

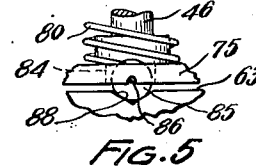
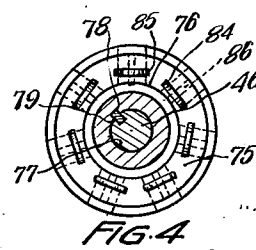
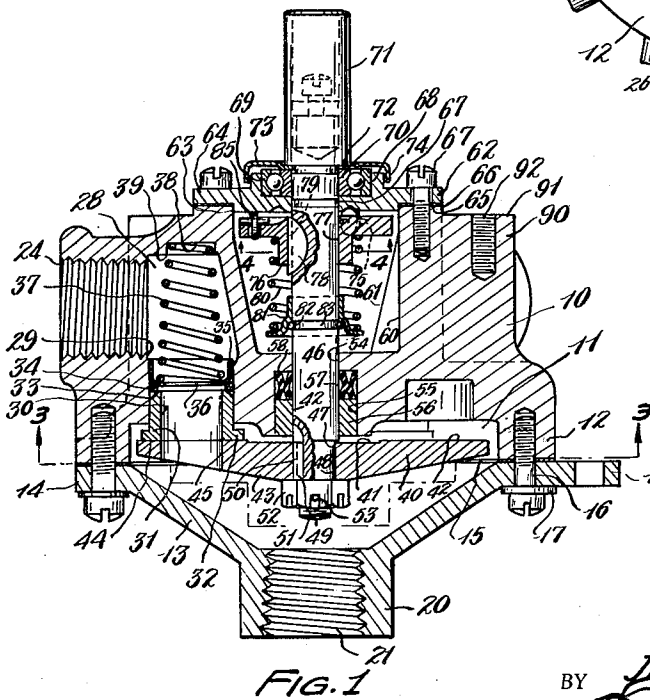
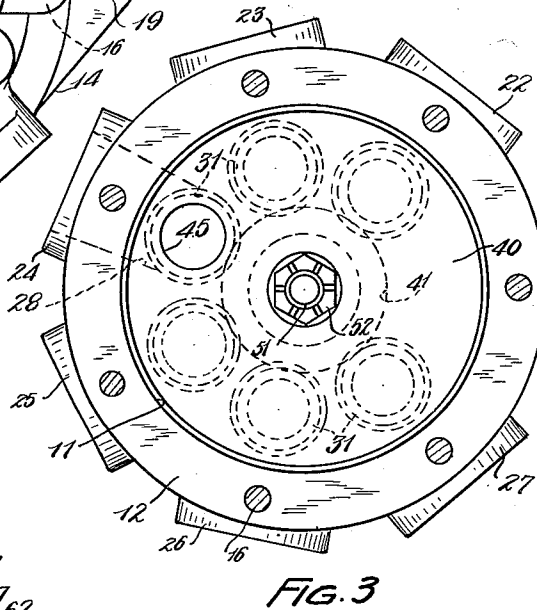
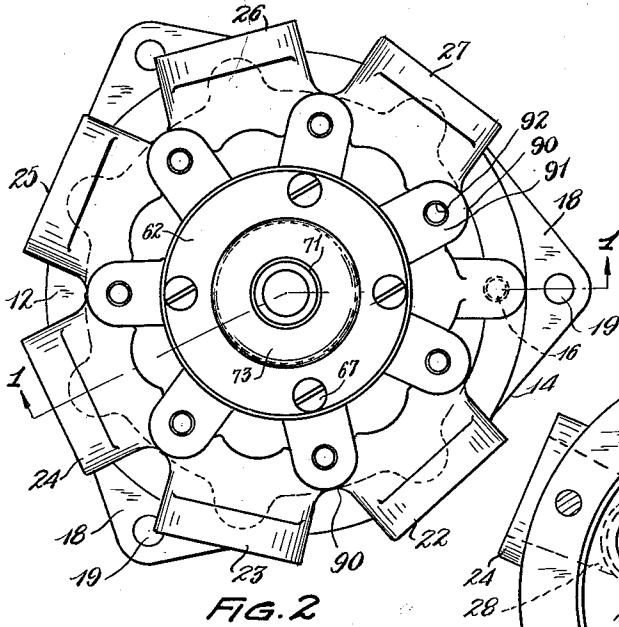
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FUEL CONTROL VALVE

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FUEL CONTROL VALVE

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6 Claims. (Cl. 251—84)

This invention relates to fuel control valves especially adaptable for embodiment in airplanes of the type employing a plurality of fuel tanks predeterminedly located in different portions of the plane so as to increase its cruising range and are so constructed as to selectively connect one or more of said fuel tanks with a fuel pump or carburetor in a well known manner although not necessarily so restricted as will be obvious to those skilled in the art.

The aforesaid type of fuel control valve is well known but is inefficient due principally to the fact that too much torque is required to operate the valve and due to the construction of the actuating means is unreliable in its indication on the dial which is mounted on the instrument panel in the cock-pit.

It is therefore, an object of the present invention to produce a fuel control valve which requires a minimum of torque in its operation due principally to the reduction of frictional resistance in the operation of the relatively movable parts.

Another object of the present invention is to provide communication between the fuel outlet opening and any one of a plurality of inlet openings in such a manner as to afford a fluid tight seal irrespective of relative movement between the cooperating parts.

Another object of the present invention resides in providing means for exerting a yieldable constant pressure for normally effecting a fluid tight seal between the fuel outlet opening and each of said fuel inlet openings and sealing means for preventing any appreciable flow of fluid except through the communicating passageways.

Another object of the present invention resides in providing a manually operated valve member having means so arranged as to predeterminedly establish communication between any of the fuel inlet openings and said outlet opening in an improved and positive manner.

Another object of the present invention resides in providing a fuel control valve embodied in a unitary housing of light weight, compact construction, efficient in operation and adapted to be connected at any desirable location on the plane or other suitable supporting structure.

With the objects above indicated, and other objects hereinafter explained in view, my invention consists in the construction and combination of elements hereinafter described and claimed.

Referring to the drawing,

Figure 1 is a vertical sectional view of a fluid control valve embodying the present invention and taken substantially along the line 1—1 in Figure 2.

Figure 2 is a top plan view of the valve shown in Figure 1.

Figure 3 is a transverse sectional view taken substantially along the line 3—3 in Figure 1 and showing further details of the structure.

Figure 4 is a fragmentary sectional view taken along line 4—4 in Figure 1 and showing details of the improved ratchet means.

Figure 5 is a fragmentary end elevational view of the ratchet means shown in Figure 4.

In the drawing, I have illustrated the present invention preferably embodied in a fuel control valve for use on aircraft but it should be understood that it may be otherwise adapted and therefore, in no manner thus restricted.

The fuel control valve comprises a housing 10 which may be made in the form of an aluminum casting for lightness and somewhat circular in transverse section as shown in Figure 2. The housing 10 is recessed at the outlet side as indicated by 11 to provide an annular flange 12 on which a cover 13 is removably mounted. The cover 13 has a laterally extending marginal flange 14 disposed in superimposed relation upon the flange 12 and a gasket 15 is disposed between the adjacent faces of the flanges to provide a fluid tight joint. Threaded bolts 16 extend through aligned openings in the flanges and gasket for securely maintaining the same in assembled relation and said bolts are suitably spaced apart as more clearly shown in Figure 3. Lockwashers 17 are preferably used to prevent accidental displacement of the bolts. The flange 14 is further provided with ears 18 spaced apart circumferentially and provided with openings 19 by means of which the unit may be attached to one type of support. The cover 13 is of frusto-conical shape extending outwardly and terminates in an axially disposed tubular extension 20 interiorly screwthreaded to provide a fuel outlet opening 21 to which a suitable fuel line (not shown), leading to a fuel pump or carburetor, may be connected.

At the upper portion of the housing 10 there is a plurality of laterally disposed tubular extensions 22, 23, 24, 25, 26, and 27 respectively which are suitably spaced apart circumferentially in the manner shown in Figures 2 and 3, the adjacent extensions 22 and 27 being spaced consid-

erably further apart for a purpose to be later described. The tubular extensions are each interiorly screw threaded to provide fuel inlet openings adapted for suitable communication with independent fuel tanks. Each fuel inlet opening is adapted to communicate with the fuel outlet opening 21 through substantially identical structures and it is believed that a detailed description of one of such structures, such as is shown in Figures 1 and 3, will suffice.

The inlet opening 24 communicates with a walled chamber 28 formed in the upper adjacent portion of the housing 10. The bottom wall 29 of the chamber is provided with a circular opening 30 of suitable diameter and is preferably finished, the opening affording communication between the chamber 28 at the inlet side and the recess 11 at the outlet side. A tubular bushing 31, of bronze or other suitable material, is slidably disposed in the opening 30 and has an outwardly extending marginal flange 32 formed integral at its outer end. The bushing 31 has sufficient clearance with respect to the opening 30 to afford slight angular variation of the outer face for a purpose to be later described. The inner end of the bushing 31 terminates about midway of the opening 30 and has a convergingly tapered face 33 upon which a flexible packing ring 34 is disposed. A cup-shaped metal gland 35 is loosely disposed in the opening 30 in engagement with the ring 34 and has a central opening 36 to permit the passage of fuel therethrough. A helically coiled spring 37 has its lower end in engagement with the bottom of the cup-shaped metal gland 35 and its upper end disposes in a recess 38 formed in the upper wall 39 of the chamber 28. The spring 37 has a predetermined tension for exerting any desired force upon the gland 35 which in turn compresses the packing ring 34 to provide a seal against the passage of fuel between the bushing 31 and opening 30 and additionally exert an outward pressure upon the bushing 31. The ring 34 is of such structure as to function as an equalizer between the spring and bushing 31 irrespective of the angular portion of the latter. It will be noted that the fuel inlet opening 24, the chamber 28, the opening 36 in the gland 35, and the opening in the bushing 31 are at all times in communication in such a manner as not to interfere with the free flow of fuel therethrough except as later described.

As before stated, it is usually desirable to have only one fuel inlet opening in communication with the fuel outlet opening at one time and suitable means is, therefore, provided for shutting off the supply of fuel from the fuel inlet openings not desired but in a manner permitting selective adjustment. The improved construction comprises a circular disk 40, of steel or other suitable material, having an inner substantially flat face 41 the marginal portion of which is formed with a seal face 42 of annular shape and an outer conically shaped face 43 spaced apart to provide sufficient inherent rigidity. The disk 40 is disposed axially within the recess 11 of the housing 10 and has its inner face 41 arranged in substantially parallel spaced relation with respect to the bottom wall of the recess as more clearly shown in Figure 1. The disk 40 is of sufficient diameter to extend slightly beyond the bushings 31 which have finished outer ends providing seal faces 44 continually in engagement with the seal face 42 on the adjacent portion of the disk to afford a fuel tight joint by reason of the pressure exerted by the springs 37. The spring pressure does not

have to be very great because the effectiveness of the sealing is increased by the pressure of the fuel at the respective inlet opening. This is due principally to the difference in relative diameters of the outside and central opening in each bushing. As before referred to the bushings 31 have sufficient clearance with respect to the openings 30 to afford slight angular movement of the former whereby the seal faces will always be effective despite any slight angular disposition of the disk 40.

The disk 40, of course, is adapted for rotation about its axial center and in the present instance is provided with an opening 45 extending transversely therethrough which is so located adjacent its marginal portion that it will register successively with each of the central openings formed in the bushings 31. The opening 45 is substantially of the same diameter as the opening in the bushings 31 and affords a means for establishing communication between any one of the inlet openings and the fuel outlet opening 21. It will be obvious therefore, that any desired inlet opening may be placed in communication with the outlet opening by merely rotating the disk until the opening 45 is in registry with the opening in the bushing 31 of the selected inlet opening. It is also obvious, that when one desired inlet opening is in communication with the outlet opening the other inlet openings are sealed by reason of the engagement between the seal faces 44 of the bushings 31 and the seal face 42 of the disk 40. Additionally, it may be desirable to completely shut off the flow of fuel from all of the inlet openings to the outlet opening in which event the greater spacing of the adjacent inlet openings 22 and 27 provides a space in which the opening 45 in the disk 40 is not in communication with any of the inlet openings, the latter being sealed in the manner heretofore described.

The disk 40 may be rotated in any suitable manner but preferably, by means of a shaft 46, of steel or other suitable metal, which is disposed axially in the housing 10 and has its inner end reduced at 47 to snugly fit within an axial opening 48 provided in the disk 40. A key-way 49 is formed on the reduced portion 47 and a cooperating key or tongue 50 is provided on the disk at its central opening 48 to prevent relative independent rotation. The extreme end of the shaft projects beyond the lower side of the disk 40 and is exteriorly screwthreaded at 51 to receive a nut 52 which securely maintains the disk upon the shaft. The nut may be locked against removal by any suitable means such as a cotter 53. The shaft 46 extends through a central opening 54 in the lower portion of the housing 10 and said opening communicates with a bore 55 of larger diameter extending inwardly from the chamber 11. A bearing 56, of bronze or other suitable material, is rigidly inserted in the outer end of the bore 55 and has an axial opening 57 in which the shaft 46 is rotatably mounted. To insure against the leakage of fuel along the shaft 46 from the chamber 11, a resilient ring 58, of any suitable compressible material, is disposed on the bottom of the bore and held in place by the bearing 56.

The outer portion of the housing 10, opposite the cover 13, through which the shaft 46 extends is provided with a central bore 60 extending inwardly from the opposite side of the housing and has an inwardly tapering wall 61. The bottom wall of the bore 60 is spaced from the bottom wall of the bore 56 and the bores are connected

by the opening 46 in which the shaft freely rotates. The bore 60 is normally closed by a cover plate 62 having a central portion 63 projecting into the open end of the bore and a laterally extending marginal flange 64 detachably mounted upon the surrounding adjacent portion 65 of the housing. A gasket 66 is disposed between the flange 64 and the portion 65 to provide a fluid tight joint and threaded bolts 67 project through aligned openings in the flange, gasket, and housing for securely maintaining the same in assembled relation. The cover plate 62 has a central opening 67 through which the shaft 46 extends and a bore 68 of larger diameter on the outside of the plate.

A ball bearing mounting is provided for the shaft 46 at the end opposite the disk 40 and comprises an outer race 69 snugly fitted within the bore 68 and an inner race 70 spaced from the outer race and securely mounted upon the adjacent portion of the shaft 46, having its lower face in engagement with the bottom of the bore 68 as more clearly shown in Figure 1. A plurality of balls are disposed between the races 69 and 70 in a well known manner. The outer end of the shaft 46 has an enlarged portion 71 forming a shoulder or abutment 72 cooperatively engageable with the outer end of the inner race 70 to take any end thrust resulting from rotation of the shaft 46 by its actuating means or from the pressure exerted, by the springs or the fuel itself, on the disk 40. The ball bearing mounting also takes care of any angular thrust load on the shaft with the result that it may be rotated with a minimum of torque for selectively changing the relative position of the disk with respect to the fuel inlet openings. The outer enlarged end 71 of the shaft may be of any desired shape or form to adapt it for connection with the usual actuating means in common use and located in and operated from the cock-pit of the plane. A metal cap 73 is disposed upon the outer end of the ball bearing and has a depending flange 74 in overlapping relation with an adjacent portion of the cover plate 64. The cap has a central opening through which a portion of the shaft extends and is secured against removal by the shoulder 72.

Of course, some means must be provided for releasably locking the disk 40 in its proper position with respect to the selected fuel inlet opening and while this should be of simple construction it is of utmost importance that its different positions be accurately indicated on a dial remotely located from the valve.

I prefer to employ a ratchet mechanism of novel construction which comprises a circular disk 75, of metal or other suitable material, provided with a hub portion 76 having a central opening 77 through which the shaft 46 freely extends. As will be apparent from Figure 1, the disk 75 is disposed within the bore 60 in substantially parallel spaced relation with respect to the under face of the central portion 63 of the cover plate 64. The disk 75 is slidably but non-rotatably mounted on the shaft 46 by employing a key 78 secured to the shaft and adapted to slidingly fit within the slot 79 formed upon the inner wall of the hub portion 76 as more clearly shown in Figures 1 and 4. The disk 75 is normally spring pressed and utilizes a coiled spring 80 which encircles a portion of the shaft and has one end in abutment with the adjacent face of the disk 75 and its opposite end in abutment with a gland 81 mounted upon

the shaft. The gland 81 is prevented from movement along the shaft axially by means of a snap ring 82 disposed within a circumferential groove 83 formed on the shaft. The ring 82 also engages the hub of the gland 81 thereby functioning as a stationary abutment for the spring 80. The spring can be of any desired tension and should be such as to normally urge the disk 75 outwardly. The disk 75 has a plurality of slots 84 extending transversely therethrough and angularly spaced apart as more clearly shown in Figure 4. There are seven of such slots shown, they preferably being equal in number to the number of fuel inlet openings and an off position but a lesser number may be used if they are spaced about the axis of the disk to prevent cocking of the latter. Circular but relatively flat metal rollers or wheels 85 are employed and one of such rollers is rotatably disposed in each slot 84, the rollers having integral axles or shafts 86 on diametrically opposite sides rotatably disposed in transversely aligned recesses 87 formed on the under face of the disk 75 adjacent each slot. The rollers are free to rotate and have portions extending below the inner face of the disk. The lower face of the central portion 63 of the cover plate 62 has a plurality of substantially elongated V-shaped indentations 88, as viewed in Figure 5, disposed in angular spaced relation and corresponding in number with the number of inlet openings and an off position, there being shown seven in number in conformance with the valve illustrated. These indentations 88 are likewise spaced apart in precisely the same manner as the spacing of the rollers and the spring 80 normally maintains them in cooperating engagement. The rollers 85 may be moved from one relative position to another by merely rotating the shaft 46 which causes the disk 40 to be likewise rotated so as to bring its opening 45 into proper position with the selected inlet opening.

The housing 10 is formed with a plurality of angularly disposed fingers 90 having smooth faces 91 arranged in a common plane and provided with tapped openings 92 by means of which the unit may be attached to a different support than that of the flange 14.

It hardly seems necessary to enter into a detailed explanation of the operation of the valve due to the foregoing description and it will suffice to say that the control valve is mounted at any desired location on the plane or other structure. It is customarily located remotely from the cock-pit in which the pilot sits but the actuating means is generally mounted upon the instrument panel convenient to the pilot. A flexible cable has one end connected to an operating lever or other means and its opposite end securely connected to the enlarged end portion 71 of the shaft 46 on the fuel control valve. The fuel inlet openings 22 to 27 inclusive, as shown on the drawing, are each connected by a suitable conduit to different fuel tanks located at various points on the plane. The fuel opening 21 is connected by suitable conduit with a fuel pump or carburetor, as the case may be, and the function of the valve is to cut in from one tank as it is implied to another tank which is full of fuel with the least effort required on the part of the pilot.

In the present case the pilot turns the actuating cable as indicated upon the dial and this causes the shaft 46 to rotate about its axis which in turn moves the disk 40 a distance from

one inlet opening to the next. This movement is limited by the cooperating rollers 88 and the indentations 88 which prevent any override thus causing proper registry between the communicating opening 45 on the disk 40 with the proper fuel inlet opening. A seal is normally effected between the bushing 31 and the disk 40 by the tension in the spring 37 but when fuel is passing from the inlet opening to the outlet opening at such times as the opening 45 is in proper registry with one of the bushings 31 an additional sealing effect is produced by the pressure of the fuel itself in passing through the opening in the bushing due to its being of smaller diameter than the outside diameter of the bushing.

There may be times when it is desirable to completely shut off the flow of fuel from any of the inlet openings in which event the pilot merely turns the actuating member until such indication is shown upon the dial at which time the disk 40 has been rotated to such an extent that the opening 45 is out of registration with any of the inlet openings or a position intermediate the inlet openings 22 and 27 as shown on the drawing.

While I have described the preferred embodiment of the invention it is to be understood that I am not to be limited thereto inasmuch as changes and modifications may be resorted to without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A fuel control valve comprising a housing having a plurality of non-communicating fuel inlet openings and a fuel outlet opening adapted for communication with each of said inlet openings; and means for selectively establishing communication between any one of said inlet openings and said outlet opening comprising; a disk rotatably mounted in said housing and disposed in spaced relation with respect to the adjacent ends of said inlet openings, said disk having an opening extending therethrough and disposed for alignment with each of said inlet openings during rotation of said disk; a tubular bushing slidably mounted in the inner end of each inlet opening and having a face engageable with the adjacent face of said disk, said tubular bushings being disposed in the path of movement of the opening in said disk; a resilient means operatively associated with each of said bushings for normally exerting a pressure upon the latter to effect a fluid tight seal between the engaging faces of said bushings and disk; a rotatable shaft disposed axially within said housing and having its inner end securely connected to the central portion of said disk for unitary rotation; said housing having a shaft encircling bore adjacent said disk; a bearing tightly fitted in the outer portion of said bore and having a central opening in which the adjacent portion of said shaft is rotatably mounted; said housing being further provided with a second shaft encircling bore at the side opposite said disk; an anti-friction bearing having concentrically disposed spaced inner and outer races with interposed balls, said outer race being securely mounted in said last mentioned shaft encircling bore and said inner race having a central opening in which the adjacent portion of said shaft is tightly fitted for unitary rotation; said shaft having a free outer end portion of relatively larger diameter providing a shoulder in operable abutment with the outer end of said inner race whereby said shaft

is relieved of end thrust load and angular thrust load thereby reducing to a minimum the torque required to rotate the same.

2. A fuel control valve comprising a housing having a plurality of non-communicating fuel inlet openings and a fuel outlet opening adapted for communication with each of said inlet openings; and means for selectively establishing communication between any one of said inlet openings and said outlet opening comprising; a disk rotatably mounted in said housing and disposed in spaced relation with respect to the adjacent ends of said inlet openings, said disk having an opening extending therethrough and disposed for alignment with each of said inlet openings during rotation of said disk; a tubular bushing slidably mounted in the inner end of each inlet opening and having a face engageable with the adjacent face of said disk, said tubular bushings being disposed in the path of movement of the opening in said disk; a resilient means operatively associated with each of said bushings for normally exerting a pressure upon the latter to effect a fluid tight seal between the engaging faces of said bushings and disk; a rotatable shaft disposed axially within said housing and having its inner end securely connected to the central portion of said disk for unitary rotation; said housing having a shaft encircling bore adjacent said disk; a bearing tightly fitted in the outer portion of said bore and having a central opening in which the adjacent portion of said shaft is rotatably mounted; said housing being further provided with a second shaft encircling bore at the side opposite said disk; an anti-friction bearing having concentrically disposed spaced inner and outer races with interposed balls, said outer race being securely mounted in said last mentioned shaft encircling bore and said inner race having a central opening in which the adjacent portion of said shaft is tightly fitted for unitary rotation; said shaft having a free outer end portion of relatively larger diameter providing a shoulder in operable abutment with the outer end of said inner race whereby said shaft is relieved of end thrust load and angular thrust load thus reducing to a minimum the torque required to rotate the same; a ratchet member slidably but non-rotatably mounted on said shaft; a plurality of rollers rotatably mounted on said ratchet member and spaced apart about the axis of said shaft; said housing being provided with a plurality of depressions predeterminedly spaced apart about the axis of said shaft adjacent said ratchet member, said depressions being at least equal in number to the number of fuel inlet openings and spaced apart relatively in definite proportion to the spacing of adjacent fuel inlet openings; said rollers being adapted for engagement with different depressions upon rotation of said shaft; and resilient means for yieldably maintaining said rollers and depressions in cooperative relation.

3. A fuel control valve comprising a housing having a plurality of non-communicating fuel inlet openings and a fuel outlet opening adapted for communication with each of said inlet openings; and means for selectively establishing communication between any one of said inlet openings and said outlet opening comprising; a disk rotatably mounted in said housing and disposed in spaced relation with respect to the adjacent ends of said inlet openings, said disk having an opening extending therethrough and disposed for alignment with each of said inlet openings

during rotation of said disk; a tubular bushing slidably mounted in the inner end of each inlet opening and having a face engageable with the adjacent face of said disk, said tubular bushings being disposed in the path of movement of the opening in said disk; a resilient means operatively associated with each of said bushings for normally exerting a pressure upon the latter to effect a fluid tight seal between the engaging faces of said bushings and disk; a rotatable shaft disposed axially within said housing and having its inner end securely connected to the central portion of said disk for unitary rotation; said housing having a shaft encircling bore adjacent said disk; a bearing tightly fitted in the outer portion of said bore and having a central opening in which the adjacent portion of said shaft is rotatably mounted; said housing having a centrally disposed bore extending inwardly from the side opposite said disk; a cover plate normally closing the open end of said bore and removably connected to adjacent portion of said housing, said plate having a shaft encircling bore at its outer side and a central opening through which said shaft extends; an anti-friction bearing having concentrically disposed spaced inner and outer races with interposed balls, said outer race being securely mounted in said last mentioned shaft encircling bore and said inner race having a central opening in which the adjacent portion of said shaft is tightly fitted for unitary rotation; said shaft having a free outer end portion of relatively larger diameter providing a shoulder in operable abutment with the outer end of said inner race whereby said shaft is relieved of end thrust load and angular thrust load thus reducing to a minimum the torque required to rotate the same; a ratchet member slidably but non-rotatably mounted on said shaft and disposed within said centrally disposed bore adjacent said cover plate; a plurality of rollers rotatably mounted on said ratchet member and spaced apart about the axis of said shaft; said cover plate being provided with a plurality of depressions predeterminedly spaced apart about the axis of said shaft adjacent said ratchet member, said depressions being at least equal in number to the number of fuel inlet openings and spaced apart relatively in definite proportion to the spacing of adjacent fuel inlet openings; said rollers being adapted for engagement with different depressions upon rotation of said shaft; a coiled spring encircling a portion of said shaft and having one end in engagement with said ratchet member; and a relatively stationary abutment on said shaft with which the opposite end of said spring engages; said spring being tensioned for yieldably maintaining said rollers and depressions in cooperative relation.

4. A fuel control valve comprising a housing having a plurality of non-communicating fuel inlet openings and a fuel outlet opening adapted for communication with each of said inlet openings; and means for selectively establishing communication between any one of said inlet openings and said outlet opening comprising; a disk rotatably mounted in said housing and disposed in spaced relation with respect to the adjacent ends of said inlet openings, said disk having an opening extending therethrough and disposed for alignment with each of said inlet openings during rotation of said disk; a rotatable shaft disposed axially within said housing and having its inner end securely connected to the central

portion of said disk for unitary rotation; said housing having a shaft encircling bore adjacent said disk; a bearing tightly fitted in the outer portion of said bore and having a central opening in which the adjacent portion of said shaft is rotatably mounted; said housing being further provided with a second shaft encircling bore at the side opposite said disk; an anti-friction bearing having concentrically disposed spaced inner and outer races with interposed balls, said outer race being securely mounted in said last mentioned shaft encircling bore and said inner race having a central opening in which the adjacent portion of said shaft is tightly fitted for unitary rotation; said shaft having a free outer end portion of relatively larger diameter providing a shoulder in operable abutment with the outer end of said inner race whereby said shaft is relieved of end thrust load and angular thrust load thereby reducing to a minimum the torque required to rotate the same.

5. A fuel control valve comprising a housing having a plurality of non-communicating fuel inlet openings and a fuel outlet opening adapted for communication with each of said inlet openings; and means for selectively establishing communication between any one of said inlet openings and said outlet opening comprising; a disk rotatably mounted in said housing and disposed in spaced relation with respect to the adjacent ends of said inlet openings, said disk having an opening extending therethrough and disposed for alignment with each of said inlet openings during rotation of said disk; a rotatable shaft disposed axially within said housing and having its inner end securely connected to the central portion of said disk for unitary rotation; said housing having a shaft encircling bore adjacent said disk; a bearing tightly fitted in the outer portion of said bore and having a central opening in which the adjacent portion of said shaft is rotatably mounted; said housing being further provided with a second shaft encircling bore at the side opposite said disk; an anti-friction bearing having concentrically disposed spaced inner and outer races with interposed balls, said outer race being securely mounted in said last mentioned shaft encircling bore and said inner race having a central opening in which the adjacent portion of said shaft is tightly fitted for unitary rotation; said shaft having a free outer end portion of relatively larger diameter providing a shoulder in operable abutment with the outer end of said inner race whereby said shaft is relieved of end thrust load and angular thrust load thus reducing to a minimum the torque required to rotate the same; a ratchet member slidably but non-rotatably mounted on said shaft; a plurality of rollers rotatably mounted on said ratchet member and spaced apart about the axis of said shaft; said housing being provided with a plurality of depressions predeterminedly spaced apart about the axis of said shaft adjacent said ratchet member, said depressions being at least equal in number to the number of fuel inlet openings and spaced apart relatively in definite proportion to the spacing of adjacent fuel inlet openings; said rollers being adapted for engagement with different depressions upon rotation of said shaft; and resilient means for yieldably maintaining said rollers and depressions in cooperative relation.

6. A fuel control valve comprising a housing having a plurality of non-communicating fuel inlet openings and a fuel outlet opening adapted

for communication with each of said inlet openings; and means for selectively establishing communication between any one of said inlet openings and said outlet opening comprising; a disk rotatably mounted in said housing and disposed in spaced relation with respect to the adjacent ends of said inlet openings, said disk having an opening extending therethrough and disposed for alignment with each of said inlet openings during rotation of said disk; a rotatable shaft disposed axially within said housing and having its inner end securely connected to the central portion of said disk for unitary rotation; said housing having a shaft encircling bore adjacent said disk; a bearing tightly fitted in the outer portion of said bore and having a central opening in which the adjacent portion of said shaft is rotatably mounted; said housing having a centrally disposed bore extending inwardly from the side opposite said disk; a cover plate normally closing the open end of said bore and removably connected to adjacent portion of said housing, said plate having a shaft encircling bore at its outer side and a central opening through which said shaft extends; an anti-friction bearing having concentrically disposed spaced inner and outer races with interposed balls, said outer race being securely mounted in said last mentioned shaft encircling bore and said inner race having a central opening in which the

adjacent portion of said shaft is tightly fitted for unitary rotation; said shaft having a free outer end portion of relatively larger diameter providing a shoulder in operable abutment with the outer end of said inner race whereby said shaft is relieved of end thrust load and angular thrust load thus reducing to a minimum the torque required to rotate the same; a ratchet member slidably but non-rotatably mounted on said shaft and disposed within said centrally disposed bore adjacent said cover plate; a plurality of rollers rotatably mounted on said ratchet member and spaced apart about the axis of said shaft; said cover plate being provided with a plurality of depressions predeterminedly spaced apart about the axis of said shaft adjacent said ratchet member, said depressions being at least equal in number to the number of fuel inlet openings and spaced apart relatively in definite proportion to the spacing of adjacent fuel inlet openings; said rollers being adapted for engagement with different depressions upon rotation of said shaft; a coiled spring encircling a portion of said shaft and having one end in engagement with said ratchet member; and a relatively stationary abutment on said shaft with which the opposite end of said spring engages; said spring being tensioned for yieldably maintaining said rollers and depressions in cooperative relation.

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