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2,515,068

FUEL VALVE

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FIG. 3

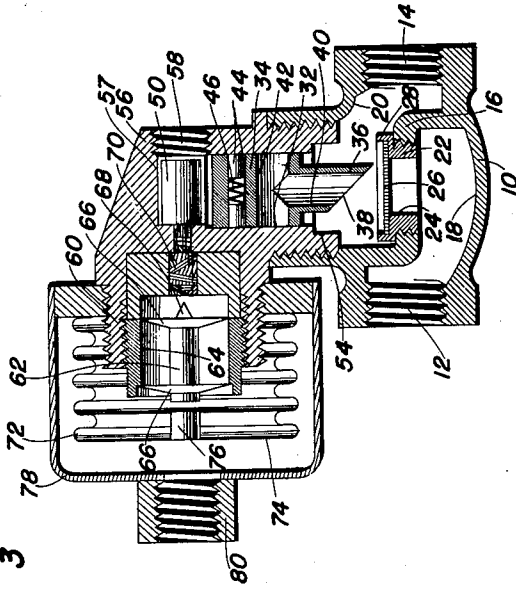


FIG. 2

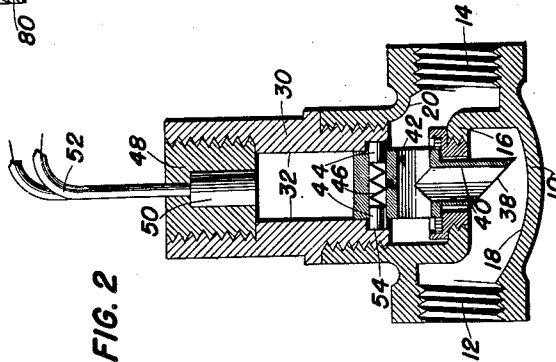
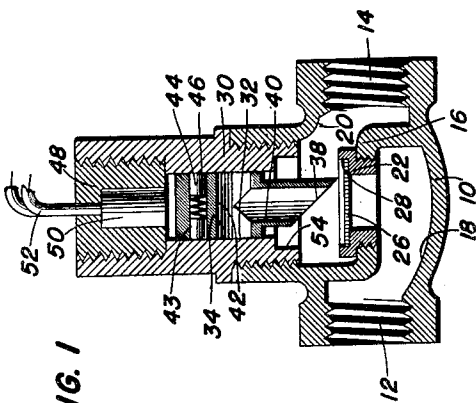


FIG. 1



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FUEL VALVE

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The present invention relates to improvements in fuel valves and more particularly to quick-opening closures for fuel systems.

In jet-propelled or rocket-propelled projectiles employing a liquid fuel and launched by some auxiliary means as, for example, a catapult, it is desirable that the passage between the fuel tank and the burner be closed prior to launching to prevent leakage and loss of fuel and that the passage be opened at the instant of launching or at a predetermined time subsequent thereto. Therefore, an object of the present invention is to provide a valve which will be operable to permit fluid flow at the instant of launching the projectile in which it is mounted or at a predetermined time thereafter.

Another object of the invention is to provide a valve which will be operable to permit fluid flow after the projectile in which it is mounted has attained normal flying speed.

Another object of the invention is to provide a valve or closure for a fuel line, including explosive means which functions to open the said valve at a predetermined time.

Another object of the invention is to provide a valve or closure for a fuel line, including pressure-actuated means which functions to open the said valve when a predetermined air pressure is reached.

A still further object of the invention is to provide improved valves which are simple in construction and positive in their operation.

Other objects of the invention will become evident from the following description taken in connection with the accompanying drawing.

In the drawing:

Figure 1 is a sectional view of a fuel valve, according to the invention, prior to its being opened by the firing of the explosive charge;

Figure 2 is a sectional view of the valve of Figure 1 after detonation of said charge; and

Figure 3 is a sectional view of a modification in which pressure-actuated means are provided, for detonating the charge that serves to open the valve.

Referring to Figure 1 of the drawing, a valve body or housing 10 having an inlet port 12 and an outlet port 14 is divided by a partition or wall 16 to form two chambers, 18 and 20, respectively. The wall 16 is pierced by a threaded aperture into which is screwed a fitting 22 having a port 24 therein. A frangible diaphragm 26 is fastened in a countersink in an annular enlargement 28 of the fitting 22 to form a liquid-tight closure for the port 24. A cylindrical fit-

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ting 30 coaxial with the port 24 is secured to the body 10. The fitting 30 contains a recess or cylindrical chamber 32 in which is carried a plunger 34, the plunger having an axial extension 36 terminating in a beveled, pointed face 38 to form a punch. An axial bore 40 in the plunger is intersected by a transverse bore 42. A second, smaller, transverse bore 43 in the plunger radially mounts the detents 44 which are separated and forced outwardly against the wall of the cylindrical chamber 32 by a spring 46 positioned between the detents. A plug 48, secured in the outer end of the cylindrical fitting 30, is recessed to contain an electrically fired squib 50, the electric leads 52 thereto being brought out through suitable aperture or apertures in the plug 48.

Prior to operation, the diaphragm 26 prevents passage of fuel between the chambers 18 and 20 and between the inlet port 12 and the outlet port 14. The electrical leads 52 may be connected to the firing circuit of the launching device whereby detonation of the squib 50 can be effected at the instant of launching the projectile. Explosion of the squib drives the plunger 34 down, forcing the beveled, pointed end 38 of the extension or punch 36 through the frangible diaphragm 26 to the position seen in Figure 2. As noted in Figure 2, when the plunger is in this position, the detents 44 are forced outward by the spring 46 to enter the countersunk portion 54 in the chamber 32, thereby preventing any possible return of the plunger to its initial position. The bores 40 and 42 now cooperate to form a passageway between the chambers 18 and 20 through which the fuel may flow.

It is evident that a delay-action type of squib may also be employed whereby instead of initiating fuel flow through the valve at the instant of launching, this may be delayed for a predetermined interval of time, as for example, until the projectile has accelerated to some particular flying speed.

The modification illustrated in Figure 3 is similar to the device of Figures 1 and 2 but includes additional pressure-responsive means for exploding the squib to drive the plunger downward to pierce the diaphragm. In this embodiment of the invention an L-shaped fitting 56 replaces the cylindrical fitting 30 of the device illustrated in Figures 1 and 2 and is similarly secured to the valve body 10. That leg of said L-shaped fitting which is attached to the valve body contains the cylindrical chamber 32 carrying a plunger 34, the construction of which is identical with that of the device of Figures 1 and 2. A bore 57 at right

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angles to the cylindrical chamber 32 and communicating therewith contains a squib 50 which is held in place by a threaded plug 58.

The firing mechanism for the squib is mounted on the free leg 60 of the fitting 56 extending at right angles to the cylindrical chamber 32. This mechanism consists of a firing pin 62 axially mounted in a cylindrical chamber 64 by means of two circular snap springs 66, known as Belleville washers, which engage in annular grooves in the said chamber. The pointed end 68 of the firing pin 62 is held in close proximity to a percussion-operated primer 70 which is positioned in an opening located at the inner end of the chamber 64 and communicating with the squib 50. A "Sylphon" bellows 72 surrounds the portion of the free leg 60 of the fitting 56 forming the cylindrical chamber 64. The bellows has a closed outer end 74 carrying a contact button 76 on its inner surface in axial alignment with the firing pin 62. A cover 78, suitably fastened to the free leg 60, forms an air-tight chamber surrounding the bellows 72 and is supplied with a suitable pipe connection 80.

When installed in a projectile, a tube connection between the pipe connection 80 and a Pitot tube (not shown), exposed to an air stream produced by the motion of the projectile, permits the dynamic pressure produced in the Pitot tube to be applied to the interior of the chamber surrounding the bellows 72. As this pressure is applied, the bellows is compressed, forcing the button 76 against the end of the firing pin 62. When a predetermined air pressure is reached, the pressure of the firing pin on the circular springs 66 is great enough to cause them to reverse their shape with a snap, driving the firing pin into the primer 70, exploding it and with it the squib 50. As in the embodiment illustrated in Figures 1 and 2, explosion of the squib drives the plunger downward to puncture the frangible diaphragm, thereby opening the valve.

From the foregoing it will be seen that there have been disclosed simple and effective means for accomplishing all of the objects of the invention. It will be evident that many changes may be made in the details of construction and arrangement of parts without departing from the spirit of the invention as expressed in the accompanying claims. It is therefore, to be understood that the invention is not to be limited to the exact details of construction and arrangement of parts disclosed, inasmuch as only the

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preferred forms have been shown and described by way of illustration.

I claim:

1. In a valve, a housing having an inlet port and an outlet port, a partition in said housing dividing the same into inlet and outlet chambers each in communication with the corresponding port, said partition having an aperture therein, a frangible closure sealing said aperture, a fitting on the housing and having a chamber and a countersunk portion at one end of said chamber, a plunger in the chamber, a punch carried by said plunger, the wall of said chamber guiding said plunger to move the punch into puncturing relationship with said closure, explosive means for so moving the plunger, whereby puncturing occurs upon detonation of said explosive means, thus establishing a path for fluid flow from said inlet to said outlet through said aperture, and detents operatively mounted in the plunger and engageable in said countersunk portion, said detents opposing no substantial restraint on the motion of said plunger toward the closure but interlocking with said plunger and its guiding means to prevent motion thereof in the opposite direction, thus maintaining the valve permanently open thereafter.

2. In a valve as defined in claim 1, additionally a bellows, means for supplying an actuating fluid pressure to said bellows, and means whereby said bellows initiates the detonation of the explosive means in response to the fluid pressure.

3. In a valve as defined in claim 1, additionally a fluid pressure responsive device, a snap-action spring preventing response of said device until a predetermined fluid pressure is applied to said device, and means initiating the detonation of the explosive means and actuated by said device upon attainment of said predetermined fluid pressure.

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