Jan. 9, 1951 D. S. WILLSON 2,537,869

FLUID DISPENSING APPARATUS

Filed June 30, 1944 2 Sheets-Sheet 1

FIG. I

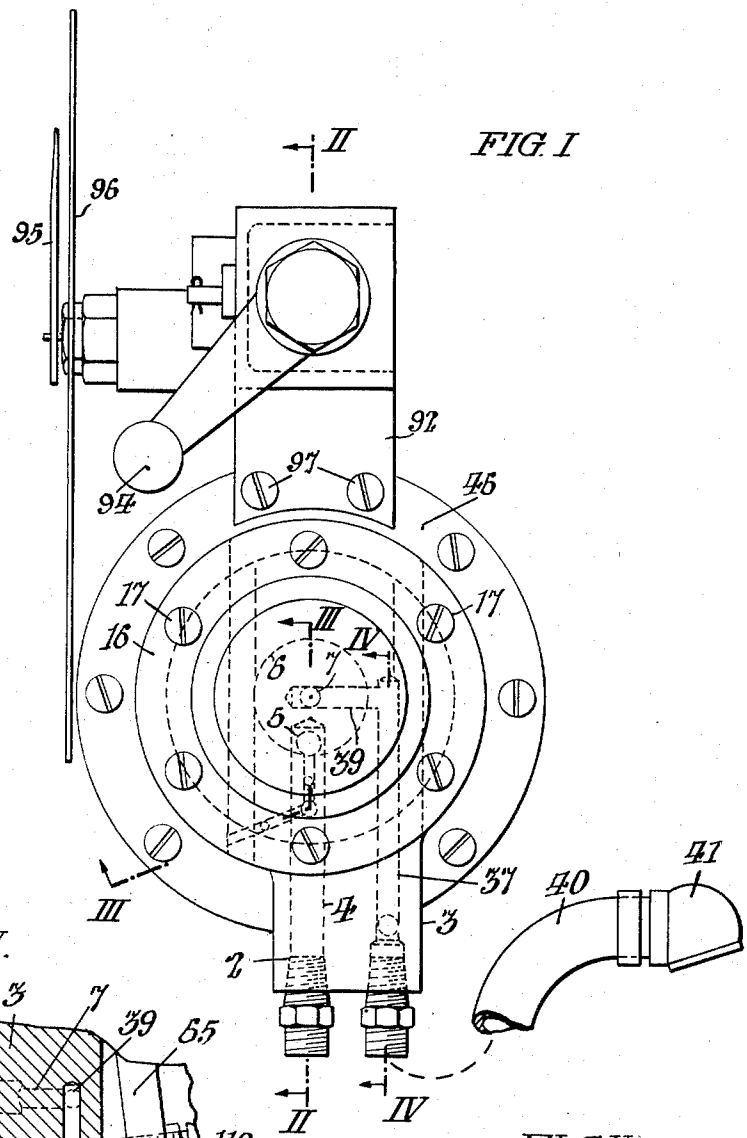


FIG. IV.

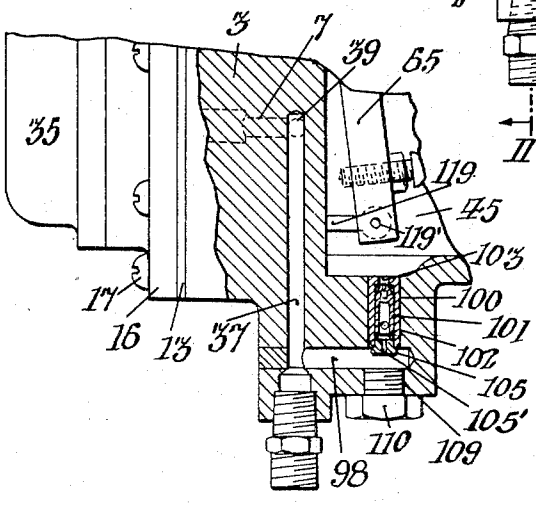
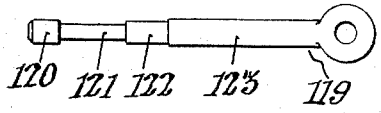


FIG. V.



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Jan. 9, 1951 D. S. WILLSON 2,537,869

FLUID DISPENSING APPARATUS

Filed June 30, 1944 2 Sheets-Sheet 2

FIG. II.

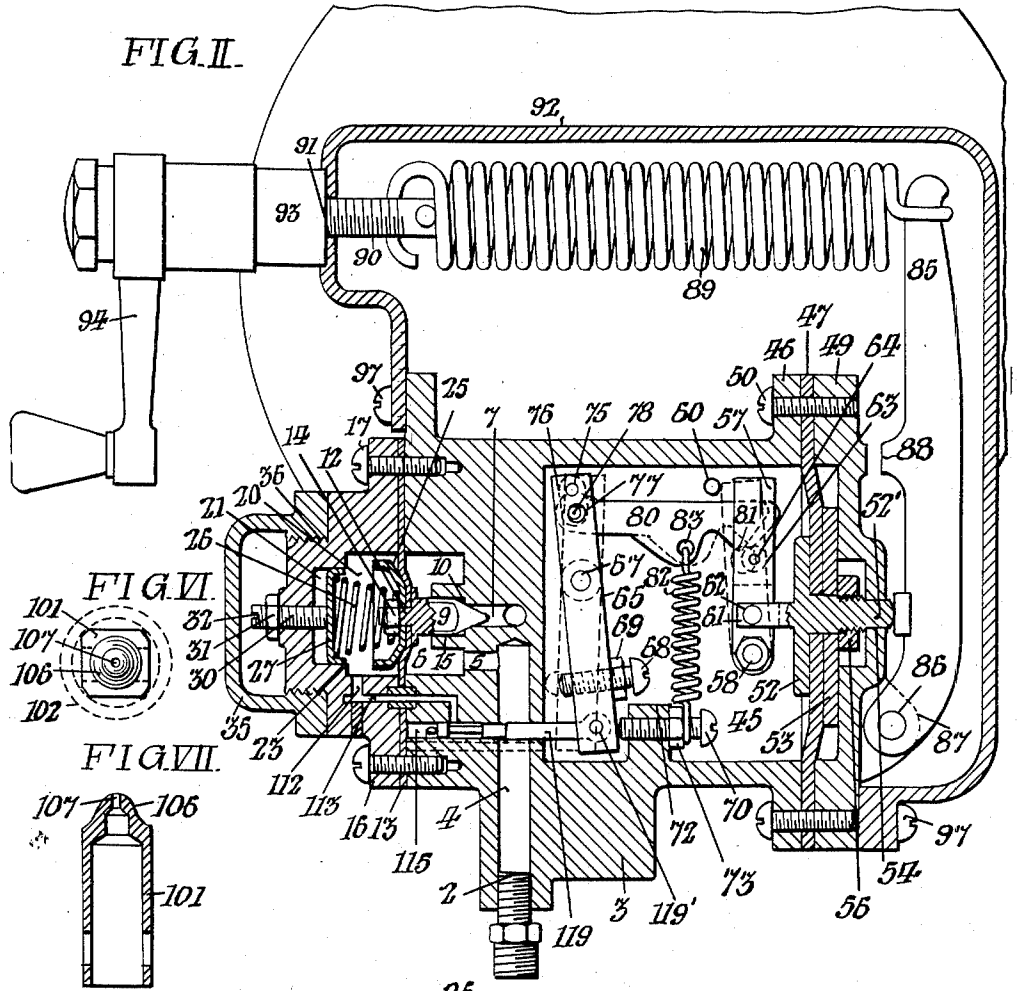


FIG. VI.

FIG. VII.

FIG. VIII.

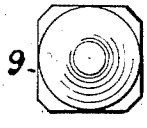


FIG. IX.

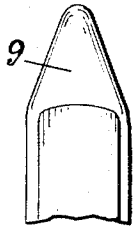
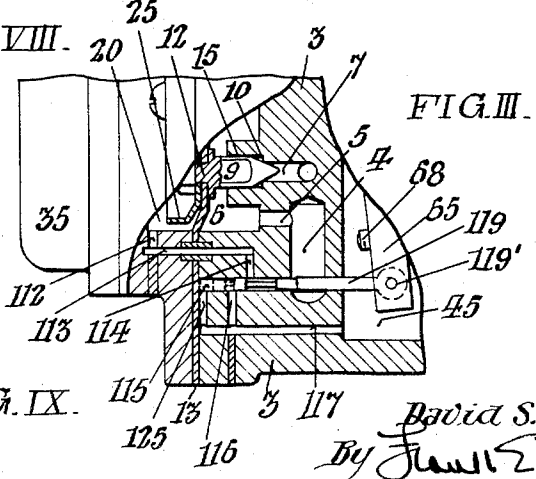


FIG. III.



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UNITED STATES PATENT OFFICE

2,537,869

FLUID DISPENSING APPARATUS

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Application June 30, 1944, Serial No. 543,019

8 Claims. (Cl. 50—5)

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My invention relates to devices for controlling the delivery of air under pressure in pulsations from a source of supply of compressed air to a receiver, for example, to an automobile tire. My invention includes means to variably predetermine the pressure to which the receiver is to be inflated and to automatically shut off the delivery of air to the receiver when the pressure in the receiver reaches the predetermined pressure. My invention relates to apparatus of the general type shown in Letters Patent of the United States No. 2,307,314 granted to me January 5, 1943, for improvement in Fluid Dispensing Apparatus.

One feature of my invention is that in my improved device a single valve having sections of different diameters performs the dual functions of the adjustable needle valve and the inflating control valve in devices of the general type disclosed in my Patent No. 2,307,314.

Another feature of my invention is that my improved valve structure so controls the air that at no time is it free to bypass directly from the inlet side of the inflating device to the outlet passages.

Aother feature of my invention is that my improved valve structure is operatively connected to the snap-action mechanism of the device.

My invention includes the various novel features of construction and arrangement hereinafter more definitely specified.

Fig. I is an end elevation of a tire inflating device embodying my invention.

Fig. II is a vertical sectional view, partly in elevation, of the structure shown in Fig. I, taken on the lines II—II in Fig. I.

Fig. III is a fragmentary vertical sectional view taken on the lines III—III in Fig. I.

Fig. IV is a fragmentary vertical sectional view taken on the lines IV—IV in Fig. I.

Fig. V is an enlarged view of the inflating control valve shown in Figs. II and III.

Fig. VI is an enlarged plan view of the check and timer valve shown in Fig. IV.

Fig. VII is a vertical sectional view of the check and timer valve shown in Fig. VI.

Fig. VIII is an enlarged plan view of the main valve shown in Figs. II and III.

Fig. IX is a fragmentary elevation of the valve shown in Fig. VIII.

Referring to said drawings; a source of air under high pressure, say 125 to 150 pounds per square inch is connected by suitable piping and fittings to the screw threaded air inlet port 2 formed in the body casing 3 of my improved tire

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inflator. The air inlet port 2 is in communication with the air passageway 4 which is in communication with the air passageway 5 leading to the chamber 6. The chamber 6 is provided with the air outlet passageway 7 under control of the main valve 9 which is arranged to control communication between said chamber 6 and outlet passageway 7. Communication between said chamber 6 and passageway 7 is shut off by a seating of the valve 9 on its valve seat 10 formed at the left-hand end of said passageway 7, as viewed in Fig. II.

The valve 9 is provided with a reduced screw threaded stem portion 12 which extends through an opening formed in the spring loaded diaphragm 13. The valve 9 is rigidly fastened to and carried by said diaphragm 13 by means of the nut 14 which engages the screw threaded stem 12 of the valve 9. Flexing of the diaphragm 13, as hereinafter described, moves the valve 9 in its guide way 15 which affords communication between the passageway 7 and chamber 6.

The outer portion of the diaphragm 13 is clamped between the casing 3 and the main valve cover 16, conveniently by a series of screws 17 which extend through matching holes in the cover 16 and diaphragm 13 into engagement with screw threaded openings formed in said casing 3. The chamber 6 provided in the casing 3 permits flexing movement of that portion of the diaphragm 13 extending across the left-hand end of said chamber 6, as viewed in Fig. II.

The main valve cover 16 is provided with the axially aligned annular recesses 20 and 21, the latter being smaller in diameter than the recess 20, thus forming the shoulder 23 which acts as an abutment to limit the movement to the left, as viewed in Fig. II, of the stop plate 25. Said stop plate 25 is carried by the screw threaded valve stem 12 and rigidly mounted thereon between the diaphragm 13 and nut 14, by means of which the valve 9 is rigidly fastened to said diaphragm 13.

Said diaphragm 13 is spring loaded by means of the coiled spring 26 located in the annular recesses 20 and 21. The right-hand end of said spring 26 is seated on the stop plate 25, connected to said diaphragm 13, and the opposite end of said spring 26 is seated in the disc 27 which is positioned in said recess 21, with the walls of said recess 21 acting as a guide for said disc 27. Said spring 26 is arranged to be adjusted manually by means of the adjusting screw 30, the right-hand portion of which extends through a screw threaded opening formed

in the main valve cover 16 and into engagement with the left-hand side of the disc 27. Said adjusting screw 30 is locked in adjusted position by means of the lock nut 31, and the outer end of said screw 30 is provided with the slot 32 for conveniently effecting adjusting movement of said screw.

The main valve cover 16 is protected conveniently by means of the cap 35 which is in screw threaded engagement at 36 with the screw thread formed on the reduced left-hand end portion of said main valve cover 16.

As best shown in Figs. I and IV, the air outlet passageway 7 is in open communication with the air outlet port 37 through the open connecting passage 38. The outer end of the outlet port 37 is screw threaded for connection by convenient means to the dispensing hose 40 which carries at its distal end an air chuck 41 of the well known conventional type, including a valve which is maintained closed by air pressure in the hose 40 and which valve is adapted to be opened by the operator pressing the chuck against the ordinary valve stem of an automobile tire.

As best shown in Fig. II, the casing 3 has formed therein the main diaphragm chamber 45. The right-hand end of said casing 3 is provided with the circular flange 46. The outer portion of the main diaphragm 47 is clamped between the flange 46 and the diaphragm chamber closure cover 49, conveniently by means of a series of screws 50 which extend through matching holes in said flange 46 and diaphragm 47 into engagement with screw threaded openings formed in said cover 49. The reciprocatory diaphragm follower plate assembly includes the pressure disc 52, and the follower plate disc 53 which is interposed between the diaphragm 47 and the diaphragm chamber cover 49. Said diaphragm follower plate assembly includes the axial stud 52' in integral relation with the pressure disc 52, and said axial stud 52' extends through the bearing guide 54 formed in the cover plate 49. Said pressure disc 52 and follower plate 53 are maintained on opposite sides of the diaphragm 47, and in rigid relationship therewith, by means of the nut 56 in engagement with the screw threaded portion of the stud 52'.

The roller lever 57 is pivotally mounted in the diaphragm chamber 45 on the pivot 58. Said roller lever 57 has the limits of its counterclockwise movement on its pivot 58 fixed by means of the stop stud 60. Said pressure disc 52 is provided with the reduced stem portion 61 which is pivotally connected at 62 with the roller lever 57. Accordingly, clockwise movement of the roller lever 57 is limited by the disc 53 coming into engagement with the diaphragm chamber cover 49.

The upper end of the roller lever 57 is bifurcated and carries between its bifurcated arms the roller 63 which is mounted with freedom of rotation on the pin 64, the opposite ends of which are fixed in the bifurcated portion of the roller lever 57.

The lever 65 is pivotally mounted in the diaphragm chamber 45 on the pivot 67. Said lever 65 is provided with the adjustable stop screw 68 rigidly connected with the lever 65 by means of the nut 69. Clockwise movement of the lever 65 is limited by the left-hand end of the stop screw 68 coming into engagement with the side wall of said diaphragm chamber 45, as indicated in dotted lines in Fig. II. Counter-clockwise movement of the lever 65 is limited by the lower end

of the lever 65 coming into engagement with the left-hand end of the adjustable stop screw 70 which is in screw threaded engagement with a screw threaded opening in the projection 72 of the casing 3. Said screw 70 is maintained in adjusted position by means of its lock nut 73.

Pivoted to the upper end of the lever 65, as at 75, are a pair of links 76, only one of which is shown, and the lever 65 is provided with the hole 77. The pin 78, of substantially smaller diameter than the hole 77, is pivoted to the arm 80 and projects through said hole 77, the periphery of which acts as a stop for limiting the pivotal movement of the links 76.

The right hand end of the arm 80 extends through the opening formed by the bifurcated arms of the roller lever 57. The lower right-hand end of the arm 80 is provided with the V-shaped point 81 which is arranged to co-act with the roller 63 carried by the roller lever 57. The spring 82 is fastened at its upper end to the arm 80, through an opening 83 in said arm 80. The lower end of said spring 82 encircles and engages the screw 70 fixed in the projection 72 extending into the diaphragm chamber 45. The spring 82 yieldingly holds the arm 80 in engagement with the roller 63, and also moves the arm 80 lengthwise as provided for by the structure and mounting of the links 76, as is hereinafter described.

The snap action linkage mechanism including the roller lever 57, lever 65, links 76, arm 80, etc., is of the same general construction as disclosed in my co-pending application Serial No. 536,497, and such linkage connection is old in the art and described in detail in Penn Patent No. Re. 19,201 dated June 5, 1934.

The lever 85 which is fulcrumed on the shaft 86 in bearings 87 (only one of which is shown in Fig. II) formed on the cover closure 49, is in cooperating relation at its lower end with the axial stud 52' of the diaphragm follower plate assembly. Counter-clockwise movement of the lever 85 is limited by the projection 88 of the lever 85 coming into engagement with the cover 49. The upper end of said lever 85 is connected with the right-hand end of the spring 89. The left-hand end of the spring 89 is connected with the screw bolt shaft 90 which extends through an opening 91 in the outer casing 92 and is engaged by the tubular screw threaded sleeve 93 provided at its outer end with the crank handle 94.

Tension of the spring 89 may be increased or decreased by rotation of the crank handle 94. That is to say, the stress of the spring 89 may be increased by turning said crank 94 clockwise, or decreased by turning said crank 94 counter-clockwise. I find it convenient to connect said screw bolt shaft 90 with indicating means for indicating in pounds by means of a pointer 95 and dial 96, the pressure of fluid to be dispensed for which said spring 89 is adjusted. Any convenient means may be used for connecting the pointer 95 with the shaft 90, for example, such means as are disclosed in detail in Manson Patent Re. 18,483. The outer casing 92 is rigidly secured to the casing 3 conveniently by means of the screws 97.

As shown in Fig. IV; the air outlet port passageway 37 is in continuous direct communication with the lateral passageway 98 which has the vertical branch passageway 100 in which is located the check and timer valve 101. Said check and timer valve 101 is rectangular in cross

section and mounted with freedom of reciprocatory movement in the circular tube bearing 102 which is pushfitted into the vertical branch passageway 100. The upper end of said tube bearing 102 is closed except for the restricted axial opening 103, which opens into the diaphragm chamber 45. The lower end of said tube bearing 102 is closed by the plug 105 which has the restricted axial opening 105' therethrough.

As best shown in Fig. VII on an enlarged scale; the check and timer valve 101 is hollow and open at its lower end and has a rounded upper end portion 106 which is closed except for an axial restricted bleed opening 107 therethrough to afford continuous restricted communication between the diaphragm chamber 45 and the lateral passageway 98 when said rounded upper end 106 of the check and timer valve 101 is seated against the restricted co-axial opening 103 of the tube bearing 102. Said timer valve 101, tube bearing 102 and plug 105 are assembled in the branch passageway 100 through the screw threaded opening 109 formed in the casing 3 and thereafter said opening 109 is closed by means of the screw threaded plug 110.

As best shown in Figs. III and II; communication between the chamber recesses 20 and 21, formed at the left-hand side of the diaphragm 13, and main diaphragm chamber 45 is arranged to be effected through the communicating air passageways 112, 113, 114, 115, 116 and 117. The inflating control valve 119 is pivotally connected at 119' to the lower end of the lever 65, and said valve 119 is mounted with freedom of reciprocatory motion in the air passageway 115 which acts as a bearing guideway for said valve.

As best shown in Fig. V; the valve 119 has at the left-hand end thereof the enlarged portion 120; the intermediate reduced diameter portions 121 and 122; and the enlarged portion 123 at the right-hand end. The reduced portion 121 is of smallest diameter, and the reduced portion 122 is of larger diameter than the reduced portion 121, but said portion 122 is of smaller diameter than the enlarged portions 120 and 123. The enlarged portions 120 and 123 are of the same diameter.

The enlarged portions 120 and 123 of the valve 119 fit the air passageway 115 closely so as to effectually prevent passage of air around and between the enlarged portions 120 and 123 and the passageway 115. Of course, the portions 120 and 123 are of slightly less diameter than the diameter of the passageway 115 so as to permit reciprocatory movement of the valve 119 in the passageway 115.

When the valve 119 is in the position shown in full lines in Fig. III, communication between the recess chambers 20 and 21 (at the left-hand side of the diaphragm 13) and the chamber 6 (at the right-hand side of the diaphragm 13) is effected through the communicating passageways 112, 113, 114, around the reduced portions 121 and 122 in the passageway 115, passageway 4, passageway 5 to the chamber 6. When the valve 119 is in the position shown in dotted lines in Fig. III, communication between the recess chambers 20 and 21 (at the left-hand side of the chamber 13) and the main diaphragm chamber 45 is effected through the communicating passageways 112, 113, 114, around the reduced portion 121, in the passageway 115, passageway 116 and passageway 117 leading into said main diaphragm chamber 45.

When the valve 119 is in the position as shown in full lines in Fig. III, the enlarged portion 120 of the valve 119 effectively cuts off passage of air between the passageways 114 and 116. When the valve is in the position indicated in dotted lines in Fig. III, the enlarged portion 123 of the valve 119 effectively cuts off passage of air between the passageways 114 and 4.

I find it convenient to provide a communicating passageway 125 between the left-hand ends of the passageways 115 and 117 to prevent the valve 119 from trapping and compressing air in the left-hand end of the passageway 115, as such trapped and compressed air might prevent the free movement of the valve 119 through its full stroke operation.

Operation

My improved tire inflating apparatus operates as follows:

At the end of a preceding inflating operation after a tire has been filled with air to the set pressure, the lever 85 is in the position shown in Fig. II, with the diaphragm 47 moved to the right, as shown. The snap action mechanism and the valve 119, pivotally connected to the lower end of the lever 65, are in the position shown in full lines in Fig. II. With the valve 119 in the position as shown in Fig. II, the chambers 20 and 21 at the left-hand side of the diaphragm 13 are in communication with the inlet passageway 4, which is continuously openly connected to the source of air under high pressure. Such communication is effected through the passageways 112, 113, 114, passageway 115 around the reduced portions 121 and 122 of the valve 119, and to the passageway 4. Said passageway 4 is in continuous open communication, through the open passageway 5, with the chamber 6 at the right-hand side of the diaphragm 13. Air pressure being equalized on opposite sides of the diaphragm 13, the main valve 9 is maintained closed by the effective forces of the spring 26 and said main valve 9 and diaphragm 13 are in the position shown in Fig. II. Soon after the end of a cycle of operation, the check and timer valve 101 drops by gravity from the position shown in Fig. IV to a position in which the lower end of the valve 101 is resting on the upper surface of the plug 105.

Assuming that it is desired to inflate an automobile tire to a pressure of 30 pounds per square inch, the operator turns the crank 94 to move the indicating pointer 95 to the numeral "30" appearing on the face of the dial 96. The operator then presses the air chuck 41 upon the stem of the automobile tire which opens the tire valve and likewise moves the valve in the air chuck to open position against the air pressure in the hose 40. If the pressure in the tire is below the set pressure of 30 pounds, the air under high pressure in the hose 40, air passageways 37 and 98, and diaphragm chamber 45 tends to equalize with the pressure in the tire, thereby reducing the pressure in the chamber 45. Air flows comparatively rapidly and freely from the diaphragm chamber 45 through the opening 103, through and around the timer and check valve 101, through the axial opening 105' to the air passageway 98 and thence through the passageway 37, hose 40, etc., to the tire.

When the air pressure in the diaphragm chamber 45 is reduced to a point where such pressure no longer can overcome the effective forces of the spring 89, the spring 89 moves the lever 85 counter-clockwise on its pivot 86. Such counter-clockwise movement of the lever 85 moves the axial stud 52' and pressure disc 52 etc. to the left,

The pressure disc 52 being pivotally connected to the roller lever 57, such movement to the left causes the roller lever 57 to be moved counter-clockwise about its pivot 58. Counter-clockwise movement of the roller lever 57 moves the roller 63 beneath the crest of the V-point 81 of the arm 80. As the roller 63 passes beneath the crest of the V-point 81, the spring 82 causes the arm 80 to move downwardly and to the right with a snap action, and the roller lever 57 and arm 80 are moved from the position shown in full lines to the position shown in dotted lines in Fig. II. Such snap action movement is transmitted to the arm 65 through the links 76 and pin 78, thus causing the lever 65 to be moved clockwise from the position shown in full lines to the position shown in dotted lines in Fig. II. Clockwise movement of the lever 65 is limited by the stop screw 68 coming into engagement with the side wall of the casing 45. The snap action linkage connection above described is old in the art and disclosed in detail in Penn Patent No. Re. 19,201.

An emergency stop stud 60 has been provided in the casing 45 for engagement with the upper left-hand corner of the roller lever 57 to prevent any collapsing of the mechanism which might occur if there was no air pressure inside the diaphragm chamber 45, in which case, the arm 80 with its spring load on the roller 63 might pull the diaphragm 47 to an abnormal far position to the left. Accordingly, counter-clockwise movement of the lever 57 would be arrested by the upper end of the lever 57 coming into engagement with the stop stud 60 only when there is a small amount of pressure or no pressure in the diaphragm chamber 45.

Such snap action movement of the lever 65 from the position shown in full lines in Fig. II to the position shown in dotted lines therein causes snap movement of the valve 119 in the air passageway 115 from the position shown in full lines in Fig. III to the position indicated in dotted lines. When the valve 119 is moved to the position indicated in dotted lines in Fig. III, the reduced portion 121 of the valve 119 is so positioned in the air passageway 115 as to permit the passage of air between the passageways 114 and 116. With communication between the passageways 114 and 116 opened, air flows from the chambers 20 and 21 through the air passageways 112, 113, 114, passageway 115 around the reduced portion 121, passageway 116 and passageway 117 to the main diaphragm chamber 45. Such reduction of pressure in the chambers 20 and 21, at the left-hand side of the diaphragm 13, results in the high pressure in the chamber 6, at the opposite side of the diaphragm 13, overbalancing the effective forces of the spring 26 and causes the valve 9 to be opened wide.

When the main valve 9 is opened, air under high pressure from the source flows through the air inlet port 2, passageway 4, chamber 6, past the open valve 9, to the air outlet passageway 7, and thence through the passageway 39 to the air outlet port 37, dispensing hose 40 and open air chuck 41 to the open valve stem of the automobile tire. The air under high pressure also simultaneously flows through the lateral passageway 98, opening 105' in the plug 105, and causes the check and timer valve 101 to be moved upwardly with its rounded end portion 106 seated against the upper end of the bearing tube 102. A restricted amount of high pressure air passes through the bleed opening 107 in the check and timer valve 101 and through the co-axial opening 103 in the tube bearing 102 into the main diaphragm chamber 45.

Because the air under high pressure is admitted slowly to the diaphragm chamber 45 through the restricted openings 105', 107, and 103, approximately one or two pounds of air is supplied to the tire before the pressure in the diaphragm chamber 45 becomes great enough to cause the diaphragm 47 to move to the right to the position shown in Fig. II against the tension of the spring 99. When the diaphragm 47 moves to the right to the position shown in Fig. II, such movement causes the roller lever 57 to be moved clockwise, thus moving the roller 63 down the left-inclined face of the arm 80 and past the crest of the V-point 81. As the roller moves past the crest of the V-point 81, the spring 82 moves the arm 80 to the left with a snap action, which snap action movement, through the linkage 76 and pin 78, is transmitted to the lever 65, causing said lever 65 to be snapped counter-clockwise from the position shown in dotted lines in Fig. II to the position shown in full lines. Counter-clockwise movement of the lever 65 is limited by the lower end of the lever 65 coming into engagement with the left-hand end of the stop screw 70.

Such counter-clockwise movement of the lever 65 moves the valve 119 from the position shown in dotted lines in Fig. III to the position shown in full lines. When the valve 119 is moved to the position shown in full lines, the enlarged portion 120 is positioned in the passageway 115 between the passageways 114 and 116, thereby effectually cutting off passage of air between said passageways 114 and 116. Communication is again effected between the chambers 20 and 21 and the inlet passageway 4 which, as stated above, is continuously openly connected to the source of air under high pressure. Such communication is effected through the passageways 112, 113, 114, passageway 115 around the reduced portions 121 and 122 of the valve 119, and to the passageway 4. When the high pressure air, passing comparatively slowly from the passageway 4 to the chambers 20 and 21, has increased the pressure in the chambers 20 and 21 to a value approaching that of the pressure of air in the chamber 6, the effective forces of the spring 26 begin to move the valve 9 toward closed position, and when the pressures in the chambers 20 and 21 and chamber 6, on opposite sides of the diaphragm 13, are nearly equalized, the valve 9 is seated. The inlet air pressure on the area of the valve 9 then adds to the force of the spring 26 to maintain the valve 9 in closed position.

The pressure of air in the diaphragm chamber 45 again tends to equalize with the pressure in the tire, or receiver, by flowing through the passageways 103, 107, 105', 98, 37, hose 40, etc., as described above, and if the pressure in the receiver has not yet reached that to which the device is set, the effective forces of the spring 99 will again move the lever 65 counter-clockwise to again move the diaphragm 47 to the left which again causes an opening of the main valve 9 to allow another surge of air to flow to the receiver, as described above.

However, when the pressure in the receiver reaches the pressure for which the device is adjusted, the pressure in the diaphragm chamber 45 is sufficient to retain the lever 65 in the position shown in full lines in Fig. II and in which the diaphragm 47 is moved to the right, and, accordingly, the main valve 9 remains closed. Thereupon, the operator removes the air chuck 41

from the stem of the tire and the air under high pressure in the hose 40 holds the valve of the air chuck closed. Of course, when the air chuck is removed from the valve stem of the automobile tire, the spring of the valve therein moves that valve to closed position and retains the desired set pressure of air in the tire.

It is obvious that various modifications may be made in my invention without departing from the essential features thereof as defined in the appended claims and, therefore, I do not desire to limit myself to the precise details of construction and arrangement hereinabove set forth.

I claim:

1. In fluid dispensing apparatus; the combination of a first conduit adapted for connection with a source of fluid under pressure; a second conduit adapted for connection with a receiver; a diaphragm; a main valve, carried by said diaphragm, between said first and second conduits; a first diaphragm chamber at one side of said diaphragm; a second diaphragm chamber at the opposite side of said diaphragm; a main diaphragm chamber, including a main diaphragm; loading means for said main diaphragm; a snap action mechanism operatively connected to said main diaphragm; conduit means arranged to connect said first diaphragm chamber with said main diaphragm chamber; conduit means arranged to connect said first diaphragm chamber with said second diaphragm chamber; and valve means connected to said snap action mechanism and arranged to selectively control the flow of fluid through both of said conduit means.

2. In fluid dispensing apparatus; the combination of a first conduit adapted for connection with a source of fluid under pressure; a second conduit adapted for connection with a receiver; a diaphragm; a main valve, carried by said diaphragm, between said first and second conduits; a first diaphragm chamber at one side of said diaphragm; a second diaphragm chamber at the opposite side of said diaphragm; a main diaphragm chamber, including a main diaphragm; loading means for said main diaphragm; a snap action mechanism in said main diaphragm chamber and operatively connected to said main diaphragm; conduit means arranged to connect said first diaphragm chamber with said main diaphragm chamber; conduit means arranged to connect said first diaphragm chamber with said second diaphragm chamber; and reciprocatory valve means connected to said snap action mechanism and arranged to selectively control the flow of fluid through both of said conduit means.

3. In fluid dispensing apparatus; the combination of a first conduit adapted for connection with a source of fluid under pressure; a second conduit adapted for connection with a receiver; a diaphragm; a main valve, carried by said diaphragm, between said first and second conduits; a first diaphragm chamber at one side of said diaphragm; a second diaphragm chamber at the opposite side of said diaphragm; a main diaphragm chamber, including a main diaphragm; loading means for said main diaphragm; a snap action mechanism in said main diaphragm chamber and operatively connected to said main diaphragm; conduit means arranged to connect said first diaphragm chamber with said main diaphragm chamber; conduit means arranged to connect said first diaphragm chamber with said second diaphragm chamber; and a reciprocatory valve connected to said snap action mechanism and arranged to selectively control the flow of fluid through both of said conduit means, said valve including an intermediate reduced portion.

4. In fluid dispensing apparatus; the combination of a first conduit adapted for connection with a source of fluid under pressure; a second conduit adapted for connection with a receiver; a diaphragm; a main valve, carried by said diaphragm, between said first and second conduits; a first diaphragm chamber at one side of said diaphragm; a second diaphragm chamber at the opposite side of said diaphragm; a main diaphragm chamber, including a main diaphragm; loading means for said main diaphragm; a snap action mechanism in said main diaphragm chamber and operatively connected to said main diaphragm; conduit means arranged to connect said first diaphragm chamber with said main diaphragm chamber; conduit means arranged to connect said first diaphragm chamber with said second diaphragm chamber; a conduit passageway common to both of said conduit means; and valve means connected to said snap action mechanism and arranged to operate in said conduit passageway to selectively control the flow of fluid through both of said conduit means.

5. In fluid dispensing apparatus; the combination of a first conduit adapted for connection with a source of fluid under pressure; a second conduit adapted for connection with a receiver; a diaphragm; a main valve, carried by said diaphragm, between said first and second conduits; a first diaphragm chamber at one side of said diaphragm; a second diaphragm chamber at the opposite side of said diaphragm; a main diaphragm chamber, including a main diaphragm; loading means for said main diaphragm; a snap action mechanism in said main diaphragm chamber and operatively connected to said main diaphragm; conduit means arranged to connect said first diaphragm chamber with said main diaphragm chamber; conduit means arranged to connect said first diaphragm chamber with said second diaphragm chamber; a conduit passageway common to both of said conduit means; and reciprocatory valve means connected to said snap action mechanism and arranged to operate in said conduit passageway to selectively control the flow of fluid through both of said conduit means.

6. In fluid dispensing apparatus; the combination of a first conduit adapted for connection with a source of fluid under pressure; a second conduit adapted for connection with a receiver; a diaphragm; a main valve, carried by said diaphragm, between said first and second conduits; a first diaphragm chamber at one side of said diaphragm; a second diaphragm chamber at the opposite side of said diaphragm; a main diaphragm chamber, including a main diaphragm; loading means for said main diaphragm; a snap action mechanism in said main diaphragm chamber and operatively connected to said main diaphragm; conduit means arranged to connect said first diaphragm chamber with said main diaphragm chamber; conduit means arranged to connect said first diaphragm chamber with said second diaphragm chamber; a conduit passageway common to both of said conduit means; and a reciprocatory valve connected to said snap action mechanism and arranged to operate in said conduit passageway to selectively control the flow of fluid through both of said conduit means, said valve including an intermediate reduced portion.

7. In fluid dispensing apparatus; the combination of a first conduit adapted for connection

with a source of fluid under pressure; a second conduit adapted for connection with a receiver; a diaphragm; a main valve, carried by said diaphragm, between said first and second conduits; a first diaphragm chamber at one side of said diaphragm; a second diaphragm chamber at the opposite side of said diaphragm; a main diaphragm chamber, including a main diaphragm; loading means for said main diaphragm; a snap action mechanism in said main diaphragm chamber and operatively connected to said main diaphragm; conduit means arranged to connect said first diaphragm chamber with said main diaphragm chamber; conduit means arranged to connect said first diaphragm chamber with said second diaphragm chamber; a conduit passageway common to both of said conduit means; and a reciprocatory valve pivotally connected to said snap action mechanism and arranged to operate in said conduit passageway to selectively control the flow of fluid through both of said conduit means, said valve including enlarged end portions and two intermediate reduced portions, one of said intermediate portions being of lesser diameter than the other and both of said intermediate reduced portions being of less diameter than said end portions; whereby, when said valve is at one end of its stroke in said conduit passageway, fluid is free to flow from said first diaphragm chamber to said main diaphragm chamber and prevented from flowing from said first diaphragm chamber to said second diaphragm chamber; and when said valve is at the opposite end of its stroke in said conduit passageway, fluid is free to flow from the said first diaphragm chamber to said second diaphragm chamber and prevented from flowing from said first diaphragm chamber to said main diaphragm chamber.

8. In fluid dispensing apparatus; the combination of a first conduit means adapted for connection with a source of fluid under pressure; a second conduit means adapted for connection with a receiver; a main valve controlling the flow of fluid from said first conduit means to said second conduit means; a first chamber and a second chamber separated by a movable element adapted to control said main valve, said second chamber communicating with said first conduit means; a third chamber, including a pressure sensitive element; loading means for said pressure sensitive element; a snap action mechanism controlled by said pressure sensitive element; a third conduit means arranged to connect said first chamber with said second chamber; a fourth conduit means arranged to connect said first chamber with said third chamber; and valve means controlled by said snap action mechanism and arranged to selectively control the flow of fluid through said third and fourth conduit means.

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