Aug. 21, 1951 A. E. ROY 2,565,094

FLUID COMPRESSOR VALVE

Original Filed Sept. 19, 1941 2 Sheets-Sheet 1

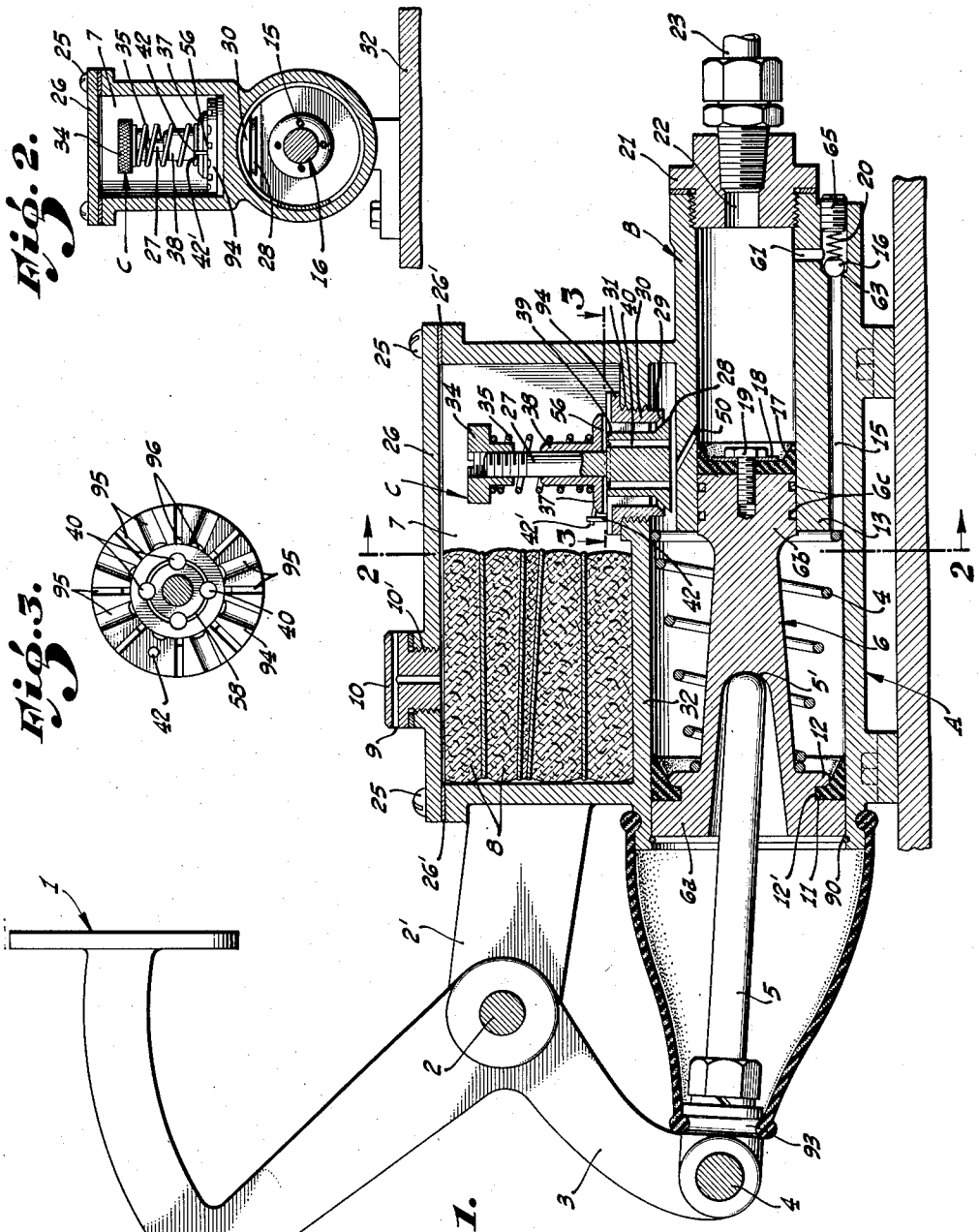


Fig. 1.

Fig. 2.

Fig. 3.

INVENTOR.
ALBERT E. ROY,
BY
Robert W. Fulwider
ATTORNEY.

Aug. 21, 1951 A. E. ROY 2,565,094

FLUID COMPRESSOR VALVE

Original Filed Sept. 19, 1941 2 Sheets-Sheet 2

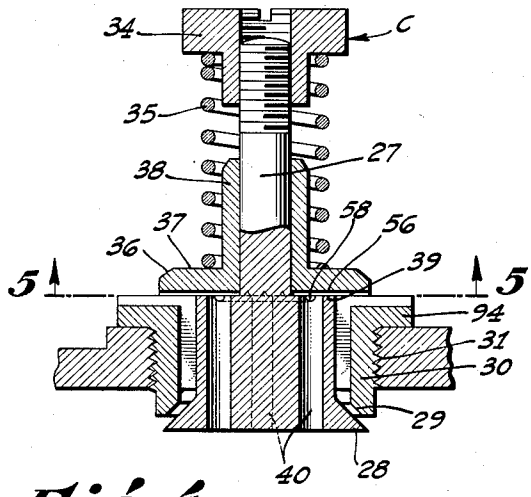


Fig. 4.

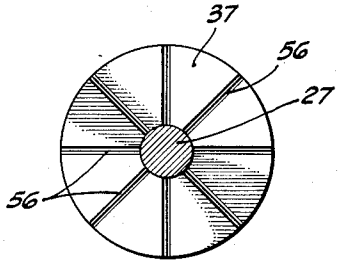


Fig. 5.

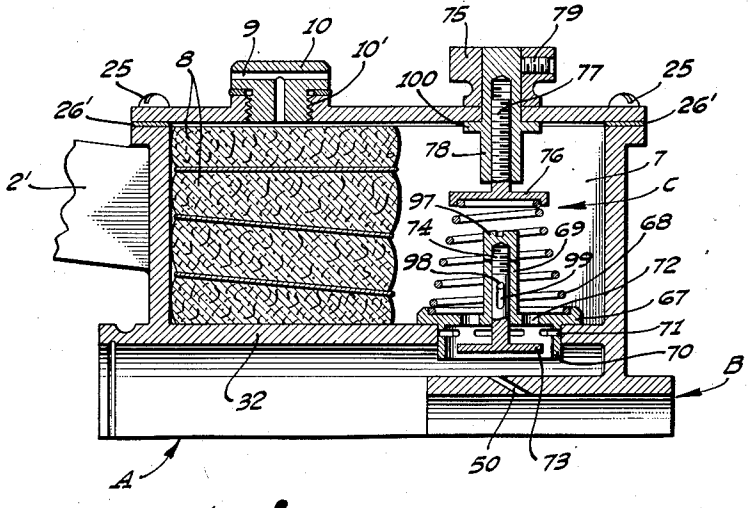


Fig. 6.

INVENTOR.
ALBERT E. ROY,
BY
Robert W. Fulwider
ATTORNEY.

Patented Aug. 21, 1951 2,565,094

UNITED STATES PATENT OFFICE

2,565,094

FLUID COMPRESSOR VALVE

Albert E. Roy, Los Angeles, Calif.

Original application September 19, 1941, Serial No. 411,542. Divided and this application February 3, 1945, Serial No. 576,001

6 Claims. (Cl. 277—60)

1

My invention relates to a compressor valve for fluids and which is particularly adapted for use in conjunction with hydraulic mechanism and especially to that adapted for association with hydraulic brake mechanisms and more specifically relates to the fluid pressure producing devices for such mechanisms. This application is a division of my co-pending application, Serial No. 411,542, filed September 19, 1941, now Patent Number 2,374,235, issued April 24, 1945.

An object of my invention is to provide a novel and improved operating mechanism and pressure cylinder construction for hydraulic braking systems whereby an initial movement of an operating lever causes sufficient pressure to be transmitted to the fluid pressure actuated motors of a braking system to actuate a friction element or brake shoe into initial contact with the braking surface of a rotatable brake drum, while further movement of the operating lever causes a high pressure to be applied to the braking motors for braking purposes.

Another object of my invention is to provide a novel mechanism comprising a low pressure cylinder and a high pressure cylinder which are in communication with one another during the initial operation of the compressor device, and including novel valve means to cut off communication between the high and low pressure cylinders when the fluid compression member has moved forward on its compression stroke and to prevent the pressure in the low pressure cylinder from rising above a desired value.

A further object of my invention is to provide novel mechanism comprising low and high pressure cylinders in communication with each other during initial movement of a common fluid compression element having piston heads mounted thereon, and reciprocal in each of said cylinders, and including novel means for adjusting the maximum value of the pressure built up in the low pressure cylinder during the brake applying movement of the parts, and to return liquid expelled from said low pressure cylinder into a reservoir after communication with the high pressure cylinder has been cut off from said low pressure cylinder when the parts move to released position.

A still further object of my invention is to provide a novel pressure cylinder construction comprising high and low pressure cylinders and novel valve and port means whereby on the commencement of the operative movement of fluid compression pistons in said cylinders, the pressure in the low pressure cylinder during the initial

2

movement of the pistons is quickly transferred to the high pressure cylinder for taking up the slack in the brake mechanism parts, and then pressure is transmitted at a higher value in the high pressure cylinder by further operative movement of the pistons, and whereby any subsequent pressure in the low pressure cylinders is relieved during further operation of the fluid compression member.

A still further object is to provide a novel fluid compressor whereby the fluid pressure is controlled by novel valve and by-pass means to obtain proper balance of the fluid pressure during the compression stroke.

Other objects, advantages and features of invention will appear from the accompanying drawings, the subjoined detail description, and the appended claims.

The accompanying drawings illustrate the invention in some of the forms I at present deem preferably, but it is to be understood that the scope of the invention is not limited to the illustrative embodiments shown and described, as the principles involved are susceptible of numerous other applications that will readily occur to persons skilled in the art.

Fig. 1 is a vertical sectional view of my preferred form of pressure producing construction, and showing the piston in retracted position;

Fig. 2 is a transverse cross sectional view on reduced scale, and taken on line 2—2, Fig. 1, and looking in the direction of the arrows;

Fig. 3 is an enlarged detail plan view of the face of the relief valve, taken on line 3—3, Fig. 1, and looking in the direction of the arrows;

Fig. 4 is an enlarged vertical sectional view of the relief valve mechanism shown in Fig. 1;

Fig. 5 is a horizontal section taken along the line 5—5 of Fig. 4; and

Fig. 6 is a fragmental vertical sectional view showing a modified form of relief valve structure.

In the preferred form of the invention illustrated in Figs. 1–5 of the drawings, it will be seen that I provide a low pressure cylinder A and a high pressure cylinder B of smaller diameter than cylinder A, and arranged co-axially therewith, and pressure release means generally indicated at C for the low pressure cylinder A, said pressure release means being arranged in a fluid reservoir and also serves to provide communication between the reservoir and cylinder A.

A brake or operating pedal 1 is pivoted at 2 to arms 2' that extend from a housing A, and has a lower arm 3 pivotally connected by pivot

bolt 4 to one end of a push rod 5, which is rounded at its inner end and engages the recess 5' formed in the back of the reciprocal piston element 6 to force the same inwardly into the cylinders A and B upon depression of the brake pedal 1.

An oil or fluid reservoir 7 is provided with an air bleed vent 9 that serves to keep the reservoir in communication with the atmosphere, and is formed by a plurality of ports or openings formed in a plug 10 which is removably mounted in a filling opening 10' formed in a cover plate 26 to enable fluid to be placed in the reservoir 7. To prevent fluid from splashing out through openings 9, a baffle in the form of a wad of steel wool 8 is positioned in the reservoir beneath the plug 10.

The piston element 6 is provided with a low pressure piston head 6a and a high pressure piston head 6b having oil grooves 6c therein; a leak proof washer or rubber piston cup 11 is secured to piston head 6a by forcing the same over a head 12 and into a recess 12' formed in the piston head 6a so as to retain the same thereon and said cup 11 operates in the low pressure cylinder A to force fluid (preferably oil) therealong, and to inhibit the seepage of fluid from the cylinder past the piston. A spring 14, arranged within cylinder A and between the inner face of piston head 6a and a wall 13 that forms the inner end of the cylinder A, serves to return the piston element 6 and rod 5 to retracted or inoperative position, as shown in Fig. 1.

The piston element 6 is retained against displacement from the open end of cylinder A by a retaining ring 90 seated in a circumferential groove in the wall of the cylinder.

The piston head 6b is provided at its inner end and within the cylinder B with a rubber piston cup 17 which is secured thereto by a disc 18 and bolt 19. The low pressure cylinder A and the high pressure cylinder B are connected by a passage 15 formed in a wall of the housing embracing such cylinders, and is controlled by a ball check valve 16 pressed into engagement with seat 63 by a light spring 20 arranged between the ball and an adjustable abutment screw 65. It will be noted that passage 15 connects beyond the check valve 16 by a branch passage 61 with the interior of the high pressure cylinder B.

The cylinder B has a head in the form of a nut 21 threaded thereinto and is provided with a discharge port 22 that is suitably connected to a fluid pressure delivery pipe 23 which leads to the remotely located fluid actuated motors (not shown) such as to the hydraulic cylinder in a braking mechanism.

A rubber boot or cover 24 for excluding dust and other foreign substances is secured by resilient tension to the open end of cylinder A and to a collar 93 on the push rod 5.

The removable cover plate 26 is secured by screw studs 25 against a gasket 26' to effectively close the top of reservoir 7.

The relief valve C as shown in Figs. 1–5, comprises a valve stem 27 carrying a valve head 28 which seats on a valve seat 29 formed in the lower end of a bushing 30 that is screw threaded at 31 into the lower wall 32 of the reservoir 7.

The valve stem 27 is threaded and fitted with an adjusting nut 34 for a spring 35 arranged between the head of nut 34 and the upper face 36 of an auxiliary plate valve 37, that has a tubular guide 38, slidable on the valve stem 27. The lower face of auxiliary valve 37 normally rests upon the top shoulder 39 of the body of valve head 28.

Auxiliary valve ports 40 are provided through the body of valve head 28 to permit fluid to flow therethrough from cylinder A to reservoir 7 under control of auxiliary valve 37. The lower face of valve 37 is provided with a minute radial groove 56 that communicates with ports 40 either direct or through a minute circular groove 58 formed in the upper surface or on the top shoulder 39 of valve head 28, and which groove 58 connects the ports 40; thereby providing a slight bleeding action between cylinder A and reservoir 7. As soon as pressure builds up in the low pressure cylinder A, the valve 28 will close, thereafter fluid will be forced upwardly through the ports 40 and against the tension of the spring 35. The tension of the spring 35 will close the auxiliary valve 37, while there is still some pressure in the cylinder A. It is this last bit of fluid under pressure which bleeds through the groove 58 and thence through the radial groove 56 into the reservoir C.

Pins 42, 42' extending from bushing 30 and valve 37 are provided to limit the rotation of the floating valve 37 when the screw 34 is adjusted to vary the tension of spring 35 and thus determine the degree of pressure required to operate valves 28 and 37.

The flange 94 of bushing 30 is provided on its upper surface within reservoir 7 with a plurality of grooves 95 that extend radially from the grooves 96 formed in the bore of bushing 30 and through which the body of valve head 28 reciprocates, thereby providing for free flow of fluid from reservoir 7 to cylinder A when the auxiliary valve 37 is closed and until the valve 28 is seated upon its seat 29 by compression of fluid in cylinder A, and upon release of such compression the valve 37 will be urged by spring 35 upon the top shoulder 39 and then the valves 37 and 28 may move as a unit by gravity to open valve 28 to permit free flow of fluid from reservoir to cylinder A.

A bleed port 50 is provided to connect the cylinder B to the atmosphere through valve means C when the piston element 6 is retracted and such port 50 is immediately cut off upon advancement of the piston on its compression stroke.

The relief valve C in Fig. 6 comprises a valve head 67 in the form of a circular disc having an upwardly projecting hollow stem 69, and a downwardly and depending skirt 70 of lesser diameter than the disc 67 and concentrically arranged relatively thereto, slidably fits in an aperture in the lower wall 32 of the reservoir 7. Slots or apertures 71 are formed in the skirt portion 70 just under the lower side of the disc 67, and when the valve 67 is seated on its seat formed by contact with wall 32, the apertures 71 will be closed.

The disc 67 is provided with apertures 72 adjacent stem 69 and within the area defined by skirt 70, and a smaller disc valve 73 is floatingly mounted by a stem 74 nested in the hollow stem 69 of disc valve 67 and underlies the apertures in position to obdurate them when fluid forced from cylinder A into the reservoir 7 carries the disc valve 73 upwardly against the underside of the valve head 67. A nut 97 threaded on stem 74 retains valve 73 in position and provides for adjustment thereof relative to its seat. Pin 98 secured in stem 69 and extending through slot 99 in stem 74 prevents rotation of valve 73 where adjusting nut 97 is operated and also prevents accidental displacement of valve 73.

The relief valve head 67 normally urged against its seat by a coil spring 68 that operates between head 67 and an abutment 76 that has a threaded stem 77 extending therefrom into a threaded sleeve 78 which extends through the cover plate 26 where a knurled nut 75 is secured thereto by a set screw 79. The tension of spring 68 may be varied by rotation of the sleeve 78 thus causing up or down movement of the upper abutment 76 of the spring. A flange 100 on sleeve 78 engages the underside of cover 26 and cooperates therewith and with nut 75 to prevent axial displacement of sleeve 78 and provide for ease of assembly.

In operation of the device shown in Figs. 1–5 and assuming the parts are initially in the released or retracted position as shown in Fig. 1, when pedal 1 is depressed the piston element 6 through rod 5 starts its compression stroke which causes the fluid in low pressure cylinder A to be displaced, thus closing valve 28. The fluid moves from cylinder A into cylinder B through passage 15 past check valve 16 which is also opened during return movement of the piston element. This initial movement serves to immediately fill the fluid pressure delivery pipes and associated motors, due to the large compressing area of head 6a and cylinder A, thereby bringing the brake shoes into engagement with the brake drum with a minimum movement of the pedal 1. The pressure in cylinder B thereafter becomes high enough to close check valve 16, after which excess compressed fluid from the low pressure cylinder A raises plate valve 37 and enters reservoir 7 through ports 40. High pressure cylinder B is then sealed against escape of fluid through any path except through outlet pipe 23, and continued depression of the pedal 1 applies the full pressure of fluid compressed in cylinder B to the braking mechanism or the remote fluid pressure actuated motors. When pedal 1 is released, spring 14 aids in returning the pistons element 6 to initial position, and such return becomes effective to return the pedal to retracted position, and spring mechanism (not shown) of element 6 tends to create a vacuum to open valves 16 and 28, and fluid from reservoir 7 will quickly fill all parts of the cylinders and connecting ports.

From the foregoing it will be observed that in the operation of my fluid compressor a slight depression of the pedal 1 operates the piston element, and such operation completely fills the fluid pressure lines and fluid operated motors and places the brake shoes into engagement with the brake drums; the low pressure cylinder then cuts off and further depression of the brake pedal operates compressed fluid in the high pressure cylinder and forces the same through the fluid pressure lines for braking operation. I, therefore, obtain immediate operation of the fluid operated motors by slight pedal pressure, and thereafter pedal pressure is available for braking operation, whereas, heretofore considerable pedal operation was required in order to obtain high line pressure or extraneous apparatus was required.

Heretofore, the pressure in fluid distributing lines has been obtained in varying degrees from approximately nine pounds to one thousand pounds, and I have found from tests made with my device that the pressure in the fluid pressure distributing lines is materially increased so that fluid pressures have been obtained in varying degrees from approximately nine pounds to two thousand pounds.

I have also found that the auxiliary valve 36 may be rigidly associated with the top shoulder 39, and in that event the grooves 56 and 58 provide sufficient passage from the low pressure cylinder to the oil reservoir to relieve excess pressure that may be created therein.

While the particular apparatus herein shown and described in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiment of my invention, and that I do not mean to limit myself to the details of construction or design herein shown, other than as defined in the appended claims.

I claim:

1. A valve assembly for controlling fluid flow between the reservoir and the cylinder of a fluid compressor comprising: a valve seat; a valve head normally urged away from said valve seat by gravity but adapted to be moved toward said valve seat by flow of fluid from the cylinder to the reservoir, said valve head having auxiliary passageways extending therethrough for connecting the cylinder and the reservoir; a valve stem attached to said valve head; a valve plate slidably mounted on said stem and arranged to cover said auxiliary passageways, said valve plate having radially extending grooves therein adapted to cooperate with said auxiliary passageways to form bleeder ports for connecting the cylinder and the reservoir when said valve plate covers said passageways; and adjustable spring means mounted on said valve stem and bearing against said valve plate to urge the latter against said valve head to thereby cover said auxiliary passageways, said valve plate being slidable on said valve stem against the action of said spring means to uncover said passageways when the pressure within the cylinder exceeds the pressure within the reservoir by a predetermined amount to thereby permit rapid equalization of said pressures, and said bleeder ports acting at all times to slowly equalize any pressure differential between the cylinder and the reservoir.

2. A valve assembly for controlling a fluid connection between the reservoir and the cylinder of a fluid compressor which assembly includes: a valve plate adapted to cover an orifice connecting the reservoir to the said cylinder, said plate having a set of openings extending therethrough; a skirt attached to said plate and extending into said orifice, said skirt having a set of apertures extending therethrough adjacent said plate and substantially parallel thereto; a valve stem attached to said valve plate; a valve slidably attached to said valve stem and normally held by gravity away from said set of openings, whereby fluid may pass from said reservoir, through said openings, and into the cylinder, but movement of fluid from the cylinder into the reservoir causes said valve to be moved against said valve plate to close said set of openings and thereby stop such movement of fluid; and spring means yieldably urging said valve plate against said orifice, whereby said valve plate may be moved away from said orifice against the urging of said spring, and fluid may pass through said set of apertures in said skirt from the cylinder to the reservoir when the pressure within the cylinder exceeds that within the reservoir by a predetermined amount.

3. A valve assembly for controlling a fluid connection between the reservoir and the cylinder of a fluid compressor which includes: an apertured member mounted in the fluid connec-

tion; a valve head mounted for slidable movement with respect to said member and normally urged by gravity away therefrom to provide a normally open passageway from the reservoir to the cylinder, said valve head being responsive to the movement of fluid from said cylinder to said reservoir and moved by said fluid movement toward said member to close said aperture and stop such movement of fluid, said valve head having auxiliary passageways extending therethrough; a valve plate mounted for slidable movement with respect to said valve head and adapted to close said auxiliary passageways, said valve plate having bleeder ports fluid connected to said auxiliary passageways and remaining open at all times; and spring means yieldably urging said valve plate against said valve head to normally close said auxiliary passageways until the pressure in the cylinder exceeds that in the reservoir by a predetermined amount, whereupon such fluid pressure overcomes the urging of said spring means and moves said valve plate away from said valve head to open said auxiliary passageways.

4. A valve assembly for controlling a fluid connection between the reservoir and the cylinder of a fluid compressor which assembly includes: a normally open valve responsive to the movement of fluid within said connection and operated solely thereby to close said connection and prevent the movement of fluid from the cylinder to the reservoir; a normally closed valve mounted on said normally open valve and operated by the fluid pressure in the cylinder when such pressure exceeds that in the reservoir by a predetermined amount, said normally closed valve thereby opening said fluid connection while said normally open valve is closed, to permit the movement of fluid from the cylinder to the reservoir; and means including bleeder ports associated with at least one of said valves for conducting fluid between said reservoir and said cylinder when both of said valves are closed, whereby pressure in said reservoir and said cylinder is gradually equalized.

5. A valve assembly comprising: a valve seat; a valve head normally urged away from said valve seat by gravity but adapted to be moved toward said valve seat by flow of fluid through said valve, said valve head having auxiliary passageways extending therethrough; a valve stem attached to said valve head; a valve plate slidably mounted on said stem and arranged to cover said auxiliary passageways, said valve plate having radially extending grooves therein adapted to cooperate with said auxiliary passageways to form bleeder ports through said valve when said valve plate covers said passageways; and adjustable spring means mounted on said valve stem and bearing against said valve plate to urge the latter against said valve head to thereby cover said auxiliary passageways, said valve plate being slidable on said valve stem against the action of said spring means to uncover said passageways when the pressure on one side of the valve exceeds the pressure on the opposite side of the valve by a predetermined amount to thereby permit rapid equalization of said pressures, and said bleeder ports acting at all times to slowly equalize any pressure differential on opposite sides of the valve.

6. A valve assembly for controlling fluid flow through an orifice, which includes: a valve head comprising a plate portion having openings therein and overlying the edges of said orifices to bear thereagainst, and a depending annular skirt attached to said plate portion and slidably positioned in said orifice, said skirt having apertures therein that are normally closed by the wall of said orifice; an abutment adjustably mounted in spaced relation to said plate portion; a spring member mounted between said plate portion and said abutment, the compression of said spring member being variable by adjustment of said abutment; and a second valve plate floatingly mounted below said openings in said plate portion of said valve head and adapted to close said openings upon upward flow of fluid through said openings, said valve head being movable against the action of said spring in response to excessive pressure, to open said apertures in said skirt.

ALBERT E. ROY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,229,885	Chadwick	June 12. 1917
1,770,064	Carroll	July 8, 1930
1,958,722	Sinclair	May 15, 1934
2,022,599	Leuschner	Nov. 26, 1935
2,101,772	Baughn	Dec. 7, 1937
2,111,310	Carroll	Mar. 15, 1938
2,166,742	Lambert	July 18, 1939
2,170,851	Carroll	Aug. 29, 1939
2,203,082	Dick	June 4, 1940
2,217,461	Weihe	Oct. 8, 1940
2,291,056	Pallady	July 28, 1942
2,345,547	Roth	Mar. 28, 1944
2,374,235	Roy	Apr. 24, 1945

FOREIGN PATENTS

Number	Country	Date
424,676	Great Britain	Feb. 26, 1935
812,483	France	Feb. 1, 1937