

Aug. 27, 1968

C. FREDERICK, JR

3,398,482

SHOCK-ABSORBING CONTROL APPARATUS FOR FIRE DOORS

Filed June 13, 1966

4 Sheets-Sheet 1

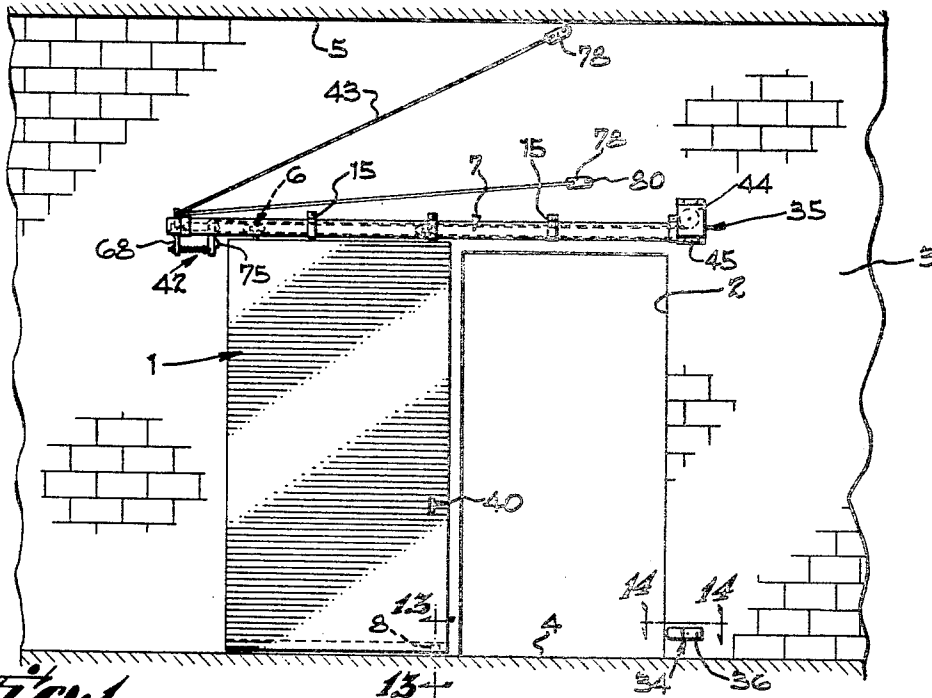


Fig. 1

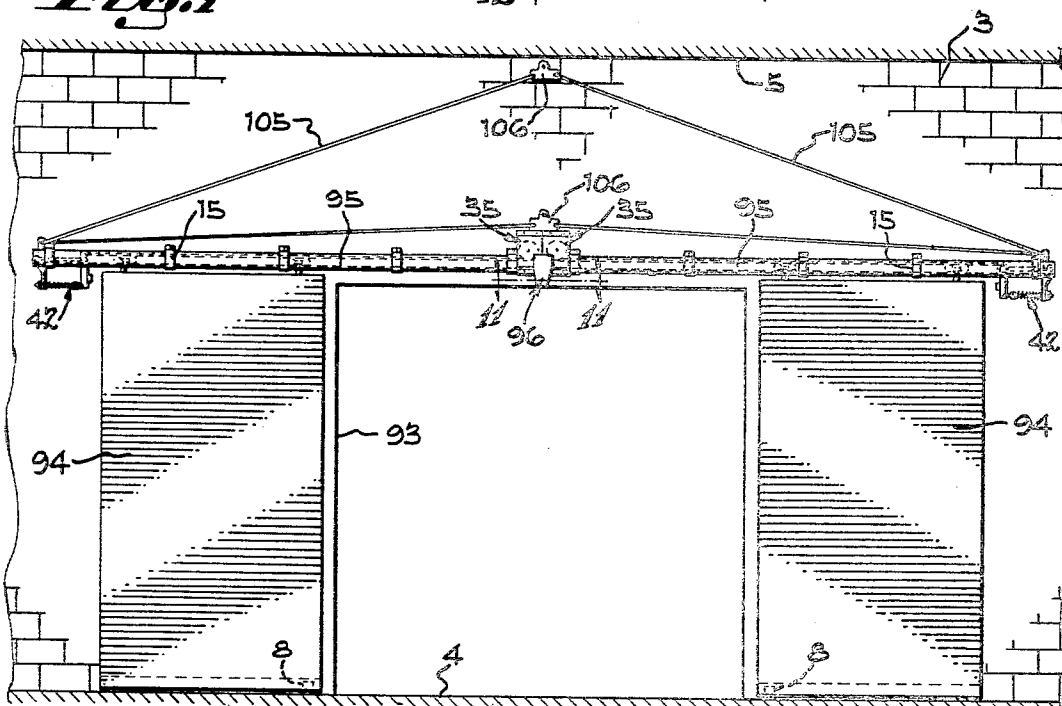


Fig. 2

INVENTOR
Cland Frederick, Jr.
BY
Wood, Henson & Evans.
ATTORNEYS

Aug. 27, 1968

C. FREDERICK, JR

3,398,482

SHOCK-ABSORBING CONTROL APPARATUS FOR FIRE DOORS

Filed June 13, 1966

4 Sheets-Sheet 2

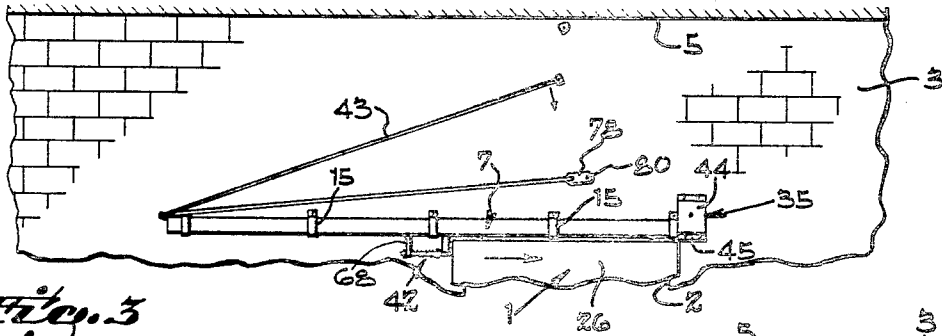


Fig. 3

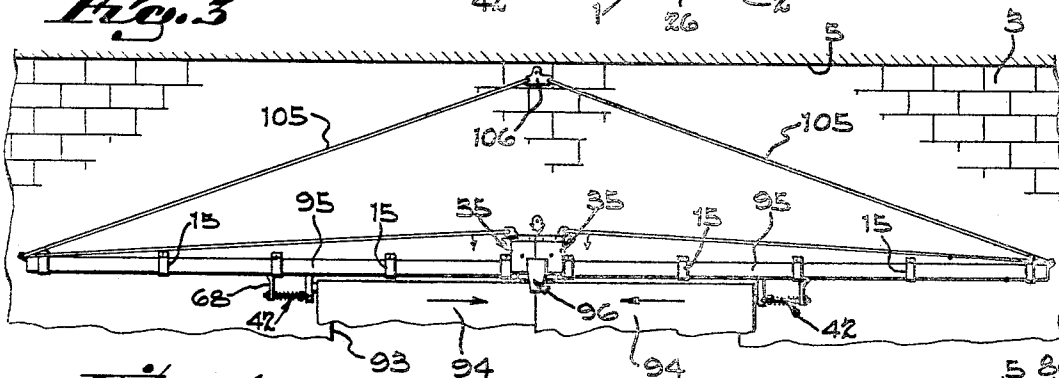


Fig. 4

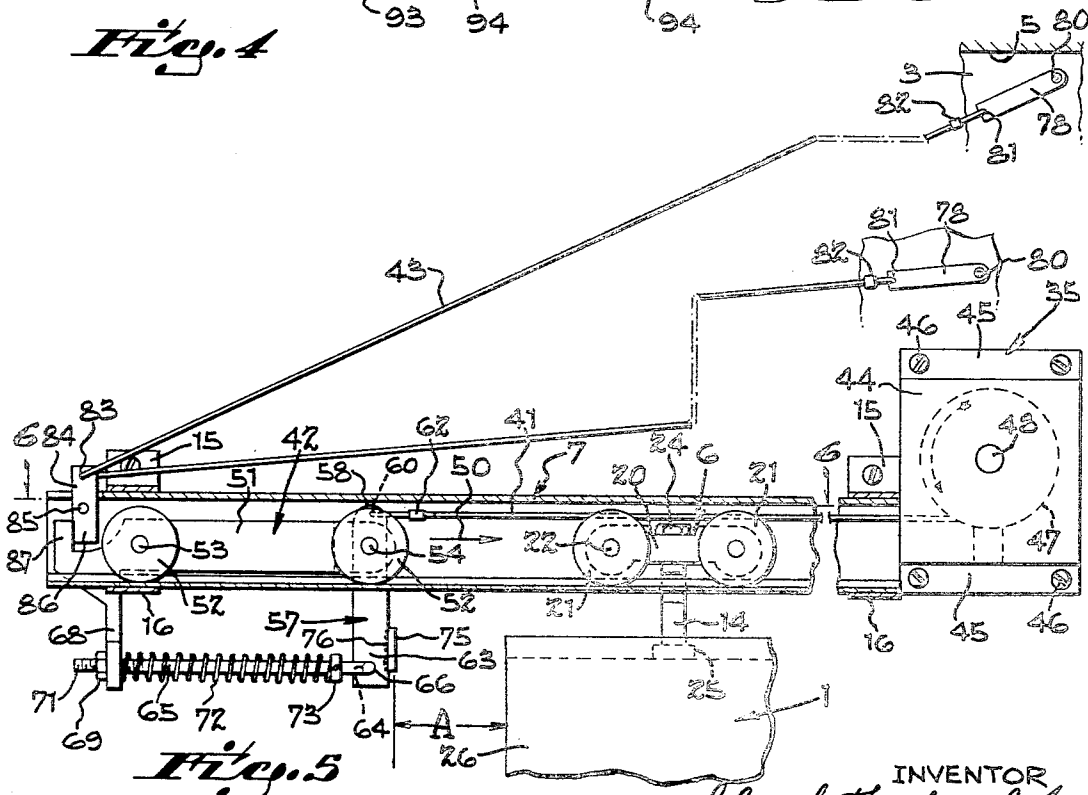


Fig. 5

INVENTOR
Klaud Frederick, Jr.
BY
Wood, Nelson & Evans
ATTORNEYS

Aug. 27, 1968

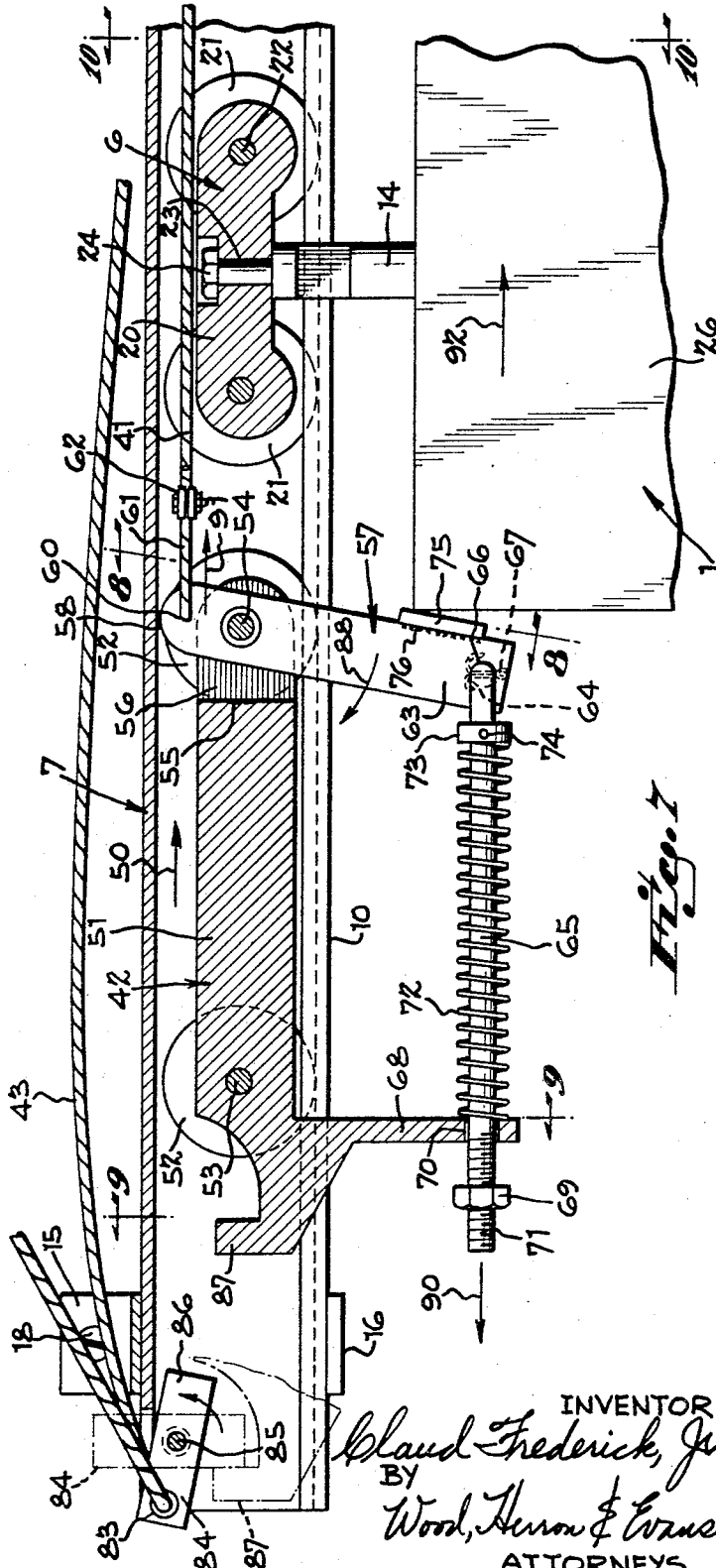
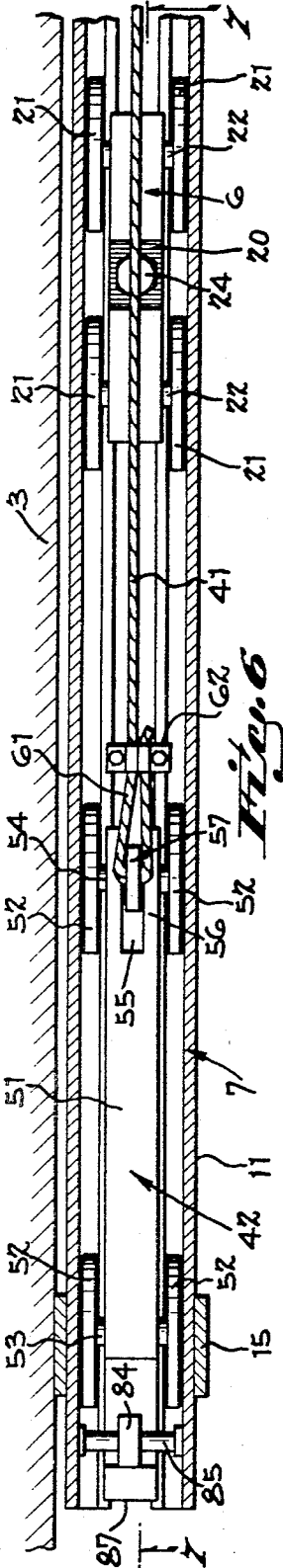
C. FREDERICK, JR

3,398,482

SHOCK-ABSORBING CONTROL APPARATUS FOR FIRE DOORS

Filed June 13, 1966

4 Sheets-Sheet 3



INVENTOR
C. Frederick, Jr.
BY
Wood, Huron & Evans.
ATTORNEYS

Aug. 27, 1968

C. FREDERICK, JR

3,398,482

SHOCK-ABSORBING CONTROL APPARATUS FOR FIRE DOORS

Filed June 13, 1966

4 Sheets-Sheet 4

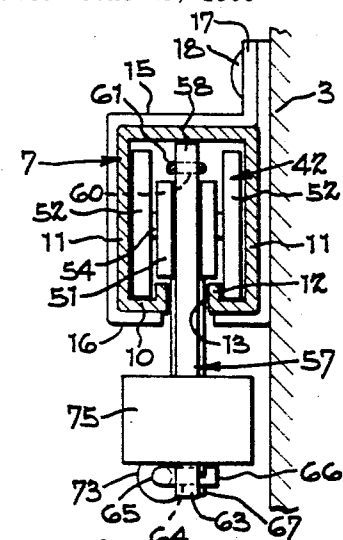


Fig. 8

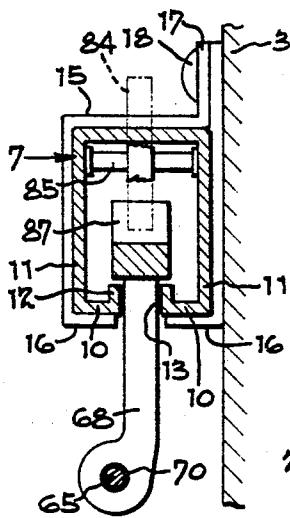


Fig. 9

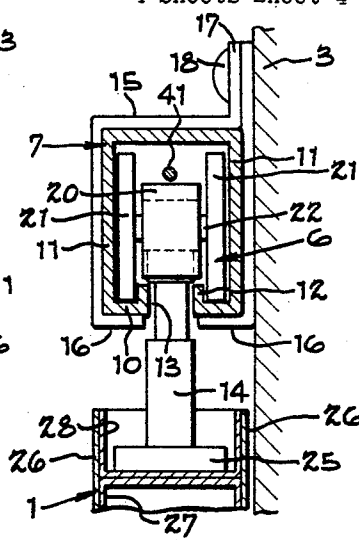


Fig. 10

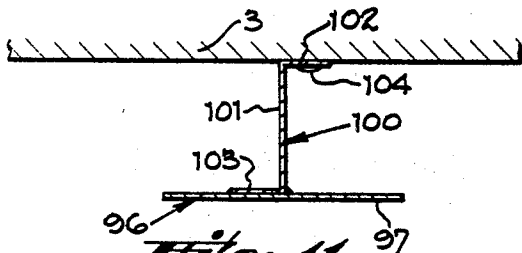


Fig. 11

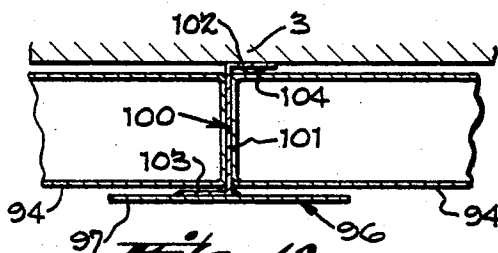


Fig. 12

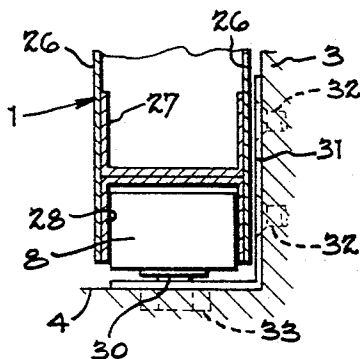


Fig. 13

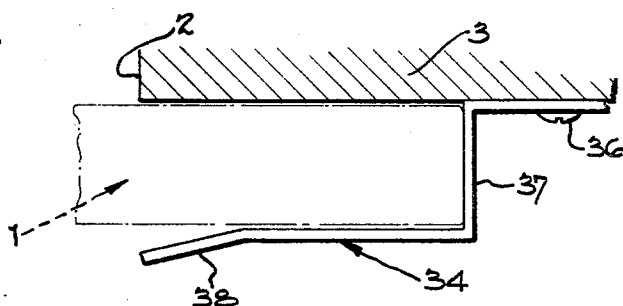


Fig. 14

INVENTOR
C. Frederick, Jr.
BY
Wood, Huron & Evans
ATTORNEYS

1

3,398,482

SHOCK-ABSORBING CONTROL APPARATUS FOR FIRE DOORS

Claud Frederick, Jr., Cincinnati, Ohio, assignor to The Steelcraft Manufacturing Company, Rossmoyne, Ohio, a corporation of Ohio

Filed June 13, 1966, Ser. No. 557,099

8 Claims. (Cl. 49-8)

ABSTRACT OF THE DISCLOSURE

The disclosure is directed to a shock-absorbing mechanism for an automatic, heat-responsive fire door control apparatus in which the door is closed automatically in the event of a fire. In general, the fire door arrangement comprises a horizontal trolley rail extending transversely across and beyond one side of a door opening, with a fire door suspended from the rail by means of trolleys tracked upon the rail, such that the door may be translated manually, under normal conditions, from an open to a closed position. For closing the door in the event of a fire, there is provided a spring-loaded retriever reel connected by a retriever cable to a pusher trolley which is normally disconnected from the door and which is released by a heat-responsive trigger mechanism in response to the melting or failure of a fusible link.

The pusher trolley normally resides in spaced relationship to the trailing edge of the door (the spacing depending upon the random position of the door as shifted manually). In order to eliminate the impact force which is developed upon release of the pusher trolley in response to a fire, the pusher trolley is provided with a shock-absorbing lever which has its upper end pivotally connected to the pusher trolley, the lever projecting downwardly, with its lower end engageable with the door. A compression spring is interposed between the pusher trolley and the midportion of the shock-absorbing lever (cushioning lever), the spring being compressed to permit the shock-absorbing lever to yield in response to the impact force developed by the pusher trolley upon engagement with the door so as to protect the mechanism against shock forces which may otherwise lead to damage or failure of the mechanism.

This invention relates to sliding fire doors which are mounted relative an opening in a fire wall, and is directed particularly to a heat-responsive apparatus adapted to shift the door or doors in an automatic manner from a normally open position to a closed position in response to heat which is generated by a fire in the building, so as to confine the fire to a given area. Fire doors of this general type, having heat-responsive control apparatus, are widely used, for example, in industrial plants, warehouses, and other commercial buildings, particularly where the danger of fire prevails.

The heat-responsive fire control apparatus of the present application is generally similar to that disclosed in the copending application of Claud Frederick, Jr., et al., Ser. No. 506,368, filed on Nov. 4, 1965.

One of the primary objectives of the present invention has been to provide a heat-responsive fire door control apparatus which includes shock-absorbing means, whereby the door-actuating mechanism is protected from impact forces which may be developed during the high-speed operation of the automatic control apparatus.

Generally speaking, the automatic, heat-responsive ap-

2

paratus comprises a power means, in the present example a spring-operated retriever reel, having a cable connected to a pusher trolley which is carried upon rollers within a trolley rail. A heat-responsive control cable, which includes one or more fusible links connected to a trigger mechanism, normally holds the pusher trolley in a retracted position within an end portion of the trolley rail.

In the event of a fire, one or both of the fusible links of the control cable are melted, thus releasing the trigger mechanism, whereby the pusher trolley is drawn in the direction of the fire door by operation of the power unit (retriever reel and cable) so as to shift the door from its open position to a closed position with respect to the door opening. The fire door, which is usually metal clad, is relatively heavy, and the retriever mechanism, due to momentum and the sudden application of force, generates considerable impact force upon engaging the trailing edge of the door.

For structural simplicity, the pusher trolley comprises a carriage, with a pair of rollers at the leading end of the carriage and a second pair of rollers at its trailing end, the pairs of rollers being tracked within the trolley rail. The leading end portion of the pusher trolley is slotted and a cushioning lever has a portion extending through the slot and pivotally connected to the axle of the pair of rollers at the leading end of the carriage. The cushioning lever depends downwardly through a longitudinal slot in the trolley rail and its lower end is adapted to engage the trailing edge portion of the fire door upon release of the pusher trolley in the event of a fire. The cushioning effect is brought about by a shock-absorbing spring seated against the lower end portion of the cushioning lever. The slotted arrangement of the carriage and utilization of the forward axle of the carriage simplifies the construction of the pusher trolley and improves its performance.

A further and more specific objective of the invention has been to reduce the tension force which acts upon the retriever cable upon release of the pusher trolley and the sudden engagement of the cushioning lever with the trailing edge of the relatively heavy fire door, thereby to prevent the failure of the cable.

According to this feature of the invention, the upper end portion of the cushioning lever projects upwardly above the axle of the pair of rollers at the leading end of the pusher trolley. The retriever cable is anchored to this upwardly projecting portion of the lever, rather than being anchored directly to the pusher trolley. Accordingly, upon release of the pusher trolley and impact of the lower end of the cushioning lever with the edge of the door, the lower portion of the lever, due to the operation of the cushioning spring, swings in a rearward direction, while the upper end portion of the lever, to which the retriever cable is attached, swings forwardly in the direction in which the retriever cable is being pulled by the retriever mechanism. Accordingly, at the moment of impact, the shock-absorbing action of the cushioning lever protects the retriever cable against overloading and failure of the cable and also against injury to the other parts of the control apparatus.

According to the present invention, the heat-responsive fire door control apparatus may be applied either to a single fire door or to a double door arrangement in which two opposed fire doors normally reside on opposite sides of an opening in the fire wall. In the single door arrangement, a single power unit, such as the retriever reel assembly, is utilized; in the double door arrangement two retriever reels, one for each door, are utilized.

3

A further feature of the present invention has been the provision of a stop element which serves the double function of securing the two retriever reels in assembly at the center of the door opening and which also provides a stop engageable with the leading edges of the two doors when the doors are closed, either manually or in response to a fire.

In general, the stop element comprises a mounting plate formed of sheet metal and attached to both retriever reels to secure them together, with a portion depending downwardly below the retriever reels. A combined reinforcement and stop bracket which is generally Z-shaped, extends from the depending portion of the plate to the fire wall, and is attached to both the mounting plate and the fire wall. The web of the Z-shaped bracket resides at right angles to the path of motion of the two fire doors and acts as a stop. By virtue of the relatively thin sheet metal construction of the Z-shaped bracket, the edges of the two doors are brought substantially into engagement with one another when the doors are shifted to the closed position and into engagement with the opposite sides of the web of the Z-shaped bracket.

Various features and advantages of the invention will be more readily apparent to those skilled in the art from the following detailed description taken in conjunction with the drawings.

In the drawings:

FIGURE 1 is an elevation of a fire wall, having a door opening, illustrating in a general way, a single fire door and the improved control apparatus of this invention.

FIGURE 2 is a general view similar to FIGURE 1, showing a modified arrangement in which two opposed fire doors and associated control apparatus are utilized in sealing off the opening in the fire wall.

FIGURE 3 is a fragmentary view of the single door apparatus shown in FIGURE 1, showing the fire door in its closed position in response to the melting of one of the fusible links of the control apparatus.

FIGURE 4 is a fragmentary view showing the double door arrangement shifted to its closed position in response to melting of one of the fusible links in response to an elevated temperature resulting from the fire.

FIGURE 5 is an enlarged fragmentary view, partially in section, similar to FIGURE 1, showing the single door and the arrangement of the fusible links and associated control mechanism of the present invention.

FIGURE 6 is an enlarged sectional view taken along line 6—6 of FIGURE 5, further illustrating the trolley rail, improved pusher device, and one of the trolleys, representing a portion of the single or double door arrangement.

FIGURE 7 is a sectional view taken along line 7—7 of FIGURE 6, showing the trigger mechanism tripped in response to the melting of one or both of the fusible links, with the pusher mechanism engaged against the fire door and shifting the fire door towards the closed position.

FIGURE 8 is a cross-sectional view taken along the line 8—8 of FIGURE 7, further illustrating the yieldable pusher mechanism which is shown in FIGURE 7.

FIGURE 9 is a cross-sectional view taken along the line 9—9 of FIGURE 7, further illustrating the pusher mechanism.

FIGURE 10 is a cross-sectional view taken along line 10—10 of FIGURE 7, illustrating one of the door-supporting trolleys and the portion of the fire door.

FIGURE 11 is an enlarged sectional view taken along the line 11—11 of FIGURE 2, detailing the gusset plate which forms a part of the double retriever reel assembly and which acts as a stop engageable with the two doors for locating the two doors in their closed position with reference to the door opening.

FIGURE 12 is a sectional view similar to FIGURE 11, showing the two doors in their closed position, with their leading edges seated against the door stop which is shown in FIGURE 11.

FIGURE 13 is a sectional view taken along the line

4

13—13 of FIGURE 1, detailing the stay roller which engages and guides the lower edge of the fire door in a vertical plane during the closing motion of the door with reference to the door opening. Respective stays or guide rollers of the same construction are utilized with reference to each of the two opposed doors in the arrangement shown in FIGURE 2.

FIGURE 14 is a sectional view taken along the line 14—14 of FIGURE 1, illustrating the binder or stop bracket which engages the leading edge of the single fire door in its closed position with reference to the door opening. This bracket is omitted in the double door arrangement shown in FIGURE 2, the leading edges of both doors being engaged by the stop bracket which is detailed in FIGURES 11 and 12.

Single fire door structure

As noted earlier, the control apparatus of the present invention is embodied in a fire door arrangement comprising either a single door shiftably mounted relative to an opening in a fire wall and arranged to be shifted to a closed position in an automatic manner in the event of a fire. In a second embodiment, two opposed fire doors are utilized in the event the opening in the fire wall is of substantial width, for example, an opening wide enough to permit equipment and vehicles, such as fork lifts, to be shifted about the plant.

In the single fire door arrangement, the door normally resides in its open position parallel with the wall and adjacent the opening, the door having a sufficient width to close the opening, with the marginal portions of the door overhanging the opening along opposite sides. In the double door arrangement, two doors are suspended along opposite sides of the opening. In this case, in the event of a fire, the two doors shift automatically to the closed position with their leading edges meeting at the center of the door opening, with marginal portions of the trailing edges of the door overhanging the opening on opposite sides.

The control apparatus of the single and double door arrangement both utilize the same principle of operation, as explained later. The single door arrangement is shown generally in FIGURES 1 and 3, and the double door arrangement is shown generally in FIGURES 2 and 4. It will be understood, at this point, that the structural details of the door suspension system and the automatic, heat-responsive control apparatus are the same, with minor modifications, for the single door and the double door arrangement, as explained later.

Referring generally to FIGURES 1 and 5—7, the single fire door, indicated generally at 1, is mounted with reference to the opening 2 of a fire wall 3 which extends from the floor of the building 4 to the ceiling 5. The door 1 is suspended for shifting motion with reference to the opening 2 by means of a pair of support trolleys 6, which traverse an overhead trolley rail, indicated generally at 7.

The trolley rail 7 is secured to the fire wall 3 and extends above the door opening 2 to the left of the opening (in the present example) a sufficient distance to suspend the door in its open position parallel to the wall and spaced outwardly a slight distance to avoid frictional contact with the wall. The arrangement is such that the door is free to be shifted manually to its open or closed position in the normal manner without interference by the heat-responsive control apparatus. The lower edge of the door 1 is spaced slightly above the surface of the floor 4 (FIGURES 1 and 13), and is guided for motion in its horizontal plane parallel with the floor by a guide or stay roller, indicated generally at 8.

It will be understood at this point that the trolley and rail construction are the same in both the single and double fire door systems. Described in detail (FIGURES

5

6-10), the trolley rail 7 is generally of inverted U-shape formed of sheet metal and having inturned horizontal flanges 10-10 projecting inwardly toward one another from the lower edges of the vertical limbs 11-11 of the rail. The inner or free edges of the horizontal flanges 10 each include a vertical lip 12 which delineate a longitudinal central slot 13. The slot 13 of the trolley rail 7 provides clearance for the hangers 14 (FIGURE 10) which depend downwardly from the trolleys 6 to support the door 1.

The trolley rail 7 is mounted with reference to the fire wall 3 by means of a series of mounting brackets 15 (FIGURES 1, 2 and 8-10) which are U-shaped in cross section embracing the trolley rail 7. The mounting brackets 15 include lower inturned lower end portions 16 which underlie the horizontal flanges 10 of the trolley rail to support the rail in load-bearing engagement. Each mounting bracket 15 includes an upstanding portion 17 traversed by a bolt 18 which is anchored in the fire wall 3.

Each door-suspending trolley 6 (FIGURES 5-7 and 10) comprises a carriage 20 supported by pairs of rollers 21-21 journaled on axles 22 at opposite ends, the rollers 21 being tracked upon the horizontal flanges 10-10 of the trolley rail 7. Each carriage, at a point midway along its length, includes one of the hangers 14 (FIGURE 10) noted earlier. The upper end portion of the hanger 14 (FIGURE 7) is necked as at 23 and the necked portion passes through a bore extending through the carriage 20, with a nut 24 threaded upon the upper end of the necked portion to clamp the hanger 14 in place. The lower end of each hanger is connected to the upper portion of the door as at 25 (FIGURE 10). In the present example, each door in the single or double arrangement is suspended by means of two trolley assemblies and hangers.

Essentially, the door (single or double) is formed of sheet metal comprising a pair of spaced panels 26-26 (FIGURES 10 and 13), the panels being held in spaced relationship by marginal, channel-shaped inner framing members 27 along its upper and lower edge portions. The inner framing members 27 include limbs facing inwardly. In addition, the upper and lower edge portions include outwardly facing channel members 28-28, thus further reinforcing the door structure. The door panels 26 preferably are spot-welded to the framing members 27 and 28 and the area between the panels 26 may include a suitable filler (not shown), which provides a stiffening and sound-deadening effect. The respective trolley hangers 14 are secured as at 25 (previously noted), to the upwardly facing channel-shaped framing member.

As indicated generally in FIGURES 1 and 2 and detailed in FIGURE 13, the guide or stay roller 8 is rotatably mounted upon a vertical shaft 30 projecting upwardly from an angle bracket 31 which seats against the floor 4 and fire wall 3. The angle bracket is secured to the wall 3 by screws 32. The shaft 30 passes through the horizontal portion of the angle bracket 31 and includes a nut 33 which clamps the shaft to the lower portion of the angle bracket 31. The roller 8 rides within the downwardly facing channel-shaped member 28 and thus confines the lower edge of the door or doors in the vertical plane of motion parallel with the fire wall.

In the closed position of the door 1, the leading edge of the door is engaged by a stop element or binder 34 (FIGURES 1 and 14). The binder stops the door before the leading door-suspension trolley 6 strikes the retriever reel assembly, which is indicated generally at 35 in FIGURES 1, 3 and 5. As detailed in FIGURE 14, the binder 34 is in the form of a bracket formed of sheet metal and secured as at 36 to the fire wall 3 adjacent the right edge of the door opening 2. The binder 34 includes an outwardly projecting stop flange 37 which engages the leading edge of the door in its closed position. The binder further includes a flared portion 38 which guides the leading edge

6

portion of the door in place with respect to the door opening.

It will be understood that the fire door 1 is free to be shifted manually to its open or closed position in the usual way without any interference from the heat-responsive door control apparatus. For this purpose (FIGURE 1), the door is provided with a hand-grip opening 40 for manual operation.

Fire door control apparatus (single door)

As best shown in FIGURES 1, 3 and 5-7, the heat-responsive control apparatus comprises the retriever reel assembly, previously indicated at 35, which is connected by a retriever cable 41 to a fire control pusher trolley, indicated generally at 42. The pusher trolley 42 is similar to the door trolleys 6 and normally resides in the left end portion of the trolley rail 7, as indicated in FIGURES 1 and 5. The pusher trolley 42 is normally restrained in its left-hand, inactive position by a heat-responsive fire control cable loop, indicated at 43.

The retriever reel assembly 35 comprises, in general (FIGURE 5), a housing 44, formed of sheet metal having mounting flanges 45-45 at opposite ends which are secured by bolts 46 to the fire wall 3. The retriever reel assembly includes a retriever reel 47 rotatably mounted upon a shaft or arbor 48 (FIGURE 5) having its opposite ends mounted within the housing 44. The reel includes an internal winding spring (not shown) having one end anchored to the shaft 48 and having its opposite end anchored to the reel 47. The spring exerts a constant winding force upon the reel in the direction indicated by the arrow 50 in FIGURES 5 and 7, thus tending to pull the fire control pusher trolley 41 constantly toward the right. The pusher trolley 42 is held in its left-hand position (FIGURE 5) counter to the pull of the retriever cable 41 by operation of the first control cable loop 43.

The fire control pusher trolley 42 embodies the shock-absorbing or cushioning mechanism of the present invention, which absorbs the shock which is generated upon release of the trolley 42 and the sudden impact force of the trolley with the trailing edge of the door. At this point, it will be understood that, since the door 1 is free to be opened and closed manually, the door will usually reside in a position with its edge spaced from the pusher trolley 42, for example, at a distance as indicated at A in FIGURE 5. The clearance A may be greater or less than that shown, depending upon the position to which the door is shifted by the user. It will be understood that the door is relatively heavy, and that the sudden impact of the pusher trolley 42 against the edge of the door upon release of the control cable is considerable. This impact force is harmful to the moving parts and may cause breakage of the retriever cable 41.

Described in detail (FIGURES 5-7), the improved pusher trolley 42 comprises a carriage 51 having rollers 52 arranged in pairs at opposite ends of the trolley and journaled upon the pair of axles 53 and 54. The pairs of rollers 52 are tracked upon the horizontal flanges 10 of the trolley rail 7 in the same manner as the rollers 21 of the door-supporting trolleys 6 as previously described (FIGURES 8-10).

The forward end of the carriage 51 of the pusher trolley 42 is slotted as at 55 (FIGURES 6 and 7) so as to provide a forked portion 56 at the leading end of the pusher trolley 42. The axle 54, upon which the forward rollers 52 are journaled, passes across the slot 55. A shock-absorbing lever 57 has its upper end portion extended through the slot 55 and is journaled upon the axle 54. The portion 58 of the shock-absorbing lever 57, which projects upwardly above the axle 54, provides an anchorage for the retriever cable 41. For this purpose, the upper end portion 58 of the cushioning lever 57 includes an aperture 60 (FIGURES 6 and 7) and the retriever cable 41 includes a looped portion 61 passing through the aperture and anchored by a cable clamp 62.

The lower portion 63 of the shock-absorbing lever 57 passes downwardly from the pusher trolley 42 and through the longitudinal slot 13 of the trolley rail 7 (FIGURES 6-8). The lower end portion of the shock-absorbing lever 57 includes an aperture 64 (FIGURES 5, 7 and 8) and a shock-absorbing rod 65 has its end portion bent at right angles as at 66, the right angular portion 66 passing through the aperture and providing a pivotal connection between the end of the rod 65 and lower end portion 63 of the shock-absorbing lever 57. The angular end 66 of the shock-absorbing rod, which passes through the lower end of the lever 63, is locked in place by a cotter pin 67 (FIGURE 8).

The end of the shock-absorbing rod 65, opposite the lever 57, passes slidably through a limb 68 (FIGURES 5, 7 and 9) which depends downwardly from the trailing end of the pusher carriage 51. The lower end portion of the limb 68 includes an aperture 70, the end portion 71 of rod 65 being threaded and passing loosely through the aperture 70. Rod 65 includes a spring 72 under compression between the limb 68 and a collar 73. The collar 73 is secured as at 74 to the rod 65.

The threaded end portion 71 of the rod 65, which passes through the limb 68, includes an adjustment nut 69 (FIGURES 5 and 7). In the normal position of the parts, as shown in FIGURE 5, the nut 69 seats against the limb 68, with the cushioning spring 72 in its expanded condition biasing the shock-absorbing lever 57 in its perpendicular position parallel with the limb 68.

It will be noted in FIGURES 5, 7 and 8, that the lower portion 63 of the shock-absorbing lever 57 includes a pad 75. The pad 75, which is preferably formed of metal, may be welded as at 76 to the lower end portion of the shock-absorbing lever 57. The pad 75 is located in the plane of the door 1 and is normally displaced from the trailing edge of the door, as previously indicated at A in FIGURE 5, so as to engage the door (FIGURE 7) upon release of the control apparatus.

As noted earlier, the control apparatus is triggered by the heat-responsive cable loop 43 (FIGURES 1, 3 and 5). The opposite ends of the fire control cable loop 43 are anchored to respective fusible links 78-78, each link having one end anchored as at 80 to the fire wall 3. The opposite or free end of each link includes an aperture 81 to receive the anchored end portions 82-82 of the cable loop 43 (FIGURE 5). The fusible links 78 are formed of a metal which melts at a temperature somewhere in the neighborhood of 160° F. so as to release one or both ends of the cable loop 43 in response to an elevated temperature resulting from a fire in the area.

The looped lower end of the control cable 43 passes slidably through an aperture 83 (FIGURES 5 and 7) formed in a trigger bar 84. The trigger bar 84 is pivotally mounted as at 85 with reference to the slotted end portion of the trolley rail 7, and its lower end 86 normally engages a spur 87 at the trailing end of the pusher trolley 42, the spur being delineated by a recess formed in the trolley. The fire control cable loop 43 and trigger bar 84 thus latch the pusher trolley 42 normally in the left-hand position (FIGURE 5), counter to the pull exerted by the retriever cable 41. It will be seen therefore, that under normal conditions, the door 1 is completely disconnected from the pusher trolley 42, leaving the door free to be shifted to its open or closed position, as stated earlier.

Operation

In case of a fire in the area which generates sufficient heat to melt one or both of the fusible links 78 (in the present illustration the upper link, FIGURE 3) the upper end of the control cable loop 43 is released and drops downwardly as indicated. Upon release of the cable loop, the trigger bar 84 is free to swing from the latching position of FIGURE 5 to the unlatching position of FIGURE 7, as indicated by the arrow. Upon release of the trigger bar 84, the fire control pusher trolley 42, by operation of

the retriever cable 41, is pulled toward the right, causing the pad 75 of the shock-absorbing bar 57 to engage the edge of the door 1, as shown in FIGURE 7.

Because of the inertia of the relatively heavy door 1, the shock-absorbing lever 57 swings through an arc about the axle 54, upon which it is pivoted, in the direction indicated by the arrow 88 (FIGURE 7). This action compresses the cushioning spring 72, allowing the shock-absorbing rod 65 to shift rearwardly with respect to the limb 68, as indicated by the arrow 90 in FIGURE 7. This action cushions the pusher trolley and its associated parts from the shock which would otherwise be developed by the rapidly moving pusher trolley.

It will also be observed that the swinging motion of the shock-absorbing lever 57 is accompanied by a forward motion of the upper portion 58 of the lever, in the direction of the pull exerted by the retriever cable 41, as indicated by the arrow 91. Accordingly, at the moment of impact and compression of the cushioning spring 72, the strain on the retriever cable 41 and upon the retriever assembly 35 will have been greatly reduced, thereby protecting the cable and the retriever mechanism against damage or failure. After the initial shock is absorbed, the door 1 begins to shift in the closing direction as indicated by the arrow 92, in FIGURE 7. The motion of the door is then accelerated and continued until its leading edge is engaged by the stop 34 with the door in its fully closed position.

After the door has thus been closed automatically by the heat-responsive control mechanism and after the fire is extinguished, the door may be pushed back to its open position, thus forcing the fire control pusher trolley 42 back to its lefthand position, counter to the pull of the retriever cable 41 (FIGURE 5). A fusible link 78, to replace the melted link, is then coupled to the control cable 43 and anchored to the wall so as to reposition the trigger bar 84 in its latching position. The door may then be opened or closed manually without interference by the fire control apparatus, as noted earlier.

Modified structure (double door)

The modified structure shown in FIGURES 2 and 4 embodies the principles described above; however, in this example, the heat-responsive mechanism is applied to two opposed fire doors which are mounted with respect to an opening 93 which is substantially twice as wide as the single door opening 2. The double doors 94-94 are suspended from two overhead trolley rails 95-95, each door being suspended by pairs of trolleys 6, as described earlier. The rails 95-95 are secured to the fire wall by mounting brackets 15, also described earlier. The lower edges of the doors 94 are guided in their vertical path of motion by stay rollers 8, as previously described.

In the modified arrangement there is provided a pair of retriever reel assemblies 35-35 secured to the fire wall at the center of the door opening 93. The retriever cables 41 of the two retriever reel assemblies are each connected to a respective fire control pusher trolley 42, identical to the trolley previously described with reference to the single door arrangement.

In the double door arrangement, the two retriever assemblies 35-35 are secured together to form a one-piece unit by means of a stop bracket indicated generally at 96 (FIGURES 2, 11 and 12). The stop bracket 96 comprises a gusset plate 97 which overlaps the two housings 44 of the retriever assemblies 35, the plate being spot welded to the two housings along their adjoining edge portions. The gusset plate 97 depends downwardly below the retriever housings 44 to provide a stop engageable with the leading edges of the double doors 94 in their closed position. For this purpose, there is provided a generally Z-shaped stop bracket indicated generally at 100 (FIGURES 11 and 12), secured to the depending portion of the gusset plate 97.

The Z-shaped bracket 100 is formed of sheet metal, providing a web cross 101 projecting outwardly at right angles to the plane of the fire wall and having opposed feet 102

and 103 formed at its opposite edges. The foot 102 is secured as at 104 to the fire wall and the foot 103 is welded to the downwardly depending portion of the gusset plate 97. The stop bracket 96 serves the double function of reinforcing the pair of retriever assemblies 35 and also of providing a stop for centering the two doors 94 in their closed position. Thus, as shown in FIGURE 12, the leading edges of the fire doors 94—94 reside in abutment along opposite sides of the web 101 in the closed position of the doors.

The control apparatus for the two fire doors 94 comprises two control cables 105—105 (FIGURES 2 and 4), in the form of loops. The inner ends of the loops, at the center of the door opening 93, are joined together by respective fusible links 106—106, which are anchored to the fire wall in the manner described earlier. The outer portions of the control cable loops pass slidably through the apertures of the respective trigger bars 84, which are identical to the trigger bars described with reference to the single door system. The trigger bars 84 are located at the opposite outer ends of the trolley rails 95—95, and each trigger bar engages and restrains a respective pusher trolley 42, one pusher trolley for each of the doors 94.

In the event of a fire, one or both of the fusible links 106 will melt at the predetermined temperature. By operation of the control cables 105, both of the trigger bars 84 will be released upon the failure of either one or both of the fusible links 106, thus releasing the two doors 94 simultaneously, and permitting the two retriever assemblies 35 to pull the doors to the closed position shown in FIGURES 4 and 12. The leading edges of the doors are thus brought into abutment with the web 101, such that both doors meet at the center of the opening 93 in the closed position.

Having described my invention, I claim:

1. An automatic heat-responsive fire door control apparatus adapted to close a fire door with reference to a door opening comprising:

- a support rail mounted in a generally horizontal plane above the door opening;
- a fire door translatablely suspended from the rail for movement to an open or closed position;
- a fire control element translatablely mounted in said support rail and normally residing in a retracted position;
- shock-absorbing means on the fire control element;
- said shock-absorbing means comprising a cushioning member shiftably connected to the fire control element and engageable with the fire door for shifting the door to its closed position;
- a spring element interposed in compression between the fire control element and cushioning member;
- said fire control element normally disconnected from the door, adapting the door to be shifted manually to an open or closed position;
- power-operated retriever means including a cable connected to said fire control element and normally urging the fire control element in a door closing direction;
- a heat-responsive fire control cable connected to said fire control element and normally holding the fire control element in said retracted position;
- said heat-responsive fire control cable releasing the fire control element at a predetermined temperature, whereby said retriever cable shifts the fire control element in a door closing direction;
- the cushioning member of the shock-absorbing means, upon release of the fire control element, engaging the door and yielding in response to the force exerted by the power-operated retriever means and thereafter engaging and shifting the door to its closed position by operation of the retriever means and absorbing the impact forces generated thereby.

2. A heat-responsive fire door control apparatus as set forth in claim 1 in which the shock-absorbing means of

the translatable fire control element comprises a cushioning lever pivotally connected to the fire control element for engaging the fire door upon release of the fire control element, said cushioning lever yielding under the impact force which is generated when the fire control element is shifted by the retriever cable in a direction to engage and close the fire door.

3. A heat-responsive fire door control apparatus as set forth in claim 1 in which the shock-absorbing means of the translatable fire control element comprises a cushioning lever pivotally connected to the fire control element for engaging the fire door upon release of the fire control element, and shock-absorbing means connected to the cushioning lever and biasing the lever toward the door, whereby the cushioning lever yields under the impact force which is generated when the fire control element is shifted by the retriever cable in a direction to engage and close the fire door.

4. A heat-responsive fire door control apparatus as set forth in claim 1 in which the fire door control element comprises a fire control trolley having respective pairs of rollers at opposite ends, the rollers being tracked within the support rail, the pairs of rollers being journaled upon respective axles passing through the end portions of the trolley, the shock-absorbing means of the translatable fire control element comprising a cushioning lever, pivotally mounted upon the axle of one of said pairs of rollers for pivotal motion relative to the fire control trolley, the cushioning lever being yieldably biased toward the door and adapted to engage the door upon release of the trolley.

5. A heat-responsive fire door control apparatus as set forth in claim 4 in which the cushioning lever depends downwardly from the support rail and has a lower end portion engageable with the fire door upon release of the fire control element, and a shock-absorbing spring element connected to the lower portion of the cushioning lever.

6. A heat-responsive fire door control apparatus as set forth in claim 4 in which the forward end portion of the trolley is slotted, the axle at the forward end of the trolley passing across the slot, the cushioning lever having an upper end portion passing through the slot of the trolley and pivotally mounted upon the axle at the forward end of the trolley, the upper end portion of the cushioning lever projecting upwardly above the trolley, the cable of the retriever means connected to the said upwardly projecting end portion of the cushioning lever, whereby upon release of the pusher trolley and impact of the lower end portion of the cushioning lever with the door, the lower end portion swings in a rearward direction while the upper end portion of the lever, to which the retriever cable is attached, swings forwardly in the direction in which the retriever cable is being pulled, thereby protecting the retriever cable against overloading and failure due to impact forces.

7. A heat-responsive fire door control apparatus as set forth in claim 1 in which two opposed fire doors are translatablely suspended from the support rail and normally reside at opposite end portions of the support rail adjacent opposite sides of the door opening, and in which two retriever means are mounted at a mid-point above the door opening, respective cables extending outwardly in opposite directions from the two retriever means and in connection with the opposed fire doors, and a stop element mounted at a midpoint along the length of the door opening, the said stop element adapted to engage the leading edges of the two fire doors and to stop the fire doors with their leading edges substantially in contact with one another when the doors are shifted to the closed position.

8. A heat-responsive fire door control apparatus as set forth in claim 1 in which two opposed fire doors are translatablely suspended from the support rail and normally reside at opposite end portions of the support rail adjacent opposite sides of the door opening, and in which two retriever means are mounted at a midpoint above the door

11

opening, respective cables extending outwardly in opposite directions from the two retriever means and in connection with the opposed fire doors, and a stop element mounted at a midpoint along the length of the door opening, said stop element connected to the two retriever means and securing them to one another, the stop element including a relatively thin section depending from the retriever means and in the path of motion of the fire doors, the said stop element adapted to engage the leading edges of the two fire doors and to stop the fire doors with their leading edges substantially in contact with one another when the doors are shifted to the closed position.

12

References Cited

UNITED STATES PATENTS

814,192	3/1906	Dentler	-----	49—3
825,449	7/1906	Fletcher	-----	49—8
3,189,142	6/1965	Carlson	-----	49—7

FOREIGN PATENTS

471,941	9/1937	Great Britain.
---------	--------	----------------

10 DAVID J. WILLIAMOWSKY, *Primary Examiner.*

J. K. BELL, *Assistant Examiner.*