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DELAY LATCH FOR BLAST VALVES

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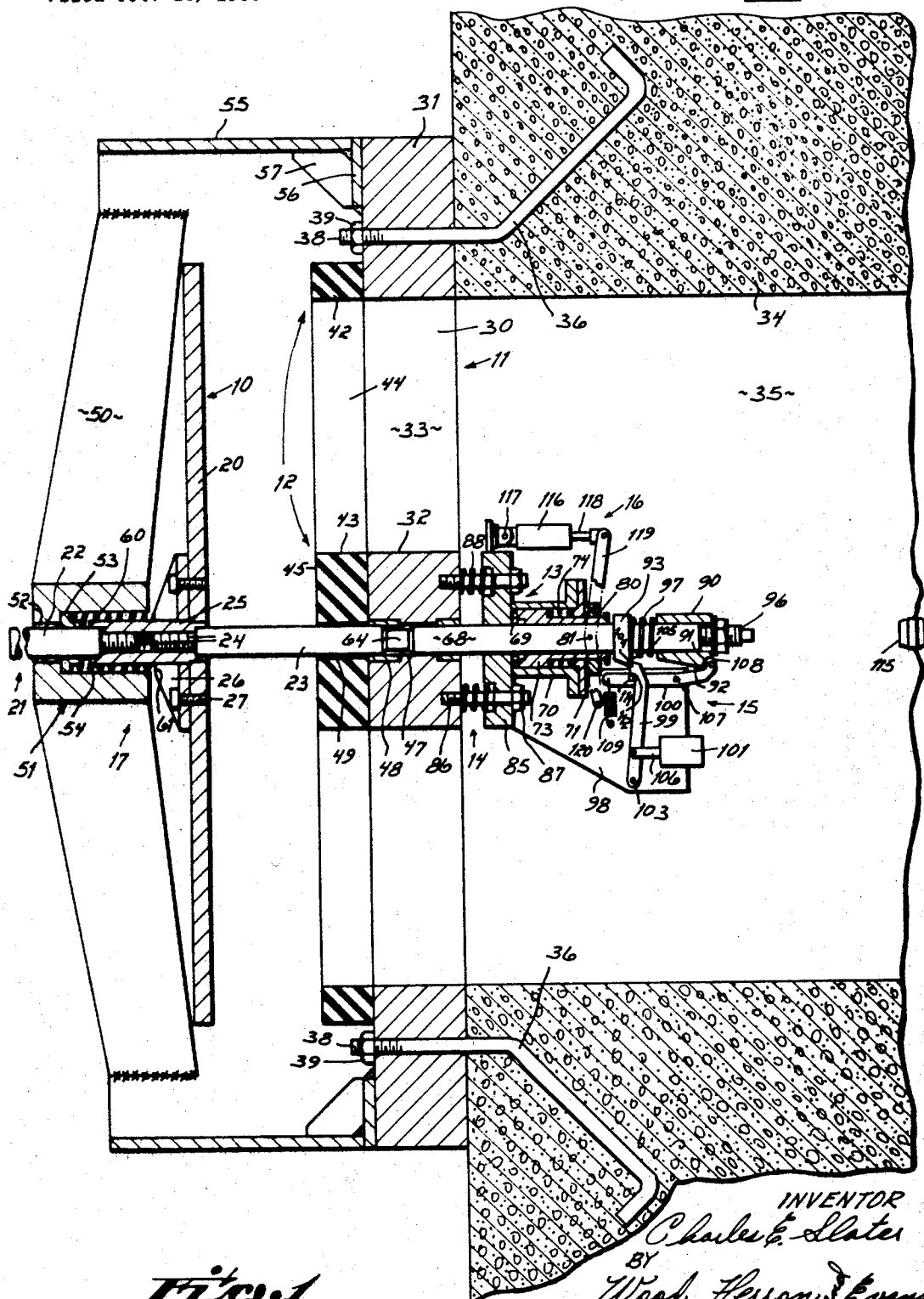


Fig. 1

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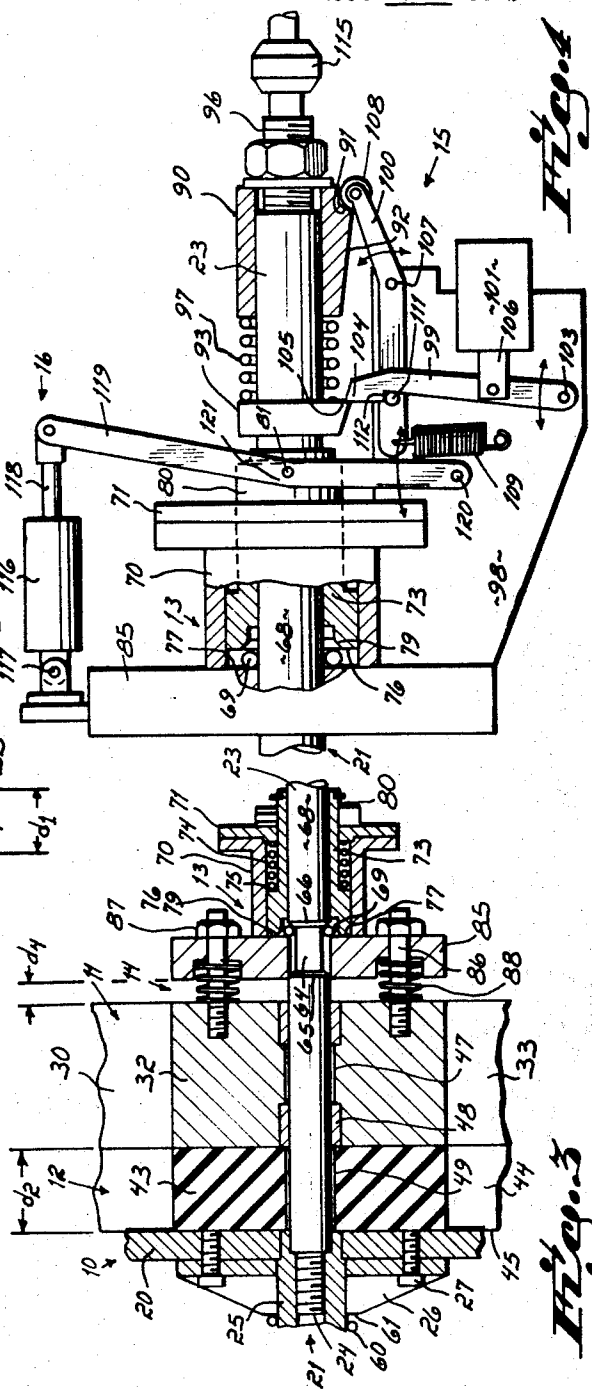
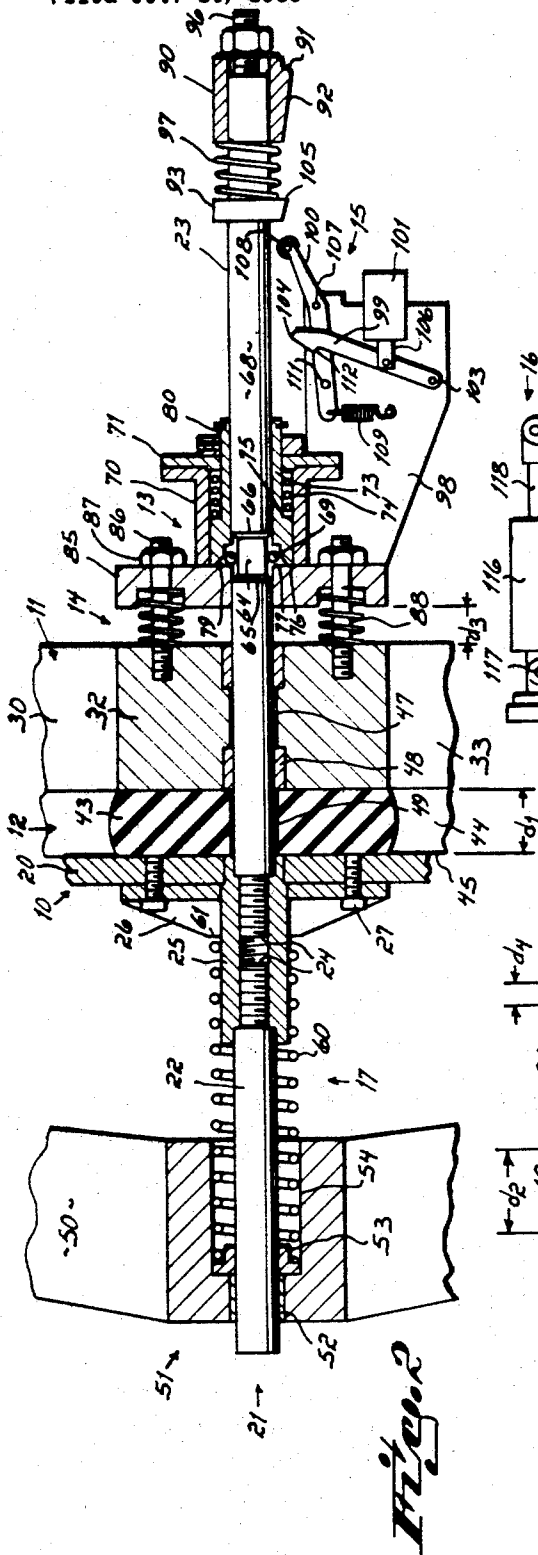
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Sheet 2 of 2



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DELAY LATCH FOR BLAST VALVES

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Int. Cl. F24f 11/00

10 Claims

This invention relates to valves which are closable by a pressure differential developed through very rapid or instantaneous changes in ambient pressure conditions, as in an atomic blast. More particularly, this invention relates to a blast valve having a delayed latching feature which secures the valve in closed position only after the impact of closure and any rebound have been dissipated.

The development of high energy explosives, for example, nuclear bombs, for use in modern warfare has created a need for highly developed, underground bomb shelters to protect the public. An air ventilation shaft communicating between the outside atmosphere and the shelter is generally necessary, to provide air circulation, cooling, etc. However, the ventilation shaft must itself be provided with a protective closure to shield the shelter from the very high pressures caused by a blast that would otherwise be transmitted through the shaft into the shelter. Also, such a protective closure is required to isolate the shelter from the heavy radioactivity which immediately follows a nuclear explosion. Therefore, the protective closure, or blast valve, must be capable of sealing the ventilation shaft to all phases of a highly explosive blast, yet should ordinarily be open to permit air at normal pressures to move through the shaft.

The prevailing atmospheric pressures immediately following a high energy explosion are dramatically increased due to the creation of shock waves of great intensity. Such shock waves may cause ambient pressure conditions to increase from normal atmospheric pressure up to as much as 100 p.s.i. or more, within a few thousandths of a second. It is obvious that the effect of such rapid and extreme changes in pressure, if reflected within the shelter, would constitute an extreme danger. Moreover, the atmosphere within the shelter would become contaminated with radioactivity. Following passage of the high intensity shock wave or overpressure conditions, a negative phase or period of partial vacuum conditions is usually presented, and this subnormal pressure condition presents problems in its own right. When the negative phase occurs, air within the shelter would be expelled if no protective closure were present.

Ventilation shafts have in the past been provided with protective closures, that is, blast valves, which are activated, closed, and sealed through the pressure differential between the outside or ground level atmosphere and the inside or shelter pressure under blast conditions. Such blast valves must of course be constantly ready to close; moreover, they should also be capable of activation and closure by manual operation. Manual operation of the valve is generally utilized where sufficient warning of the possibility of a blast is received; but if no warning is received the valve must close automatically in response to the pressure differential caused by the shock wave of the blast itself, within a few thousandths of a second after the first impingement of the shock wave so that the atmospheric pressure change behind the valve, that is, within the bomb shelter, is limited.

When activated by a high energy blast the closure of the valve must not impose an excessive shock on the valve seat, ventilation shaft walls or surrounding support structure. To alleviate this problem it is known to provide a rubber bumper to cushion closure of the movable mem-

ber or head of the valve, in an attempt to dissipate the impact energy of the head upon the seat by compression of the energy absorbing means.

To prevent valve opening under the negative phase of the blast, it is desirable to provide a quick acting latch mechanism in a blast valve to hold the valve in sealed or closed position, until opening is desired. However, because of the extremely high energy content of the shock waves promulgated by nuclear or other high energy explosions, and also because of the low pressure phase which usually follows the initial high energy shock wave, the latching mechanisms will be subjected to heavy compressional and other forces. If the valve head is latched against a highly compressed elastomeric bumper or sealing element, very high forces are charged within the valve that would impose severe loads on the latch, due to the tendency of the head to rebound off the seat. In other words, if the valve head were locked in sealed position on the valve seat when the cushioning means is very highly or substantially fully compressed, the large compressional stresses within the blast valve structure and latch mechanism would be perpetuated, and the normal rebound movement of the valve head would be "frozen" by the latching mechanism at just the moment when the cushioning or energy absorbing means are compressed most highly. Thus, if the valve head were to be latched under high compressive forces, heavy structural elements would be required within the valve to carry the high forces. There has been no known blast valve latch mechanism which would permit a valve head to rebound, release or damp the high compressive forces generated by the initial impact yet which at the same time is capable of maintaining a good seal thereafter and preventing opening under the negative phase pressures.

This invention is based on the concept of a latch for a blast valve which has a built-in delay feature to prevent rigid locking or latching of the valve in closed position on the seat at the moment the elastomeric sealing means is under great compression by reason of the impact of the head. This invention provides mechanism which permits the valve members automatically to close into an initial closure relationship in response to a high energy blast, thereafter to rebound one or more times over a limited distance to dissipate or damp the impact compression energy of the elastomer seal, and then to be held in secure closure relationship against negative phase reverse pressure conditions. By eliminating rigid latching at the moment when the elastomeric seal is most highly compressed, high stresses in the latch mechanism are avoided. Consequently, a higher, less critical valve and latch construction can be used.

Thus, it has been a primary objective of this invention to provide a blast valve wherein final closure of the movable valve member on the seat is delayed until the impact and rebound energy in the elastomeric closure seal has been substantially damped.

It has been another objective of this invention to provide a blast valve wherein the compression energy imparted to the valve seal by the impact of closure is cushioned and transferred to secondary resilient members upon latching.

It has been a further objective of this invention to provide a blast valve having improved energy absorbing means.

Briefly, the delay latch blast valve of this invention comprises a first valve member in the form of a movable valve head supported on a shaft. The head is engageable to form a closure with a second valve member or fixed valve seat. The valve head is movable relative to the seat, the latter preferably being affixed to supporting structure. An elastomeric seal is provided on one or both of the

head and seat, to cushion the impact of closure of the head upon the seat under blast conditions. Preferably these energy absorbing means are associated with the valve seat.

The delay latch associated with the blast valve includes means functioning as a strike associated with one of the valve members, and having a bearing surface on at least one side of an elongated aperture or recess therein. The elongated aperture has a stop edge for latching engagement with means functioning as a bolt. The bolt means are associated with the other of the valve members and ride on the bearing surface of the strike means during relative movement of the valve members before latching occurs. The elongated aperture in the strike means is of such length and is so positioned that it is engaged by the bolt prior to the point of maximum compression of the cushioning means, and it permits limited inward movement thereafter of the head relative to the seat.

Upon closing movement imparted to the valve head by a high energy explosion or through other means, the strike means is moved toward the bolt means as the head moves toward the seat. The bolt means are urged toward engagement with the aperture of the strike means, and engage therewith during initial compression of the elastomeric cushioning member. One of the bolt or strike means is mounted upon springs for movement relative to the seat, and the compression load of the cushioning member is transferred resiliently through the latch to these springs, so that the impact is ultimately damped by resilient compression of these springs rather than being absorbed non-resiliently by the latch itself. The valve head may rebound off the seat, until the compression and/or kinetic energy is dissipated. The assembly comes to rest with the head sealed to the seat, and remains so until the latch is released when it is desired to open the valve again.

The more specific details of the invention, as well as its additional objectives and advantages, are best further described in relation to the accompanying drawings, in which:

FIGURE 1 is an axial section of a preferred embodiment of a blast valve in accordance with this invention, showing the valve and latch elements in the "set" or open position;

FIGURE 2 is a partial axial section similar to FIGURE 1 but showing the relationship of the elements after closure, at the point of maximum compression of the elastomeric seal, as latching is just occurring;

FIGURE 3 is a partial axial section similar to FIGURE 2 but showing the relationship of the elements after latching at a time when the impact and rebound energy of closure have been dissipated; and

FIGURE 4 is a partial side elevation, partly broken away, showing the latch while being reset to the open position.

In preferred embodiment, the blast valve of this invention basically includes a movable valve head 10, a fixed valve seat 11, elastomeric sealing and impact energy absorbing means 12 between the head and seat, latching means generally at 13, resilient latch mounting or rebound springs generally at 14, a trigger mechanism 15, a valve reset mechanism 16, and valve actuator means 17.

The valve head 10 includes a head plate 20 which may be a circular disk, mounted to a stem or shaft 21. Shaft 21 extends through the head plate 20, being assembled from an outboard or upstream portion 22 and an inboard or downstream portion 23. Each of the two stem portions 22, 23 carries a stud 24 which is threaded internally to a connector or sleeve 25. Sleeve 25 is connected to head plate 20 through angled braces 26 which are suitably secured to the head for example, by bolts 27.

The valve seat 11 includes an apertured seat plate 30 having an outer peripheral or ring portion 31 and a central hub 32, the ring and hub portions being interconnected by spokes, ribs or braces 33. In a typical installation the

outer ring 31 is mounted to the concrete walls 34 of an air ventilator shaft 35, by reinforcing or mounting arms 36 embedded in the walls. At their other ends 38, the crooked arms 36 are secured to the outer ring 31 of seat 30 by nuts 39.

The resilient impact energy absorbing or cushioning means 12 is mounted on seat plate 30, and comprises an outer ring 42, a hub 43 and connecting spokes or ribs 44, being similar in outline to seat plate 30. The member 12 is formed of an elastomeric material, for example, a rubber, which is capable of cushioning the impact of high velocity closure of the valve head 10 on valve seat 11. It will be noted that the elastomeric means 12 serves a secondary function as a seal, as well as an impact energy absorber. That is, the resilient material presents a sealing face 45 to the head plate 20, thereby providing a seal (after rebound has been damped) to the flow of air between the valve head and seat.

The central hub 32 of plate 30 has an axial shaftway 47 which is provided with sleeve bearings 48 supporting sliding movement of the inboard portion 23 of the valve stem or shaft 21. The hub 43 of elastomeric member 12 has a larger aperture 49 for the shaft, axially aligned with plate shaftway 47.

The bearings 48 guide the valve head 10 in its reciprocal movement into and out of engagement with the valve seat 11. In addition to these bearings, however, it is desirable that valve head 10 also be provided with outboard supporting structure because of the severe stresses placed on the valve structure by a high energy explosion. Valve stem portion 22 is slidably journaled in a stem outboard support 51 by a bearing sleeve 52 and a flanged bearing collar 53, the collar being disposed within a spring chamber 54. The outboard support housing 51 is supported by ribs 50 which extend centrally from a surrounding cylindrical blast wave collimator 55. Collimator 55 is mounted to the ventilator shaft walls 34 by a flange 56 secured to the periphery of plate 30. Angle pieces 57 provide reinforcement between flange 56 and collimator walls 55.

Partially positioned within the chamber 54 defined in support 51 is the valve actuator means 17 which comprises a coil compression spring 60. Spring 60 bears at one end on collar 53, and at the other end against a spring surface 61 of the valve head assembly 10. The actuator spring is under compression when the valve is in the "cocked" or "set" altitude shown in FIGURE 1, and constantly urges the valve head 10 toward the seat, with sufficient force to move the head onto seal 12 when the trigger 15 is released.

Latch 13 includes strike means presenting an elongated aperture or circumferential groove 64 in the inboard portion 23 of valve shaft 21. The groove 64 is provided with cam or angulated edges 65 at both ends, the edge farthest from the valve head 10 comprising a stop 66. Shaft surface 68, on the inboard side of groove 64, serves as a bearing surface against which bolt means comprising a plurality of spheres or ball bearings 69 ride during unlatched movement of the valve head 10 with respect to the valve seat 11.

Latch 13 also includes a movable hollow cylindrical or sleeve-like bolt housing 70 having a cap 71 at one end, and the balls 69 are carried within housing 70. A camming or latching collar 73 is slidable around shaft 21 and within the housing 70. This latch collar 73 is constantly urged outboard, that is, toward the face 77 of a latch mounting plate 78, by a latch spring 74 compressed between the housing cap 71 and a step 75 on the collar 73. Latch collar 73 is provided on the forward edge 76 thereof with an inwardly angulated surface 79 which urges the latch balls 69 against the bearing surface 68 of stem 21. The latch collar 73 has an end portion 80 extending beyond the bolt housing 70, that is, through cap 71. This end portion 80 carries two diametrically opposed external pivots or pins, one of which is designated at 81, near the end thereof.

The rebound absorber means 14 includes the plate 85 to which bolt housing 70 is rigidly secured. Shaft 21 passes freely through a central aperture in latch plate 85 and the plate is mounted for movement relative to seat plate 30 on a plurality of studs 86 having nuts or stops 87. Each stud 86 is secured to the seat hub 32 and passes through the latch mounting plate 85, and a rebound shock absorber spring 88 encircles each stud 86 and is compressed between the latch plate 85 and seat hub 32. Thus, the latch plate 85 can move toward seat plate 30 but is constantly urged away from the latter by the springs 88. The stop means 87 limit movement of plate 85 away from the seat. Springs 88 exert a total force great enough to absorb the rebound of the head off elastomeric seal 12, and also great enough to prevent the head from moving off the seal during the negative pressure phase of the blast.

The trigger mechanism 15 cooperates with valve stem 21 to hold the valve in the set or open position, against the force of spring 60, until released either by an explosion or by other means. The trigger mechanism 15 includes a trigger cam sleeve 90 having an angulated cam surface 91, the sleeve being slidably mounted on valve stem inboard portion 23. Sleeve 90 also presents a more gradual, oppositely tapered surface 92 at the opposite or forward end thereof. At its inner end, stem portion 23 carries an adjustable stop 96 which limits movement of sleeve 90 on the stem, and the sleeve is urged toward this stop 96 by a movement take-up compression spring 97 between sleeve 90 and a stop 93 secured to shaft portion 23. Spring 97 is relatively light as compared to spring 60, and urges sleeve 90 toward stop 96.

A trigger 99, a restrainer arm or lever 100 and a solenoid 101 are all connected to the latch plate 85 by means of a mounting plate 98. Trigger 99 is pivoted at 103 to mounting plate 98 and is of such length that its pointed upper end or tip 104 just engages a rim or shoulder 105 on stop 93 when the trigger is in the set or valve open position, as shown in FIGURE 1. The trigger can be swung about pivot 103 by actuation of solenoid 101 which is connected to the trigger by an arm 106. The solenoid may be activated, for example, by a manually closed switch not shown, or by a relay in response to a remote explosion sensor which may be of known type. The restrainer arm 100 is pivoted to mounting plate 98 at point 107, and carries a freely rotating wheel 108 which rides on sleeve 90 and which, when the valve is set or open, engages cam 91. A tension spring 109, which is relatively light as compared to spring 97, urges arm 100 in the counterclockwise direction about pivot 107, thereby urging wheel 108 against sleeve 90. The trigger 99 ordinarily prevents arm 100 from rotating in the clockwise direction from the position shown in FIGURE 1 by engagement of a shoulder 112 on the trigger with a pin 111 on arm 100.

The trigger holds the valve open, until solenoid 101 is energized, by blocking arm 100 from being swung about pivot 107. Spring 60 urges the shaft 23 inboard, and this force is transmitted through spring 97 to sleeve 90, which bears on wheel 108 and tends to cam arm 100 clockwise. However, engagement of pin 111 against trigger shoulder 112 prevents such rotation, and wheel 108 therefore prevents sleeve 90 and shaft 23 from moving to closed position.

A valve reset mechanism 16 is provided for cooperation with the latch 13 to move the valve head to open position after closure. Reset mechanism 16 includes a ram 115, preferably hydraulically operated by means not shown, which upon actuation bears upon stop 96 at the inboard end of the valve stem, to push the valve head 10 from the closed position shown in FIGURE 4, back into the set position shown in FIGURE 1.

To permit the valve head 10 to be moved from latched closed position, the latch collar 73 must first be drawn

back against spring 97 sufficiently to permit the balls 69 to be cammed out of groove 64. That is, the angled edge 79 of the latch collar 70 must be removed from face 77 of the latch mounting plate 85. To this end, there is provided a fluid pressure operated cylinder 116 pivotally mounted to the plate 85 at 117. The cylinder shaft or ram 118 is pivotally connected to split lever 119 which straddles the end 80 of the sleeve 73. The lower ends are pivotally connected to the mounting plate 98 at 120. On each side of the end 80 of the sleeve 73, lever 119 has an elbow 121 provided with an aperture in which are engaged the respective pivot pins 81 projecting from the latch collar. Thus, as the shaft 118 is extended to the right in FIGURE 1, lever 119 pivots about point 120, and pulls latch collar 73 back against the force of latch spring 74, providing a space between surface 79 and plate 85 to receive the balls 69.

In operation, the valve head 10 is set or positioned within the air ventilator shaft 35 so that air may pass around the outer edges of the valve head plate 20 into a shelter located downstream, that is, the ordinary airflow is from left to right as the valve is depicted in FIGURE 1; similarly, shock waves of an explosion impinge on the head from the left. When open, the valve head is maintained in such position by the engagement of pin 111 with trigger shoulder 112, as previously explained.

When the valve is to be closed in response to an electric signal, for example, the closing of a switch or relay in the solenoid circuit, the solenoid 101 is energized and pulls in arm 106. This pivots trigger 99 about point 103 and out of engagement with the stop pin 111 carried by the restrainer arm 100. Once trigger 99 is disengaged from stop 111, the force of the compressed actuator spring 60 is released, and that spring, acting through shaft 21, stop 93, spring 97, and cam sleeve 90, causes the arm 100 to be swung out of restraining position, and the valve head 10 is rapidly moved into engagement with the sealing face 45 of the elastomer seal 12. As the valve head engages the seal, the circumferential groove 64 on the valve stem 21 is moved into the bolt housing 70 sufficiently that at least part of the groove is positioned on the right side of latch mounting plate face 77, see FIGURE 3. The groove 64 should ideally be so positioned just when the head first engages the seal, and before the seal is highly compressed. Inasmuch as the balls 69 are constantly urged radially by latch collar 73, when the detent groove 64 enters bolt housing 70, the latch collar pushes the ball bearings 69 into the groove 64. Once the balls 69 have dropped into groove 64, the latch collar 73 moves against the latch plate 85, being urged to that position by the latch spring 74, so that the balls cannot thereafter fully retreat into the bolt housing 70 to permit the head to open. Any opening movement is then transmitted from shaft 21 through balls 69 to plate 85, which resists motion relative to the shaft.

When the blast valve is operated by either a manual switch or a remote blast sensor, the impact of the valve head 10 against the elastomeric seal 12 of the valve seat 11 is of lower magnitude than when the valve is actuated by blast shock waves, and rebound is not a severe force. When the blast valve is closed by blast shock waves, its operation proceeds in substantially the same manner as described above, but because of the great impact of the high velocity closure of the valve head 10 on seal, the resilient mounting of latch 13 permits the valve head 10 to rebound, even momentarily off the seal if necessary, to damp the force of closure.

When blast shock waves contact the valve head 10, the valve head plate 20 and valve stem 21 start to move toward seat 11. However, trigger shoulder 112 engages pin 111, and to prevent the pin from being sheared off or bent as the valve stem 21 and stop 93 accelerate to the right, the spring 97 intermediate the sliding sleeve 90 and the valve stem stop 93 permits initial relative movement

between the sliding sleeve and the valve stem. In other words, stop 93 pushes the trigger off pin 111, thereby freeing arm 100 to rotate clockwise before wheel 108 is pivoted about pivot point 107.

Depending upon the force of the shock waves, the valve head 10 is pushed to the right, as shown in the figures, to a position where the seal 12 is compressed to a high degree, see FIGURE 2. The seal cushions the impact of the valve head 10, but it is not desirable to latch the valve head rigidly to the seat when the seal 12 is in a state of very high compression, corresponding to the thickness dimension d_1 in FIGURE 2. Therefore, groove 64 is preferably of such length that edge 66 thereof extends well into the bolt housing 70 when the blast overpressure is at its height, see FIGURE 2. In such position it can be seen that the latch, though engaged permits some inward movement of the head stem 21 relative to the latch plate 85, over a distance equal to the length of that portion of groove 64 which is then on the right side of the latch plate, less the diameter of the balls 69.

As the valve head begins to rebound in response to the high compression of seal 12, the stem can move to the left relative to plate 78 to that point at which the balls 69 are trapped between plate 85 and groove edge 66, see FIGURE 3. At this point seal 12 is less compressed, and preferably is under no or only low compressive stress, having a thickness corresponding to dimension d_2 in FIGURE 3. In this position further outward movement of the stem and head relative to the latch plate 78 is arrested, and seal 12 is maintained in engagement with the head. The springs 88 take up and cushion movement imparted to the latch and latch plate, compare dimensions d_3 and d_4 in FIGURES 2 and 3. Thus, even when the head is latched rigidly to the latch plate, movement of the head relative to the seat is permitted by the resilient mounting of the latch. Thus, immobilization of the valve head is postponed or delayed until the seal 12 has substantially returned to an uncompressed state.

To reset the valve head 10 to its original or open position, the latch collar 73 is moved inwardly against the latch spring 74, by actuating the cylinder 116. Actuation of the cylinder 116 causes the cylinder arm 118 to extend, thereby pivoting the bellcrank arm 119 and moving collar to the right. Plunger head 115 is extended and engaged with the end of stem 21 and the valve stem pushed toward its original position. As the valve stem 21 proceeds toward the left, the shaft groove camming surface 66 and balls 69 out of the groove, and onto the bearing surface 68. When the valve head 10 has been moved to its original position, the trigger 99 is reset with the stem stop 93, see FIGURE 4. Cylinder 116 is deactivated to return the latch collar 73 to normal position.

While the blast valve of this invention has been primarily described in connection with an air ventilation shaft and blast shelter, the invention is not limited to such use and may, for example be employed in intake or exhaust stacks of power plants or the like to protect machinery or electrical or electronic equipment against possible damage from overpressures. The invention is well suited for such varying purposes without departing from its principles.

Having described the invention, what is desired to claim and protect by Letters Patent is:

1. A pressure actuated, normally open, latching valve mechanism comprising,

a fixed valve seat,

a valve head assembly including a valve head and movable in response to an overpressure of blast magnitude toward said seat to form a closure,

an elastomeric member on one of said head and seat for cushioning the impact of closure,

inter-engageable latch means presented in part on said head assembly and in part on latch mounting means,

the parts of said latch means cooperating to latch said head assembly to said latch mounting means when said elastomeric member is engaged by closure of said valve mechanism,

said latch means permitting limited movement of said head relative to said latch mounting means over a distance corresponding substantially to the compression imparted to said elastomeric member in cushioning said closure,

spring means supporting said latch mounting means for elastic movement relative to said seat, and means for selectively disengaging said latch means.

2. The valve mechanism of claim 1 wherein said latch means comprises strike means on a shaft supporting said valve head for movement relative to said seat, and bolt means mounted by said latch mounting means, said strike means being positioned to receive said bolt means when said elastomeric member is initially engaged by closure of said valve mechanism, thereby preventing rebound movement of said head away from said latch mounting means after said initial engagement.

3. The valve mechanism of claim 2 further comprising, resilient means constantly urging said head toward closed position,

trigger means blocking closure until released, and means releasing said trigger means upon impingement of a shock wave on said head.

4. In a blast valve having a head movable relative to a seat to effect a closure therebetween, and resilient energy absorbing means for cushioning the impact of said head upon said seat in closure of said valve under blast conditions, the improvement comprising,

a delay latch associated with said valve comprising, bolt means associated with one of said head and seat, strike means associated with the other of said head and seat,

said strike means including structure defining an elongated bolt receiving aperture, said aperture having a bolt bearing surface on one side thereof and presenting at least one stop edge to said bolt means when said bolt means is engaged in said aperture, spring means continuously urging said bolt means against said bolt bearing surface when said valve is in open position,

and resilient mounting means for said latch permitting limited rebound of said head off said seat when said bolt and strike means are inter-engaged.

5. A blast valve comprising,

a valve seat,

a valve head mounted to a shaft for movement relative to said seat,

an elastomeric member mounted to one of said head and seat for cushioning the impact of closure of said head with said seat under blast conditions,

a groove formed in said shaft,

a latch mounting plate supported on springs for movement relative to said seat, said shaft passing through said plate,

a sleeve on said shaft and a plurality of balls confined around said shaft between said sleeve and said plate, said sleeve having a cam surface formed thereon urging said balls radially inward on said shaft, and a spring urging said sleeve toward said plate, said balls and groove interengaging when said elastomeric member is initially contacted during closure of said valve.

6. A valve as set forth in claim 5 further including an actuator spring associated with said head urging said head toward said seat, and

releasable trigger means for selectively permitting and restraining relative movement between said head and said seat when said head is in open position with respect to said seat.

7. A device as set forth in claim 6 wherein said trigger means comprises

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a stop secured to said shaft,
 a trigger pivotally movable into and out of engagement
 with said stop, said trigger carrying a stop shoulder,
 a camming sleeve slidably disposed on said shaft and
 continuously urged away from said stop, and
 a pivotally mounted restrainer arm carrying a stop pin
 and a cam follower, said cam follower engaging said
 camming sleeve when said valve is open and the
 stop pin thereon being urged thereby against said
 stop shoulder to restrain said valve against the
 force of said actuator spring until said stop shoulder
 is moved away from said pin.

8. A valve as set forth in claim 5 further wherein said
 elastomeric member has a peripheral surface in the form
 of a ring positioned between said head and seat for form-
 ing a seal between said head and seat when said valve is
 closed.

9. A blast valve as set forth in claim 5 further including
 reset means comprising,
 a lever arm pivotally connected to said sleeve, and
 means related to said lever arm for actuating said

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arm to overcome the force of said spring urging
 said sleeve toward said plate, said means being
 mounted on said plate,

a fluid pressure operated piston selectively operable
 to move said sleeve away from said latch mounting
 plate, to thereby permit said balls to move out of
 said groove.

10. A blast valve in accordance with claim 9 wherein
 said groove has an angulated edge tending to cam said
 balls out of said groove.

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HAROLD W. WEAKLEY, *Primary Examiner*.

U.S. Cl. X.R.

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