March 4, 1941. G. J. KOEHLER 2,233,840

LIQUID CONTROL VALVE

Filed Jan. 29, 1940

Fig. 1

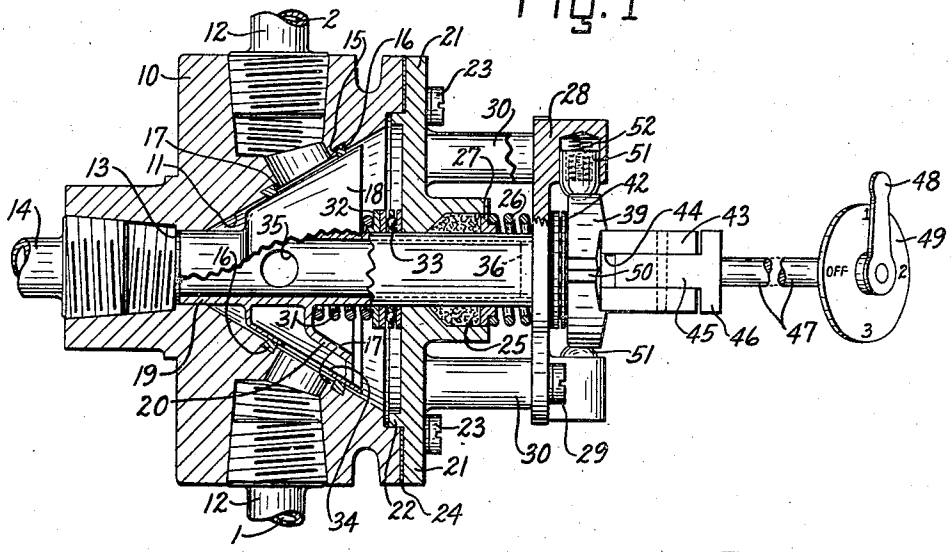


Fig. 2

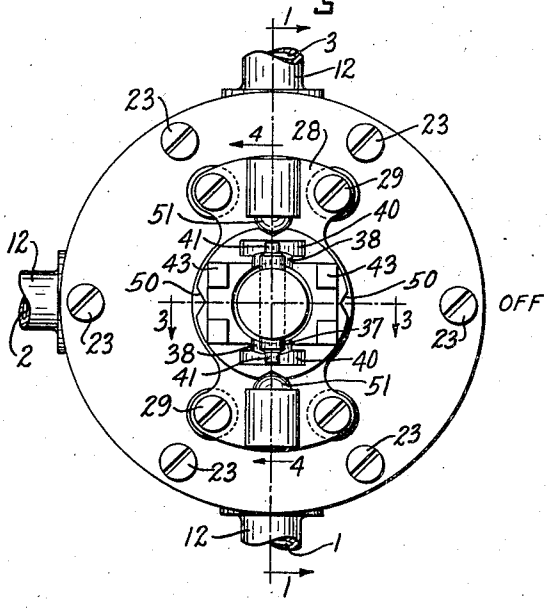


Fig. 3

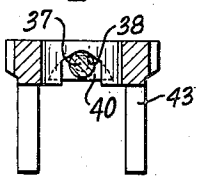
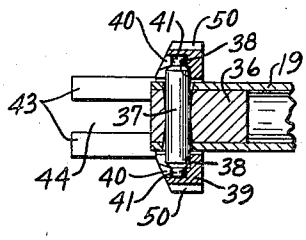


Fig. 4



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Patented Mar. 4, 1941 2,233,840

UNITED STATES PATENT OFFICE

2,233,840

LIQUID CONTROL VALVE

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Application January 29, 1940, Serial No. 316,123

3 Claims. (Cl. 251—97)

This invention relates to improvements in liquid control valves and is particularly directed to a novel device for lifting the valve member off of the valve seat to ease the turning of said valve member.

Valves used for controlling the flow of liquid fuel from a supply source, such as the tanks of an air or land vehicle, to a demand source, such as the engine of an air or land vehicle, for example, require extreme pressure on the valve members or plugs to retain said plugs in firm contact with the valve seats to prevent leakage of the highly volatile and inflammable fuel to eliminate the hazards attendant therewith.

This extreme pressure on the valve member has a tendency to make said valve member hard to turn, and it is broadly an object of this invention to provide means to relieve this pressure during the turning of the valve member so that said valve member may be turned with ease from one position to another.

A more specific object is the provision of means to lift the valve plug or member, of a liquid control valve, off of its seat while said member is being turned from one position to another, to ease the turning of said member.

Another object is to provide a liquid control valve with means to connect the operating means to the valve member, said connecting means adapted to lift the valve member a slight distance off of its seat, upon operation of the operating means, to ease the turning of said valve member.

With these and incidental other objects in view, the invention includes certain novel features of construction and combinations of parts, the essential elements of which are set forth in appended claims and a preferred form or embodiment of which is hereinafter described with reference to the drawing which accompanies and forms a part of this specification.

In the drawing:

Fig. 1 is a sectional view of the liquid control valve of this invention, taken along line 1—1 (Fig. 2) looking in the direction indicated by the arrows.

Fig. 2 is a top plan view of the control valve.

Fig. 3 is a sectional view taken along line 3—3 (Fig. 2) looking in the direction indicated by the arrows, showing the valve lifting roller and its associated cam member.

Fig. 4 is a sectional view taken along line 4—4 (Fig. 2) looking in the direction indicated by the arrows, showing in detail the valve lifting mechanism.

Description

Referring to the drawing the device embodying the present invention has a main body portion 10, made of any suitable material, with an opening therein having a cone-shaped surface 11. Connecting with the conical surface 11 and spaced at regular intervals around the body portion 10, are three inlet openings or ports, numbered 1, 2 and 3 respectively, connected by their respective tubes 12 to three liquid supply sources, such as the fuel tanks of an air or land vehicle. The apex of the conical surface 11 terminates in an outlet port 13 connected by a tube 14 to a liquid demand source, such as the internal combustion engine of an air or land vehicle.

Around each inlet port is a boring 15 adapted to receive a bearing or sealing ring 16 made of any suitable plastic material which may be molded or pressed into the borings 15 to form a valve seat. The outer walls of the borings 15 are angular, as shown in Fig. 1, to lock the plastic compound in said borings, and the inner walls of said borings 15, together with the inlet ports, form annular rings 17 which assist in anchoring the plastic seats in place and eliminate any possibility of small fragments of said plastic seats breaking off and interfering with operation of the valve or clogging the fuel line.

The plastic sealing rings 16 formed around each inlet port, extend a slight distance above the conical surface 11 and are adapted to be engaged by the outer surface of a frustro-conical head 18 of a male valve member or plug made preferably of some non-corrodible material. The apex of the head 18 is integral with a tubular stem 19; and a brace member 20, secured between the head 18 and the stem 19, prevents distortion of said head with relation to said stem.

The upper end of the hollow stem 19 is journaled in a boring in a cover plate 21 having a tenon 22 thereon which engages a boring in the body portion, said boring being concentric with the surface 11. Six screws 23 secure the cover 21 to the body portion 10 and a gasket 24, interposed between said cover and said body portion, prevent leakage of fuel therebetween.

The boring in the cover 21, for the stem 19, is enlarged at its upper end to receive a packing medium 25 which snugly encircles the outer surface of said hollow stem 19. A spring 26, compressed between a shouldered washer 27, which engages the packing medium 25, and a locating plate 28, causes the angular bottom of the enlarged boring to wedge the packing medium

against the stem 19 to form a leak-proof seal. The plate 28 is secured by screws 29 to four upwardly extending posts 30 of the cover plate 21.

Fitting loosely around the outside diameter of the hollow stem 19 is a comparatively strong compressible spring 31, the lower end of which engages a depression in the brace-plate 20 and the upper end of which engages a shouldered washer 32 free around the tubular stem 19, said washer in turn engaging the bottom portion of a ball thrust bearing 33 which is interposed between said washer and the cover 21. The spring 31 is compressed by the cover 21 to force the outer surface of the conical head 18 into engagement with the plastic valve seat rings 16, and said spring provides sufficient pressure between said plastic seats and the valve head to prevent the leakage of liquid therebetween. The ball bearing 33 relieves the friction between the spring 31 and the cover plate 21, thereby making for easy operation of the valve. The lower end of the hollow stem 19 journals in the outlet boring 13 which boring is in axial alignment with the boring for the upper end of said stem in the cover 21.

A hole 34 in the conical head 18 is adapted to be brought into register with the 3 inlet ports upon rotation of the male valve member to permit the fuel to flow from the selected one of the supply tanks into a chamber formed by the hollow interior portion of the frustro-conical head 18, the boring 11 and the cover plate 21. From this chamber the fuel flows through a plurality of holes 35 in the hollow stem 19 into the interior of said stem, and from thence out the outlet port 13 and through the tubing 14 to the fuel demand source. A plug 36 (Figs. 1 and 4) secured in the upper end of the stem 19, closes the upper end of said stem to the flow of fuel, thereby causing said fuel to flow out the bottom end of said tube into the outlet port.

When the hole 34 is brought into register with any of the inlet ports the plastic ring 16 around the port also encircles said hole to form a leak-proof seal, and at the same time the outer face of the conical head 18 in cooperation with the plastic rings around the other inlet ports likewise seals them against leakage.

The spring 31 holds the outer surface of the conical head 18 against the plastic rings 16 with sufficient pressure to prevent leakage of liquid therebetween and the friction created in this manner makes the valve comparatively hard to turn from one position to another, particularly when said valve has been standing in one position for a considerable length of time or has been allowed to dry out. In order to overcome this objectionable condition means, now to be described, have been devised to lift the conical head 18 off of the plastic seats 16 during rotation of the valve member from one position to another.

The valve lifting means includes a roller 37 (Figs. 2 and 4) which fits freely in a hole in the upper end of the tube 19 and the plug 36, said hole being enlarged at each end and tapered towards the center to relieve the friction between said hole and the roller 37. The outer ends of the largest diameter of the roller 37 are adapted to engage the angular faces of identical camming surfaces 38 in depressions in a valve rotating and lifting member 39, said lifting member having identical clearance cuts 40 therein adjacent the camming surfaces 38, the outer walls of which cuts, in cooperation with the ends of similar tenons 41 on each end of the roller 37, maintain said roller against horizontal displacement with relation to said lifting member 39 and the stem 19. The upper end of the stem 19 fits freely in a hole in the lifting member 39.

The lifting member 39 has four upward extensions 43 which form a clutch-cut 44 adapted to be engaged by a tenon 45 of a driving member 46 connected by a rod 47 to an operating lever 48 which is conveniently located for manipulation by the operator of the vehicle. An indicating dial 49, concentric with the rod 47 and stationary in relation thereto, in cooperation with the lever 48 provides means for determining the position of the hole 34 in the valve member 18 with respect to the inlet ports 1, 2 and 3 and an "off" position later to be described.

The lifting member 39 has four equally spaced angular locating notches 50 in the periphery thereof adapted to be engaged by the rounded noses of diametrically opposed locating plungers 51 free in borings in cylindrical projections of the locating plate 28.

Compressible springs 52 (Fig. 1) which fit in borings in the locating plungers 51, are compressed between the bottoms of said borings and the bottoms of the borings in the projections of the plate 28 to maintain said plungers in yielding engagement with the notches 50 to locate the valve member 18 in any of its various positions.

The indicating dial 49 has engraved on the face thereof the numerals 1, 2 and 3 corresponding to the three inlet ports and the word "off" engraved opposite the "off" position of the valve member, which position is likewise indicated by the word "off" in Fig. 2.

When the valve is in "off" position, a plastic ring (not shown) similar to the rings 16 and similarly retained in a boring in the conical surface 11 seals the hole 34 against leakage and at the same time the outer surface of the conical head 18, in cooperation with the plastic rings 16 seals the inlet ports against leakage.

As here shown the operating lever 48 is in No. 1 position in which position the opening 34 is opposite the No. 1 inlet port, as shown in Fig. 1. Turning the lever 48 clockwise, as viewed in Fig. 1, causes the camming surfaces 38 on the lifting member 39, in cooperation with the roller 37, to cam said roller upwardly, which in cooperation with the hole in the upper end of the stem 19 raises the conical head 18 upwardly against the action of the spring 31 to lift the outer surface of said head off of the plastic seats 16. During the lifting of the valve member the lifting member 39 turns independently thereof until the roller 37 engages the opposed vertical walls of the camming depressions 38, whereupon said roller forms an operating connection between the lifting member 39 and the stem 19 to rotate the valve member 18. During this rotation of the lifting member 39, one set of the angular locating notches 50 therein rides off of the rounded noses of the spring-pushed plungers 51, causing said noses to bear upon the periphery of said lifting member 39 until the second set of notches in said member engage said plungers.

Continued rotation of the operating lever 48 to No. 2 position causes the second set of notches 50 in the lifting member 39 to engage the plungers 51 to locate the hole 34 in the conical head 18 opposite the No. 2 inlet port, and after pressure is released on said lever 48 the camming action between the lifting member 39 and the roller 37 ceases, whereupon the spring 31 forces

the outer face of the conical head 18 into firm contact with the plastic seats 16 to seal the valve against leakage. A ball thrust bearing 42 (Fig. 1) interposed between the lifting member 38 and the locating plate 28, relieves the friction between said parts during the camming action between said lifting member 38 and the roller 37 to further ease operation of the valve.

After the second supply source has been exhausted, the lever 48 may again be operated to move the hole 34 in the conical head 18 opposite the No. 3 inlet port to connect the third supply source to the source of demand. When the vehicle is not in use the lever 48 may be moved to "off" position to shut off all the inlet ports and thus terminate the flow of liquid to the demand source.

Summarizing briefly, the above specification discloses a novel mechanism for lifting the male member of a fuel valve off of its seat while said member is being turned from one position to another to ease the operation of said fuel valve.

While the form of mechanism herein shown and described is admirably adapted to fulfill the objects primarily stated, it is to be understood that it is not intended to confine the invention to the one form or embodiment herein disclosed, for it is susceptible of embodiment in various forms, all coming within the scope of the claims which follow.

What is claimed is:

1. In a liquid control valve having a body portion with a valve seat therein, the combination of a valve member rotatable from one position to another; a stem on the valve member having a transverse hole near the upper end thereof, said stem journaled in the body portion; a spring to yieldingly retain the valve member in engagement with the seat to form a liquid seal therebetween; means, including a notched disk with a hole therein which hole fits loosely on the stem, to rotate the valve member from one position to another; means cooperating with the notches in the disk to locate the valve member in any of its positions; camming surfaces formed in depressions in the disk; and a roller adapted to pass freely through the transverse hole in the stem and into the depressions to form a lost-motion connection between the disk and the stem so that movement of said disk to take up the lost motion will cause the camming surfaces, in cooperation with the roller, to lift the valve member off of the seat to ease the turning thereof, whereupon the walls of the depressions adjacent the camming surfaces terminate the lifting movement and cause the valve member to rotate in unison with the disk.

2. In a liquid control valve having a body portion with a seat therein, the combination of a rotatable valve member cooperating with the seat, said valve member having a plurality of positions; a stem on the valve member, said stem journaled in the body portion and having a transverse hole at the upper end thereof, said hole being enlarged at each end and tapered towards the center; a spring to yieldingly urge the valve member into engagement with the seat to form a liquid seal therebetween; an element for rotating the valve member from one position to another, said element having a boring which fits loosely on the upper end of the valve stem; camming surfaces formed in diametrically opposed depressions in the element; a roller adapted to fit loosely in the tapered hole in the stem, opposite ends of said roller adapted to extend within the depressions and to cooperate with the camming surfaces to form an operating connection between the rotating element and the valve member, whereupon rotation of said rotating element causes the camming surfaces in cooperation with the roller to counteract the action of the spring and to lift the valve member off the valve seat preliminary to rotation of said member by said element, to ease the rotation of said valve member, the tapered hole functioning to reduce the frictional drag on the roller to facilitate the rolling and lifting action thereof; tenons formed on each end of the roller and cooperating with the outer walls of the depressions to retain the roller against lateral displacement; diametrically opposed locating notches in the rotating element; and diametrically opposed spring plungers cooperating with the notches to assist the valve member to its various positions and to retain said member in said positions.

3. In a liquid control valve having a body portion with a valve seat therein, the combination of a valve member cooperating with the seat to form a liquid seal, said member rotatable to several positions; spring means to urge the valve member into yielding engagement with the valve seat; a stem on the valve member, said stem journaled in the body portion and having a transverse hole near the upper end thereof, said hole enlarged at each end and tapered towards the center; an element for rotating the valve member from one position to another, said element having a boring which loosely engages the upper end of the valve stem; diametrically opposed depressions in the element; a roller adapted to fit freely in the tapered hole in the valve stem, opposite ends of said roller arranged to extend within the depressions to form a lost-motion operating connection between the rotating element and the valve member, to permit said element to be turned a slight distance independently of said member; camming surfaces formed in the depressions and cooperating with the roller while the rotating element is being turned independently of the valve member, to force said member upwardly against the action of the spring means to separate said member from the seat to ease the turning thereof, the tapered hole functioning to reduce the frictional drag on the roller to facilitate the rolling and lifting action thereof; diametrically opposed notches formed in the peripheral edge of the rotating element; and diametrically opposed spring plungers cooperating with the notches to assist the valve member to its several positions and to retain said member in said positions.

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