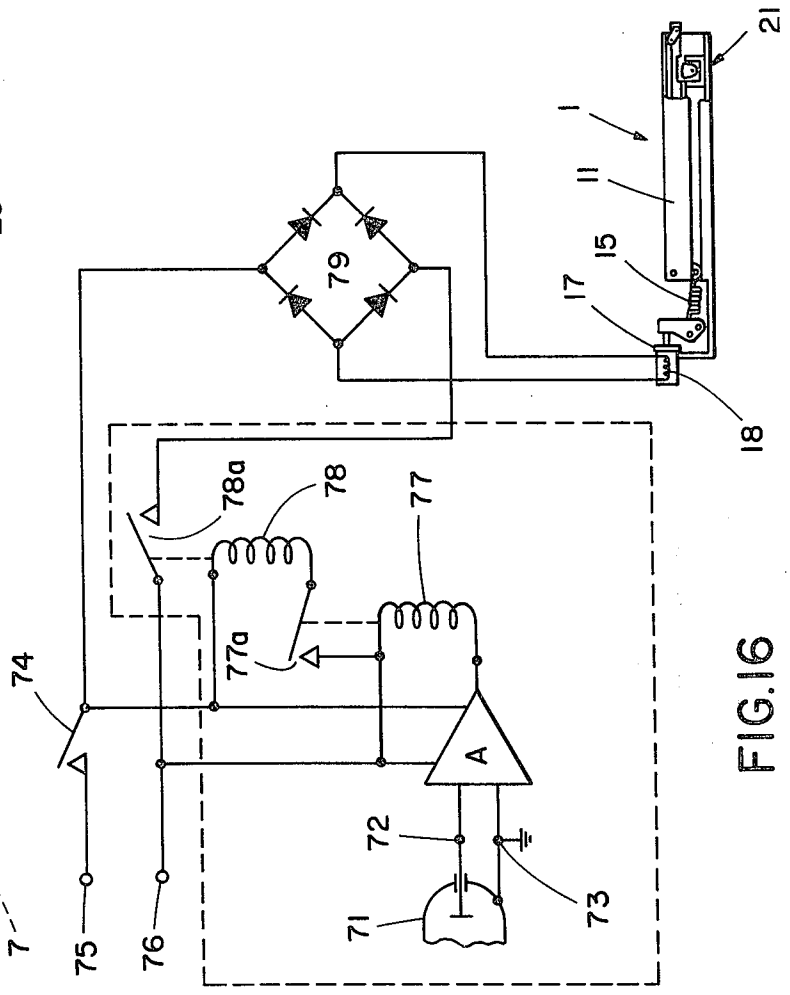


FIG. 16

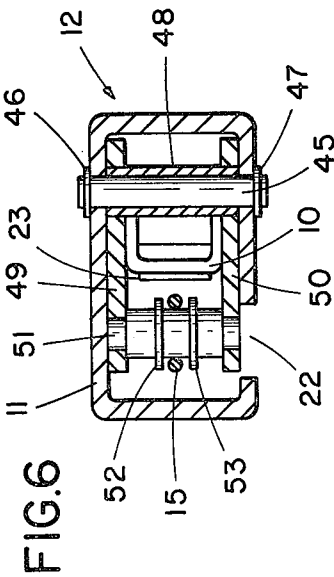


FIG. 6

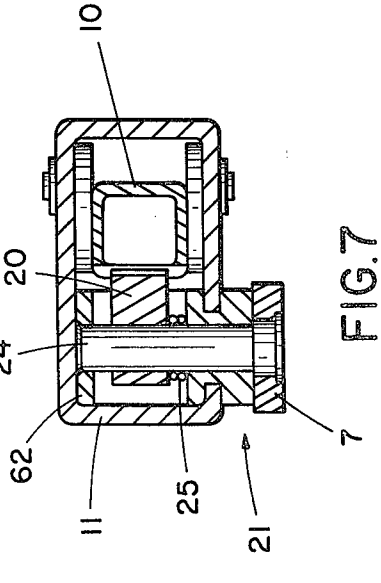


FIG. 7

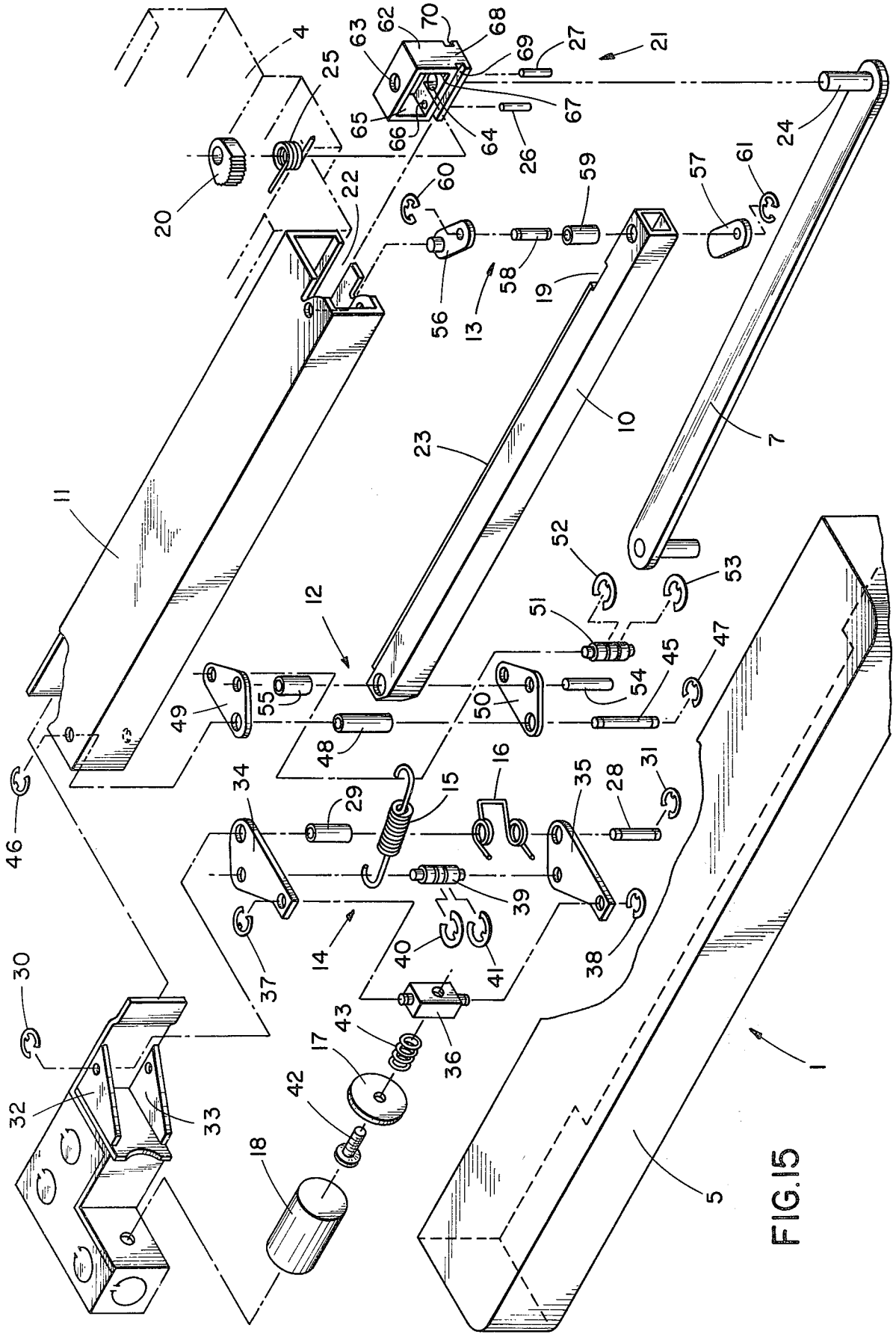

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70

FIG. 15

ELECTRICALLY ACTUATED DOOR HOLDER AND RELEASE

FIELD OF THE INVENTION

This invention relates to an electrically actuated door holder and release for the multi-point holding of a pivoted door throughout a range of door open angles. The device also provides for the release of a held door either electrically or in response to manual override.

BACKGROUND OF THE INVENTION

The concept of smoke-actuated door control has become a proven technique, required today by most of the nation's major model building codes. These codes specify that the control must be applicable to doors which may be left open occasionally or at all times; because in many instances, it is desirable to hold a door in an open position to permit adequate air flow or free flow of traffic.

The prior art is prolific in door hold-open devices. Many of these devices include an electrically actuated control which releases the hold-open mechanism. Devices of this type are shown, or example, in U.S. Pat. Nos. 3,164,404; 3,415,562; 3,729,770 and 3,796,451.

SUMMARY OF THE INVENTION

This invention relates particularly to the means for effecting door hold open at any desired angle throughout a specified range and at the same time providing for release of the door either electrically or by manual override. The principal structure for attaining the foregoing object is briefly set forth in the Abstract.

DETAILED DESCRIPTION OF THE DRAWINGS

In order that all of the structural features for attaining the objects of this invention may be readily understood, reference is herein made to the accompanying drawings wherein:

FIG. 1 is a perspective view showing the application of the door holder and release of this invention to a single door;

FIG. 2. is a view showing the application of the door holder and release to each of a pair of corridor doors;

FIG. 3 is a perspective view in which the standard arm of the door holder and release is coupled to a conventional door supported closer;

FIG. 4 is a front elevation view of the door holder and release with the holder cover removed;

FIG. 5 is a section view taken along ling 5—5 of FIG. 4 and showing the armature link assembly;

FIG. 6 [drawing sheet 4] is a section view taken along line 6—6 of FIG. 4 and showing the inside linkage assembly for the hold-open bar;

FIG. 7 [drawing sheet 4] is a section view taken along line 7—7 of FIG. 4 and showing the frictional engagement of the hold-open bar by the hold-open cam;

FIG. 8 [drawing sheet 2] is a section view taken along line 8—8 of FIG. 4 and showing a bottom view of the internal door holder and release mechanism in a door closed position with the electromagnet energized;

FIG. 9 [drawing sheet 2] is a view related to that of FIG. 8 with the door being opened;

FIG. 10 [drawing sheet 2] is a view related to that of FIG. 9 with the door in hold open;

FIG. 11 [drawing sheet 3] is a view related to that of FIG. 10 with the door in the initial stage of manual override release;

FIG. 12 [drawing sheet 3] is a view related to that of FIG. 11 with the door closing in response to release effected by manual override;

FIG. 13 [drawing sheet 3] is a view related to that of FIG. 11 with the door in the initial stage of electrical release;

FIG. 14 [drawing sheet 4] is a view related to that of FIG. 13 with the door closed in response to release effected by deenergization of the electromagnet;

FIG. 15 [drawing sheet 5] is an exploded view of the door holder and release; and

FIG. 16 [drawing sheet 4] is an electrical circuit incorporating the door holder and release as part of a smoke actuated door control system.

DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

Briefly described, the present invention contemplates a novel door holder and release for the multi-point holding of a pivoted door throughout a range of specified door opening angles. Additionally, the device permits the release of a hold door either electrically or in response to a manual overriding force applied to a controlled door.

The door holder and release mechanism is contained within a housing which is preferably surface mounted upon a door frame header. An arm couples the door holder and release to a door supported pivot pin, or alternatively to an integral closer which is surface mounted upon the controlled door.

An elongated hold-open bar is pivotally supported relative a channel by a plurality of linkages. An elongated friction strip is carried by the hold-open bar.

The hold-open bar is normally held in hold-open position under the tension generated by an armature spring which biases an armature linkage coupled to the hold-open bar. The channel is formed with an elongated slot having adjacent edges which guide a plastic slide block which moves linearly along the length of the hold-open bar in response to changes in the angle of door opening.

The slide block carries a pivotally supported hole-open cam which engages the friction strip to effect door hold-open in the event the armature linkage is further placed under tension by energization of an electromagnet.

On deenergization of the electromagnet, or alternatively upon the application of a manual override door closing force to a controlled door, the hold-open bar and its friction strip are pivoted away from the slide block and the friction strip engaging cam and the door is thus released.

In the event an external door closer is coupled to the door, the release operation will also effect automatic door closing.

Referring now to FIG. 1, the electrically actuated door holder and release 1 of this invention is shown typically applied to a flush door 2 which is supported by a plurality of butt hinges 3 (only one of which is shown) upon a conventional metal door frame 4.

The internal mechanism of holder-release 1 is contained within an elongated housing cover 5. A pivot pin 6 is surface mounted to the upper edge of door 2, and standard arm 7 couples pivot pin 6 to the internal mechanism of holder-release 1.

Accordingly, the opening of door 2 causes the right end of standard arm 7 to reciprocate within slot 8. This reciprocation moves responsively the slide block mech-

anism hereafter described in the specification.

In the embodiment shown in FIG. 1, door holder-release 1 merely accomplishes a hold-open and release function. In the event automatic closing is required, a surface mounted closer may be substituted for pivot pin 6. Alternatively, other means for closing door 2 may be provided as is well known in the art.

FIG. 2 shows the application of holder-release 1 of this invention to control a pair of corridor doors. In particular, holder-release 1 is adapted to control corridor door 2, and companion holder-release 1' is adapted to control adjacent corridor door 2'. In view of the fact that the holder-release of this invention is applicable to life safety control systems now generally required throughout the United States, a pair of electrically controlled holder-releases 1, 1' as shown in FIG. 2 may be advantageously incorporated in smoke and fire detection systems for such institutions as hospitals and schools.

FIG. 3 shows the application of holder-release 1 to a door incorporating a surface mounted closer 9. Accordingly, the installation of FIG. 3 is not only capable of performing a door hold-release function, but in addition by connecting the left end of standard arm 7 to surface mounted closer 9, a companion closing function can be attained in response to door release.

Referring to FIGS. 4 and 8, the principal elements of holder-release 1 comprise elongated hold-open bar 10 which is pivotally supported relative metallic channel 11 by inside hold-open bar linkage assembly 12 and outside hold-open bar linkage assembly 13.

Armature linkage assembly 14 is coupled to inside bar linkage assembly 12 by armature spring 15.

Armature linkage assembly 14 is normally biased by armature linkage return spring 16 so that armature plate 17 contacts the right pole of electromagnet 18.

Hold-open bar 10 is formed with a recess 19, which recess as hereafter described retains hold-open cam 20 in the door closed position of FIG. 8.

Hold-open cam 20 is a part of slide block assembly 21. Slide block assembly 21 reciprocates within the guide provided by channel slot 22 so that cam 20 travels along a linear path which is adjacent a urethane friction contact strip 23 affixed to a vertical surface of hold-open bar 10. Slide block drive post 24 performs the function of reciprocating slide block assembly 21 within the path formed by channel slot 22. Additionally, drive post 24 serves as a pivot for hold-open cam 20.

Cam bias spring 25 envelopes the shaft of drive post 24. Cam pins 26 and 27 restrain the terminal ends of cam spring 25 so as to normally bias cam 20 in the position shown in FIG. 8.

In the event that electromagnet 18 is energized, thereby reinforcing the armature linkage assembly 14 tension generated by return spring 16, and door 2 is also opened as is shown in FIG. 9, standard arm 7 will be angularly rotated from the position shown in FIG. 8 to that of FIG. 9, thereby causing slide block assembly 21 to move leftwardly causing a rotation of hold-open cam 20. With this rotation of cam 20, the friction engaging teeth of the cam contact an adjacent portion of friction strip 23. When door 2 has been manually placed at the desired door hold-open position, cam 20 will engage friction strip 23 as is shown in FIG. 10, thereby holding the door in hold-open.

In the event that door 2 is manually closed by an overriding manual force, cam 20 will be rotated in the counterclockwise direction as is shown in FIG. 11. With this rotation, a force is applied to hold-open bar 10 so as to elongate armature spring 15, thereby pivoting the linkage assemblies 12 and 13 so as to move hold-open bar 10 away from slide block assembly 21.

It should be noted as shown in FIG. 11, upon the initiation of the manual release of door 2, hold-open cam 20 is vertically disposed in the same attitude as the attitude assumed by the cam when the door is closed (FIG. 8).

As door 2 is in the closing phase, cam 20 is rotated counter-clockwise in the attitude shown in FIG. 12. Accordingly, hold-open bar 10 is moved closer to slide block assembly 21 somewhat. However, fixed holding engagement is not maintained between friction strip 23 and the teeth of cam 20. Accordingly, door 2 ultimately closes with the internal components assuming the disposition shown in FIG. 8.

In FIG. 13 electromagnet 18 has been deenergized either in response to a switch opening function, or in the event that the electromagnet is part of a fire and smoke detection system in response to the detection of the products of combustion. Accordingly, armature linkage 14 pivots clockwise in response to the release of armature 17 from the right pole of electromagnet 18. With this operation, hold-open bar linkages 12 and 13 are pivoted in a counterclockwise manner in view of the fact that armature spring 15 is no longer under tension. With this operation, hold-open bar 10 is moved away from slide block assembly 21, and the cam return spring 25 rotates hold-open cam 20 in a clockwise direction. With this operation slide block 21 moves to the right as is shown in FIG. 13, until slide block assembly 21 assumes a disposition within recess 19 as is shown in FIG. 8.

Details of armature link assembly 14 are shown in FIG. 5. The entire linkage 14 pivots about pivot pin 28. Pivot pin 28 is enveloped by bearing 29 which in turn supports and locates return spring 16. Retainer clips 30 and 31 fix pivot pin 28 with respect to frame sections 32 and 33.

Armature links 34 and 35 pivot about bearing 29. The free end of links 34 and 35 are joined together by coupling block 36. Retainer clips 37 and 38 lock coupling block to armature links 34 and 35.

Spring support pin 39 is sandwiched between armature links 34 and 35. Retainer clips 40 and 41 locate armature spring 15 with respect to spring support pin 39. Armature adjusting screw 42 couples armature plate 17 to coupling block 36.

As is shown in FIG. 14, the threaded shaft section of adjusting screw 42 supports armature bias adjusting spring 43. In FIG. 14, screw 42 has been partially withdrawn from the threaded bore within coupling block 36. Accordingly, the tension in spring 43 has been reduced as compared to the tension of the same spring with the screw 42 adjustment shown in FIGS. 8 through 13. This reduction in spring 43 tension effects a reduced or minimum hold-open poundate adjustment. Accordingly, manual override may be accomplished more easily.

FIG. 6 shows details of inside linkage assembly 12 for hold-open bar 10. Pivot pin 45 extends through the walls of channel 11 and is retained with respect to the channel by means of retainer clips 46 and 47. Bearing 48 is carried by pivot pin 45. Inside links 49 and 50 are supported on bearing 48. Support pin 51 is carried by links 49 and 50. The central portion of support pin 51

is coupled to armature spring **15**. Retainer clips **52** and **53** locate armature spring **15** with respect to support pin **51**.

As is shown in the exploded view of FIG. **15**, inside links **49** and **50** also carry hold-open bar connector pin **54** and hold-open bar bearing **55**. As is also shown in the exploded view of FIG. **15**, the other end of hold-open bar **10** is pivoted relative channel **11** by outside links **56** and **57**. These links are coupled to hold-open bar **10** by pin **58** and bearing **59**. Links **56** and **57** are retained on pin **58** by retainer clips **60** and **61**.

As is shown in FIGS. **7** and **15**, slide block assembly **21** includes a slide block **62** which is formed with a pair of holes **63** and **64** which receive slide block drive post **24**. The shaft of drive post **24** carries cam **20** and cam bias spring **25** within the rectangular opening **65** formed in the slide block. Pivot pins **26** and **27** are lodged within holes **66** and **67** formed in slide block **62** so that the terminal ends of cam bias spring **25** will be limited as to movement by the pins. The lower end of slide block **62** is formed with a T-flange **68** which defines elongated grooves **69** and **70**. T-flange **68** and its grooves **69** and **70** are matingly engaged by slot **22** formed in channel **11** so that slide block **62** is guided by the channel slot.

The schematic circuit of FIG. **16** shows an electrical circuit connecting electromagnet **18** to ionization chamber **71** to effect hold open and release of door **2** in a failsafe manner of operation. The detailed operation of the circuitry of FIG. **16** is as follows.

Assuming ionization detector **71** is in proper operating condition and that the ionization chamber **71** input appearing to terminals **72** and **73** indicates an absence of a flame or smoke condition, door **2** will be held in an open position in response to manual closing of switch **74**; that is, the closing of switch **74** applies line voltage from terminals **75** and **76** to amplifier A. The application of line voltage to amplifier A energizes the amplifier output relay **77**, thereby closing normally open contacts **77***a*.

The closing of contacts **77***a* applies line voltage to the coil of power relay **78**. With this occurrence, normally open contact **78***a* is closed, thereby applying line voltage to fullwave bridge rectifier **79** to energize electromagnet **18** with a pulsating-direct-current voltage.

The energization of electromagnet **18** attracts armature plate **17**. With this operation, armature linkage **14** places armature spring **15** under tension which in turn pivots hold-open bar **10** into a close engagement position with respect to slide block assembly **21**, as previously outlined.

In the event that ionization detector **71** detects a smoke condition, electromagnet **77** will be deenergized, thereby releasing contact **77***a*. This in turn removes line voltage from electromagnet **78**, thereby opening contact **78***a* and thus deenergizing electromagnet **18**. The deenergization of electromagnet **18** releases armature linkage **14** in a manner hereinbefore outlined with respect to FIG. **13**, and accordingly, slide block cam **20** will be released relative hold-open bar **10**. In the event a door closer is connected to door **2**, as is set forth with respect to FIG. **3**, door **2** will be automatically closed in response to the detection of smoke at ionization detector **71**.

It should be understood that the above described structure is merely illustrative of the principles of this invention, and that modifications can be made without departing from the scope of the invention as set forth in the claims.

What is claimed is:

1. An electrically actuated door holder for the multipoint holding of a pivoted door through a range of opening angles, comprising a holder element, an adjustable linkage of a generally parallelogram configuration including an elongated hold-open bar and a pair of links each individually coupling a different end of the hold-open bar to the holder element, hold-open bar engaging means moved lengthwise relative the hold-open bar in response to variations in door opening angles to thereby engage the hold-open bar at any selected lengthwise point corresponding to the desired angular door opening, and electro-mechanical means including an electromagnet and an armature coupled to the parallelogram linkage and in which the energization of the electromagnet and the resulting armature action moves the hold-open bar into frictional engagement with the hold-open bar engaging means.

2. The combination of claim **1** in which the path of movement for the hold-open bar engaging means is linear, and in which the hold-open bar is supported for pivotal movement by the adjustable linkage toward and away from the linear path followed by the hold-open bar engaging means so as to maintain a substantially parallel spacing between the linear path followed by the hold-open bar engaging means and the hold-open bar.

3. The combination of claim **1** in which the hold-open bar engaging means includes a movable slide block, and a cam pivotally supported relative the slide block to engage frictionally the hold-open bar and to effect a yieldable latch therewith.

4. The combination of claim **3** in which the hold-open bar includes an elongated cam engaging friction surface.

5. The combination of claim **2** in which the hold-open bar engaging means includes a slide block movable within the elongated opening of the channel, and a cam pivotally supported relative the slide block to engage frictionally the hold-open bar and to effect a yieldable latch therewith.

6. The combination of claim **5** in which a door arm is coupled to the slide block to move responsively the slide block within the elongated opening.

7. The combination of claim **6** in which deenergization of the electrical actuated means enables the door arm to move freely the slide block in response to inadequate frictional engagement of the cam with respect to the hold-open bar.

8. An electrically actuated door holder for the multipoint holding of a door throughout a range of door opening angles, comprising a holder frame, an elongated hold-open bar adjustably supported by the frame, an elongated friction engaging means affixed to or an integral part of a surface of the elongated hold-open bar, hold-open bar engaging means movable lengthwise in a linear path relative the hold-open bar in response to variations in door opening angles, adjustable linkage means coupling the hold-open bar to the holder frame to provide a plurality of generally parallel spaced positions between the hold-open bar and the linear path followed by the hold-open bar engaging means, and electromechanical means including an electromagnet and an armature coupled to the hold-open bar and in which energization of the electromagnet and the resulting armature action moves the hold-open bar into a

closer generally parallel spacing with respect to the linear path followed by the hold-open bar engaging means, thereby enabling the hold-open bar engaging means to frictionally engage the hold-open bar and further in which the deenergization of the electromagnet releases the armature enabling the hold-open bar engaging means to increase the spacing between the linear path and the hold-open bar by moving the hold-open bar away from the linear path thus effecting release of any door that is held in an open position.

* * * * *