United States Patent

[11] 3,597,809

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[45] Patented **Aug. 10, 1971**
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[54] **SEPARATING LINK**
10 Claims, 16 Drawing Figs.

[52] **U.S. Cl.** ..... **24/201 LP,** 16/230 LP, 49/8
[51] **Int. Cl.** **A44b 17/00**
[50] **Field of Search** ..... 49/7, 8, 379, 401; 292/273, 144, 262, 341.17; 16/48.5; 160/5, 1; 24/230.1 U, 230 LP, 230, 201 LP, 201 SL, 201

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Primary Examiner—David J. Williamowsky
Assistant Examiner—Philip C. Kannan
Attorney—Augustus G. Douvas

ABSTRACT: A separating link and operator particularly adapted as a substitute for the fusible links employed in prior art closure control systems.

A first embodiment of the separating link has two link sections whose joinder is controlled by a pull wire latch. One section is a cam link section having an integral ball cam. The second section is a socket link section formed with a socket for receiving the cam in mating relationship. A pair of locks couple the link sections together. The latching engagement of one lock is dependent upon the latching engagement of the other or operating lock.

The pull wire latch is connected to a magnetizable armature which reciprocates within a solenoid. Upon deenergization of the solenoid, the pull wire latch is removed from the operating lock thus disengaging this lock. The ball cam then partially separates the two links sections with a resultant disengagement of the dependent lock. Accordingly, the links sections are fully separated in response to external forces applied by a closure, for example.

A modification is incorporated within a second embodiment by which each link is a sandwich of elements including a fusible layer. This embodiment thus fully separates in response to excessive heat which causes melting of one or both of the fusible layers, or, alternatively, in response to the removal of the pull wire latch.

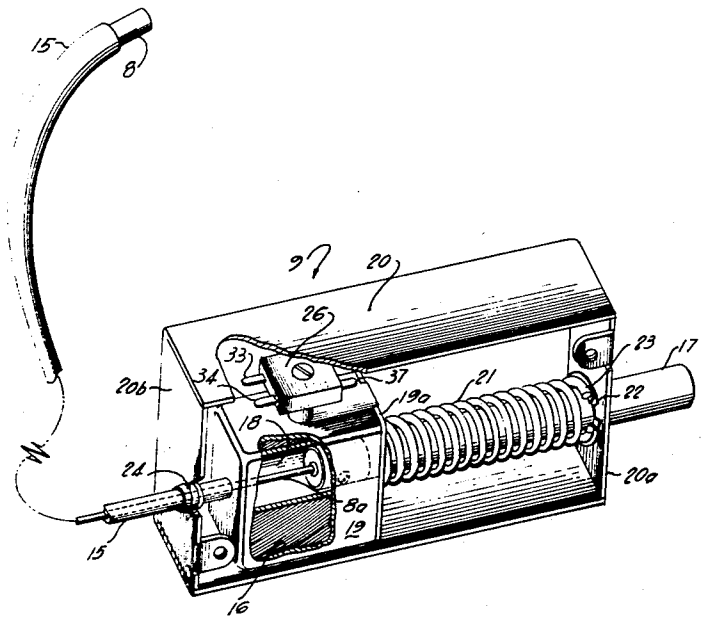

FIG.2.

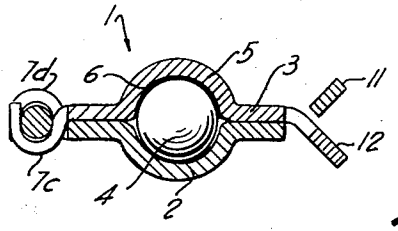

FIG. IA.

FIG.3.

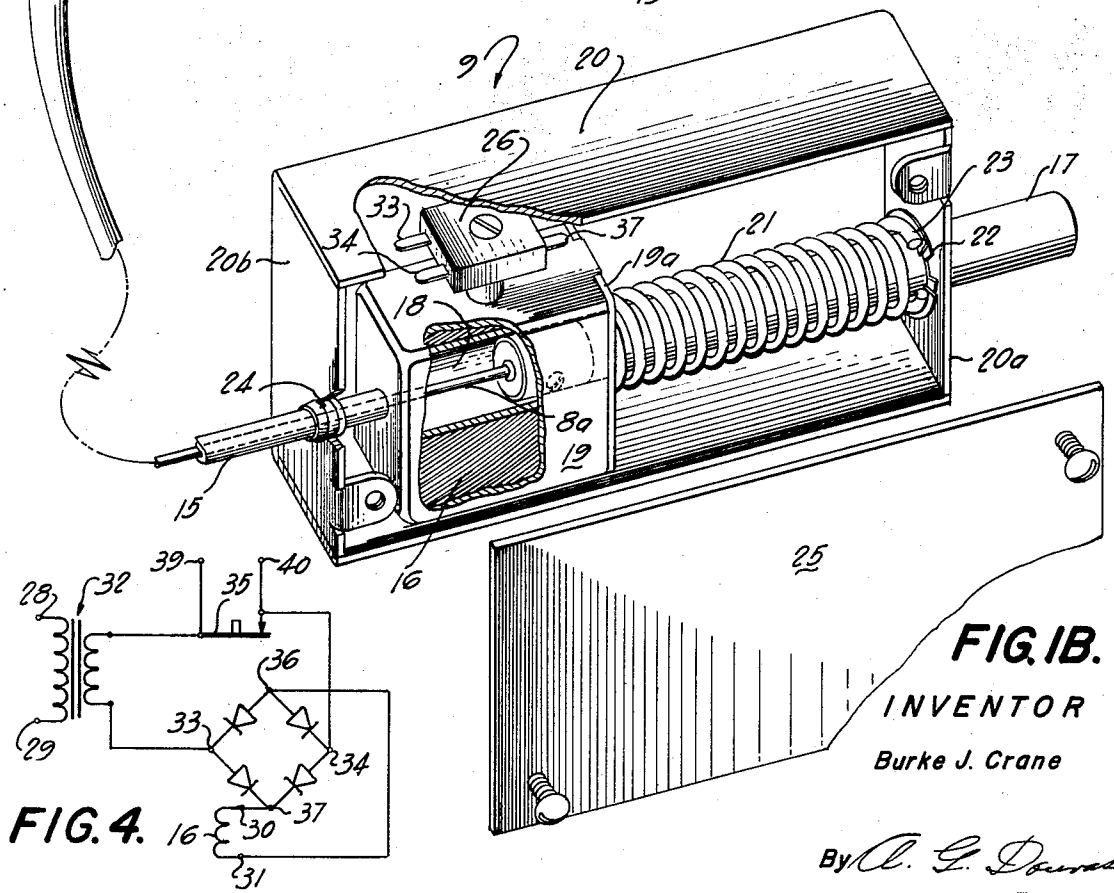

FIG. 4.

FIG. IB.

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FIG. 5.

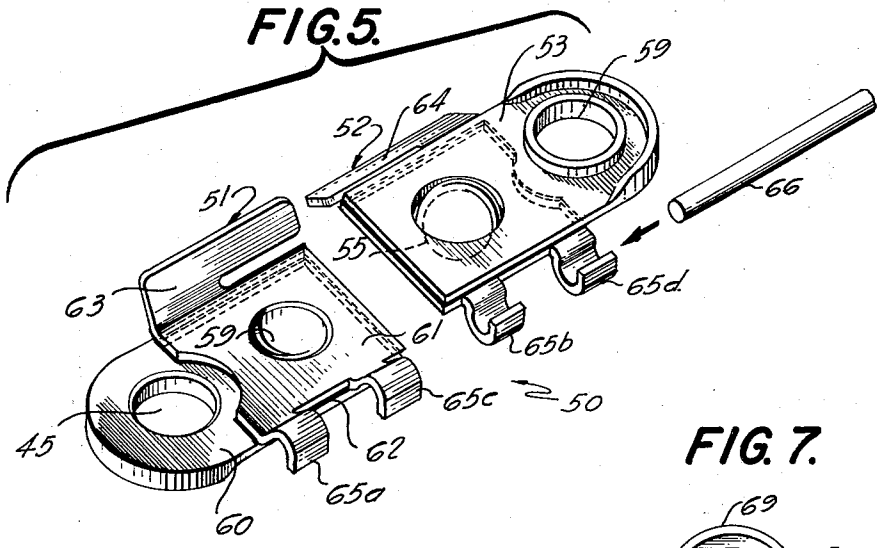


FIG. 7.

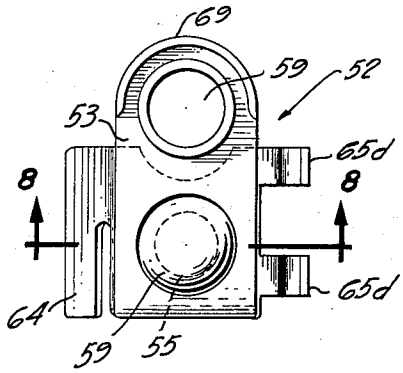
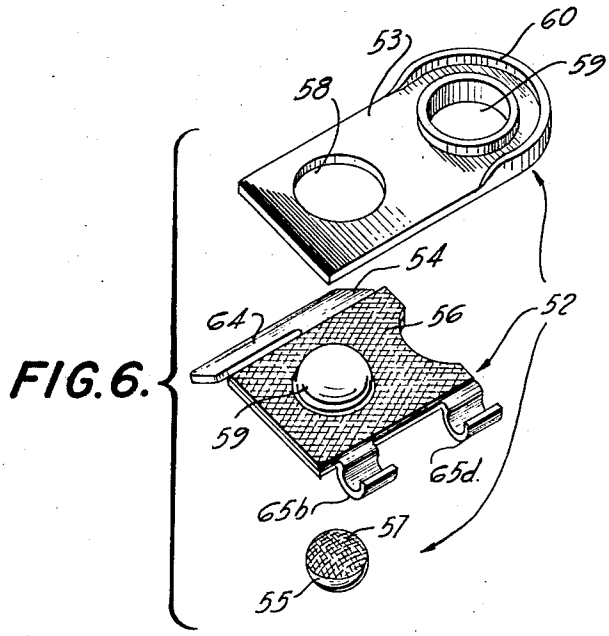


FIG. 6.



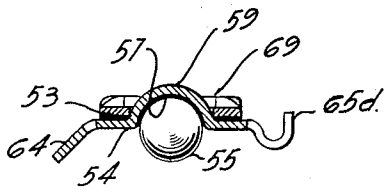


FIG. 8.

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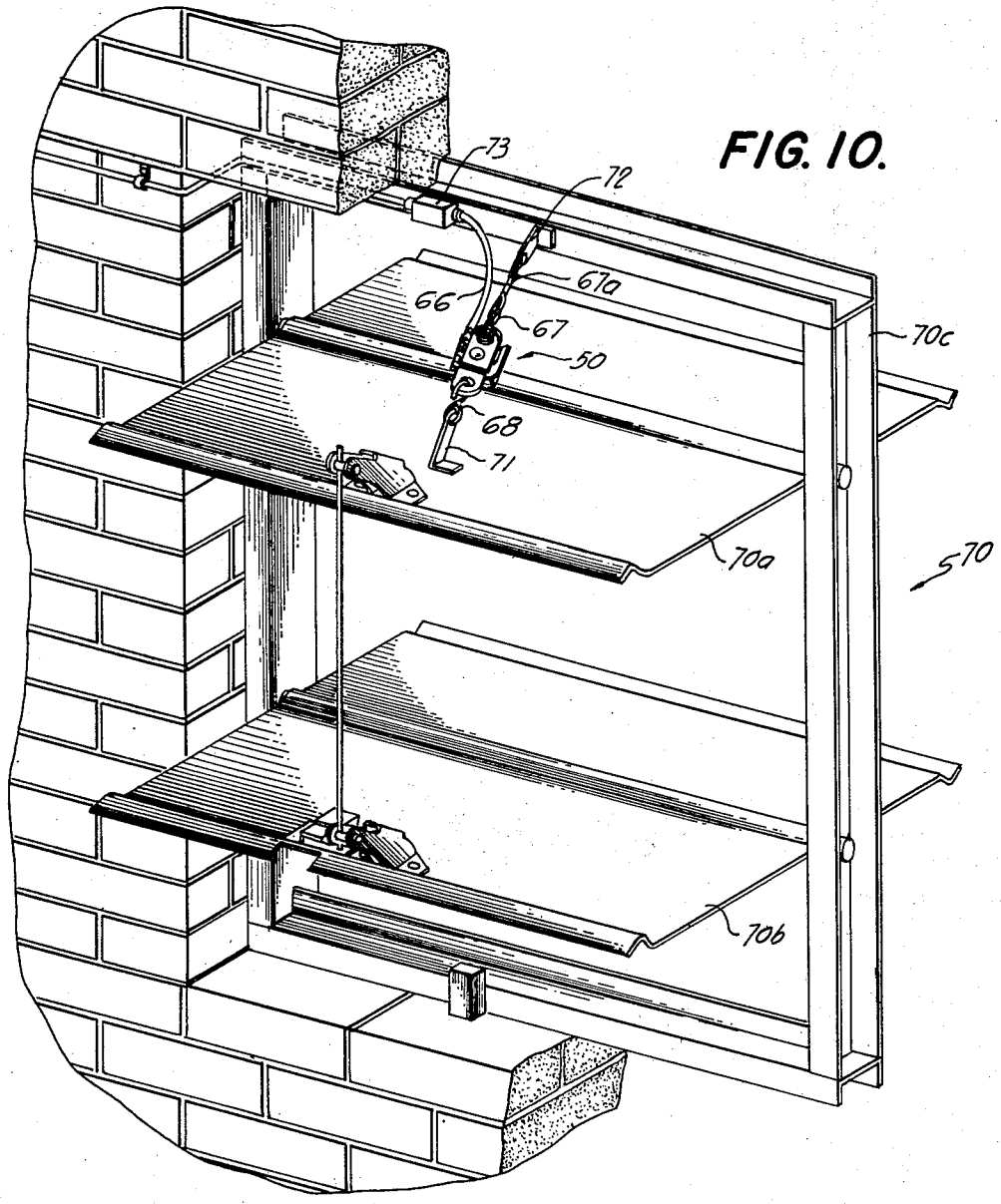

FIG. 10.

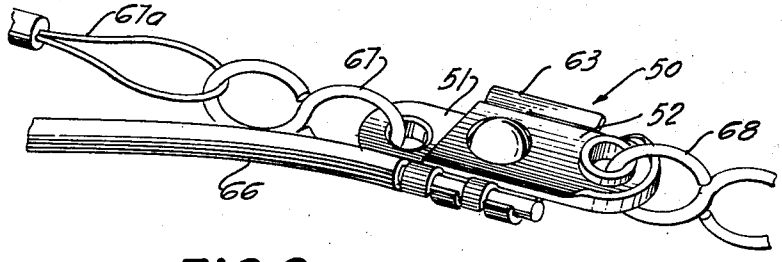

FIG. 9.

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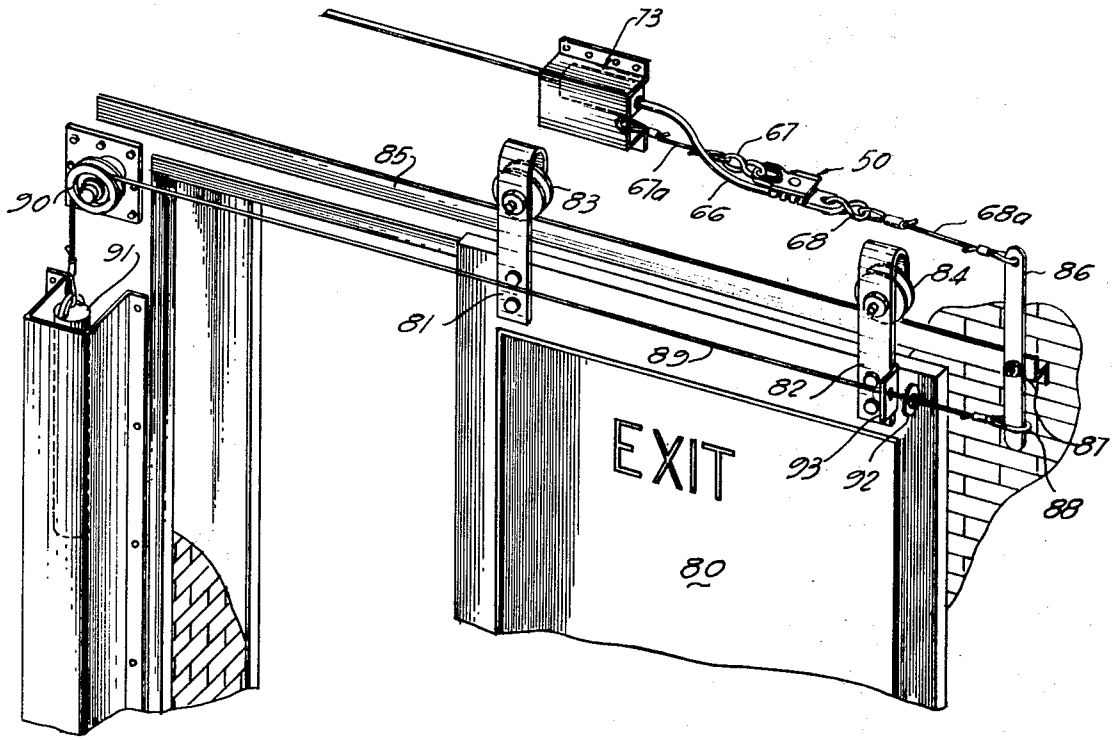

FIG. 13.

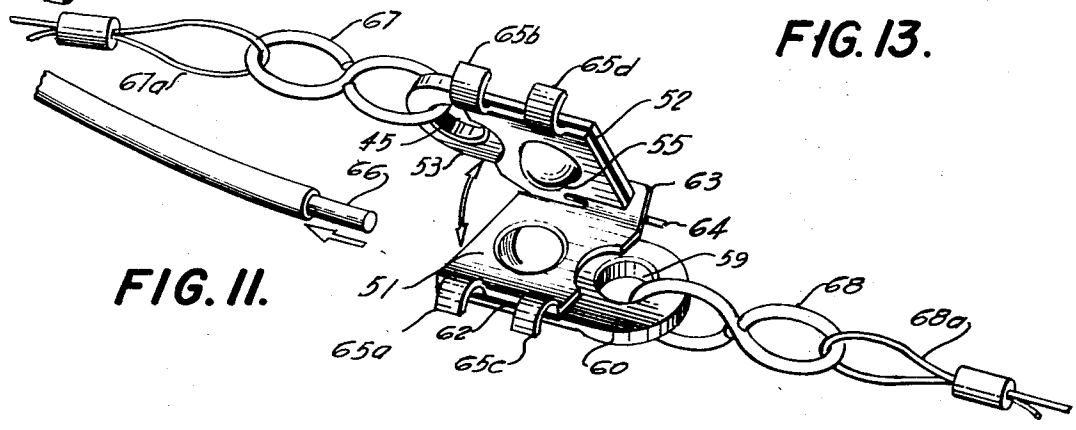

FIG. 11.

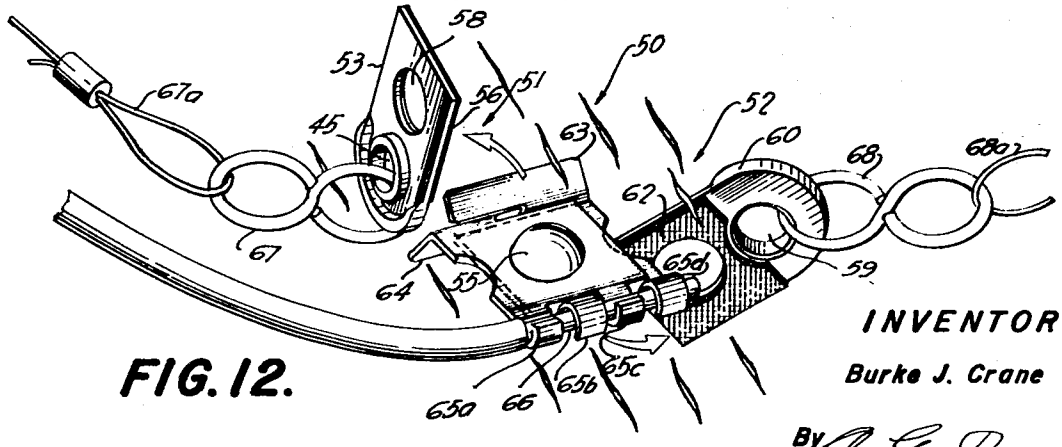

FIG. 12.

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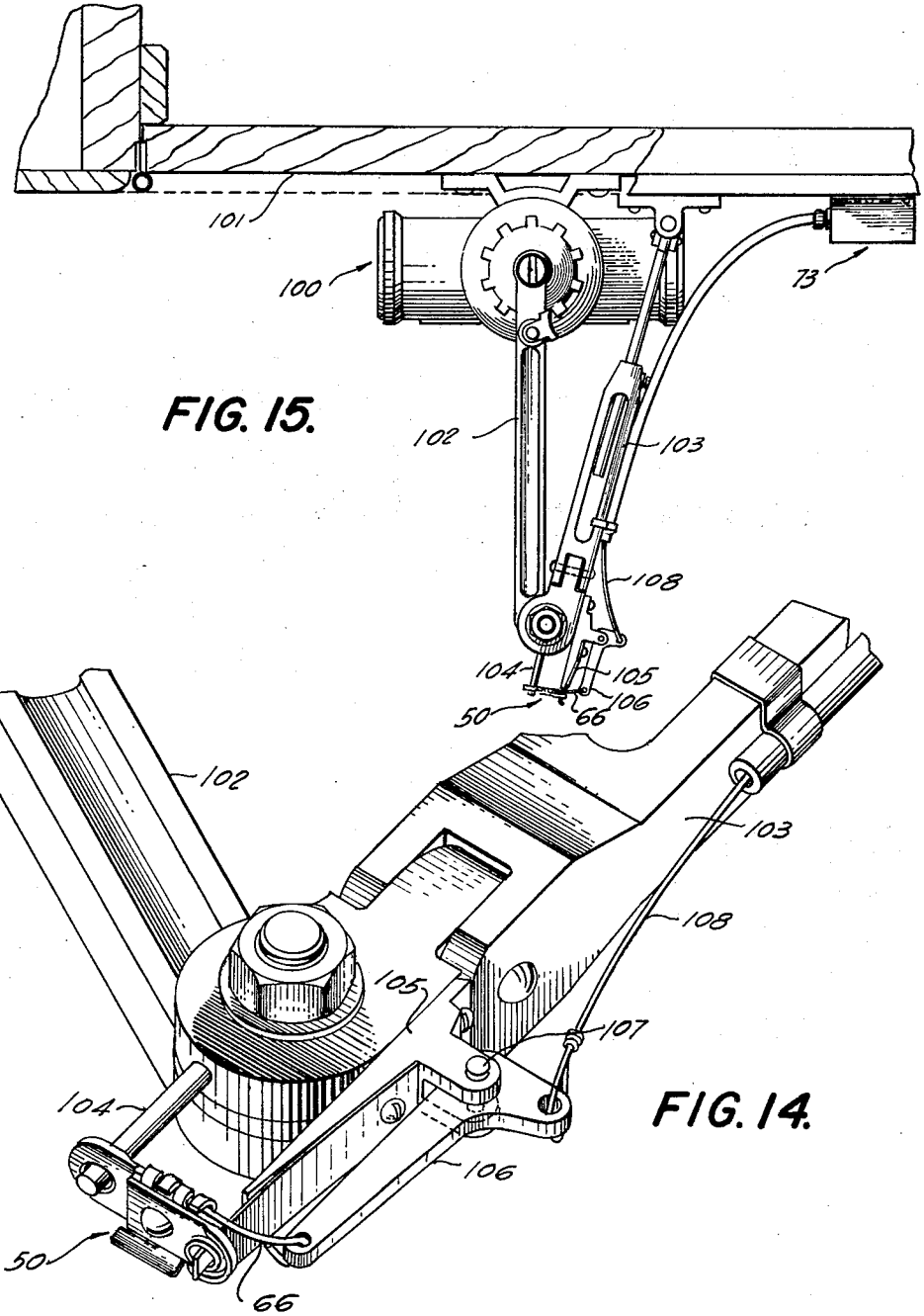

FIG. 15.

FIG. 14.

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SEPARATING LINK

BACKGROUND OF THE INVENTION

Fusible links have been employed extensively in the prior art to effect the closure of a door, damper, or like structure in response to a fire or other excessive heat condition.

The operation of these links necessarily depended upon the melting of a fusible material to effect link separation. With this mode of operation, the link was necessarily destroyed and had to be discarded. Replacement of the destroyed link was time consuming and expensive.

Accordingly, a principal object of this invention is the design of a separating link which is not destroyed upon link separation and which may be readily reassembled manually for continued operation.

A second object is the design of a separation link which is automatically separable immediately in response to the detection of any undesired condition including excessive heat.

A third object of the invention, featured in the particular embodiment incorporating fusible layers, is fail-safe operation in response to excessive heat in the event a pull wire latch operator does not function properly upon the occurrence of a fire.

DESCRIPTION OF THE PRIOR ART

The following patents are noted as of possible interest:

Andersen U.S. Pat. No. 2,250,787 shows two mechanical elements employing latching wings to provide a fusible nut.

Birkemeier U.S. Pat. No. 2,751,053 discloses a door holder employing a heat-responsive element (bimetal leaf or expansible bellows) to release a door holding rod.

Engresser U.S. Pat. No. 3,126,219 discloses two latching elements held together by a manually operated hook bar.

Peterson U.S. Pat. No. 3,415,562, Ulman U.S. Pat. No. 3,284,840 and U.S. Pat. No. 3,258,875, and Jurin U.S. Pat. No. 3,207,273 are typical patents showing electromagnet or solenoid-armature combinations in door checks.

Beachy U.S. Pat. No. 2,310,672 discloses a curtain damper employing two mechanical latching elements which are released when moisture, such as rain, softens a retaining element.

Commonplace fusible links engaging door-handling arms are shown in Laiser U.S. Pat. No. 2,131,564 and other patents.

SUMMARY OF THE INVENTION

The two embodiments of this invention are briefly described in the Abstract, and are described in detail in the following specification.

DESCRIPTION OF THE DRAWINGS

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

FIG. 1A is a perspective view of a first embodiment of the separating link of this invention, and FIG. 1B is a perspective view of the pull wire operator for actuating the operator latch wire which interconnects the structure of the two figures;

FIG. 2 is a sectional view of the separating link taken along line 2–2 of FIG. 1A, but with the pull wire latch in position to lock the two link sections one to the other;

FIG. 3 is a perspective view of the socket link section of the separating link;

FIG. 4 is a schematic circuit diagram for energizing the solenoid of the pull wire operator;

FIG. 5 is a perspective view of a second embodiment of the separating link of this invention in which each link section is a sandwich of elements including a fusible layer, and with the link sections separated;

FIG. 6 is an exploded view of the cam link section of the embodiment of FIG. 5;

FIG. 7 is a plan view of the cam link section of FIG. 6 in assembled form;

FIG. 8 is a sectional view taken along line 8–8 of FIG. 7;

FIG. 9 is a perspective view showing typical operative wire connections required to apply the separating link embodiments of this invention to a closure, such as a multiblade damper;

FIG. 10 is a perspective view of a multiblade damper to which the separating link of FIG. 9 has been applied;

FIG. 11 is a perspective view showing the separation of the link of FIGS. 5 through 8 in response to the withdrawal of the pull wire latch;

FIG. 12 is a perspective view showing the separation of the link of FIGS. 5 through 8 in response to the melting of both fusible layers;

FIG. 13 is a view of a sliding closure supported upon rollers and to which the separating link of FIGS. 5 through 8 has been applied;

FIG. 14 is a plan view of a door holder and closer of the type shown in U.S. Pat. No. 2,131,564 and to which the separating link of FIGS. 5 through 8 has been applied; and

FIG. 15 is an enlarged perspective view of a portion of the structure of FIG. 14 showing the detailed application of the separating link to the door holder and closer.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A first preferred embodiment of the separating link of this invention and its pull wire operator is shown in FIGS. 1A, 1B, 2 and 3. Referring in particular to these figures, separating link 1 includes two principal components; namely, socket link section 2 and cam link section 3.

As is shown in FIG. 2, spherical ball cam 4 is fixedly adhered to a semispherical indentation 5 in link section 3 by an adhesive or solder layer 6. The lower half of spherical ball cam 4 projects from the lower surface of cam link section 3 to present a semispherical surface which is received within mating socket 7' formed in socket link section 2 (FIG. 3). When the link sections are coupled one to the other as is shown in FIG. 1A, ball cam 4 is received within socket 7' and the links are coupled by two locks which are hereafter described.

In particular, the first lock, operating lock 7, includes four hooks 7*a* through 7*d* which are integral to the link sections 2 and 3. In particular, upwardly directed hooks 7*a* and 7*c* are integrally formed from cam link section 3, and downwardly directed hooks 7*b* and 7*d* are integrally formed from socket link section 2.

When separating links 2 and 3 are in the coupled position shown in FIG. 1A, the centers of hooks 7*a* through 7*d* are in axial alignment to receive the upper tip of pull wire latch 8. When the upper tip portion of pull wire latch 8 is engaged by hooks 7*a* through 7*d*, the operating lock 7 is latched. Pull wire 8 is shown in its withdrawn or delatched position in FIGS. 1A and 1B (which position is effected by deenergization of pull wire operator 9 as hereafter set forth).

A second or dependent lock 10 is also integral to link sections 2 and 3. This dependent lock includes an upwardly directed latch finger 11 as a part of link section 2, and a downwardly directed latch finger 12 as a part of link section 3. The dependent lock 10 is engaged when latch fingers 11 and 12 are interleaved or interlocked as is shown in FIG. 1A.

The terminal end of link section 2 is formed with a connector hole 13, and the terminal end of link section 3 is also formed with a connector hole 14.

In the application of separating link 1 to a particular installation, connectors, wires, hooks, ropes or other means are tied or coupled to link sections 2 and 3 through holes 13 and 14 so that separating forces are applied to the link sections which tend to disengage the otherwise coupled link sections. In the event that the upper end of pull wire latch 8 is inserted within

operating lock hooks 7*a* through 7*d*, the operating lock 7 is latched and as a result the dependent lock 10 is also latched. With this disposition, link sections 2 and 3 of separating link 1 are coupled one to the other and the means coupled to these link sections through holes 13 and 14 (not shown) are prevented from separating.

In the event, however, that the upper tip of pull wire latch 8 is withdrawn as is shown in FIG. 1A, operating latch 1 is disengaged. Separating forces are thus applied to link sections 2 and 3 by the means connected at holes 13 and 14 (not shown) so that the lower half, or projecting half of ball cam 4 slips out of its socket 7'. This action partially separates link section 2 away from link section 3 so that latch fingers 11 and 12 of dependent lock 10 are disengaged thus permitting full separation of link section 2 from link section 3.

Pull wire latch 8 is a flexible wire which reciprocates within casing 15. This reciprocating motion is effected by pull wire operator 9 (FIG. 1B). The principal components of pull wire operator 9 include solenoid 16, and armature 17 which reciprocates within the bore 18 of solenoid 16. The lower terminal end 8*a* of pull wire latch 8 is fixed to the left terminal end of armature 17 so that pull wire 8 moves responsively with armature 17.

Solenoid 16, housed within solenoid housing 19, in turn is contained within pull wire operator housing 20. A helical spring 21 is sandwiched between solenoid housing end wall 19*a* and end wall 20*a* of operator housing 20. Armature 17 is formed with a circular groove which receives snap ring 22 which in turn serves as a stop for washer 23 which envelopes the shaft of armature 17.

Accordingly, helical spring 21, when in a compression, exerts a force against washer 23 which in turn exerts a force against snap ring 22 which tends to drive armature 17 to its stop position as is shown in FIG. 1B. However, when solenoid 16 is energized by DC voltage, typically of the order of 12 to 24 volts, armature 17 is manually pushed to the left and is more fully retained within bore 18.

This action compresses spring 21 and enables pull wire latch 8 to emerge from casing 15 sufficiently so as to be manually placed within the hooks 7*a* through 7*d* of operator lock 7 so as to engage this lock. A feed-through bushing 24 passes through end wall 20*b* of operator housing 20 and casing 15 is held fixedly relative the feed-through bushing; however, pull wire latch 8 moves responsively with the movement of armature 17.

In the event that solenoid 16 is deenergized, the previously compressed helical spring 21 expands to the position shown in FIG. 1B so that snap ring 22 is driven into engagement with end wall 20*a*. With this occurrence as previously explained, the operator lock 7 is disengaged, and in turn dependent lock 10 is disengaged. Thus separating link sections 2 and 3 are separated one from another.

After link sections 2 and 3 are separated and in the event it is desired to couple these sections together again, link sections are manually placed in the positions shown in FIG. 1A with ball cam 4 within its receiving socket 7'. Thereafter, solenoid 16 is energized and the right end of armature 17 is manually pushed so that armature 17 is received within bore 18 of solenoid 16. With this occurrence, pull wire latch 8 is manually inserted within hooks 7*a* through 7*d* of operator lock 7.

In the usual installation, cover 25 is affixed to the operator housing 20 so that the internal components are protectively covered.

Module 26 shown in FIG. 1B houses the four rectifiers of full-wave bridge circuit 27 shown in FIG. 4. FIG. 4 shows a typical energizing circuit for solenoid winding 16. This circuit converts the AC line voltage applied to terminals 28 and 29 to a desired DC voltage of the order of 12 to 24 volts which appears at solenoid terminals 30 and 31. The line voltage appearing at terminals 28 and 29 is stepped down by means of transformer 32, and this reduced voltage is in turn applied to input terminals 33 and 34 of bridge circuit 27 through manual operated switch 35. The rectified direct-current output of bridge circuit 27 appears at output terminals 36 and 37. This rectified voltage is applied to solenoid 16.

In the event that manual switch 35 is closed as is shown in FIG. 4, solenoid 16 is energized so that armature 17 is retained within solenoid bore 18. If pull wire latch 8 is in the latching position relative hooks 7*a* through 7*d*, links sections 2 and 3 are coupled one to the other. Upon the manual opening of switch 35, solenoid 16 is deenergized thereby enabling spring 21 to withdraw armature 17 from solenoid bore 18 and thus cause pull wire 8 to disengage from operating lock hooks 7*a* through 7*d*. With this occurrence, the link sections are separated one from the other.

In certain applications it may be desired to have separating link 1 separate in response to the occurrence of an undesired condition such as excessive heat, smoke, water flooding, etc. If this operation is desired, an appropriate detector is connected to detector input terminals 39 and 40. The detector should be so constructed so that a closed circuit is normally presented across terminals 39 and 40. In response to the undesired condition, this circuit connection is opened, thereby deenergizing solenoid 16 so that separating links may separate as previously explained thus closing a door or operating an alarm or other device as may be desired. With this alternative circuit operation, manual switch 35 should, of course, be open.

FIGS. 5 through 8 show a second preferred embodiment of the separating link of this invention. In this embodiment, each link section is a sandwich of elements including a fusible layer. Accordingly, the separating link is capable of separating either in response to the withdrawal of the latch wire or in response to the melting of a fusible layer. In the event the condition detecting apparatus connected to terminals 39 and 40 of FIG. 4 is inoperative, excessive heat will cause melting of the fusible layers and thus cause separation of the link. This separation can, of course, be used to close a fire door, damper, or other device as may be required.

Referring now to FIGS. 5 through 8, separating link 50 comprises a socket link section 51 and a cam link section 52.

Cam link section 52 comprises a connector element 53, a locking cam element 54, and spherical ball cam 55. A layer of fusible alloy 56 is applied to the upper surface of locking cam element 54. In the final assembly, layer 56 fixedly adheres the connector element 53 to locking cam element 54 as is shown in the cross section view of FIG. 8. The upper semispherical surface of ball cam 55 (FIG. 6) is coated with a solder or other adhesive 57 so that this ball cam is rigidly fixed to locking cam element 54.

Connector element 53 is formed with a hole 58 which receives the projection 59 which houses ball cam 55. Additionally, connector element 53 is formed with a reinforced connector hole 59. The peripheral edge of the connector element 53 adjacent connector hole 59 is also reinforced by a flange 60. Thus, reinforced hole 59 and flange 60 give the connector hole 59 of the second embodiment substantially more strength than that obtained from the corresponding hole of the first embodiment of FIGS. 1 through 4.

Socket link section 51 shown in FIG. 5 comprises a connector element 60 formed with a connector hole 45, a locking socket element 61, and fusible layer 62 which joins elements 60 and 61.

Latch fingers 63 and 64 perform a function which is identical to latch fingers 11 and 12 of the first embodiment shown in FIGS. 1 through 4, and operating lock hooks 65*a*, *b*, *c* and *d* perform a function which is identical to operating lock hooks 7*a*, *b*, *c* and *d* shown in the embodiment of FIGS. 1 through 4.

FIG. 9 shows the connection of separating link 50 to suitable connectors and also pull wire latch 66. In particular, socket link section 51 is connected to connector S-ring 67, and cam link section 52 is connected to S-ring 68.

The typical application of the structure of FIG. 9 to a multiblade damper is shown in FIG. 10. In FIG. 10, multiblade damper 70 comprising blades 70*a* and 70*b* pivoted on frame 70*c* is retained in the open position by link 50. Link 50 is coupled to blade 70*a* through S-ring 68 and tie bracket 71; and

link 50 is likewise coupled to frame 70c by means of S-ring 67, tie wire 67a, and tie bracket 72. A pull wire operator 73, corresponding to pull wire operator 9 shown in FIG. 1B is also suitably attached to frame 70c. In the event the solenoid of pull wire operator 73 is deenergized as previously explained with respect to solenoid 16 of FIG. 1B, pull wire 66 is withdrawn from separating link 50, and link sections 51 and 52 separate enabling gravity to close damper blades 70a and 70b relative frame 70c.

As an alternative mode of operation, in the event the operating solenoid of pull wire operator 73 fails to deenergize upon the occurrence of an undesired condition such as excessive heat, the fusible layers incorporated within separating link 50 will melt also enabling the separating link sections 51 and 52 to separate thus closing blades 70a and 70b relative frame 70c.

In FIG. 11 the separation of link sections 51 and 52 in response to the removal of pull wire latch 66 is shown as applied to separating link 50. In particular, wire 66 is drawn into its casing due to the deenergization of the solenoid thus causing disengagement of the operating lock including hooks 65a through 65d. This disengagement causes the separation forces applied through S-ring 67 and S-ring 68 to force the links to separate through the cam action exerted by spherical ball cam 55, and as a result the dependent lock including fingers 63 and 64 is also disengaged thus enabling the link sections to separate completely.

In FIG. 12 the separating link 50 is shown decoupled in response to excessive heat which melts fusible layers 56 and 62 thereby causing the sandwich which forms socket link section 51 and also the sandwich which forms cam link section 52 to separate. This separation, of course, causes decoupling of the separating link.

FIG. 13 shows the application of separating link 50 to a sliding closure 80. Closure 80 is supported upon brackets 81 and 82 which carry rollers 83 and 84. These rollers travel upon track 85 in the customary manner to provide sliding movement of closure 80.

Lever 86 is pivoted on track 85 by means of pivot bolt 87. End loop 88 of weight wire 89 envelopes the lower end of lever 86. Weight wire 89 passes over pulley 90 to carry weight 91. Washer 92 is also carried by weight wire 89 immediately adjacent flange 93.

In the event the solenoid located within pull wire operator 73 is deenergized as previously outlined, pull wire latch 66 is removed from the operating lock of separating link 50, and the link sections separate as previously outlined. With this occurrence, weight 91 pivots lever 96 clockwise until loop 88 is disengaged from the lower end of the lever. The lowering of weight 91 causes loop 88 to pick up washer 92 so that this washer engages flange 93 thus driving the door to the left and closing the closer.

FIGS. 14 and 15 show the application of the separating link 50 to a typical door holder and closer of the prior art. In particular, the structure shown in U.S. Pat. No. 2,131,564 is adapted for presentation of this particular example. However, it should be understood that the many different door holder and closer arrangements of the prior art employing extensible arms which are engaged by fusible links may be adapted to incorporate separating links 1 or 50 of this invention.

In the door closer shown in U.S. Pat. No. 2,131,564, a fusible link is applied to this mechanism so that in response to excessive heat the door is closed. In the usual situation, the holding device may be adjusted to provide a frictional binding action at any desired angular position so that the door or other closer, upon a predetermined degree of opening movement, is held to the selected position. In the event it is desired to close the door, the frictional holding means may be released by exerting manually a closing pressure on the door sufficient to break the frictional engagement between the friction heads which are employed in this particular closer.

Alternatively, the door may be closed by separation of the separating links as shown in the patent, or separating link 50 as is shown in FIGS. 14 and 15 of the drawings.

Referring now to FIGS. 14 and 15, door holding and closing device 100 is applied to door 101 in the manner shown in the patent. Device 100 includes a crank arm 102 and a forearm 103 as described in the patent. Pin 104 and friction head 105 are coupled to arms 102 and 103 as is also described in the patent. Separating link 50 is coupled to pin 104 and friction head 105 by engaging these latter elements in the connector hole 45 and 59 of the separating link.

Bellcrank 106 is coupled to friction head 105 by pivot pin 107. The lower arm of bellcrank 106 is connected to pull wire latch 66; and the upper arm of bellcrank 106 is connected to pull wire 108. Pull wire 108 is in turn connected to pull wire operator 73. Upon deenergization of the solenoid of operator 73, wire 108 is pulled upwardly turning the bellcrank counterclockwise on pin 107, thus causing pull wire latch 66 to be removed from separating link 50 as previously described. The decoupling of this link, enables pin 104 and friction head 105 to separate in a manner described in the patent, and thus close an otherwise open door.

As an alternative mode of operation, in the event that separating link 50 is subjected to excessive heat, the link will separate as previously described due to the melting of the fusible layers, thus also effecting a door closing.

It should be understood that separating links 1 and 50 of this invention may alternately be employed in all of the particular applications disclosed in this specification, as well as the other applications to which separating links have previously been employed in the prior art. Separating link 1, of course, will function only in response to the removal of the pull wire latch; whereas separating link 50 will respond additionally in response to excessive heat which causes melting of one or more of the fusible layers.

Either or both of the link sections 51, 52 of separating link 50 may be a sandwich having a fusible layer. In either case, link 50 will separate out in response to excessive heat.

In the particular application of FIGS. 14 and 15, bellcrank 106 may be eliminated, if desired; and the pull wire latch connected directly to the pull wire operator.

What I claim is:

1. A separating link whose joinder is controlled by a pull wire latch, comprising a cam link section having an integral ball cam, a socket link section formed with a socket for receiving the cam in mating relationship, a pair of locks with the latching engagement of one lock being dependent upon the latching engagement of the other or operating lock, both locks having components integral with both of the link sections to couple the link sections one to the other, the dependent lock including a latch finger integral with each link section and both fingers slideably interleaved to engage that lock, and the operating lock including one or more hooks integral with each link section for receiving the pull wire which serves as a latch to engage the operating lock and thus the dependent lock to couple both link sections one to the other.

2. The combination of claim 1 having a pull wire operator comprising an electrically energizable solenoid, and a magnetizable armature associated with the solenoid and connected to the pull wire to remove the wire from latching position with the hooks of the operating lock to disengage that lock thus enabling the ball cam to separate the two link sections and thus also disengage the dependent lock.

3. The combination of claim 2 in which the terminal end of each link section is coupled to closure-controlling means by which separation of the link sections enable a related closure to assume a desired position.

4. The combination of claim 1 in which the cam link section includes a connector element, a locking cam element, and a layer of fusible material sandwiched therebetween, and the socket link section includes a second connector element, a locking socket element and a layer of fusible material sandwiched therebetween.

5. The combination of claim 4 in which the latch fingers and the hooks are integral with the cam and socket link elements.

6. A separating link whose joinder is controlled by remote operation of an actuating element which extends from the link

to a remote location, comprising first and second link sections, a pair of locks as integral parts of the link sections with the latching engagement of one lock being dependent upon the latching engagement of the other or operating lock, link separating means operable when the operating lock is disengaged to exert a separating force upon the link sections, and in which the actuating element serves as a latch for the operating lock which when remotely actuated disengages the operating lock to enable the link separating means to produce automatic disengagement of the dependent lock and thus separation of the two link sections in response to forces tending to pull the links one from the other.

7. The combination of claim 6 in which the link separating means includes a cam fixed to one of the link sections which acts to separate both link sections one from the other upon actuation of the actuating element.

8. The combination of claim 6 in which one or both link sections includes a pair of elements and layer of fusible material sandwiched therebetween by which melting of either or both of the fusible layers effects separation of the link sections.

9. The combination of claim 8 in which the terminal end of each link section is coupled to closure-controlling means by which separation of the link sections enables a related closure to assume a desired position.

10. The combination of claim 8 in which the terminal end of each link section is coupled to closure-controlling means by which separation of the link sections by either actuation of the actuating element or melting of a fusible layer effects separation of the links.