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VALVE CONSTRUCTION

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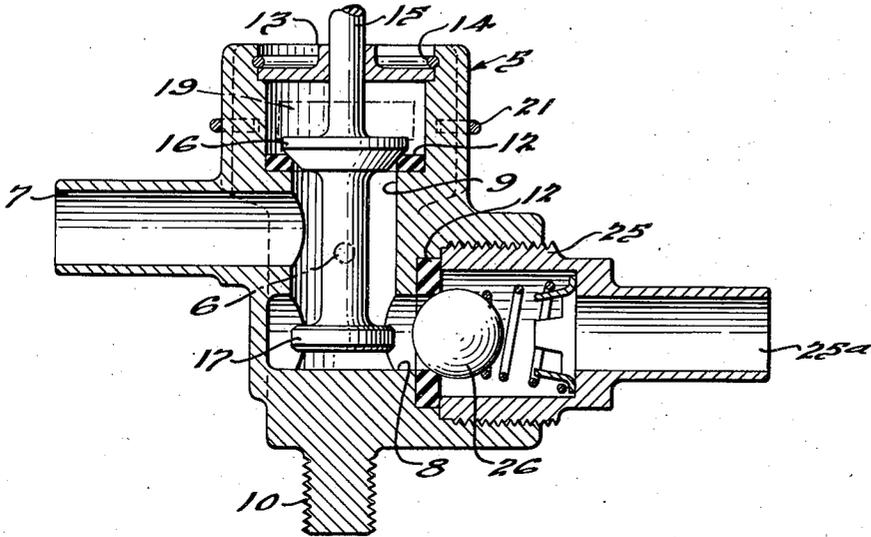


FIG. 1.

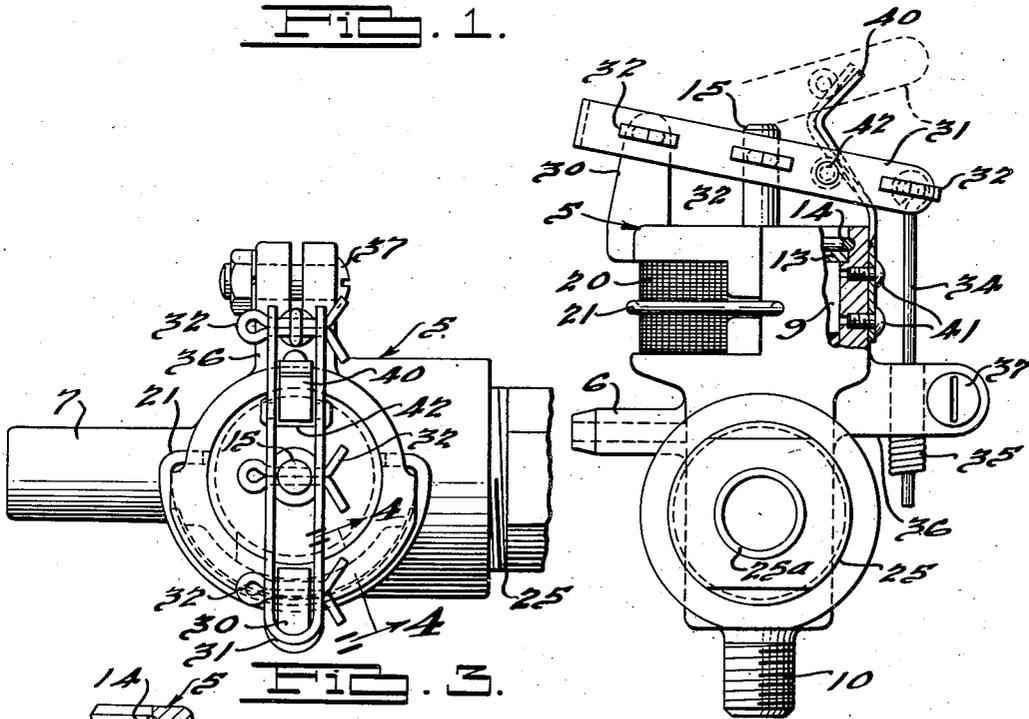


FIG. 2.

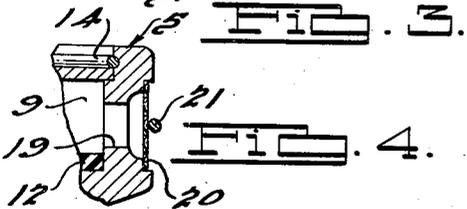


FIG. 3.



FIG. 4.

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VALVE CONSTRUCTION

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7 Claims. (Cl. 277-50)

This invention relates to valve structures in general, and, more particularly, concerns a valve construction for regulation of fluid power systems.

Valve structures per se of the general type illustrated are known to be old, but the particular combination and arrangement of the component parts of the present valve are believed to be distinctly novel and possess much utility for fluid power-operated systems in general, wherein it is desired to vent a portion of the system to the atmosphere during one phase of its operation and still afford uninterrupted operation to the power side of the system. While this valve structure was designed primarily for use as a single control means in a system embodying a plurality of remotely disposed change speed mechanisms it may be used equally well as a control means of a single fluid power operated change speed mechanism. In any fluid power system of the general type mentioned some of the important functions of a control valve therefor are reliability, freedom from inadvertent change of sub-atmospheric pressures in the operating fluid, economy of manufacture, and simplicity of structure and operation. Accordingly, to this end, the present invention provides the aforementioned important functions in a novel construction which is believed to be new in the art to which it relates.

Among the objects of the present invention is the provision of a control valve for fluid power systems which provides in a single valve body a plurality of communicating means so constructed and arranged as to reduce leakage, when the valve is closed, to a single sealing point; the provision in a metal control valve body, as above described, of yieldable rubber-like valve seat ring inserts; the provision in a control valve body, as above described, having a poppet valve and piston valve fixed thereto of a check valve means retained in fixed position in the control valve body for separate regulation of a portion of the control valve when the main valve body is vented to the atmosphere.

Another object of the present invention is the provision of a single control valve body to serve a plurality of remotely separated units to be operated thereby from regulated fluid power and wherein the valve body itself receives fluid to operate said units from a remote source of fluid power, in which said control valve body is simple in design, compact, efficient, and economical to manufacture.

Further and other objects and advantages of this invention reside in the novel combination and arrangement of parts about to be described when taken in conjunction with the accompanying drawing, forming a part of this specification,

and pointed out with particularity in the appended claims.

In the drawing, like reference characters denote corresponding parts in the several views,

5 and in which:

Fig. 1 is a vertical sectional view through a preferred form of control valve body embodying the features of this invention; and

10 Fig. 2 is an elevational view of the valve shown in Fig. 1 with one form of control means fixed thereto; and

Fig. 3 is a top plan view of the same valve; and

15 Fig. 4 is a sectional view of a detail surrounding the screened atmospheric opening of the valve and taken on the line 4-4 of Fig. 3.

In the drawing, having reference particularly to Fig. 1, there is shown a vertical sectional view through a preferred form of the present valve body forming the subject matter of this invention, and designated generally by the reference character 5. The metal valve body 5 comprises a plurality of ports or openings 6, 7 and 8 in communication with a main axial bore 9 which terminates in a stud threaded base 10 for support attachment of the valve in any convenient location with respect to a powered source of operating fluid (not shown) with which it may be associated, in this instance a separately generated vacuum power as the intake manifold of an internal combustion engine. The main axial bore 9 in the valve body is enlarged to form a shoulder above its midpoint which provides a support for an inserted valve seat ring 12, and axially outward is a counterbore for seating an apertured sealing disc 13 which centers and guides a valve stem projected therethrough and is held in fixed position by a snap ring 14. The valve stem 15 is arranged to be moved in the apertured disc 13 and has an annular valve head 16 of the poppet type with a tapered seating surface which seals against the valve seat ring 12. It will be noted that the valve seat ring insert is made preferably of rubber, as shown, or other suitable yieldable material having rubber-like properties not affected by the type of operating fluid employed, such as the synthetic material Neoprene. From the lower end of the valve stem 15, below the head 16, depends an integral piston type valve 17 which is arranged to substantially seal off the main bore 9 of the valve body from the port 8 when the valve 16 has been raised from its seat.

The means for venting the valve body 5 to the atmosphere is best shown in Fig. 2, and the detail in Fig. 4, and consists of an opening 19, into the main bore 9 above the valve head 16, which is baffled to the entrance of foreign matter by a fine wire mesh screen 20 retained in place by snap ring 21 suitably fixed in the valve body. The

valve head 16 is intentionally of a relatively large size so that the area exposed to the sub-atmospheric pressure being maintained in the valve body assists in maintaining the valve seated. With the valve head 16 in seated position the valve body is sealed from atmospheric air with the exception of that portion of the bore 9 above the valve head and atmospheric pressure at this point tends to maintain the valve on its seat, especially if the operating fluid be a vacuum medium.

Into a counterbored and enlarged threaded end of the opening 8 into the main axial bore 9 of the valve body is first inserted another yieldable valve seat ring 12, similar in size and properties to the first mentioned seat ring, for economy of manufacture and utilization of the beneficial qualities thereof. Backing up the seat ring and screwed into the enlarged threaded end of the opening 8 is a fitting 25, having an open outer shank 25a for attachment of a conduit thereto, and an inner chamber in axial communication therewith and with the valve seat ring 12 for reception of a spring pressed check valve 26 to be seated thereon.

Means for external regulation of the control valve body either automatically or manually, as shown, is best illustrated in Figs. 2 and 3 of the drawing. From a lug 30 upstanding on the valve body 5 a U-shaped lever 31 is pivotally secured at one end thereto by a pivot pin 32. Adjacent the midpoint of the lever 31 the upper end of valve stem 15 is likewise suitably pinned to the lever for reciprocating movement thereby. The opposite end of the lever is pivotally connected by a similar pin 32 within the looped end of a Bowden wire 34 which has a sheathed cable 35 attached to the valve body housing 5 by means of a bifurcated lug 36 and fastening means 37. A spring metal member 40 is anchored to the valve body 5 by any suitable threaded fastening means 41 and cooperates with a roller 42, extended between the arms of the U-shaped lever 31, to yieldably fix the lever 31 and attached valve stem 15 in open or closed position by means of the Bowden wire control 34, as shown in dotted lines in Fig. 2.

As one example of a powered means having a source of pressure fluid with which the present invention may be associated and by means of which the mode of operation and function of the control may be clearly illustrated, assume an automotive vehicle having a two speed axle drive mechanism. With a vehicle as assumed the present control valve may be used to effect power shifting of the two speed axle drive mechanism from one ratio to another, and also to effect simultaneous shifting of a speedometer gear drive mechanism from one ratio to another to correspond to the altered axle drive ratio so as to record the correct mileage and speed figure. In use the valve body may be mounted at any convenient part of the vehicle by means of the threaded mounting stud thereon; and the shank 25a, of the fitting 25 threaded into the valve body, be connected by any conduit means to the vehicle intake manifold as a source of sub-atmospheric fluid power. The other ported opening 7 may also be connected by conduit means to a diaphragm cylinder associated with a lever of the axle shifting mechanism. Similarly the remaining port 6 into the valve body may be communicated with the speedometer speed change gearing mechanism by means of another diaphragm cylinder.

During operation of the vehicle engine the spring pressed check valve 26 will be moved off its seat by sub-atmospheric pressure existing in the intake manifold and with which it is in communication. In the closed position of the valve 16, as shown, the axle and speedometer diaphragm shifting mechanisms will be held in one position by reason of the fluid power exerted against one side of the diaphragm. To effect a change of ratio the interior 9 of the valve body may be vented to atmospheric air by means of the Bowden wire 34 which may have a control adjacent the vehicle operator and which moves the valve stem 15 to raise the valve head 16 off its seat. Under this condition the piston valve 17 dependent from the lower end of the valve stem 15, will be elevated sufficiently so as to substantially close off the vented bore 9 of the valve body from the unseated check valve 26 and permit separate uninterrupted functioning of the vehicle engine and manifold. It will be understood, of course, that as soon as the fluid pressure on one side of the axle and speedometer diaphragms has been released they will be returned to original position by means of any suitable return spring.

In light of the foregoing steps of operations it will be apparent that leakage of the valve, when closed, is confined to one location, namely, between the valve head and valve seat. Furthermore by use of yieldable rubber-like valve seat inserts, which may be cemented in to insure against displacement of the parts, the metal poppet valve or the spring pressed ball check valve will be positively seated. By the use of an artificial or synthetic seat ring the valve may also be used with compressed air, or other liquids, in various systems up to temperatures not injurious to the elasticity or yieldability of the seat ring material, or any fluid that would not be corrosive thereto. In the broad concept of the invention it might also be used in other systems having liquid or corrosive operating fluids by substitution of some other inert valve seat material of soft ductile metal such as lead or babbitt. The spring metal arm associated with the valve stem actuating lever will now be seen to maintain the valve in adjusted position against accidental displacement. Since the valve body is of one piece construction and the fitting 25 is threaded into one side thereof against the valve seat ring 12 it will be apparent the only possible source of fluid loss will be between the valve head and seat ring to the screen baffled atmospheric vent, and due to the aforementioned seal effected between these parts this possibility is reduced to the minimum. The valve body is very economical to manufacture, simple in design, compact, with a minimum of parts and joints or plumbing required and adaptable to many installations necessitating this type of control valve for operation of remotely disposed branches in a normally closed system.

From the foregoing disclosures it will be apparent there has been described a novel control valve construction embodying, among other things, the objects and advantages of the invention first enumerated, although it is not intended to be limited to the specific use of the invention described in detail as further and other uses will become apparent to those skilled in the art to which this invention relates, and the spirit of the invention is considered to be as broad as the scope and substance of the following claims.

What I claim is:

1. A vacuum power operated control valve con-

struction comprising in combination, a metal valve body having a main axial bore and a plurality of openings thereinto, said control valve body adapted to be in communication with a vacuum power source, automatic check valve means adapted to regulate flow of vacuum power with the interior of the control valve body, poppet valve means in the body of said control valve to regulate flow of vacuum power through said valve body and said openings thereinto, and yieldable seat ring inserts fixed in said valve body for sealing said check and poppet valves therein when in closed position.

2. A vacuum power operated control valve construction comprising in combination, a metal valve body having a main axial bore and a plurality of openings thereinto, said control valve body adapted to be in communication with a vacuum power source, automatic check valve means adapted to regulate flow of vacuum power with the interior of the control valve body, poppet valve means in the body of said control valve to regulate flow of vacuum power through said valve body and said openings thereinto, yieldable seat ring inserts fixed in said valve body for sealing said check and poppet valves therein when in closed position, and said check and poppet valves being so constructed and arranged as to be urged upon their respective seats by loss of vacuum and flow of vacuum power, respectively.

3. A control valve construction for regulation of a fluid-power-operated mechanical device, said control valve comprising in combination, a valve body having a main axial bore and a plurality of ported openings thereinto, said control valve body adapted to be connected to a source of fluid power and some of said ported openings arranged to receive conduit means thereover in communication with said remote mechanical device to be operated by said fluid power, means comprising an automatic check valve adapted to regulate communication of power fluid with the interior of the body of said control valve, other means consisting of a poppet valve and an integral dependent piston valve in the body of said control valve arranged to be actuated to one position to regulate flow of power fluid through said valve body and other of said ported valve body openings and to dissipate said power fluid when in another position.

4. A control valve construction comprising in combination, a valve body having a main axial bore and a plurality of ported openings thereinto, said control valve body adapted to be in communication with a separately generated source of fluid power and said ported valve body openings permitting fluid flow therethrough for regulation of a fluid-power-operated mechanical device to be operated thereby, means to vent the axial bore of said control valve body to atmospheric pressure, spring-pressed check valve means adapted to automatically regulate flow of fluid power with the interior of the body of said control valve, poppet valve means in the body of said control valve arranged to be actuated to one position to regulate flow of fluid power through said ported openings, and to vent said ported openings through said atmospheric vent when in another position, and said poppet valve means including a piston valve integral therewith for substantially sealing off flow of fluid power into the valve body

when the axial bore thereof is vented to the atmosphere.

5. A control valve construction for regulation of a fluid-powered system having a source of fluid power and apparatus to be operated thereby; said control valve comprising in combination, a valve body having a main axial bore and a plurality of ported openings thereinto, valve means in said control valve body controlling fluid flow through the valve body openings, one of said valve means in the control valve body regulating communication of fluid power with the interior thereof, other of said valve means consisting of poppet valve means in the axial bore of said valve body regulating flow of fluid power with the valve body openings, said poppet valve means including an integral dependent piston valve means arranged, when in one position, to substantially close off flow of fluid power to the valve body and vent the valve body to the atmosphere, and, when in another position, to effect communication of fluid power with the valve body.

6. A control valve construction for regulation of a fluid-powered system having a source of fluid power and apparatus to be operated thereby; said control valve comprising in combination, a valve body having a main axial bore and a plurality of ported openings thereinto, valve means in said control valve body controlling fluid flow through the valve body openings, one of said valve means in the control valve body regulating communication of fluid power with the interior thereof, other of said valve means consisting of poppet valve means in the axial bore of said valve body regulating flow of fluid power with the valve body openings, said poppet valve means including an integral dependent piston valve means arranged, when in one position, to substantially close off flow of fluid power to the valve body and vent the valve body to the atmosphere, and, when in another position, to effect communication of fluid power with the valve body, and yieldable valve seat ring inserts for sealing said check valve and poppet valve in selected position.

7. A control valve construction for regulation of a fluid-powered system having a source of fluid power and apparatus to be operated thereby; said control valve comprising in combination, a valve body having a main axial bore and a plurality of ported openings thereinto, valve means in said control valve body controlling fluid flow through the valve body openings, one of said valve means in the control valve body regulating communication of fluid power with the interior thereof, other of said valve means consisting of poppet valve means in the axial bore of said valve body regulating flow of fluid power with the valve body openings, said poppet valve means including an integral dependent piston valve means arranged, when in one position, to substantially close off flow of fluid power to the valve body and vent the valve body to the atmosphere, and, when in another position, to effect communication of fluid power with the valve body, yieldable valve seat ring inserts for sealing said check valve and poppet valve in selected position, and said check valve and poppet valve means and their respective seats being so arranged each to the other that upon adjustment movement thereof during operation each valve is urged toward its seat.

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