United States Patent

[11] **3,589,065**

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[54] **FIRE VENT HATCH**
19 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **49/7,** 49/279, 49/379, 52/1
[51] **Int. Cl.** **E05f 15/20**
[50] **Field of Search** 49/6, 7, 8, 1, 280, 279, 4, 379, 139; 52/1

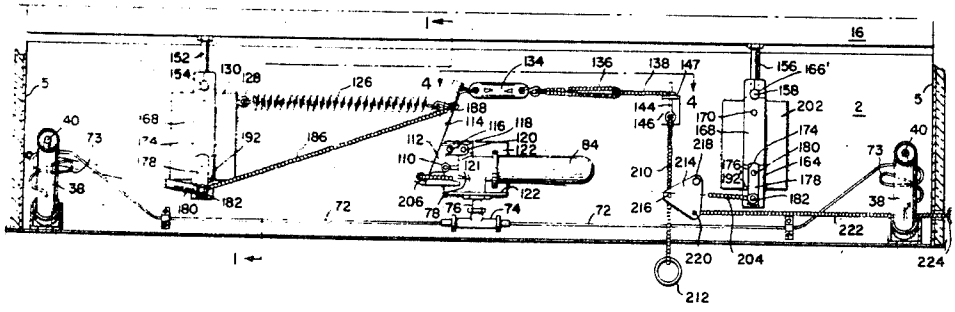
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ABSTRACT: A fire vent hatch has a housing with upstanding sidewalls and a cover pivotally secured to one of the sidewalls. A pair of rams are mounted on the housing to raise the cover, the rams being connected to a sealed container containing gas under pressure. The lower end of the rams are each pivotally connected to an arm which in turn is pivotally connected to the housing, the arms swinging downwardly when the rams are actuated. A restrictor is provided to throttle the flow of gas to the cover. A scissor latch is provided for holding the cover in the closed position. Thermally and manually controlled means are provided to release the gas to the rams and to open the latch.



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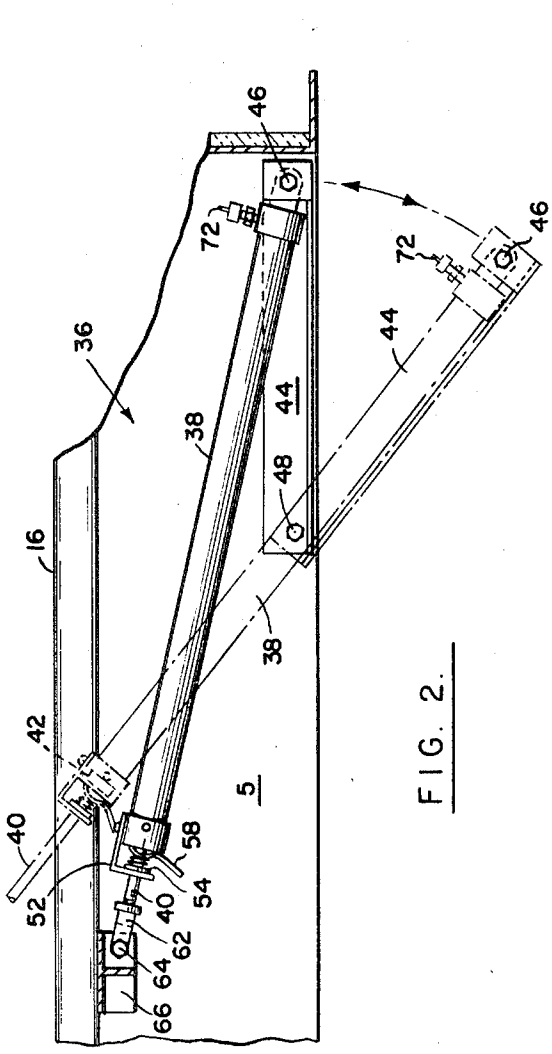


FIG. 2.

FIG. 1.

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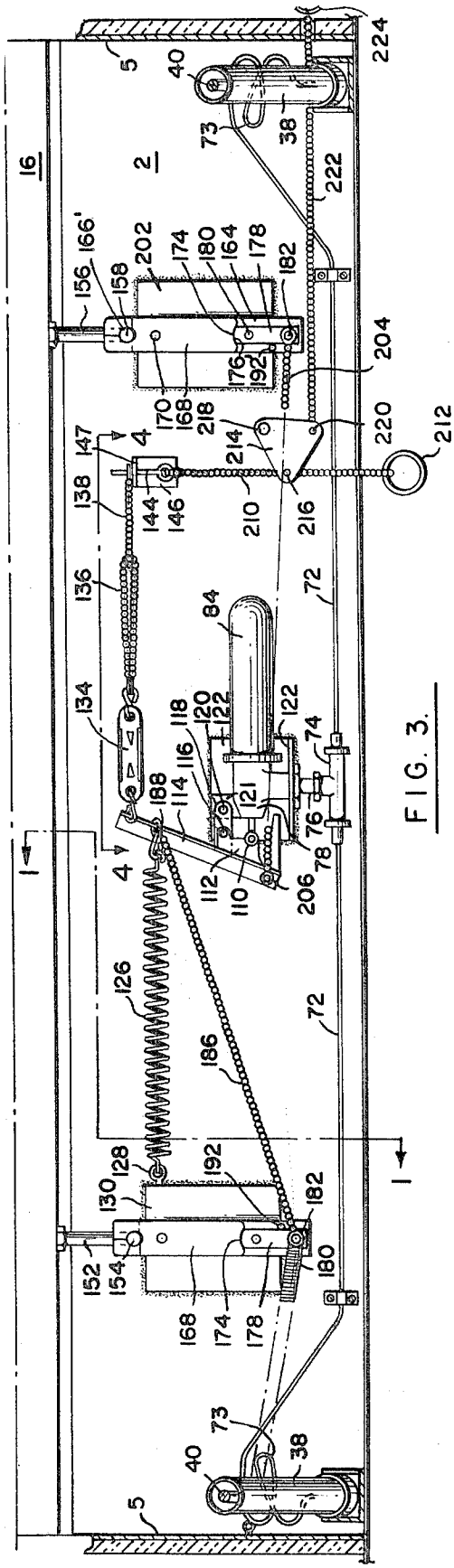


FIG. 3.

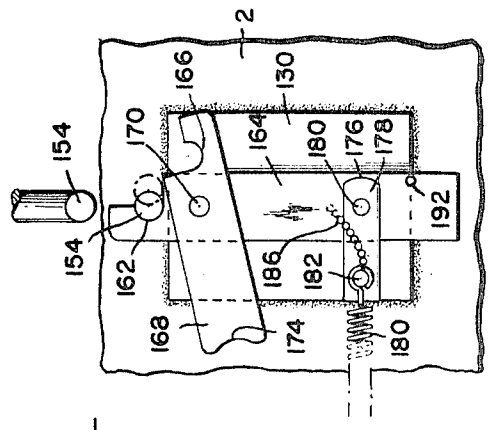


FIG. 6.

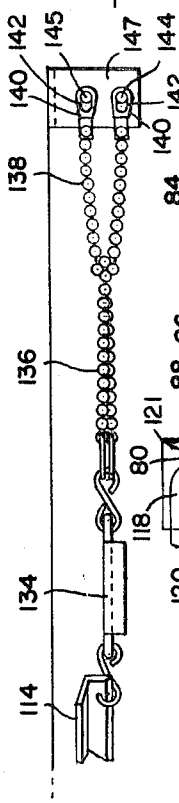


FIG. 4.

FIG. 5.

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FIRE VENT HATCH

BACKGROUND OF THE INVENTION

It is well known to provide buildings with fire hatches in order to release smoke and gases incident to a fire in order to relieve internal pressure to prevent the ignition of gases and blowout of the building walls. In addition such vents are helpful in preventing suffocation of people trapped in upper levels of the building.

The typical fire vent is provided with springs and latches released by breakdown of a fusible link to provide for the opening of the hatches at a predetermined temperature. Since the springs must be kept cocked, they and their associated mechanisms such as latches and linkages are under constant stresses. Further, in such a hatch it is difficult to provide sufficient force to open the hatch under difficult conditions, for example, when a large amount of snow is holding down the hatch. In addition, such hatches are a safety hazard even prior to installation since accidental opening in transit or during construction can be very damaging. These problems are all solved by this invention.

SUMMARY OF THE INVENTION

A fire vent hatch has a ram connected to the cover and to a source of fluid under pressure, advantageously a gas, preferably nitrogen. Preferably the ram at its lower end is connected to a pivoted lever which, upon actuation of the ram, swings downwardly to increase the angle between the ram and the cover. Also, the ram desirably has a vent in its upper end to provide for the escape of fluid in the ram when the cover is fully opened. Means are provided to hold the cover in the open position. The cover may be locked in the closed position by a scissor latch. Advantageously, there is provided a restrictor to throttle the gas when it is released to the rams to provide for a slow opening of the hatch cover. Temperature controlled means are provided to control the release of the fluid and the release of the scissor latch. This latter means has a spring which is restrained by the use of a fusible link and a release mechanism which can be actuated manually if desired.

Typically, using a gas in a storage container under a pressure of 2,100 p.s.i., a hatch of this invention has available a lifting force initially of in excess of 1,450 pounds as contracted to a comparable spring operated hatch which would have a lifting force in the area of 150 pounds.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical section through a fire vent hatch in accordance with the invention;

FIG. 2 is a view of the structure of FIG. 1 partially broken away and illustrating the operation of a ram;

FIG. 3 is a vertical section, partially broken away, taken on a plane indicated by the line 3–3 in FIG. 1;

FIG. 4 is a fragmentary plan view showing a portion of the quick release mechanism;

FIG. 5 is a vertical section, partially broken away, of the gas container and the means for releasing the gas; and

FIG. 6 is an enlarged elevation, partially broken away, showing one of the latch mechanisms.

PREFERRED EMBODIMENT

Referring now to FIG. 1, a fire vent hatch 2 in accordance with the invention has an upstanding rear wall 4, upstanding sidewalls 5, (only one being shown in FIG. 1) and an upstanding front wall 6. Each of the upstanding walls is bounded on its exterior side by rigid insulation 8 which lies within flashing member 10.

A cover 14 has an inner frame 16 which acts as a weather seal and which has a depending curb frame 18. A retaining frame 20 is secured to frame 16 by machine screws 22 and acts to hold down the entire periphery of dome 24 against gasket 25 which rests on the periphery of frame 16. Frame 16 has a pair of arms 26 (only one of which is shown in FIG. 1) which are fixedly secured to curb frame 18 and pivotally secured at 28 to a bracket 30, each bracket 30 being secured to the portion of flashing member 10 integral with wall 4.

As thus far described, the fire vent hatch is well known to the art and hence need not be described in any greater detail.

Adjacent each sidewall 5 there is a ram 36 having a cylinder 38 and a ramrod 40 secured to a piston 42 (FIG. 2). Each cylinder 38 is pivotally connected to an arm 44 as indicated at 46, each arm 44 being pivotally connected to its adjacent sidewall 5 as indicated at 48.

A bracket 52 is secured to cylinder 38 and through which ramrod 40 passes has secured thereto a washer 54 which backs up a compression coil spring 56 which in turn biases a conventional locking toggle plate 58 through which ramrod 40 passes. This arrangement desirably is employed on only one of the ramrods.

The outer end of each ramrod is threadedly connected to an arm 62 which is pivotally connected at 64 to a beam 66 which extends entirely across frame 16 and is fixedly secured thereto at each end thereof.

Cylinder 38 has a vent opening 70 connecting the interior of the cylinder to atmosphere permitting gases within cylinder 38 to exhaust to the atmosphere after piston 42 clears the opening with the cover 14 in the open position. Gas under pressure is supplied to each cylinder 38 to extend ramrod 40 through lines 72,72. Each line 72 is looped as shown at 73,73 to accommodate movement of cylinders 38,38. As seen in FIG. 3, each line 72 from its associated cylinder 38 is connected to a tee 74 which is threadedly connected to a restrictor 76 which is best seen in FIG. 5. Restrictor 76 has a reduced opening 78 to throttle the gas passing therethrough and reduce the velocity at which it travels to cylinders 38,38. Restrictor 76 is threadedly connected to a fitting 78 which has a bore 80 and a passage 82 providing communication between restrictor 76 and bore 80. A conventional container 84 containing a gas under pressure, preferably nitrogen, is threadedly connected at 86 to fitting 78 and abuts a sealing washer 88 which in turn abuts against shoulder 90 of fitting 78. Container 84 has a perforatable closure seal 92. A perforator 96 has a chamfered face 98 which is connected by a central opening 100 to a side opening 102 to facilitate the flow of gas into bore 80 after perforator 96 has pierced seal 92. Perforator 96 passes through a bore 104 in fitting 78 containing packing 106.

At best seen in FIG. 3 perforator 96 is pivotally connected at 110 to a plate 112 fixedly secured to lever 114. Plate 112 is also pivotally connected at 116 to a lever 118 which in turn is pivotally connected at 120 to lug 121 on fitting 78. A bracket 122 which is fixedly secured to wall 2 supports fitting 78.

As viewed in FIG. 3 lever 114 is biased counterclockwise by an extension spring 126 which is also connected to an eye 128 on a bracket 130 secured to wall 2. The action of spring 126 is restrained by virtue of lever 114 being connected to a fusible link 134 which in turn is connected to looped chain 136 which is connected to looped chain 138. Each end of chain 138 has a fitting 140 with an opening 142 one of which receives a pin 144 passing through an opening 147 in a bracket 146 secured to wall 2 and the other of which receives a fixed pin 145 on bracket 146. Pin 144 is held by the frictional engagement between the pin and the associated fitting 142.

Depending latch member 152 and 156 are fixedly secured to frame member 16 of the cover 14 and have respectively substantially horizontal portions 154 and 158 spaced below frame 16. As best seen in FIG. 6 horizontal portion 154 of latch member 152 is adapted to be received in recess 162 of a plate 164. It is also adapted to be received in recess 166 of lever 168 which is pivotally secured on headed pin 170 which passes through lever 168 plate 164 and is secured to bracket 130. Lever 168 has an arcuate recessed portion 174 in its lower end which is adapted to receive the arcuate end 176 of lever 178 which is pivotally mounted on headed pin 180 which passes through lever 178 and plate 164 to be secured to plate 130. The center of the arcs of portion 174 and end 176 is at

pin 180 which permits lever 178 to move without any movement of lever 168 but not vice versa since the distance of these arcs from pin 170 is much greater than their distance from pin 180. As best seen in FIG. 3, lever 178 is connected to an extension spring 180 which engages pin 182 on lever 178 and biases lever 178 clockwise as viewed in FIG. 3. A chain 186 is also connected to pin 182 and in turn is connected to lever 114 as indicated at 188. A stop pin 192 secured to plate 164 limits the movement of lever 178 counterclockwise.

Similarly the substantially horizontal portion 158 of latch 156 is adapted to be engaged by elements which are identical to the elements which engage latch 152 and which are given corresponding numbers. Thus, member 158 is adapted to be engaged by plate 164 and lever 168 which is pivotally mounted on headed pin 170 which passes through plate 164 and is secured to plate 202 secured to wall 2. Lever 168 has a recess for receiving latch 156 and a lower recess 174 for receiving the upper end 176 of lever 178 which is pivotally mounted on headed pin 180 which passes through plate 164 and is secured to plate 202. A stop 192 on plate 164 limits the movements of lever 178 clockwise. Lever 178 has a pin 182 to which is secured a chain 204 which in turn is secured to lever 114 as indicated at 206.

Referring further to FIG. 3 pins 144,144 are each secured to an end of chain loop 210 which in turn carries a pull ring 212 which can be reached from inside the building with which the hatch is employed. Loop 210 is also secured to triangular plate 214 at 216. Plate 214 is pivotally mounted on wall 2 at 218 and is secured at 220 to a chain 222 which passes through the adjacent sidewall 5 to the exterior of the hatch where it is connected to a pull ring 224 which is exterior of the hatch.

All parts of the above described embodiments, except the fusible link 134, are of metals which readily withstand the temperature to which they may be exposed as is conventional in such a hatch.

OPERATIONS

After the hatch has been installed it is placed in the operative condition by closing cover 14 and placing latch members 152 and 154 respectively in the accommodating recesses of adjacent plates 164,164. Each lever 168 in unison with the associated lever 178 is moved to a position so that recess 166 receives the adjacent latch member and portion 176 of lever 178 meshes with recess 174 of lever 168. Looped chain 138 is advanced to the right as shown in FIG. 3 which causes lever 114 and chain 186 to bring lever 178 against stop 192 and by the same token causes lever 114 and chain 204 to bring associated lever 178 against stop 192. At this stage fittings 140,140 of chain 138 have openings 142,142 in line with the openings in bracket 146 which permits pins 144,144 to be advanced through the openings in bracket 146 and through openings 142,142 to secure looped chain 138.

With the plates in the positions described above, perforator 96 is in its withdrawn position. Gas container 84 can now be threadedly secured to fitting 78 to complete putting the hatch in condition for operation. At this stage it is noted that the hatch is not fully armed until it is fully installed thus reducing the hazards during transit and installation to a minimum.

Assuming that a fire causes an elevation of the temperature sufficient to break down fusible link 134 (for example, 160° F.), the link 134 will release lever 114 which will be moved counterclockwise as viewed in FIG. 3 by spring 126. This relaxes chain 186 which permits spring 180 to urge lever 178 clockwise as viewed in FIG. 3 leaving lever 168 free to move clockwise. Simultaneously, the movement of lever 114 relaxes chain 204 leaving the associated lever 178 free to move counterclockwise as viewed in FIG. 3. Perforator 96 penetrates seal 92 permitting the gas in container 84 to escape into bore 80, passage 82, through restrictor 78 into pipes 72, and into cylinders 38,38 resulting in the extension of the piston rods 40,40 and the upward movement of cover 14. As cover 14 moves upwardly latch portions 154 and 158 cam out of the associated recesses 162 and cam the associated levers 168 clockwise which are free to move because of the release of levers 178,178 all as viewed in FIG. 3. Lever 168 associated with latch member 156 moves the associated lever 178 counterclockwise as viewed in FIG. 3. However, because of the associated stop pin 180, lever 168 associated with latch member 154 cannot move the associated lever 168 counterclockwise, but need not do so since spring 180 has already pivoted lever 178 away from the associated lever 168.

As ramrods 40,40 extend outwardly and commence to lift hatch cover 14 arms 44,44 rotate clockwise as viewed in FIG. 1 until in alignment with their respective rams. This increases the angle between the rams and cover 16 and provides for a larger vector of forces urging the cover 14 to rotate. When the rams have rotated the cover 14 to the fully opened position as determined by the limit of travel of pistons 42,42 within cylinders 38,38, the pistons 42,42 will have cleared the openings 70,70 in their respective ram cylinders which will permit gas to exhaust from the cylinders and the equalization of the internal cylinder pressures with the pressure of the atmosphere. As this occurs, the locking toggle plates 58 lock the ramrods 40 as they initiate their movement back into cylinder 38 due to the pressure drop.

After the necessity of the opening of the hatch cover 14 has passed the cover can be readily closed by first removing container 84 and then rotating locking toggle plate 58 so as to release the frictional engagement with the associated ramrod 40 and manually lowering the cover 14. The locking of the cover 14 in the closed position is then accomplished as described above and a new gas container 84 can be screwed into fitting 78 to fully return the hatch to the operative condition.

Manual operation of the hatch in an emergency can be accomplished either by pulling ring 212 or ring 224 which causes the withdrawal of pin 144 from the associated fitting 140 which then permits spring 126 to rotate lever 114 to produce the same results as are produced when fusible link 134 breaks down.

If it is desired to open the hatch in a nonemergency situation, gas container 84 can be unscrewed from fitting 78 and the pin 144 withdrawn. This causes the unlatching operation as previously described and permits the raising of the cover 14 manually.

It will be understood that the above described preferred embodiment is by way of illustration and is not intended to be limiting.

I claim:

1. In a fire vent hatch comprising a housing having upstanding sidewalls and a cover pivotally secured to one of the sidewalls the improvement comprising:

a ram having one end pivotally connected to the cover on an axis parallel to the pivotal axis of the cover and having the other end pivotally connected to a sidewall on an axis parallel to the pivotal axis of the cover and lower than the pivotal axis of said one end,

removable means to store a fluid under pressure connected to the ram, and

temperature controlled means to control the flow of fluid from the storage means to the ram to provide for the flow of fluid to the ram to raise the cover at a predetermined temperature.

2. The device in accordance with claim 1 in which said other end of the ram is pivotally connected to an arm on an axis parallel to the pivotal axis of the cover, the arm is pivotally connected to a side at a point in a vertical plane lying intermediate the vertical plane containing the pivotal axis of said one end of the ram and the vertical plane containing the pivotal connection of the ram to the arm, said arm being free to move downwardly on actuation of the ram to increase the angle between the ram and the cover to increase the force exerted by the ram in the early stages of opening the cover.

3. The device in accordance with claim 1 having means to release fluid in the ram when the cover reaches a fully open

position and having means to retain the cover in said open position.

4. The device in accordance with claim 2 having means to release fluid in the ram when the cover reaches a fully open position and having means to retain the cover in said open position.

5. The device in accordance with claim 1 having means to lock the cover in a closed position comprising a bar having substantially horizontal portions spaced below the cover, a fixed keeper plate having a recess accepting one half of the bar and a pivoted keeper plate accepting the other half of the bar and means controlled by the temperature controlled means to hold the pivoted plate in position receiving the bar until said predetermined temperature is reached.

6. The device in accordance with claim 2 having means to lock the cover in a closed position comprising a bar having a substantially horizontal portion spaced below the cover, a fixed keeper plate having a recess accepting one half of the bar and a pivoted keeper plate accepting the other half of the bar and means controlled by the temperature controlled means to hold the pivoted plate in position receiving the bar until said predetermined temperature is reached.

7. The device in accordance with claim 3 having means to lock the cover in a closed position comprising a bar having a substantially horizontal portion spaced below the cover, a fixed keeper plate having a recess accepting one half of the bar and a pivoted keeper plate accepting the other half of the bar and means controlled by the temperature controlled means to hold the pivoted plate in position receiving the bar until said predetermined temperature is reached.

8. The device in accordance with claim 4 having means to lock the cover in a closed position comprising a bar having a substantially horizontal portion spaced below the cover, a fixed keeper plate having a recess accepting one half of the bar and a pivoted keeper plate accepting the other half of the bar and means controlled by the temperature controlled means to hold the pivoted plate in position receiving the bar until said predetermined temperature is reached.

9. The device in accordance with claim 1 in which the temperature controlled means includes a spring biased actuating lever, a fusible link connected to the lever, connector means connected to the fusible link, a bracket, a pin passing through an opening in the bracket and an opening in the connector means and means to pull the pin out of said openings to permit the spring to move said actuating lever.

10. The device in accordance with claim 2 in which the temperature controlled means includes a spring biased actuating lever, a fusible link connected to the lever, connector means connected to the fusible link, a bracket, a pin passing through an opening in the bracket and an opening in the connector means and means to pull the pin out of said openings to permit the spring to move said actuating lever.

11. The device in accordance with claim 4 in which the temperature controlled means includes a spring biased actuating lever, a fusible link connected to the lever, connector means connected to the fusible link, a bracket, a pin passing through an opening in the bracket and an opening in the connector means and means to pull the pin out of said openings to permit the spring to move said actuating lever.

12. The device in accordance with claim 6 in which the temperature controlled means includes a spring biased actuating lever, a fusible link connected to the lever, connector means connected to the fusible link, a bracket, a pin passing through an opening in the bracket and an opening in the connector means and means to pull the pin out of said openings to permit the spring to move said actuating lever.

13. The device in accordance with claim 8 in which the temperature controlled means includes a spring biased actuating lever, a fusible link connected to the lever, connector means connected to the fusible link, a bracket, a pin passing through an opening in the bracket and an opening in the connector means and means to pull the pin out of said openings to permit the spring to move said actuating lever.

14. The device in accordance with claim 1 in which the connection between the fluid storage means and the ram has a restrictor to throttle the flow of fluid to the ram.

15. The device in accordance with claim 2 in which the connection between the fluid storage means and the ram has a restrictor to throttle the flow of fluid to the ram.

16. The device in accordance with claim 3 in which the connection between the fluid storage means and the ram has a restrictor to throttle the flow of fluid to the ram.

17. The device in accordance with claim 4 in which the connection between the fluid storage means and the ram has a restrictor to throttle the flow of fluid to the ram.

18. The device in accordance with claim 5 in which the connection between the fluid storage means and the ram has a restrictor to throttle the flow of fluid to the ram.

19. The device in accordance with claim 10 in which the connection between the fluid storage means and the ram has a restrictor to throttle the flow of fluid to the ram.