

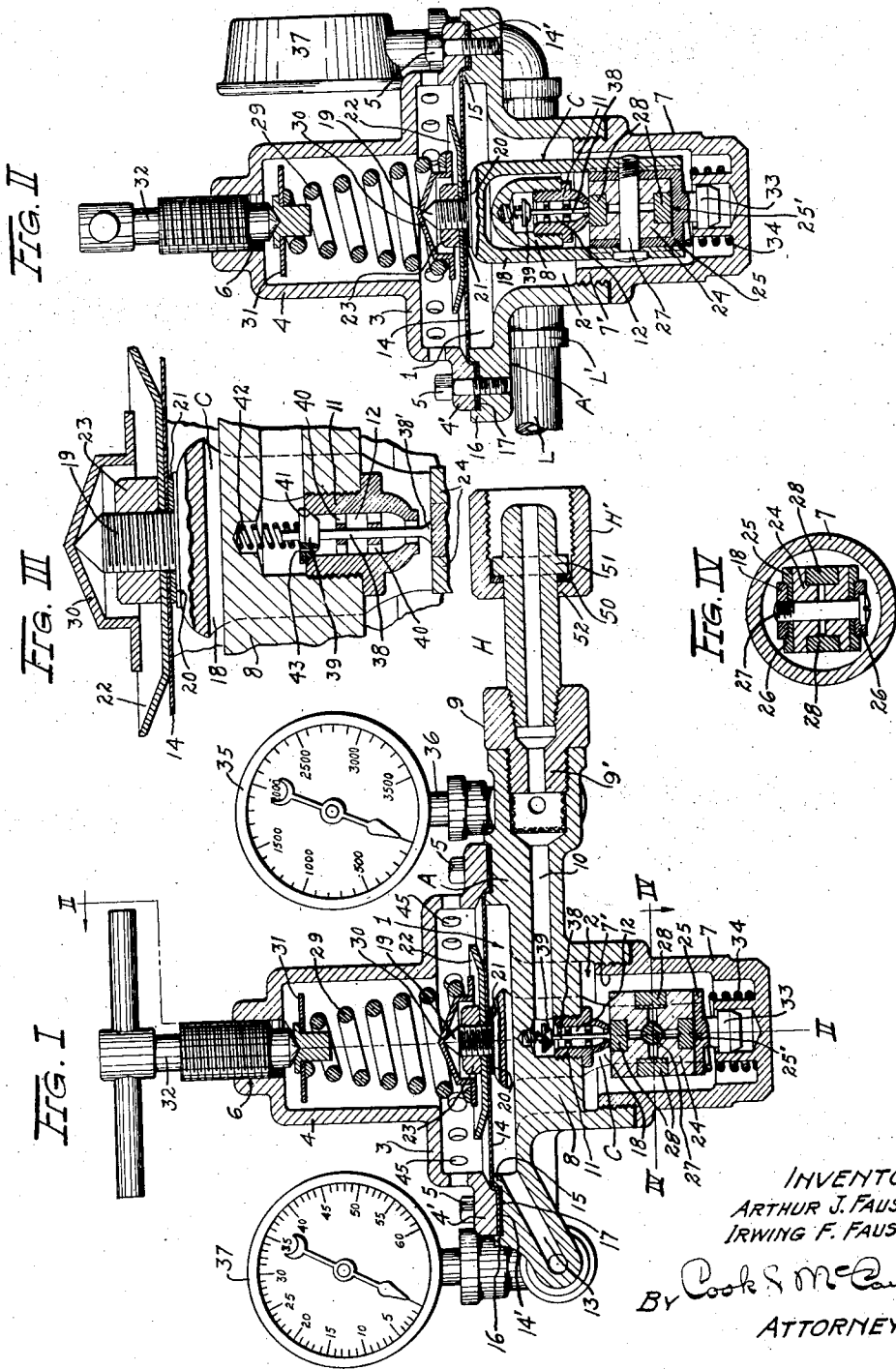
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REDUCING VALVE

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REDUCING VALVE.

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Our invention relates to improvements in reducing valves, one of the objects being to provide a simple, efficient and inexpensive means for regulating the flow of fluid under pressure, a more specific object being to produce a valve of this kind having a diaphragm through the medium of which the flow of fluid is regulated in combination with means for choking the initial flow of fluid immediately after said fluid is permitted to pass into the valve. The last mentioned means is intended to prevent the injurious consequences resulting from permitting fluid under high pressure to rush suddenly into the valve housing and actuate the parts of said valve with such violence as to work an injury thereto.

With the foregoing and other objects in view, the invention comprises the novel construction, combination and arrangement of parts hereinafter more specifically described and illustrated in the accompanying drawings wherein is shown the preferred embodiment of the invention. However, it is to be understood that the invention comprehends changes, variations and modifications which come within the scope of the claims hereunto appended.

Fig. I is a vertical section of our reducing valve.

Fig. II is a section on line II—II of Fig. I.

Fig. III is a fragmentary section view showing the auxiliary valve or choking means of our improved reducing valve.

Fig. IV is a section on line IV—IV of Fig. I.

In the drawing, A designates the housing of our improved valve which is provided with a diaphragm chamber 1. The lower portion of the cavity within the valve housing A constitutes a valve chamber 2, and as seen in Fig. II, said diaphragm chamber and said valve chamber are in direct communication with each other. Secured to the valve housing A at a point immediately above the diaphragm chamber 1 is a diaphragm cover 3, which is provided with an upwardly extending hollow portion 4 and is secured by means of bolts or similar fastening devices 5 to the housing A. Formed in the top wall of the upwardly extending portion 4 of the diaphragm cover is an internally threaded opening 6 which is intended for a purpose to be hereinafter set

forth. 7 designates a cap having an externally threaded portion 7' which is screwed into the valve chamber 2, said cap functioning as a closure member for the lower end of said valve chamber. Arranged transversely of the cavity within the housing A at a point immediately below the diaphragm chamber 1 is a bridge member 8. The bridge member 8 is not a solid wall separating the diaphragm chamber 1 from the valve chamber 2, as might appear from Fig. I, but is an integral bar, the side faces of which are spaced apart from the wall of the housing so as to provide a space on either side of said bridge member (Fig. II).

H designates a high pressure conducting member screwed into a socket 9 and communicating with an inlet passageway 10 formed in the bridge member 8. A valve seat member 11 screwed into the bridge member 8 is provided with a passageway 12 which forms a continuation of the inlet passageway 10 leading to the valve chamber 2.

A low pressure conducting pipe L screwed into a socket L' communicates with a discharge passageway 13 formed in the wall of the valve housing A. The discharge passageway communicates with the diaphragm chamber 1.

14 designates a diaphragm arranged in the diaphragm chamber 1, said diaphragm being arranged to rest upon an annular flange 15 extending upwardly from the top face of the valve housing A. An annular portion 14' of the diaphragm 14 extends downwardly from the main portion of said diaphragm, and said portion 14' fits into an annular depression between the annular flange 15 already mentioned and a similar annular flange 16 formed on the valve housing A. Located between the portion 14' of the diaphragm 14 and the base of the depression in which it is located is a gasket 17 to prevent the escape of fluid at the marginal edge of said diaphragm. To securely anchor the marginal edge portion of the diaphragm and the gasket 17 in place, we interpose said marginal edge portion of said diaphragm and said gasket between the top wall of the valve housing A and the flange 4' of the diaphragm cover 4, and pass the threaded shanks of the bolts 5 through apertures in said diaphragm portion and said gasket. It is apparent that when the bolts 5 are screwed

downwardly as far as they will go a fluid-tight joint will be obtained between the valve housing, diaphragm and diaphragm cover. C designates a closure member which is arranged partly within the valve chamber 2 and partly within the diaphragm chamber 1, said closure member preferably comprising a U-shaped member 18 which straddles the bridge member 8 (Fig. II). The U-shaped member 18 is provided with a threaded stem 19 at its upper end which passes through the diaphragm 14, and said member 18 is provided with a shoulder 20. Interposed between the shoulder 20 and the lower face of the diaphragm is a gasket 21. Located above the diaphragm 14 and in contact with the top face thereof is a disk 22 which is provided with a central opening through which the threaded stem of the U-shaped member 18 passes, and arranged above the disk 22 on the threaded stem 19 is a nut 23. From the disclosure illustrated in Fig. I it is plain that when the nut 23 is screwed downwardly on the threaded stem 19 as far as it will go the disk 22, diaphragm 14 and gasket 21 will be clamped between said nut and the shoulder 20, and consequently if the diaphragm were deflected the U-shaped member 18 would move with said diaphragm. The closure member also includes a head 24 at the lower end of the U-shaped member 18, said head being located between the upturned legs of a U-shaped member 25. The legs of the U-shaped member 25 are each provided with a rectangular depression 26 into which one of the legs of the U-shaped member 18 extends, and said U-shaped member 25 and said head 24 are secured to the U-shaped member 18 by means of a bolt 27 which passes through the legs of said U-shaped members 18 and 25 and through said head 24. From the foregoing it is apparent that the U-shaped member 25 and head 24 are very securely fixed to the U-shaped member 18, the bolt 27 preventing vertical movement of said U-shaped member 25 and head 24, and because the side walls of the depression 26 are in contact with the edges of the legs of the U-shaped member 18, said member 25 and head 24 will be prevented from rotating about said bolt.

The head 24 is very frequently thrown into engagement with the valve seat 11, and this head is also subjected to the action of the fluid under high pressure escaping from said member 11, consequently the portion of the head which engages the valve seat member soon becomes worn or mutilated. To avoid the necessity of renewing or refinishing the head 24 it is preferably provided with a plurality of seats 28 any one of which may be arranged in position to close the valve seat member 11. In adjusting the head 24 the cap 7 is removed from the valve housing, and the bolt 27 is withdrawn from its posi-

tion. This will permit the U-shaped member 25 to be withdrawn from between the legs of the U-shaped member 18 and the head 24 may then be turned to the desired position, after which the parts are reassembled.

Arranged within the portion 4 of the diaphragm cover 3 is a coil spring 29, said coil spring being interposed between a spring seat 30 supported by the threaded stem 19 in the U-shaped member 18 and a spring seat 31 at the upper end of said spring. The spring seat 30 is provided with a conical portion which contacts with the conical end of the threaded stem so that said spring seat will always be properly aligned with respect to the spring 29. Arranged within the internally threaded opening 6 in the top wall of the diaphragm cover 3 is a hand-operated screw 32, the lower end of which contacts with the spring seat 31. The screw 32 is provided with a conical lower end portion which contacts with the walls of a conical depression in the spring seat 31 whereby said spring seat 31 may also be properly aligned with respect to the spring 29.

The lower end of the U-shaped member 25 is provided with an extension 33 which projects into a recess formed in the cap 7, and interposed between the bottom wall of said U-shaped member 25 and the bottom wall of said cap 7 is a coil spring 34.

The spring 29 tends to force the head 24 away from the valve seat member 11, and the fluid pressure in the diaphragm chamber tends to force said head into engagement with said valve seat member. Fluid passing from the high pressure member H flows through the inlet passageway 10 through the ported valve seat member 11 and into the diaphragm chamber by passing upwardly on either side of the bridge member 8. The fluid escapes from the diaphragm chamber through the discharge passageway 13 which communicates with the low pressure pipe L. When the pressure in the diaphragm chamber rises to a predetermined degree, the diaphragm is deflected with the result of compressing the spring 29 and moving the head 24 into engagement with the flat bottom face of the ported valve seat member 11. This closes communication between the inlet and discharge passageways, and when the pressure drops to a predetermined degree the head 24 recedes in response to the pressure of the spring 29. The pressure of the spring 29 is opposed by the fluid pressure on the diaphragm and the head reciprocates in response to these counteracting pressures so that the pressure in the low pressure pipe is maintained at a predetermined degree. The downward movement of the head 24 is resisted by the light spring 34 which serves as a shock absorber and insures contact between the head 24 and the valve seat member

11, when the pressure of the spring 29 has been greatly reduced by the hand-operated screw 32 being unscrewed.

A high pressure gage 35 is attached to a member 36 having a passageway which communicates with the inlet passageway 10. 37 designates a low pressure gage associated with the low pressure pipe.

In the use of reducing valves such as that disclosed in the present application, it frequently happens that an inexperienced person will screw the hand-operated screw 32 downwardly until the head 24 has been separated from the bottom face of the valve seat member 11. The valve controlling the passage of high pressure fluid into the valve housing will then be opened and the fluid under very high pressure will be permitted to rush into the valve chamber 2 and from there into the diaphragm chamber 1 where the diaphragm will be violently deflected, whereby the head 24 is drawn with much force against the lower face of the valve seat member 11, thus frequently shattering the seat 28. Our improved reducing valve is provided with means for preventing the occurrence of the injury suggested above, and this means will now be described.

Arranged within the port 12 in the valve seat member 11 is a vertically operated valve comprising a valve stem 38 provided at its upper end with a valve head 39. The valve stem 38 is provided with a pair of guide members 40 which may be secured to or integrally formed on said stem. The guide members 40 are of such size as to be capable of sliding vertically within the port of said valve seat member, the outer edges of said guide members contacting with the wall of said port. Arranged at the upper end of the port within the valve seat member 11 is a valve seat 41 which is adapted to be engaged by the valve head 39. Located above the valve head 39 is a coil spring 42 which is so arranged that it will exert a downward pressure against the valve head. Formed through the valve head 39 is a bleeding port 43. The lower end of the valve stem 38 is provided with an outwardly flaring portion 38' which is intended for a purpose to be hereinafter set forth.

Assume in the operation of our improved valve that, as already suggested, an inexperienced person causes the head 24 to be withdrawn from the lower face of the valve seat member 11, and said person then opens the valve controlling the flow of high pressure fluid to the valve housing. When the head 24 moved downwardly away from the bottom face of the valve seat member, the valve stem 38 moved a corresponding distance downwardly due to the fact that the lower end of said valve stem is forced firmly against the head by the spring 42 and said spring is exerting a downward pressure on

said valve head 39. It is apparent therefore that if this inexperienced person moved the head 24 a sufficient distance downwardly the valve head 39 would rest upon the valve seat 41, as shown in Fig. III, and thus interfere with the passage of fluid through the valve seat member 11. Some of the fluid, however, would pass through the bleeding port 43 and this fluid would pass through the valve chamber 2 into the diaphragm chamber 1; where its pressure would be gradually increased by the incoming fluid until the pressure within said diaphragm chamber is sufficient to deflect the diaphragm. Upon the movement of the diaphragm 14 the head 24 will be drawn toward the lower face of the valve seat member 11, thus causing the valve stem 38 to be moved upwardly and the valve head 39 to be raised off of the valve seat 41. In view of the foregoing it is plain that instead of the fluid being permitted to rush into the valve housing and violently operate the moving parts of the valve, said fluid is compelled to gradually build up pressure within said valve housing whereby said working parts of said valve are gently operated.

If the head 24 has not been moved a sufficient distance away from the lower face of the valve seat member 11 to cause the valve head 39 to be seated on the valve seat 41, the action will be the same as just explained for it is apparent that the fluid will be compelled to pass through the restricted opening between the valve head 39 and the valve seat 41, thus rendering it necessary that said fluid gradually build up pressure within the diaphragm chamber before the diaphragm may be deflected.

The lower end of the valve stem 38 is flared, as shown most clearly in Fig. III. This flared end of the valve stem co-operates with the wall of the port formed through the valve seat member 11 in such manner as to choke the flow of fluid through said port when said valve stem is in the position shown in Figs. I and III, and to provide an opening which gradually increases in size as the head 24 moves away from the lower face of the valve seat member 11.

To permit the escape of fluid in the event that the diaphragm 14 is broken we provide the diaphragm cover 3 with a plurality of apertures 45.

To insure successful operation of our improved reducing valve the upper face of the seat 28 should be in perfect horizontal alinement with the lower face of the valve seat member 11. This alinement is obtained in the following manner:

The bolt 27 is unscrewed so that the friction between the legs of the U-shaped member 25 and the head 24 is reduced. This will permit the head 24 to move slightly about the bolt 27 due to the fact that there

is a slight space between the lower face of said head 24 and the adjacent face 25' of the U-shaped member 25. The pressure of the conical coil spring is then greatly reduced by unscrewing the screw 32 whereby the spring 34 will be permitted to move the top face of the head 24 against the lower end of the valve seat member 11. The contact between the head 24 and the valve seat member 11 will cause said head to be moved about the bolt 27 until the contacting faces of said head and said valve seat member are in perfect alinement after which the bolt 27 may be screwed inwardly to grip said head 24 firmly in place.

Heretofore reducing valves of the type disclosed herein have been connected to a tank by having a rigid tube screwed directly into the housing, the opposite end of said tube being attached to the tank. Quite frequently it happened that the tank would topple over and as this tube was the weakest part of the structure said tube would be broken. It often happened that the tube mentioned above would be broken at a point very close to the housing of the valve and it was a difficult task to remove that portion of the tube which was screwed into the housing. To eliminate the difficulty mentioned above we employ the socket 9. This member 9 is provided with a threaded portion 9' which is screwed into the valve housing and an internally threaded opening adapted to receive an end of the member H. With this arrangement, in the event the member H is broken at a point close to the member 9 said member 9 is removed from the housing and a new member 9, member H and coupling member H' are applied to the housing.

It is, of course, necessary that the coupling member H' rotate relative to the member H so that said coupling member may be screwed on a suitable nipple on the tank to which the reducing valve is attached and to insure the free rotation of said coupling member with a minimum of friction, we employ a steel washer 50 which is interposed between an annular flange 51 on the member H and the inwardly extending annular flange 52 on the coupling member H'.

We claim:

1. A reducing valve comprising a housing having inlet and discharge passageways, means associated with said inlet passageway provided with a port formed therethrough, a diaphragm secured within said housing, a closure member, said closure member being adapted to close communication between said passageways, and means whereby the passage of fluid through said inlet passageway may be controlled when said closure member is in an open position, the last mentioned means comprising valve mechanism including a valve head, a valve stem on which said valve

head is mounted, said stem being located within the port in said means associated with said inlet passageway, a valve seat, said valve stem being of less diameter than the port in which it is located and said stem being in contact with said closure member so that said valve head and said closure member move simultaneously and guiding means within the port in which said valve stem is located for guiding said valve stem.

2. A reducing valve comprising a housing having an inlet passageway and a discharge passageway, and an automatic valve device for opening and closing communication between said passageways, said valve device including a ported abutment member and a closure member, and means whereby the passage of fluid through said ported abutment member may be controlled when said closure member is in an open position, said last mentioned means comprising valve mechanism including a valve head, a valve stem on which said valve head is mounted located within the port in said abutment member, guide members within said ported abutment member for guiding said valve stem, a valve seat, and a spring associated with said valve head and arranged to urge said valve head against said valve seat, said valve stem being in contact with said closure member so that said valve head and said closure member move simultaneously.

3. A reducing valve comprising a housing having an inlet passageway and a discharge passageway, and an automatic valve device for opening and closing communication between said passageways, said valve device including an abutment member having a port formed therethrough and a closure member, and means whereby the passage of fluid through the port formed in said abutment member may be controlled when said closure member is in an open position, said last mentioned means comprising valve mechanism including a valve head, a valve stem on which said valve head is mounted, guide members secured to said valve stem and adapted to contact with the wall of the port in said abutment member, a valve seat, and a spring associated with said valve head and arranged to urge said valve head against said valve seat, said valve stem having a flared lower end portion which contacts with said closure member whereby said valve head and said closure member move simultaneously.

4. A reducing valve comprising a housing having inlet and discharge passageways, a diaphragm secured within said housing, a closure member, said closure member being adapted to close communication between said passageways, means for securing said closure member to said diaphragm, and means whereby the passage of fluid through the inlet passageway may be controlled, said means

including a member having a restricted port formed therethrough through which fluid is permitted to pass when said member is in a closed position.

5 5. A reducing valve comprising a housing having inlet and discharge passageways, a diaphragm secured within said housing, a closure member, said closure member being adapted to close communication between said
10 passageways, means for securing said closure member to said diaphragm, and means whereby the passage of fluid through said inlet passageway may be controlled when said closure member is in an open position,
15 said last mentioned means comprising valve mechanism including a valve head, a valve stem on which said valve head is mounted, a valve seat, and a spring associated with said valve head and arranged to urge said valve
20 head against said valve seat, said valve stem being in contact with said closure member so that said valve head and said closure member move simultaneously, and said valve head being provided with a restricted port formed
25 therethrough through which fluid is permitted to pass when said valve head is in a closed position.

6. A reducing valve comprising a housing having inlet and discharge passageways, a
30 diaphragm secured within said housing, a closure member, said closure member being adapted to close communication between said passageways, means for securing said closure member to said diaphragm, said diaphragm being operable in response to fluid
35 pressure on one side thereof, a spring arranged adjacent to said diaphragm and adapted to oppose the pressure exerted against said diaphragm by the fluid, seats
40 for said spring, means associated with said seats whereby said seats are alined with said spring, and means whereby the passage of fluid through said inlet passageway may be controlled when said closure member is in
45 an open position, said last mentioned means comprising valve mechanism including a valve head, a valve stem on which said valve head is mounted, a valve seat, and a spring associated with said valve head and arranged
50 to urge said valve head against said valve seat, said valve stem being in contact with said closure member so that said valve head and said closure member move simultaneously.

55 7. A reducing valve comprising a housing having inlet and discharge passageways, a diaphragm secured within said housing, a closure member, a member provided with a seat with which said closure member con-
60 tacts to close communication between said

inlet and discharge passageways, a U-shaped member for connecting said closure member to said diaphragm, said closure member being located between the downwardly extending legs of said U-shaped member, a
65 threaded pivot extended through the legs of said U-shaped member and through said closure member, said closure member being movable about said threaded pivot whereby said closure member may be alined with the
70 seat with which it contacts, and said threaded pivot being capable of drawing the legs of said U-shaped member together to clamp said closure member in a fixed position.

8. A reducing valve comprising a housing
75 having inlet and discharge passageways, a diaphragm secured within said housing, a closure member, a member provided with a seat with which said closure member contacts to close communication between said
80 inlet and discharge passageways, a U-shaped member for connecting said closure member to said diaphragm, a second U-shaped member located between the downwardly extending legs of said first mentioned U-
85 shaped member, said closure member being located between the upwardly extending legs of said second mentioned U-shaped member, a threaded pivot extended through the legs of said U-shaped members and through said
90 closure member, said closure member being movable about said threaded pivot whereby said closure member may be alined horizontally with the seat with which it contacts and said threaded pivot being capable of
95 drawing the legs of said U-shaped member inwardly to clamp said closure member in a fixed position, and an extension on said second mentioned U-shaped member which extends into a recess formed on the housing
100 of the reducing valve whereby the closure may be alined vertically with respect to the member with which it contacts.

9. A reducing valve comprising a housing having inlet and discharge passageways, a
105 diaphragm secured within said housing, a closure member, said closure member being adapted to close communication between said passageways, means for securing said closure member to said diaphragm, and
110 means whereby the passage of fluid through the inlet passageway may be controlled when said closure member is in an open position, said means including a valve which is so arranged that fluid is permitted to leak by
115 said valve when it is in a closed position.

In testimony that we claim the foregoing we hereunto affix our signatures.

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