Sept. 6, 1955 H. C. GRANT, JR., ET AL 2,717,042

IMPACT OPERATED VALVE

Filed March 31, 1950

Fig. 1

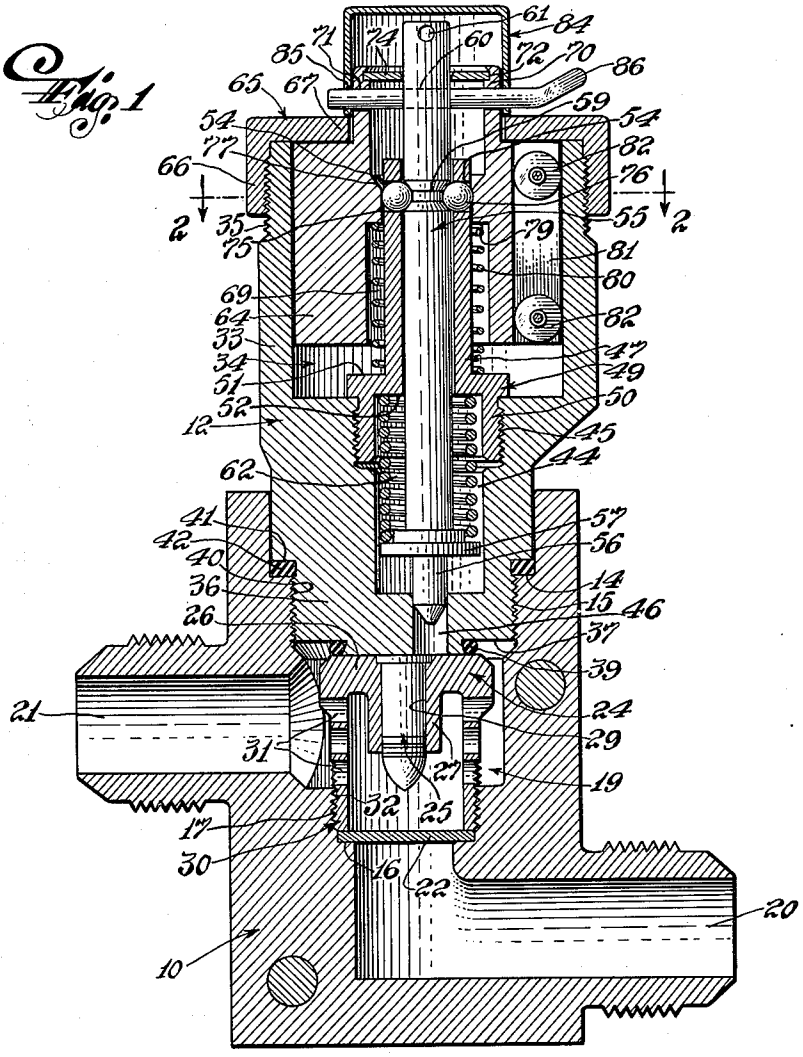
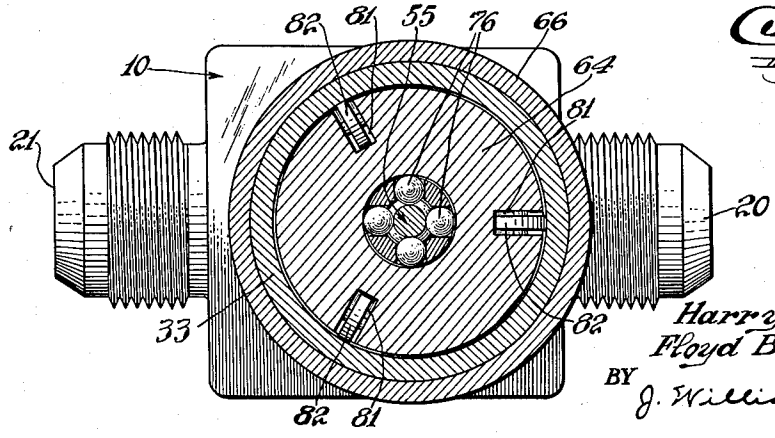


Fig. 2



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IMPACT OPERATED VALVE

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9 Claims. (Cl. 169—11)

The present invention relates to valves, and, more particularly, relates to valves which normally prevent the flow of fluid therethrough and are operated by impact responsive means to render the same effective to permit the flow of fluid therethrough.

Heretofore it has been desirable to protect aircraft and the like with a fire preventing or extinguishing system which is rendered effective to discharge the fire extinguishing medium in the event of crash or collision of the craft. In United States Patent No. 2,189,147, a fire preventing and extinguishing system is disclosed which represents one of the most generally acceptable and commercially successful systems of this type.

Such a system generally comprises a plurality of individual receptacles containing fire extinguishing fluid which are positioned adjacent the fire hazard to be protected, individual electrically actuatable release means associated with each receptacle for controlling the release of fluid therefrom, a central control switch electrically connected to all of the release means, and impact responsive means for actuating the switch.

The primary objection to systems of the type just described is that the electrical wiring required may be disrupted or rendered ineffective by gun fire or the like or upon collision or crash, whereby the release means cannot be operated to effect discharge of the fire extinguishing fluid when required to prevent or extinguish a fire.

Accordingly, an object of the present invention is to provide an impact or inertia actuated valve which overcomes the foregoing difficulties.

Another object is to provide such a valve which can be directly connected with the source of fire extinguishing medium, the source being at the location to be protected whereby long lengths of electrical control wires, control conduits and discharge directing conduits are eliminated.

A further object is to provide such a valve which is simple and economical in construction and is reliable in operation.

A still further object is to provide such a valve which can be locked in an ineffective position at such times when operation thereof is not desired but can be readily unlocked for operation thereof by impact.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In accordance with the invention, the foregoing objects are accomplished by providing an impact actuated valve comprising a housing having an inlet and an outlet, a closure such as a rupturable disc for normally preventing the flow of fluid from the inlet to the outlet means for rendering the closure ineffective, preferably including an explosive cartridge and a spring operated firing pin, means for normally restraining the firing pin

from detonating the cartridge, and impact responsive means such as a movable mass for normally maintaining the restraining means effective but upon movement allowing the restraining mens to be rendered ineffective.

In an illustrative embodiment of the invention about to be described, the firing pin and the mass are adapted to be locked in a non-operating position together with an indicator by a common element; and the cartridge is supported in a chamber formed in an element which also serves to hold the disc in place and to prevent fragments of the ruptured disc from entering the outlet of the valve.

A preferred embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawing, forming a part of the specification, wherein:

Figure 1 is a longitudinal sectional view of a valve in accordance with the invention with the movable parts thereof locked in non-operating position.

Figure 2 is a sectional view taken along the line 2—2 on Figure 1.

Referring to the drawing in detail, there is shown a unitary valve structure comprising generally a valve body or housing 10, a valve operating assembly secured in the housing and a control head body or casing 12 secured to the housing 10 over the assembly.

The housing 10 is formed with a cylindrical bore extending from the upper end thereof which comprises a shoulder 14 adjacent the upper end, a threaded section 15 beneath the shoulder, a shoulder 16 at the lower end, and a threaded section 17 above the shoulder 16, the portion of the bore between the threaded sections 15 and 17 constituting a chamber 19. The housing is further formed with an inlet passage 20 merging with the bore at the shoulder 16, and an outlet passage 21 extending from the side of the chamber 19.

The valve operating assembly comprises a rupturable or shatterable disc 22 seated on the shoulder 16, a bushing member 24, and an explosive cartridge 25 mounted in the bushing member.

The bushing member 24, as shown, is in the form of an inverted cup having an upper end wall 26 provided with a depending sleeve portion 27 through which a bore 29 extends serving as a chamber for the cartridge 25, and having a depending skirt 30 provided with radial apertures 31 and a threaded section 32 at the lower portion thereof.

The threaded section 32 cooperates with the threaded section 17 of the housing 10 to secure the bushing member therein with the lower end of the skirt 30 sealing the disc on the shoulder 16 and with the projectile of the cartridge pointing downwardly at the disc. The apertures 31 are positioned in the chamber 19 for establishing fluid flow communication between the inlet passage 20 and the chamber when the seal provided by the disc 22 is destroyed, and to prevent fragments of the disc from entering the chamber or the outlet passage 21.

The control head casing 12 generally comprises a hollow cylindrical upper portion 33 providing a chamber 34 therein and having a threaded section 35 at the exterior upper end, and an exteriorly cylindrical lower portion 36 of reduced diameter and eccentrically disposed with respect to the upper portion for the purpose which will become apparent hereinafter.

The exterior of the lower casing portion 36 comprises a lower end surface 37 for compressing a gasket 39 against the end wall 26 of the bushing member 24, a threaded section 40 for cooperating with the threaded section 15 of the housing 10 to secure the housing and casing together, and a shoulder 41 above the threaded

section 40 for compressing a gasket 42 against the shoulder 14 to seal the casing and housing connection against leakage therebetween.

The interior of the lower casing portion 36 is formed with a longitudinally extending bore 44 which is concentrically disposed with respect to chamber 34 but is eccentrically disposed with respect to the cartridge chamber or bore 29. The bore 44 has an upper threaded section 45 and a lower portion 46 of reduced diameter, the center of which is disposed over the rim of the cartridge so that a firing pin associated with impact actuated mechanism, about to be described, is adapted to be guided therethrough and detonate the cartridge.

Referring now to the impact actuated control means of the valve, a hollow sleeve 47 is provided with an inverted cup-shaped lower end portion 49 formed with a threaded section 50 on its exterior for cooperating with the threaded section 45 of the casing to secure and support the sleeve in longitudinally extending upright position within the chamber 34. As shown, the sleeve portion 49 is formed with an upwardly facing shoulder 51 and a downwardly facing shoulder 52, and the upper portion of the sleeve 47 is formed with radial openings 54.

A plunger 55 is slidably mounted in the sleeve 47, and comprises a firing pin section 56 at its lower end positioned in the guide portion 46, a flange 57 above the firing pin slidably disposed in the bore 44, an annular peripheral groove or recess 59 adjacent the upper end, an aperture 60 extending diametrically through the plunger above the groove, and an opening 61 or other tool receiving portion at the upper end.

A relatively strong compression spring 62 has one end seated against the shoulder 52 and has its other end seated on the flange 57, whereby, when this spring is loaded, it is effective to drive the firing pin into contact with the rim of the cartridge with a force sufficient to detonate the cartridge. However, when the spring is loaded the plunger is normally restrained against movement by impact sensitive means about to be described.

To accomplish the foregoing, a generally cylindrical mass 64 is slidably confined in the chamber 34 by a cap 65 having a threaded skirt section 66 cooperating with the threaded section 35 of the casing and having a centrally apertured cover part 67. The mass is formed with a central bore 69 through which the sleeve 47 is adapted to extend and slidably position the mass in the chamber. The mass is further formed at its upper end with a collar 70 extending upwardly through the aperture in the cover part 67. The collar has a pair of diametrically opposite apertures 71 therein and an internal recess 72 in which a ring or washer 74 is mounted for slidably receiving the upper end of the plunger 55.

The central bore 69 of the mass 64 has an annular inwardly extending projection therein which is provided with a cylindrical wall surface 75 for normally retaining detent means, such as a ball 76, in each of the apertures 54 of the sleeve 47 and in the groove 59 of the plunger 55 to lock the plunger against movement. This projection also has an upwardly and outwardly inclined surface 77 for permitting the balls to move outwardly of their apertures 54 into the bore 69, when the mass is actuated by an impact, and for guiding the balls into their apertures when the mechanism is reset.

The bore projection further has a downwardly facing shoulder 79 for engaging one end of a compressible spring 80 which has its other end supported on the shoulder 51 whereby the mass 64 is normally urged upwardly to position the surface 75 to render the detent means effective. The force of the spring 80 is so related to the weight of the mass that the mass can only overcome the force of the spring when subjected to an impact of a predetermined value.

Sliding friction between the mass 64 and the side wall of the chamber 34 may be reduced to a minimum by forming vertical slots 81 at the outer wall of the mass and mounting rolling elements 82 therein which contact the wall of the casing.

In order to lock the mass 64 and the plunger 55 against operation during shipment of the valve or at such other times when actuation thereof is not desired, a cap 84 having a pair diametrically opposite aperture 85 in the skirt is telescoped over the collar 70 with the lower edge of the skirt resting on the cover part 67, and a pin 86 is inserted through the apertures 85 of the cap, the apertures 71 of the collar 70, and the aperture 60 of the plunger 55. The cap in addition to cooperating as an interlocking element, as just described, also serves as an indicator to give warning that the impact actuated mechanism is locked in ineffective position. Suitable legend may be placed on the cap giving instructions that the pin 86 should be withdrawn when it is desired to condition the valve for operation.

In operation, with the pin 86 withdrawn and the cap 84 removed, the mass 64, upon being subjected to an impact of a value at which the valve is to be opened, overcomes the force of the spring 80 and moves downwardly within the chamber 34 causing the wall surface 75 to release the balls 76. The balls are then permitted to move outwardly into the upper portion of the bore 69 of the mass to release the plunger 55, which, under the influence of its spring 62, is driven downwardly to cause the firing pin 56 to strike the rim of the cartridge and detonate the same. The projectile of the cartridge is projected against the disc 22 to shatter, rupture or puncture the same, whereby fluid can pass from the inlet passage 20 to the outlet passage 21.

When it is desired to recondition the valve after operation thereof as just described, the casing 12 is unscrewed from the housing 10, and the bushing member 24 is removed. The fragments or pieces of the disc 22 are removed and the fired cartridge is extracted from its chamber and a new one is inserted. A new disc 22 is placed on the shoulder 16 and the bushing member 24 is screwed into place again as shown.

The impact actuated control mechanism of the valve is reloaded by inserting a tool in the opening 61 and using the tool to pull the plunger 55 upwardly in opposition to its spring 62 whereby the inclined surfaces 77 guide the balls 76 into the plunger groove 59 to relock the plunger. The cap 84 is replaced and the pin 86 is reinserted to positively lock the plunger. The control head casing is now ready to be again secured to the valve housing, it being noted that accidental operation of the plunger cannot take place at this time because of the positive lock afforded by the pin.

While the valve has been illustrated and described herein with reference to a rim fire cartridge, it will be readily understood that center fire cartridges could be utilized by constructing the internal parts of the lower casing portion concentric with the cartridge chamber so that the firing pin would strike the center of the cartridge.

From the foregoing description, it will be seen that the present invention provides an improved impact operated valve which is compact and of minimum size and weight, the latter being particularly important in aircraft installation. The valve is positive and reliable in operation but cannot be operated accidentally. The valve makes available simple and practical locally controlled automatic valve operation for fire extinguishers which may be located in the immediate vicinity of the fire hazard.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

We claim:

1. An automatically impact actuated valve comprising a housing having an inlet and an outlet, a disc-like closure

positioned in said housing for normally preventing the flow of fluid from said inlet to said outlet, means for rupturing said closure including a cartridge chamber adapted for mounting a cartridge therein, said chamber having one end facing one side of said closure and a spring actuated cartridge firing pin facing the other end of said chamber, detent means in said housing for normally restraining said firing pin, and impact responsive means in said housing for rendering said detent means ineffective including a movable mass, means for guiding said mass for movement in a path parallel to the longitudinal axis of said pin and a spring in said housing engaging said mass for opposing movement of said mass, said mass being formed with means for retaining said detent means in position to restrain said pin and with an inclined surface adjacent said detent retaining means for permitting said detent means to move out of pin restraining position upon movement of said mass.

2. An impact actuated valve comprising a housing having an inlet and an outlet, a disc-like closure positioned in said housing for normally preventing the flow of fluid from said inlet to said outlet, means for rupturing said closure including a cartridge chamber adapted for mounting a cartridge therein, said chamber having one end facing one side of said closure and a spring actuated cartridge firing pin facing the other end of said chamber, detent means in said housing for normally restraining said firing pin, impact responsive means in said housing for rendering said detent means ineffective including a movable mass, means for guiding said mass for movement in a path parallel to the longitudinal axis of said pin and a spring in said housing, said spring engaging said mass for opposing movement of said mass, said firing pin and said mass each having an aperture extending therethrough, and a removable element extending into said apertures for normally locking said pin and said mass, said mass being formed with means for retaining said detent means in position to restrain said pin and with an inclined surface adjacent said detent retaining means for permitting said detent means to move out of pin restraining position upon movement of said mass.

3. An impact actuated valve comprising a housing having an inlet and an outlet, a disc-like closure positioned in said housing for normally preventing the flow of fluid from said inlet to said outlet, means for rupturing said closure including a cartridge chamber adapted for mounting a cartridge therein, said chamber having one end facing one side of said closure and a spring actuated cartridge firing pin facing the other end of said chamber, detent means in said housing for normally restraining said firing pin, impact responsive means for rendering said detent means ineffective including a movable mass, means for guiding said mass for movement in a path parallel to the longitudinal axis of said pin and a spring in said housing, said spring engaging said mass for opposing movement of said mass, one end of said pin and said mass extending outwardly of said housing, a cap for enclosing said outwardly extending end of said pin and said mass, said firing pin, said cap and said mass each having an aperture extending therethrough, and a removable element extending into said apertures for normally locking said pin and said mass and said cap, said mass being formed with means for retaining said detent means in position to restrain said pin and with an inclined surface adjacent said detent retaining means for permitting said detent means to move out of pin restraining position upon movement of said mass.

4. A valve of the class described comprising a housing having a passage extending therethrough provided with an inlet, an outlet and a chamber intermediate said inlet and outlet formed with an upwardly facing seat, a disc on said seat, and an inverted substantially cup-shaped hollow plug secured to said housing and positioned in said chamber with its lower end holding said disc on its seat, said plug having a cartridge chamber in the upper end thereof adapted for mounting a cartridge therein, said chamber facing said disc and having a plurality of apertures in the side wall thereof for establishing fluid flow communication between said inlet and outlet and for preventing fragments of said disc from being carried into said outlet.

5. An impact actuated valve comprising a housing having an inlet and an outlet, a closure for normally preventing the flow of fluid from said inlet to said outlet, means in said housing for opening said closure, a sleeve mounted in said housing having radial openings therein, a plunger slidably mounted in said sleeve having recess means therein, a spring adapted to be compressed by said plunger and operate said plunger for effecting operation of said closure opening means, detent means in said openings adapted to extend into said recess means to lock said plunger in a position to compress said spring, an impact responsive mass slidably mounted about said sleeve, said mass being arranged to move along said sleeve from one position to another upon being subjected to impact and having means for retaining said detent means in said recess means while said mass is in a predetermined position and having an inclined annular shoulder for urging said detent means into said recess upon movement of said mass into said position and for permitting said detent means to move out of said recess means when said mass is moved out of said position, and yieldable means for normally positioning said mass whereby said detent means extend into said recess means, said yieldable means being adapted to be overcome upon subjecting the mass to impact whereby said mass is adapted to move out of said position to permit said detent means to move out of said recess means.

6. A valve according to claim 5, wherein said closure ineffective rendering means includes an explosive cartridge and said plunger has a firing pin thereon for contacting said cartridge to fire the same.

7. A valve according to claim 5, wherein manually removable means lock said mass and plunger against movement.

8. A valve according to claim 5, wherein said mass has slots at the periphery thereof in which rolling elements are positioned for contacting the interior of the casing.

9. A valve according to claim 5, wherein said detent means retaining means of said mass includes a cylindrical surface for engaging said detent means to retain the same in said recess means.

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