United States Patent [19]

Coulter et al.

[11] **3,777,423**

[45] **Dec. 11, 1973**

[54] **CONDITION RESPONSIVE DOOR HOLDER-CLOSER**

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

[22] Filed: **Jan. 7, 1972**

[21] Appl. No.: **216,202**

[52] **U.S. Cl.** ..... **49/31**, 16/48.5, 49/2, 49/279, 49/379, 340/237 S

[51] **Int. Cl.** **E05f 15/20**

[58] **Field of Search** ..... 49/1, 2, 31, 279, 49/364, 379; 16/48.5, 65, 80; 317/131, 132; 340/220, 222, 237 S

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Primary Examiner—J. Karl Bell
Attorney—Augustus G. Douvas

[57] **ABSTRACT**

A surface-mounted door holder-closer responsive to the products of combustion passing through multiple passageways formed in a holder-closer housing cover, a holder-closer assembly frame, and a static shield which is an integral part of an ionization chamber module. The ionization chamber module is insertable into the holder-closer frame with the frame and static shield not only defining the passageways, but also isolating the ion chamber from spurious static charges generated within the housing which would render a false alarm or false emergency door release. The frame also houses the principal components of the holder-closer, namely, a closer spring, a dashpot, a latching lever assembly, and an electromagnet responsive to modulated current flow in the ionization chamber to effect alarm or emergency release of the latching lever to close an otherwise open door. The integrated detector-holder-closer is advantageously and simply mounted on the lintel or header of a door frame.

29 Claims, 17 Drawing Figures

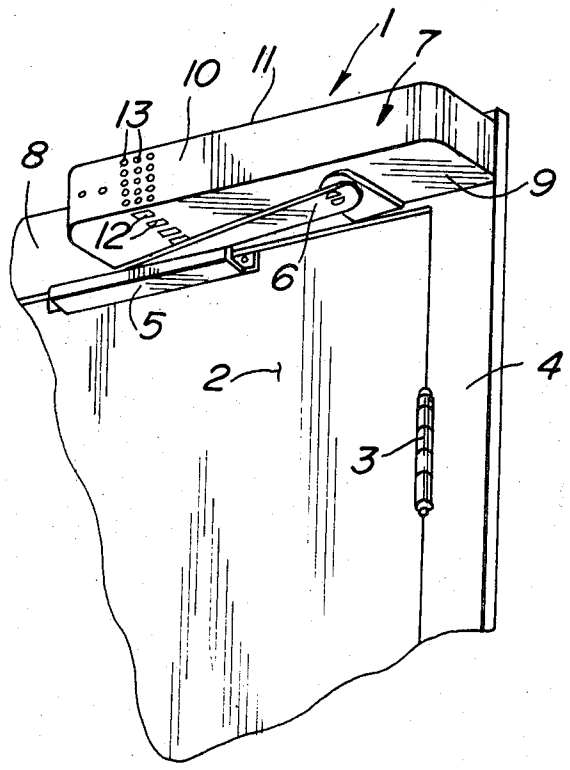


FIG. 2

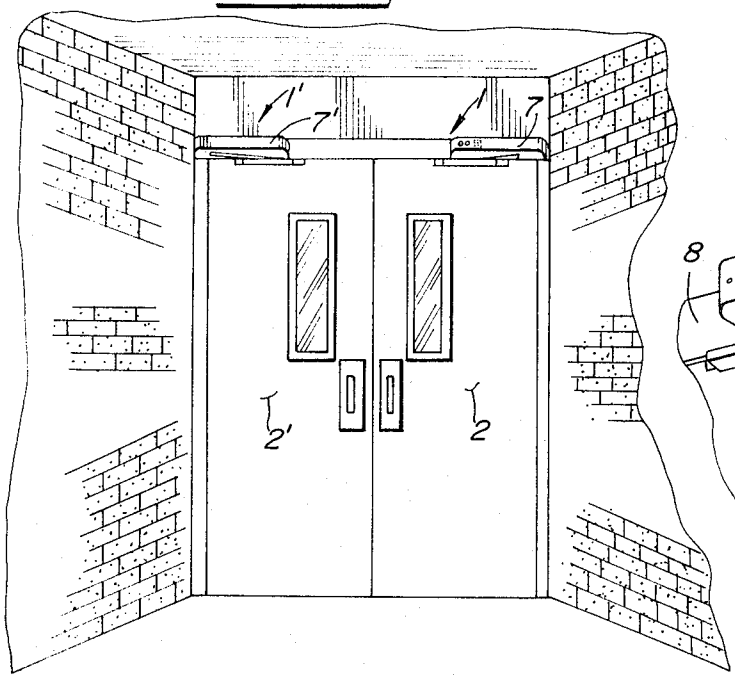


FIG. 1

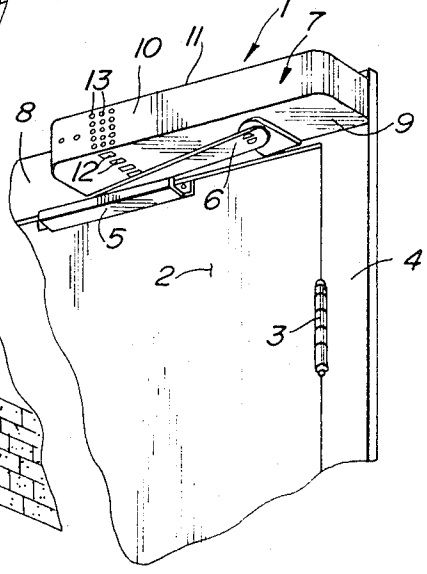


FIG. 17

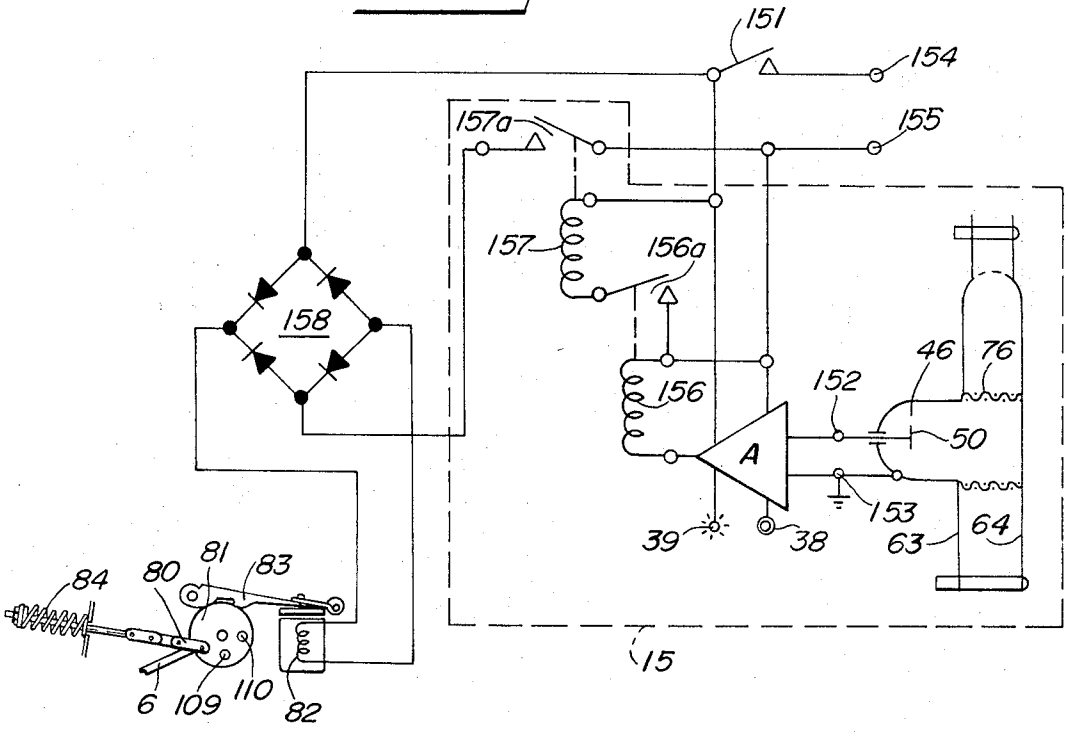


FIG. 4

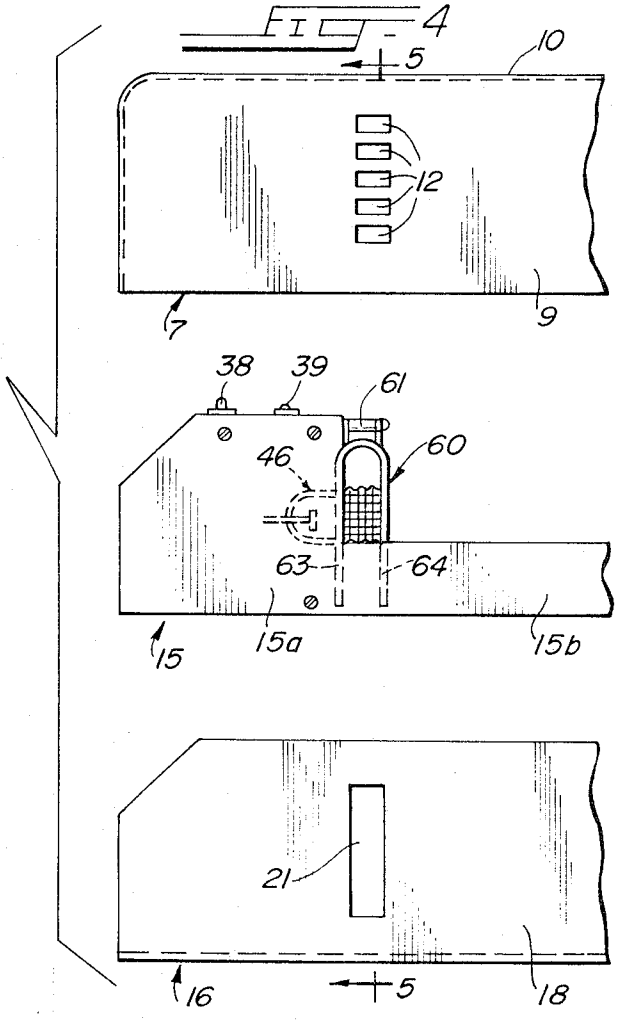


FIG. 5

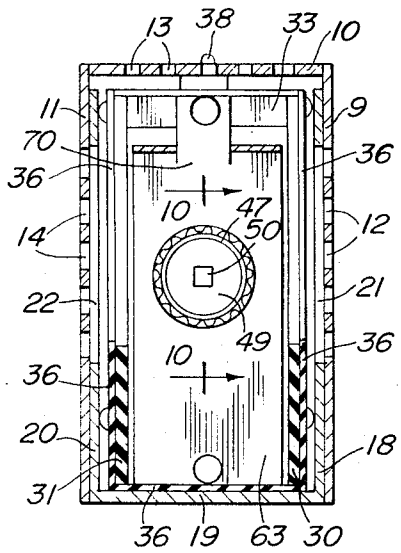


FIG. 3

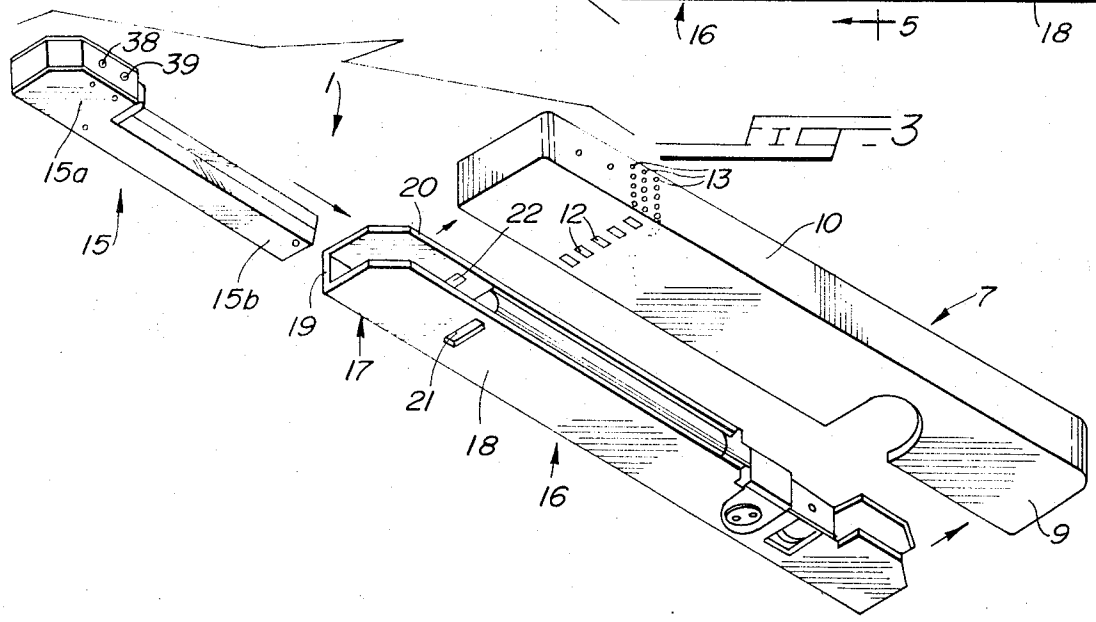


FIG 6

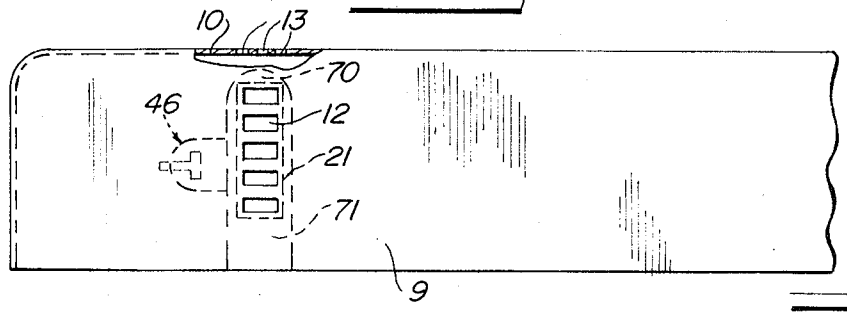


FIG 7

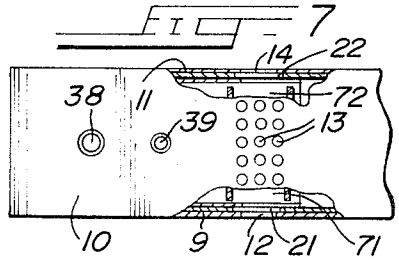


FIG 10

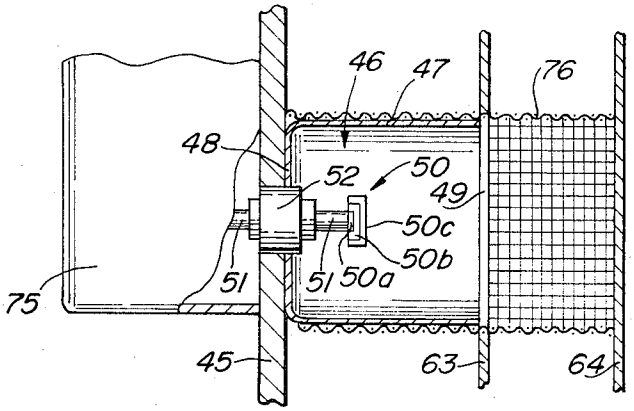


FIG 8

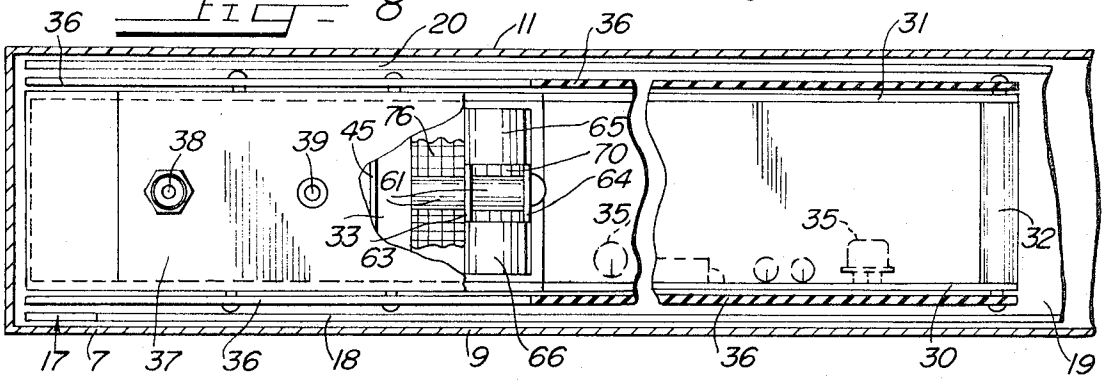
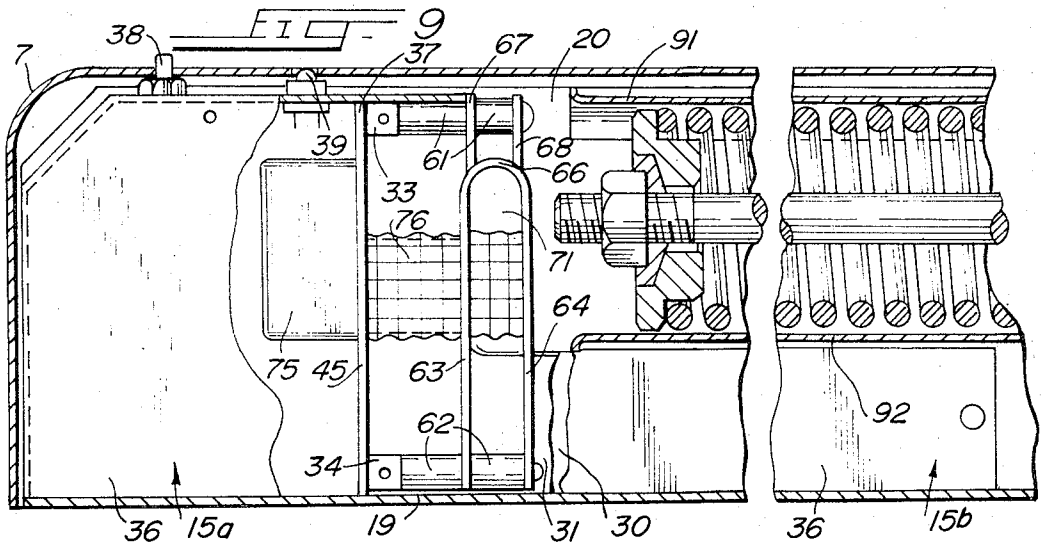


FIG 9



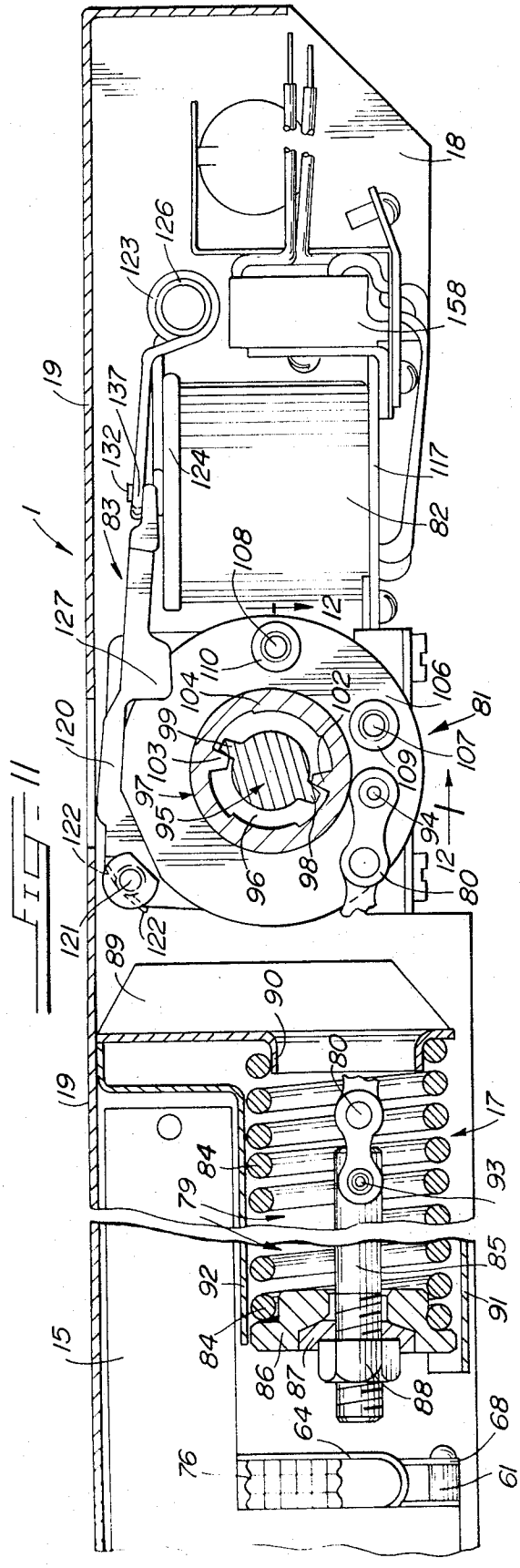


FIG. 11

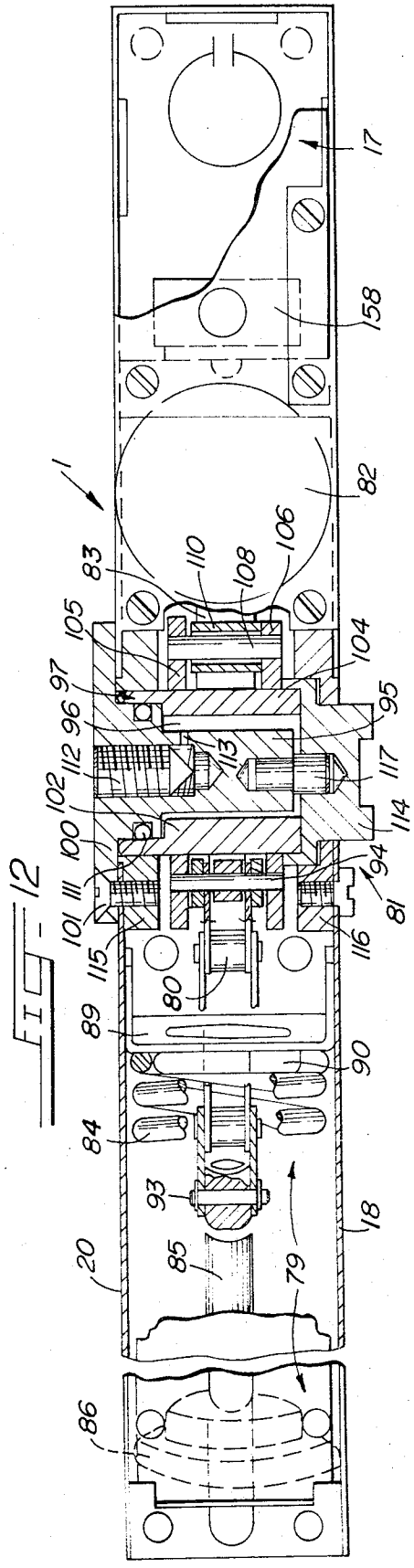


FIG. 12

FIG 13

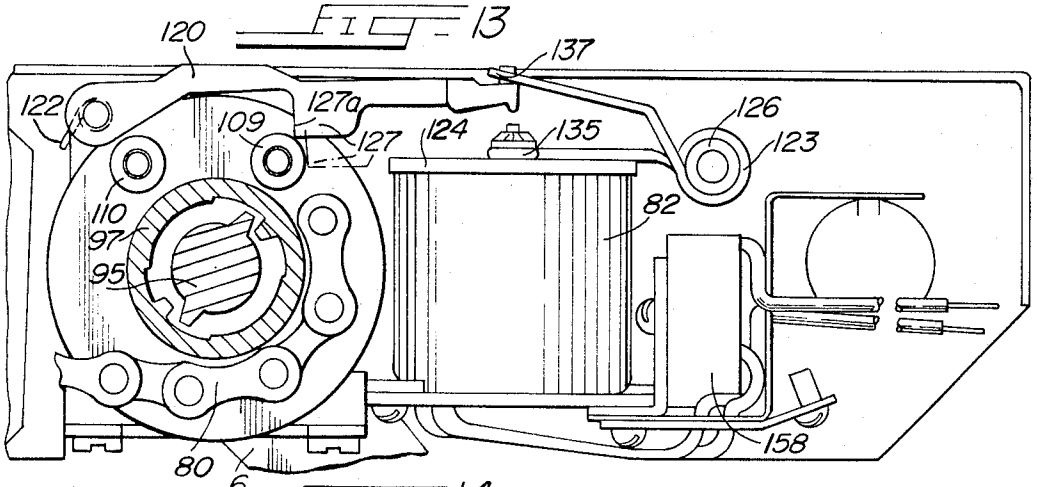


FIG 14

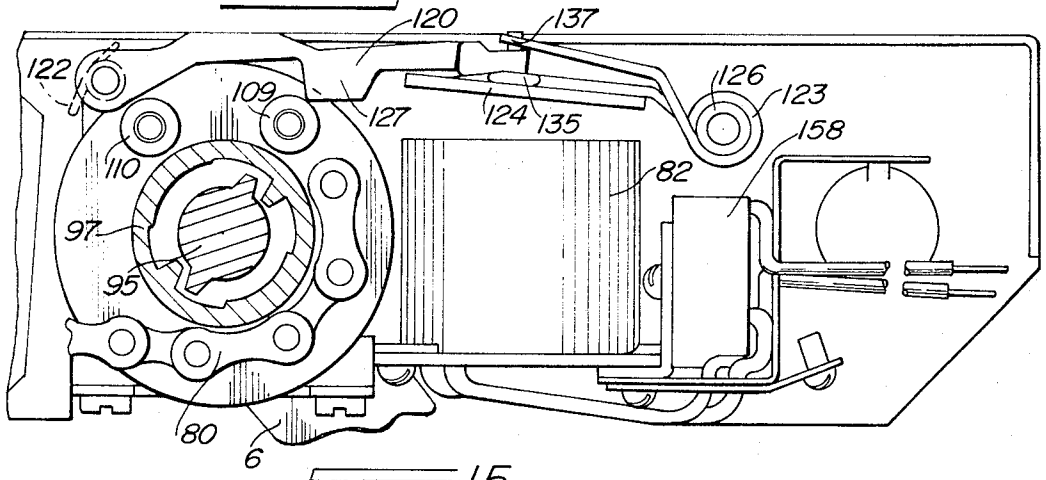


FIG 15

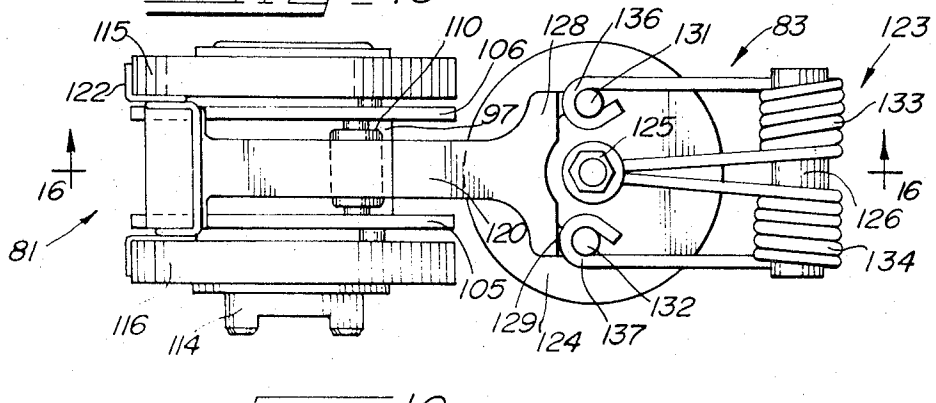
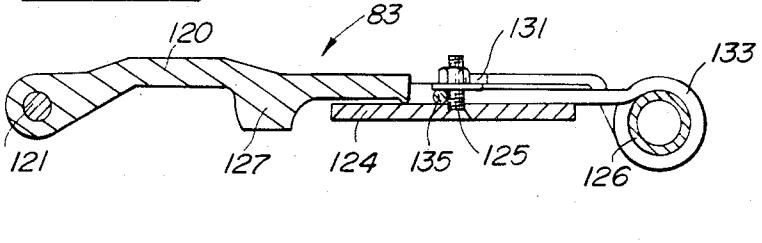


FIG 16



CONDITION RESPONSIVE DOOR HOLDER-CLOSER

BACKGROUND OF THE INVENTION

The prior art is prolific in door holder-closer structures responsive to the products of combustion to effect an alarm or emergency release of open doors. Where such doors are released by detectors, several approaches have been employed, generally ranging from door release by a complex central fire alarm system characterized by detectors spaced throughout a structure under surveillance to a simple form of a fusible element mounted on the arm of a door closer.

The most common type of quick response detector employed has been a photocell (refraction type) detector or an ionization detector mounted on the ceiling of a corridor, approximately five feet from a fire resistant door to effect a barrier which will prevent passage of the products of combustion from one section of a building to another. As a general rule, if the top of the door, or lintel, extends below the corridor ceiling over 18 inches, it is standard practice to install a second detector on the opposite side of the door, again, approximately 5 feet from the door. The corridor closure may be a single door or a dual door using an electromagnetic door holder-closer on each door. In any event, each detector is located remotely from the controlled holder-closer. Accordingly, at least two units must be separately mounted with interconnecting wiring.

In the event products of combustion are generated, a detector located on the ceiling causes the release of all controlled doors to close the corridors. At this stage, personnel evacuation of a building is possible since the doors will open in the direction of egress from the building. However, in many cases premature and unsafe door closing is effected because the detection of ceiling smoke will occur well before the exitways through the doors become smoke laden. Accordingly, the doors must be manually reopened to permit evacuation of those persons who may have delayed their exit.

Examples of prior art patents relating to condition detectors and also detector responsive doors are as follows:

U.S. Pat. No.	Filed	Inventor	Title
2,665,129	1-5-54	Durbin et al.	Thermoelectric Door Operating Mechanism
3,009,138	11-14-61	Lindsay	Radioactive Burglar Alarm System
3,039,764	6-19-62	Heinsman et al.	Electric Door Operator
3,069,997	12-25-62	Julian	Apparatus for Preventing Exfiltration of Smoke-Laden Air from Smokehouse Enclosures
3,207,273	9-21-65	Jurin	Closure Release Device
3,430,220	2-25-69	Deuth	Fire Detector
3,445,669	5-20-69	Jordan et al.	Radiation Sensitive Carbon Monoxide Detector
3,447,152	5-27-69	Jensen	Fire and Smoke Alarm Device
3,495,353	2-17-70	Forsberg	Door Operating Mechanism
3,496,381	2-17-70	Wisnia	Proximity Control Guard Plate
3,497,995	3- 3-70	Forsberg	Height Sensitive Proximity Door Operator System
3,500,368	3-10-70	Nagoa Abe	Automatic Ionic Fire Alarm System

3,534,499	10-20-70	Chaffee	Door Opening Apparatus

SUMMARY OF THE INVENTION

The invention herein described incorporates an ionization detector in the holder-closer housing. The housing is preferably located above the door on the lintel or header of the door frame. Any products of combustion pass through multiple passageways located within the holder-closer housing to actuate the detector. Location of the detector at this point and within the holder-closer housing effects a major safety advantage. Instead of each controlled door closing at the first evidence of smoke at the ceiling (and the ceiling may be from 7 to 14 feet high), each door will now remain open until the smoke "level" builds downward from the ceiling to the height of the door — leaving the doors open for persons to move in either direction — until such time as smoke or products of combustion begin to block the actual exitway.

It is impossible to predict the logic of most persons under a fire or panic condition. Faced with closed doors, many persons will panic even though the doors will manually open with a normal force. Moreover, early door closing is highly disadvantageous for those buildings within which non-ambulatory patients are housed.

The location of the detector near the center of the door or, in the case of a double door closure, near the center of the corridor, is simply the best location to detect smoke. This detector location is effectively attained by this invention because the end of the closer-holder housing containing the detector is generally so located. There is a natural flow of air or draft through a closure opening. This flow will carry the products of combustion through this opening and also effectively through the detector fluid flow passageways formed into the surface mounted holder-closer of this invention. The detector, however, is not actuated until the exitway is subject to smoke passage; thus, facilitating evacuation until the last possible safe moment.

Additionally, the present invention has the economic advantage that regardless of the height of the corridor ceiling relative to the height of the door, one detector is all that is required to properly monitor the door. The interconnection of separated detectors and controlled holder-closers is eliminated.

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 drawings, wherein:

FIG. 1 is a view showing the surface application of the condition responsive door holder-closer of this invention to a single door;

FIG. 2 is a view showing the application of one door holder-closer of this invention to control a pair of corridor doors;

FIG. 3 is an exploded view showing certain principal components of the door holder-closer, namely, the ionization chamber module, the holder-closer assembly, and the cover;

FIG. 4 is an exploded fragmentary view showing the top-bottom access openings for the products of combustion in the cover, the ionization chamber module, and the holder-closer frame;

FIG. 5 is a section view taken along line 5—5 of FIG. 4 showing the relative alignment of the front-top-bottom openings of the cover, frame and module which provide fluid flow access to the ionization chamber;

FIG. 6 is a bottom view showing the relative alignment of the front and bottom openings;

FIG. 7 is a front view of the cover with portions broken away to show the relative alignment of the openings;

FIG. 8 is a front fragmentary view of the portion of the door holder-closer containing the ionization chamber module with certain components being broken away to expose principal elements of the ionization chamber module;

FIG. 9 is a bottom fragmentary view of the portion of the door holder-closer containing the ionization chamber module with certain components being broken away to expose elements of the ionization chamber module and also to show the relative disposition of the module relative the closer spring;

FIG. 10 is a section view taken along line 10—10 of FIG. 5 showing details of the ionization chamber, its protective screen, and also the static shield;

FIG. 11 is a top fragmentary view of the door holder-closer assembly, showing in full or in section the principal components of the holder-closer,namely, the closer spring, dashpot, electromagnet, and the latching lever assembly;

FIG. 12 is a front view of the structure of FIG. 11 with the dashpot partially in section (see lines 12—12 of FIG. 11) to show the details of the dashpot and the dashpot rollers;

FIG. 13 is a fragmentary view of the door holder-closer showing the latching lever assembly being manually overridden from a hold-open position and with the electromagnet energized;

FIG. 14 is a fragmentary view of the door holder-closer showing the latching lever assembly being released in response to the deenergization of the electromagnet;

FIG. 15 is a rear view showing the latching lever assembly coupled to the holder-closer dashpot by a fulcrum pin;

FIG. 16 is a section view of the latching lever assembly taken along line 16—16 of FIG. 15; and

FIG. 17 is a schematic circuit, with the principal components of the door holder-closer being diagrammatically shown, which shows the failsafe connection of the ionization chamber module to its associated circuitry.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, the condition responsive electromechanical door holder-closer 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.

In general, door holder-closer 1 includes a track 5 within which a slide block (not shown) reciprocates. The left end of standard arm 6 is coupled to the slide block. The right end of arm 6 is coupled to the projecting end of a rotating drive spindle (114 of FIG. 12) which is an integral part of the holder-closer dashpot.

The door holder-closer housing includes a cover 7 which contains the principal components of this invention, namely, an ionization chamber module, a coil spring, a link chain, a dashpot and an electromagnetic lever assembly.

In the usual preferred installation of door holder-closer 1, cover 7 and its contained components are fixedly positioned on the header trim 8 of door frame 4, and track 5 is fixedly positioned immediately below cover 7 adjacent the upper edge of flush door 2 as is shown in FIG. 1.

As is shown in FIGS. 1, 3, 4, 5 and 7, cover 7 has a planar bottom wall 9, a planar front wall 10 with curved ends, and a planar top wall 11.

Bottom wall 9 is formed with a plurality of rectangular openings 12, front wall 10 is formed with three rows of circular openings 13, and top wall 11 formed with a plurality of rectangular openings 14. As is hereafter outlined in detail, openings 12, 13 and 14 located in cover 7 are so aligned with other openings to provide fluid flow access for the products of combustion to an ionization chamber which is part of the ionization chamber module located within the housing.

FIG. 2 shows the application of one condition responsive door holder-closer 1 of this invention to control a pair of corridor doors 2 and 2'. Each door 2, 2' is controlled by a closer 1, 1', respectively.

It should be noted, however, that only door 2 is controlled by a holder-closer 1 which includes a cover 7 formed with a plurality of openings such as shown with respect to cover 7 of FIG. 1. Holder-closer 1' which controls door 2' is contained within a cover 7' which has no openings that correspond to openings 12, 13 and 14 of cover 7. In general, holder-closer 1' is constructed in a manner identical to that of condition responsive holder-closer 1 with the exception that no ionization chamber module is included within the closer 1'. As will be hereinafter outlined, the electrical circuitry of closers 1 and 1' are interconnected so that if holder-closer 1 detects products of combustion, both closers are activated simultaneously so as to close doors 2, 2' in response to such detection. It has been found that it is unnecessary in the application of a pair of doors which close off a hall or corridor to employ individual detectors within each of closers 1 and 1' inasmuch as the single detector is capable of adequate response to close off both doors.

FIG. 3 is an exploded view showing the two principal components of the door holder-closer 1, namely, the ionization chamber module 15 and the door holder-closer assembly 16. Module 15 is insertable within assembly 16 by module movement in the direction of the arrow, and the combined module holder-closer assembly is enclosed by cover 7 by relative movement of combined components 15 and 16 in the direction of the arrows toward cover 7.

Door holder-closer assembly 16 includes a metallic frame 17 which is generally U-shaped in cross section, having an elongated irregular bottom 18, a connecting back 19, and an elongated irregular top 20. As is shown in FIGS. 3, 4, 5, 6 and 7, frame bottom 18 and frame top 20 are formed with elongated openings 21 and 22, respectively. The plurality of cover openings 12 are aligned with frame opening 21 as is shown in FIGS. 6 and 7, so that opening 21 provides bottom access for openings 12 into the interior of frame 17. Similarly, the plurality of cover openings 14 are aligned with frame opening 22 so that top access may be had into the interior of frame 17.

In view of the fact that frame 17 has no front covering adjacent frame openings 21 and 22, cover openings 13 permit direct fluid flow access into frame 17 (see FIGS. 5 and 6).

As is shown in FIGS. 3 and 4, ionization chamber module 15 is an integral electrical unit having a body portion 15*a* from which a finger portion 15*b* projects. As is shown in FIGS. 8 and 9, frame 17 is formed with a chamber which will receive module 15. Module 15 comprises basically two parallelly disposed circuit boards 30 and 31 (see FIGS. 5, 8) which are fabricated of insulated material. Circuit boards 30, 31 are fixed in the parallel disposition by means of metallic spacer bars 32, 33, 34 (FIGS. 8, 9) and others which are not shown in the drawings.

Electrical components and interconnecting wiring generally denominated by numeral 35 are mounted between circuit boards 30, 31 and in some cases the components are supported directly by the circuit boards. These components constitute part of the ionization chamber amplifier hereinafter described. The exterior sides of circuit boards 30, 31, as well as the bottom edges of these boards adjacent frame connecting back 19 and the top edges of module finger portion 15*b* are all protectively insulated by a paper insulator covering 36. A metallic shield plate 37 covers the edges of module body portion 15*a* adjacent cover 7 (see FIGS. 8 and 9).

Cover plate 37 supports reset pushbutton switch 38 and pilot light 39 so that these two components are exposed through appropriately located openings positioned in cover 7 (see FIGS. 7, 8 and 9). The operation of these components is hereafter described with respect to FIG. 17.

Referring to FIGS. 8 and 9, spacer bars 33 and 34 support metallic plate 45 transversely disposed between circuit boards 30 and 31.

As is best shown in FIG. 10, the right surface of metallic plate 45 supports ion chamber 46. Ion chamber 46 is generally cup-shaped in cross section having a cylindrical side wall 47 joined by a bottom 48 contacting plate 45. Circular opening 49 provides access to the interior of ion chamber 46 (see FIG. 5).

Radioactive source 50 is supported on the right end of metallic positive electrode post 51 so that the source is centrally located within the ion chamber (see FIG. 5 also). Insulator bushing 52 isolates electrode 51 from the metallic plate 45.

In the preferred commercial embodiment, radioactive source 50 is a sandwich comprising a silver layer 50*a*, a gold layer 50*b* containing dispersed Americium oxide and a gold sealing layer 50*c*.

A U-shaped metallic static shield 60 is supported on spacer bars 33 and 34 by a plurality of front spacer bushings 61 and a plurality of bottom spacer bushings 62.

Electrostatic shield 60 generally comprises two rectangular, metallic, plate-like spaced legs 63 and 64 connected by curved portions 65 and 66 (see FIGS. 8, 9). Support tabs 67 and 68 project from between curved connector portions 65, 66 so as to be supportedly sandwiched between front spacer bushings 61. Front access opening 70 which provides a fluid passageway to ion chamber 46 is defined by connector portions 65, 66 and tabs 67, 68 (see FIGS. 6 and 8).

The spacing of shield legs 63 and 64 defines a bottom access opening 71 and top access opening 72 to ion chamber 46 (FIG. 7).

As is shown in FIG. 5, shield leg 63 is formed with a central hole which defines opening 49 for ion chamber 46. Accordingly, fluid flow access into the interior of chamber 46 is provided by the following three passageways:

(1) front passageway — through cover openings 13, front shield opening 70 to chamber opening 49 (FIGS.5,6,7 and 8);

(2) bottom passageway - through cover openings 12, frame opening 21, shield opening 71 to chamber opening 49 (FIGS.4,5, 6,7); and

(3) top passageway - through cover openings 14, frame opening 22, shiled opening 72 and chamber opening 49 (FIGS. 5, 7).

As is hereinafter outlined with reference to the schematicdiagrammatic representation of FIG. 17, fluid flow, i.e., the passing of the products of combustion through the foregoing passageways affects the electrical conductivity between source 50 and ion chamber sidewall 47 so that appropriate amplifier circuitry can detect such products.

Positive electrode 51 and associated components are shielded within metallic housing 75 supported on the left surface of metallic plate 45.

In view of the fact that small particles other than those created by the products of combustion, such as insects, can also create a current flow change within ion chamber 46 which simulates smoke or fire, screen 76 envelops the outside surface of cylinder sidewall 47. This screen also extends between shield legs 63 and 64 (FIGS. 9 and 10). Accordingly, all fluid flow into ion chamber 46 must pass through the cylindrical wall of the screen located between shield legs 63 and 64.

Additionally, the screen prevents the radioactive source 50 from falling outside of cover 7 in the event the source support on post 51 is broken. This is a necessary safety measure.

The principal components of door holder-closer 1 which cooperate with ionization chamber module 15 will now be described. Referring to FIGS. 11 and 12, support frame 17, which is enclosed within cover 7, houses the following principal components; namely, spring coil assembly 79, link chain 80, dashpot 81, electromagnet 82 and latching lever assembly 83.

Lating lever assembly 83 is described in U. S. Pat. 3,729,771 granted May 1, 1973 to Burke J. Crane, Richard E. D'Hooge and Frank D. Roberts for Latching Lever Assembly for Door Holder-Closer.

Spring assembly 79 includes compression coil spring 84 which envelops a spring rod 85. The left end of spring rod 85 is threaded (FIGS. 9 and 11) so that the adjacent end of spring 84 is held by spring retainer 86. Retainer 86 is adjustably mounted relative threaded rod 85 by washer 87 and spring tension adjusting nut 88.

The right end of spring 84 is supported on spring support plate 89 which has a retaining circular flange 90. Flange 90 receives the adjacent contacting spring 84 turn. Accordingly, spring 84 is positioned relative to rod 85 by spring retainer 86 and spring support plate 89 so that adjustment of nut 88 can vary the static compression force generated by spring 84.

Lateral movements of spring **84** relative to frame **17** are limited by front spring guide **91** and rear spring guide **92.**

The right end of spring rod **85** (FIGS. **11** and **12**) is coupled to link chain **80** by connecting pin **93.** The right end of link chain **80** is coupled to dashpot **81** by connecting pin **94.**

The details of the dashpot, particularly with reference to FIGS. **11** and **12,** will now be described. In FIG. **11,** a simplified horizontal section view of the dashpot is shown and in FIG. **12** a simplified vertical section view taken along lines **12—12** of FIG. **11** is shown.

In its principal aspects, dashpot **81** comprises a fixed stator **95** which is housed within cavity **96** defined by generally cylindrical rotor **96.** Stator **95** is formed with a pair of stator vanes **98** and **99.** The stator and its vanes remain fixed at all times relative support frame **17.** Stator **95** is formed with a mounting flange **100** (FIG.12) which is fixed to frame top **20** by a plurality of screws **101.**

Rotor **97** supports a pair of integral vanes **102** and **103** (FIG.11) which rotate with the rotor. As is shown in FIG. **12,** rotor **97** comprises a cylindrical section **104** to which annular flanges **105** and **106** are fixedly attached. The rotation of rotor **97** produces a corresponding rotation of annular flanges **105** and **106.**

Connecting pin **94** extends betwen flanges **105** and **106** to anchor chain **80** respectively to rotor **97.** Likewise, roller pins **107** and **108** extend between the flanges so that rollers **109** and **110** may rotate relative their associated pins and between the flanges. Rollers **109, 110** also move responsively with rotor **97** and flanges **105, 106.**

The interior dashpot cavity **96** defined between rotor **97** and stator **95** contains a viscoelastic plastic solid. This material may preferably be either a natural or synthetic unvulcanized rubber or an elastomeric-like material known as "bouncing putty". This damping medium is contained within cavity **96** by means of O-ring seal **111;** damping adjusting screw **112** is manually movable within its threaded bore to exert a varying pressure upon the damping medium through port **113** (FIG. **12**). Rotor spindle stem **114** receives the lower end of rotor cylindrical section **104** so that elements **104, 114** rotate in unison. Consequently, the attachment of standard arm **6** to spindle stem **114** produces related movement between arm **6** and the dashpot rotor elements. Rotor elements **104, 114,** including flanges **105** and **106** are rotatably fixed relative frame **17** by bearing plates **115** and **116.**

Stepped pin **117** serves as an alignment bearing for rotor **97** relative stator **95.**

As is shown in FIG. **11,** electromagnet **82** and lever assembly **83** are closely associated with dashpot **81.** In particular, electromagnet **82** is supported on frame **17** by electromagnet support plate **117.**

Referring now principally to FIGS. **11, 13, 14, 15** and **16,** the latching lever assembly **83** will now be described. The principal elements of lever assembly **83** are lever **120,** lever fulcrum shaft **121,** lever assembly biasing spring **122,** armature-lever coupling spring **123,** armature plate **124,** screw-washer-nut **125,** and spring alignment cylinder **126.**

Lever **120** is formed with a latch detent **127** whose main function is to engage rollers **109** and **110** to effect hold open. The lever is also formed with a yoke having legs **128** and **129** from which lugs **131** and **132** project to receive coupling spring **123.**

Coupling spring **123** (FIG.**15**) is a helical wound torsion spring formed into two divided and joined sections **133** and **134** having a central spring connector loop **135** (FIG.**16**) and two end connector loops **136** and **137** (FIG.**15**).

Spring **123** is shown in its tensioned position; that is, end connector loops **136** and **137** have been relatively rotated under spring tension so that loops **136** and **137** are adjacent central connector loop **135** as is shown in FIG.**15.** This disposition of connector loops **135, 136** and **137** places spring sections **133** and **134** in torsional tension. Accordingly, when loop **135** is rigidly fixed to armature **124** by bolt and nut **125** (FIG.**16**) and end connector loop **136** is fixed to lug **131** and end connector loop **137** is fixed to lug **132** (FIG.**15**), coupling spring **123** develops a strong torsional force which tends to force armature plate **124** against lever **120** as is shown in FIGS. **11, 14** and **16.** However, it should be noted that as shown in FIG. **13,** the resiliency of spring **123** enables armature plate **124** to be separated from lever **120** in response to oppositely directed forces as will be hereafter outlined.

When door **2** is closed, as is shown in FIG. **1,** and regardless of the energized or deenergized condition of electromagnet **82,** lever assembly **83** assumes the position shown in FIG. **11.** As is shown in this Figure and also FIG. **15,** lever **120** is pivoted relative dashpot **81** by fulcrum pin **121.** Fulcrum pin **121** also receives biasing spring **122** so that a force is exerted by this spring which normally urges the lever assembly to the position shown in FIG. **11**; that is, a position in which armature **124** rests against electromagnet **82.**

When electromagnet **82** is energized, armature **124** is magnetically attracted to the core of the electromagnet. However, as door **2** is opened, rotor **97** (FIGS.**13** and **14**) is rotated counterclockwise moving therewith chain **80** and thus compressing closer spring **84.** The counterclockwise motion of the rotor also causes rollers **110** and **109,** in that sequence, to pass under latching detent **127,** thus elevating lever **120** as is shown in FIG. **13.** Armature **124,** however, is magnetically fixed against electromagnet **82** in response to the energization of this electromagnet.

As the rotor **97** is rotated counterclockwise a further slight angle from that shown in FIG. **13,** roller **109** (or roller **110** depending upon the amount of angular hold-open desired) is held in engagement against latching surface **127*a*** of latching detent **127.** With this occurrence, lever **120** is lowered so that it assumes the relative position with respect to armature **124** shown in FIG. **11.** Door **2** is thus held open by the engagement of either roller **109, 110** and latching surface **127*a*.**

In the event it is decided to manually override the hold-open latch of door holder-closer **1,** the clockwise movement of rotor **97** causes rollers **109, 110** to elevate or cam away lever **120** so that the closer spring **84** can rotate rotor **97,** thereby causing standard arm **6** to move within track **5** to close door **2.**

It is important to note that during this condition of manual override, armature **124** is retained against electromagnet **82** as is shown in FIG. **13.** In other words, during manual override, armature **124** always maintains contact with electromagnet **82.** The resiliency of coupling spring **123** enables lever **120** to move up-

wardly without a corresponding movement in armature **124.**

In the event door **2** is held open in response to the engagement of either roller **109, 110** with respect to latching surface **127**a, and electromagnet **82** is deenergized due to the opening of a manual operate switch or the detection of an undesired condition by ionization chamber **46,** lever assembly **83** is released as is shown in FIG. **14** and rollers **109, 110** cam latching detent **127** upwardly. In view of the fact that electromagnet **82** is deenergized, a holding force is not applied to armature **124** and the armature maintains its contact position with respect to lever **120** as a result of the torsional forces applied to armature **124** and lever **120** by coupling spring **123.**

In all situations in which electromagnet **82** is denergized, lever latching assembly **83** produces a characteristic release noise which is undesirable. However, in the usual installation of a holder-closer of the type described, an emergency or alarm release rarely occurs; accordingly, such noise can be tolerated. Manual override, however, is a commonplace occurrence, and in this instance latching lever release noises can attain an intolerable frequency unless eliminated by appropriate latching lever designs. Also, the tendency for the armature to move away from an energized electromagnet can produce static charges if of sufficient intensity will erroneously simulate a fire, etc if the conductive condition of the ionization chamber **46** is affected. Accordingly, a latching lever design which only releases the armature from an electromagnet during an alarm condition is desirable.

The schematic circuit of FIG. **17** shows an electrical circuit effecting the interconnection of electromagnet **82** to ionization chamber **46** to effect hold-open and closing of door **2** in a failsafe manner of operation. Additionally, the schematic circuitry incorporates a condition responsive detector and amplifier unit within module **15** which is failsafe in operation. In particular, if all of the components of the module **15** are properly operating, door **2** will remain in hold-open effected by the latching of either roller **109** or **110** against latching detent **127** in response to the manual closing of control switch **151.** If, however, module **15** is not properly operating or, alternatively, this unit senses a condition such as flame or smoke, door **2** will be released from a latched hold-open position effected either by roller **109** or **110** and closed in response to the closing force exerted by coil spring **84.**

The detailed operation of the circuitry of FIG. **17** is as follows. Assuming module **15** is in proper operating condition and that the ionization chamber **46** input applied to terminals **152** and **153** indicates an absence of a flame or smoke condition, door **2** will be held in the open position in response to the manual closing of switch **151**; that is, the closing of switch **151** applies line voltage from terminals **154** and **155** to amplifier A of module **15.** The application of line voltage to amplifier A energizes amplifier output relay **156,** thereby closing normally open contact **156***a*.

The closing of contact **156***a* applies line voltage to the coil of power relay **157.** With this occurrence, normally open contact **157***a* is closed, thereby applying line voltage to fullwave bridge rectifier **158** to energize electromagnet **82** with a pulsating-direct-current voltage. (The physical position of a module containing bridge **158** is shown in FIGS. **11–14**).

The energization of electromagnet **82** causes magnetic armature **124** to resiliently hold lever **120** downwardly (FIG. **11**) and into locking engagement with either roller **109** or roller **110** against latching detent **127** (if door **2** is manually opened).

Accordingly, lever **120** holds rotor **97** with sufficient force to overcome the otherwise closing force exerted by coil spring **84.** Thus, so long as electromagnet **82** is energized, door **2** will be held in an open position.

In the event, however, (a) a slight manual closing force is applied to door **2,** (b) switch **151** is opened, (c) module **15** malfunctions, or (d) an undesired condition such as smoke or flame is detected by chamber **46,** lever detent **127** will be pivoted from engagement with roller **109** or **110,** as the case may be, and spring **84** will close the door to the position shown in FIG.**1.**

In the situation of case (a) above, the manual override closing force causes disposition of the lever assembly **83** components as shown in FIG. **13** during the point of operation at which roller **109,** for example, is in camming engagement with latching detent **127.**

In situations (*b*), (*c*) and (*d*) above, electromagnet **82** is deenergized, thereby enabling the camming action of roller **109** or **110,** as the case may be (see FIG. **14**), to elevate lever **120** as well as armature **124** as is shown in this Figure.

In a multiple door installation, such as the corridor application shown in FIG. **2** in which only holder-closer **1** need incorporate a detector module **15,** the electromagnet of holder-closer **1**′ is merely interconnected with the circuitry for holder-closer **1** so that both electromagnets (corresponding to electromagnet **82**) are energized or deenergized simultaneously.

Reset pushbutton switch **38** is connected to amplifier A of module **15** so that the circuitry can be again placed in a detecting readiness condition after the closer has released in response to a fire or alarm condition. Switch **38** is accessible for manual operation from the front of cover **7** (FIGS. **7** and **9**).

Pilot light **39** is also connected to amplifier A of module **15.** When the circuitry is in a properly operating supervisory condition, the pilot light will periodically emit light. When a fire, etc. is detected, the pilot light will remain on. A deenergized pilot light indicates an electrical malfunction. In a preferred circuit arrangement the circuitry "locks" into an alarm condition (pilot light **39** on) and remains in an alarm condition until the unit is reset by manual operation of switch **38.**

A preferred detailed circuit for module **15** is described in U. S. Pat. 3,673,586 granted June 27, 1972 to Lyman C. Blackwell for Resistance Con-trolled Timed Pulse Generator.

It should be understood that the structure shown in the drawings is merely typical, and that modifications can be made without departing from the scope of the invention.

What is claimed is:

1. A condition responsive door holder-closer comprising a housing, a closer spring and a dashpot disposed within the housing, a drive spindle projecting through the housing and coupled to the spring-dashpot subcombination to be responsive to the damped forces exerted by the subcombination, means within the housing for latching the spindle at a door hold-open position, means including one or more openings in said housing for defining passageways within said housing to facilitate fluid flow within the housing including the

products of combustion, a detector for the particulate products of combustion located within the housing and in which detector an electrical current characteristic is altered in response to the detection of such particulate products of combustion, and means interconnecting the detector to the spindle latching means to actuate the latch in response to the flow of the particulate products of combustion through said housing passageway means.

2. The combination of claim **1** in which the housing is generally horizontally disposed on a door frame immediately over the door, and an arm couples the spindle to the door so that the door and spindle are responsive motionwise to one another.

3. The combination of claim **2** in which the door is pivoted for movement relative the frame, the spindle being located adjacent the pivot axis for the door and generally at one end of the housing, and the passageway defining means being generally located at the opposite end of the housing remote from the pivot axis.

4. The combination of claim **3** in which the door holder-closer housing is elongated and generally horizontally disposed on the surface of the frame.

5. The combination of claim **4** in which the passageway defined through the housing is generally vertical.

6. The combination of claim **5** in which the passageway defined through the housing is both vertical and horizontal attained by openings located on the top, front, and bottom of the housing.

7. The combination of claim **1** in which the passageway means includes an electrostatic shield, and the detector is an ionization chamber.

8. The combination of claim **1** in which the detector is an ionization detector.

9. A condition responsive door holder-closer contained within a housing and including means for mounting the housing adjacent the header portion of a door frame, comprising a particulate products of combustion condition detector located within the housing and responsive to fluid flow carrying the particulate products of combustion and in which detector an electrical current characteristic is altered in response to the detection of such particulate products of combustion, means including one or more openings in said housing defining a fluid flow passageway within said housing to said condition responsive detector, a closer-holder spring-dashpot combination including electrically operated means for arresting the spring-dashpot combination to a door hold-open position with the spring, dashpot and electrically operated means being disposed within the housing, and means interconnecting the condition responsive detector to the electrically operated arresting means whereby the passage of the particulate products of combustion through an opening into the passageway releases an arrested spring-dashpot combination.

10. The combination of claim **9** in which the one or more openings is located generally at one end of the housing, and means located generally at the other end of the housing and projecting therethrough for coupling to a door to effect hold-open and also door release.

11. The combination of claim **10** in which a door opening is defined by a frame having a header portion at the top of the frame, and in which the housing is supported at the top of the frame with one or more housing openings being generally located toward the mid-portion of the header and the door coupling means being located generally at an end portion of the header.

12. The combination of claim **9** in which a plurality of housing openings defines a complete fluid flow passageway into and out of the housing.

13. The combination of claim **11** in which a plurality of housing openings defines a complete fluid flow passageway into and out of the housing.

14. The combination of claim **9** in which an electrostatic shield located within the housing isolates the fluid flow passageway therein electrostatically, and in which the detector is an ion chamber communicating with the passageway.

15. The combination of claim **12** in which an electrostatic shield located within the housing isolates the fluid flow passageway therein electrostatically, and in which the detector is an ion chamber communicating with the passageway.

16. The combination of claim **9** in which the detector is an ionization detector.

17. A condition responsive door holder-closer to control a door pivotally mounted relative an opening defined by a frame having a header portion at the top of the frame, comprising a housing adapted to be supported above the door on or near the header portion, a closer spring and a dashpot disposed within the housing, a drive spindle projecting through the housing and coupled to the spring-dashpot combination to be responsively rotatable by the damped forces exerted by the combination, the spindle being located adjacent the pivot axis of the door and generally near an end of the housing mounted adjacent an end of the header portion, an arm coupling the projected end of the spindle to the door to also responsively rotate the spindle by forces exerted on the door, a detector for the particulate products of combustion located generally at the opposite end of the housing toward the mid-portion of the door opening and in which detector an electrical current characteristic is altered in response to the detection of such particulate products of combustion, electrically operated means located within the housing for arresting the spring-dashpot combination to a door hold-open position, and means interconnecting the condition responsive detector to the electrically operated arresting means whereby the passage of the particulate products of combustion through the door opening releases an arrested spring-dashpot combination to close an open door.

18. The combination of claim **17** in which the housing is elongated and is disposed generally horizontally on its elongated axis.

19. The combination of claim **17** in which the detector is an ionization detector.

20. In a condition responsive door holder-closer contained within a housing and adapted to be mounted immediately over a door opening, the holder-closer including electrically operated means within the housing for effecting door hold-open and door-closing conditions, the improvement comprising a particulate products of combustion detector located within the housing and responsive to particulate products of combustion and in which detector an electrical current characteristic is altered in response to the detection of such particulate products of combustion, means including one or more openings in said housing defining a fluid flow passageway within said housing to said detector, and means interconnecting the detector to the electrically

operated means whereby the passage of the particulate products of combustion through the passageway actuates the door holder-closer from a hold-open to a door closing condition.

21. The combination of claim **20** in which the detector is an ionization detector.

22. The combination of claim **21** including means for shielding the ionization detector from spurious electrostatic charges.

23. The combination of claim **20** in which the housing is generally elongated with passageway openings being located generally at one end of the elongated housing.

24. The combination of claim **23** in which the housing is adapted to be generally horizontally mounted on a header portion of a door frame with the openings being located generally toward the center of the door header.

25. The combination of claim **24** in which the detector is an ionization detector.

26. The combination of claim **25** including means for shielding the ionization detector from spurious electrostatic charges.

27. The combination of claim **25** in which the housing openings are disposed to provide generally vertical fluid flow through the housing for the particulate products of combustion.

28. The combination of claim **25** in the housing includes top, bottom and front walls and in which openings are provided in all of said walls for passage of the particulate products of combustion.

29. In a condition responsive door holder contained within a housing and adapted to be mounted immediately over a door opening, the holder including electrically operated means within the housing for effecting a door hold-open condition, the improvement comprising a particulate products of combustion detector located within the housing and responsive to particulate products of combustion and in which detector an electrical current characteristic is altered in response to detection of such particulate products of combustion, means including one or more openings in said housing defining a fluid flow passageway within said housing to said detector, and means interconnecting the detector to the electrically operated means whereby the passage of the particulate products of combustion through the passageway actuates the door holder from a hold-open condition whereby the door is no longer positively held open by the door holder.

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