

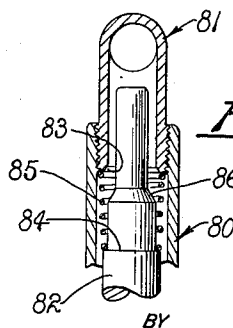
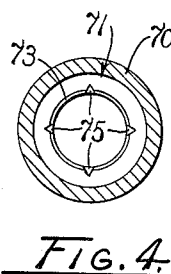
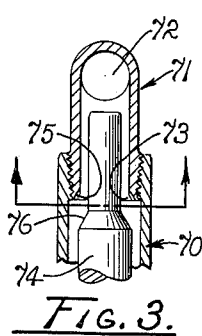
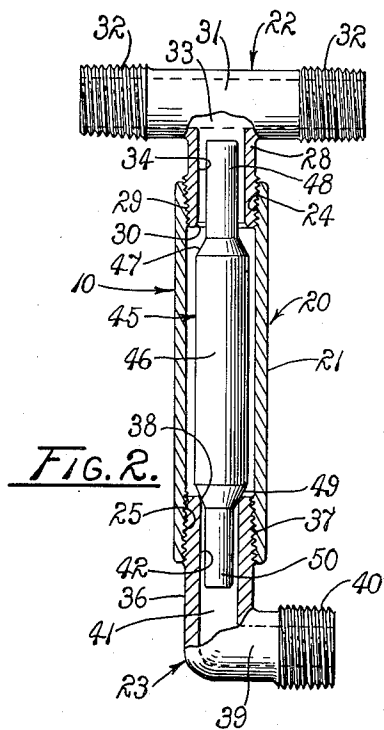
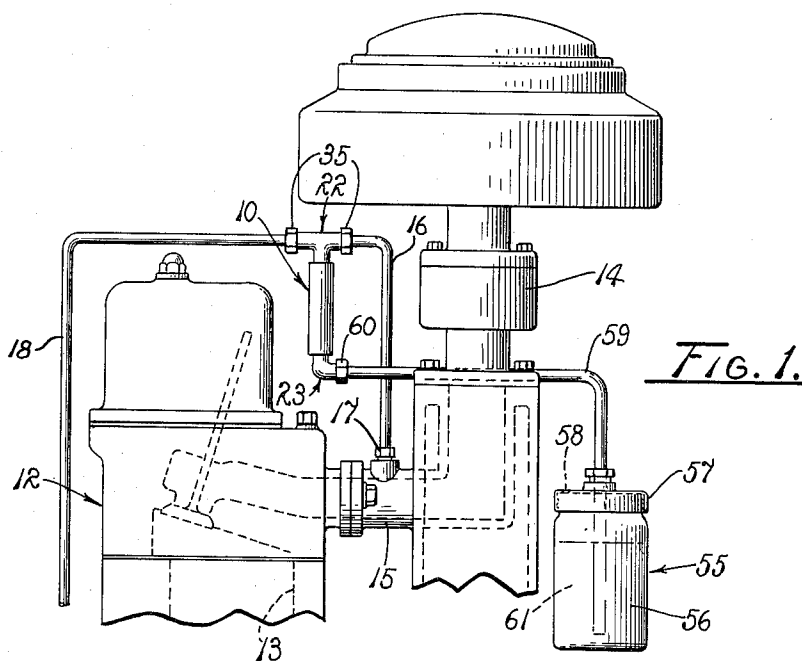
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AUTOMATIC VALVE

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AUTOMATIC VALVE

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The present invention relates to an automatic valve and more particularly to such a valve for controlling the flow of a fluid between a source and a receiving member subjected to varied relative pressures in which such control is accomplished by variations in such pressures.

It is well-known as desirable in internal combustion engines on occasions to impart additives to the fuel or to the air drawn into the combustion chambers thereof. Such additives include solvents, lubricants, fuel supplements, water and the like. For example, in the latter instance, the addition of water in properly controlled amounts to intake air facilitates combustion so as to derive more power from the fuel utilized. Thus, although the valve of the present invention has many useful operational environments, it is conveniently illustrated in connection with the introduction of water into the combustion chamber of an internal combustion engine.

An object of the present invention is to provide an improved device for controlling the flow of fluid from a source of such fluid to a receiving member, which are subjected to relative pressure variations, in which such control is accomplished by the relative pressure changes.

Another object is automatically to meter the flow of an additive fluid into a conduit in which the metered quantities are controlled by pressure variations in the conduit.

Another object is to provide an automatic valve for regulating the fluid flow therethrough in response to pressure variations on opposite sides thereof.

Another object is to provide an automatic control valve for metering fluids into the intake manifold of an internal combustion engine.

Further objects are to provide a valve of the class described which is economical, durable and fully dependable in performing its intended functions.

Other objects and advantages will become more fully apparent upon reference to the following description in connection with the accompanying drawing, in which:

FIG. 1 is a fragmentary end elevation of an internal combustion engine having a carburetor and intake manifold associated therewith and showing the valve of the present invention in operative position in such environment.

FIG. 2 is a side elevation of the valve with a central portion thereof shown in section to reveal internal structure.

FIG. 3 is a fragmentary vertical section of the upper end portion of a second form of the invention.

FIG. 4 is a horizontal section of the second form taken at the position represented by line 4-4 in FIG. 3 looking in the direction of the arrows but omitting the valve member.

FIG. 5 is a fragmentary vertical section through the upper end portion of a further form of the invention.

Referring in greater detail to the drawing:

The valve of the present invention is shown at 10. An internal combustion engine 12 has a combustion chamber 13 and a carburetor 14. An intake manifold 15 interconnects the carburetor and the combustion chamber for the passage of intermixed fuel and air from the carburetor to the combustion chamber. When the engine is in operation and drawing fuel and air from the carburetor, the interior of the manifold is at a pressure less than atmospheric pressure. Such engines, particularly

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when utilized in an automobile, normally provide a vacuum conduit having a first portion 16 connected to the intake manifold 15, as at 17. The vacuum conduit also includes a second portion 18 which is conventionally connected to a vacuum actuated associated structure, such as a windshield wiper, a spark regulator, a gasoline pump, or the like, not shown. The conduit 16-18 exemplifies conduits generally, subject to fluctuating pressures, with which the valve 10 of the present invention is suitably employed, or that of the other forms soon described.

The valve 10 utilizes a housing 20 that includes an erect tubular member 21 having upper and lower ends, a T connector 22 and an L connector 23. The tubular member 21 is formed with internal threads 24 at its upper end and with like threads 25 at its lower end.

The connector 22 is T-shaped and has a vertical hollow portion 28 that is externally threaded at 29 whereby the connector is screw-threadably connected to the upper end of the housing 20. This vertical portion 28 terminates at its lower end in a valve seat 30 having a port therethrough to which reference will subsequently be made. The connector 22 has a horizontal hollow portion 31 that terminates outwardly from the vertical portion 28 with external threads 32. The connector 22 thus has a T-shaped passage 33 therethrough communicating between the valve seat and opposite ends of the horizontal portion 31. A vertical portion 34 of the passage 33 is of predetermined size or diameter for metering purposes and constitutes a port. The T connector 22 is interposed between the portions 16 and 18 of the vacuum conduit and connected in vacuum-tight association therewith by the compression nuts 35 and thus is of the same internal pressure as the conduit. When the engine 12 is in operation, the T connector 22 is at a pressure less than atmospheric.

The aforementioned L connector 23 is somewhat similar to the T connector 22 and has a vertical hollow portion 36 provided with external screw threads 37 whereby it may be threadably engaged into the lower end threads 25 of the tubular member. The vertical portion 36 of the L connector terminates in an upwardly disposed valve seat 37. The L connector also has a hollow horizontal portion 38 integral with the vertical portion thereof that is formed with external threads 39 for the purpose hereinafter more fully described. The hollow portion of the L connector 23 provides an L-shaped passage 40 therethrough. A vertical portion 41 of the passage 40 communicates between the valve seat 37 and the horizontal portion of the L connector and is of predetermined size for metering purposes, as hereinafter described.

An elongated valve member 45 is located inside the valve housing 20 and is free to move longitudinally thereof. The valve member is formed with a central cylindrical body 46 with the upper end thereof shaped frusto-conically to provide an upper valve portion 47 that is adapted at times to seat against the valve seat 30 in the T connector 22. The valve member terminates above the upper valve portion 47 in a cylindrical metering pin 48 of reduced diameter axially aligned with the body 46. This metering pin is extended into the metering portion 34 in the T connector 22 and is slightly smaller in diameter than said portion for the metered passage of fluid therebetween. The body 46 is formed at its lower end in a frusto-conical valve portion 49 adapted to seat gravitationally against the lower valve seat 37 in the valve housing. The valve member below the lower valve portion terminates in a cylindrical metering pin 50 axially aligned with the body 46 which is located in the port 41 in the L connector 23. The diameter of the passage 41 is a predetermined larger diameter than the lower metering pin 50 for the controlled passage of fluid therebetween. The ports 34 and 42 are of different sizes and

similarly the metering pins 48 and 50 are of different sizes.

A fluid additive container 55 is provided in the form of a jar 56 and a cover 57 releasably closing the jar. An opening 58 is formed through the cover for the admittance of air. A fluid additive tube 59 is connected to the cover of the jar and extends downwardly into and terminates near the bottom of the jar. The tube 59 is also connected to the lower end of the housing 20 by means of a compression nut 60. Thus communication is provided between the container and the valve housing for the passage of fluid therebetween. Fluid additive 60 is contained in the container 55 which may be a powder, gas or liquid such as lubricant, solvent, water or other fluid that it is desired to be injected into the mechanism to which it is connected.

The form of the invention shown in FIGS. 3 and 4 is substantially identical to that shown in FIG. 2 and is only fragmentarily represented. This second form includes a cylindrical tubular housing 70 screw-threadably connected to a T-fitting 71 having a passage 72 and being provided with a valve seat 73. A valve body 74, similar to the valve body 46 is provided in the housing 70 for elevational movement in the manner of the body 46. The valve seat 73 is notched at 75 so that when the valve body 74 rises in the housing 70 to bring its valve face 76 into engagement with the valve seat 73, the passage upwardly from the body 70 into the T-fitting 71 is never entirely closed. The remainder of the form of the invention of FIGS. 3 and 4 is identical to that of the form shown in FIG. 2 and no further description or illustration thereof is provided.

A third form of the invention is shown in FIG. 5. It also includes a tubular cylindrical housing 80, similar to that shown at 20, screw-threadably connected to a T-fitting 81, similar to that shown at 22, and a valve body 82. The T-fitting 81 provides a valve seat 83, similar to either of the valve seats 30 or 73, and the valve body 82 is provided with an upwardly disposed shoulder 84. A compression spring 85 is provided between the T-fitting 81 and the shoulder 84 to urge the body away from the seat. As before, the body 82 provides an endwardly disposed valve face 86 adapted to engage the seat 83. Like the valve of FIGS. 3 and 4, the valve of FIG. 5 is identical to that shown in FIG. 2 except for the differences described and shown in FIG. 5.

Operation

The operation of the described embodiments of the subject invention is believed to be readily apparent and is briefly summarized at this point. When the engine 12 is operated, the pressure in the manifold 15 and the portions 16 and 18 of the vacuum conduit is less than atmospheric pressure while the fluid in the container 55 is subjected to atmospheric pressure. So long as the pressure differential in the first and second forms of the invention is less than the weight of the valve bodies 45 and 74, the valve remains closed. When the pressure differential increases sufficiently to lift the valve members 45 and 74 from their lower valve seats, the valve is opened and fluid under atmospheric pressure from the container 55 is forced through the tube 59, valve 10 and into the conduit 16 from which it is drawn through the manifold 15 into the combustion chamber of the engine. The amount of fluid permitted to pass into the portion 16 of the conduit and manifold 15 is regulated by the spacing between the metering pins, such as 48 and 50, and the respective passages in which they are mounted. Of course, the metering pin and passage providing the smaller cross-sectional area circumscribing the pin, determine the maximum opening for fluid passage.

When the pressure differential is such that the valve member 45 and 74 are lifted so as to engage their respective upper seats 30 and 73 respectively, the valve 10 shown in FIG. 2 is closed precluding fluid passage

from the container 55 into the engine and the valve shown in FIGS. 3 and 4 is closed except for the notches 75 which still accommodate a predetermined restricted flow of fluid. When water is used in the container 55 in connection with the engine of an automobile, the weights of the valve bodies are so selected as to be lifted to open their respective valves at a predetermined speed and to raise completely to engage their upper seats at a higher predetermined speed, these two speeds preferably being selected to define the upper and lower limits of normal driving range in which the aid of the water injection is desired. It should be understood that any desired opening and closing speeds can be provided within the operating range of the automobile. In a popular form of the invention, the valve is adapted to open when the automobile reaches twenty miles per hour and to close when it reaches sixty-five miles per hour. In such an arrangement, none of the fluid from the container 55 reaches the engine when the automobile is traveling at less than twenty miles per hour. Between twenty and sixty-five miles per hour, a maximum amount of fluid is permitted to pass through the valve. The amount is dependent, of course, upon the effective size of the passage and the pressure differential as it affects fluid velocity. Over sixty-five miles per hour, the valve of FIG. 2 precludes fluid passage and the valve of FIGS. 3 and 4 minimizes such passage.

When water is employed in the container 55, the desired rate of supply to the engine varies between summer and winter. It will be noted that the metering pins 48 and 50 are of different diameters as are the passages in which they are located. Thus, when it is desired to reduce the maximum fluid flow through the valve of FIG. 2, the nut 60 is removed, the L connector 23 unscrewed from the housing 20 and the valve body 45 inverted. The larger metering pin 48 is then downwardly disposed and when the L connector is returned to position the opening therethrough is minimized. It is employed as shown in FIG. 2 during hot weather and in inverted position during cold weather.

The forms of the invention shown in FIGS. 1 through 4 depend upon the weights of the valve bodies 45 and 74 to keep their valves closed when the pressure differential between the container 55 and the portion 16 of the conduit is at a minimum, to resist opening when the pressure differential increases, and to return the valves to closed condition when the pressure differential subsequently decreases. Obviously, forces other than gravity may be utilized for this purpose. In the form of the invention shown in FIG. 5, a compression spring 85 bears against the shoulder 84 on the body member 82 and urges the latter into closed position. This structure is not limited to employment in any specific attitude but operates satisfactorily when inverted, disposed on its side, in an erect position, or otherwise positioned. When the pressure differential on opposite sides of the valve body 82, as for example between the container 55 and the portion 16 of the conduit, is sufficient to overcome the spring 85, the valve opens. When the differential increases sufficiently that the face 86 engages the seat 83, the valve is closed. If a notched seat, such as that shown at 75 in FIG. 4 is employed, the valve is closed except for the passages defined by the notches.

The valve has proved excellently suited to the automatic metering of flowable materials from containers into intake manifolds of internal combustion engines. It is simple in structure and virtually foolproof. It is easily installed and may be alternatively adjusted between two predetermined operational conditions by inverting the valve bodies.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein

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but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices and apparatus.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A device adapted to introduce fluid additive into an internal combustion engine, the engine having a carburetor and a combustion chamber interconnected by a conduit which is at reduced pressure less than atmospheric during operation of the engine comprising a valve housing, a valve in the valve housing having predetermined open and closed positions, means urging the valve into closed position, and a source of fluid additive at atmospheric pressure, the valve housing being connected at one side to the source of fluid and at the other side to the conduit between the carburetor and the combustion chamber, the pressure difference between the source of additive and the conduit urging the valve in a direction opposite to force exerted by the urging means and causing a flow of the fluid additive from the source to the conduit.

2. A device for metering fluid additive into a conduit having fluctuating pressures less than atmospheric pressure comprising an elongated vertical hollow valve housing, a valve seat in the upper and the lower end portions of the housing, each seat being provided with a port of predetermined size communicating with the exterior of the housing, the ports being of different sizes, means connecting the upper end portion of the housing to the conduit, a source of fluid additive under atmospheric pressure connected to the lower end portion of the housing, and a weighted valve member having oppositely facing valve closing portions fitted to the valve seats, said valve member being vertically movable between the valve seats alternately to close said seats, metering pins of different sizes extended oppositely endwardly from the valve member and slidably located in the ports, the valve member being endwardly reversible to locate the metering pins in their respectively opposite ports.

3. A device for metering fluid additive into a conduit having fluctuating pressures comprising a valve housing having a pair of spaced opposed valve seats, each valve seat having a port of predetermined size, the ports being of different sizes, means connecting one port to the conduit, a source of fluid additive under pressure greater than the fluctuating pressure connected to the port opposite to the conduit, a valve member mounted between the valve seats and having opposite valve closing por-

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tions disposed toward the valve seats and reciprocally movable in the housing between alternate engagement of the valve seats, the valve member having oppositely extended metering pins of different sizes extended into the ports, the valve member being reversible selectively to locate either of the metering pins in either port, and means urging the valve member toward the valve seat having the port connected to the source of additive.

4. A device for regulating the flow of fluids comprising a tubular valve housing having a fluid passage therethrough communicating between ports at each end thereof with one port being larger than the other, a valve seat circumscribing each of the ports, an elongated valve member located within the housing having opposite valve closing portions directed toward the valve seats with the valve member movable in the housing alternately to engage the valve seats, a metering pin extended longitudinally of the valve member outwardly of the valve closing portions thereof and extended into the ports, the metering pins being of different sizes, and means urging the valve member endwardly of the housing toward the smaller port.

5. A device for regulating fluid flow between a pair of members having chambers therein and said chambers having different internal pressures, comprising a tubular valve housing having a fluid passage therethrough interconnecting a pair of spaced fluid flow ports each of which is circumscribed by a valve seat, means connecting opposite ends of the valve housing individually to the chambers of said members, and an elongated valve member mounted between the valve seats for reciprocal movement longitudinally of the valve housing throughout a range of movement therebetween and having opposite end portions adjacent to the valve seats and disposed theretoward, said end portions being releasably fitted to their respectively adjacent valve seats, at least one of said end portions carrying a metering pin longitudinally extended through one of said ports, and said valve member being urged toward one of said seats.

6. The structure according to claim 5 in which said ports are of different relative dimensions.

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