Jan. 3, 1961 J. U. STEWART ET AL 2,966,861

MEASURING PUMP

Filed Oct. 8, 1956

FIG. 1.

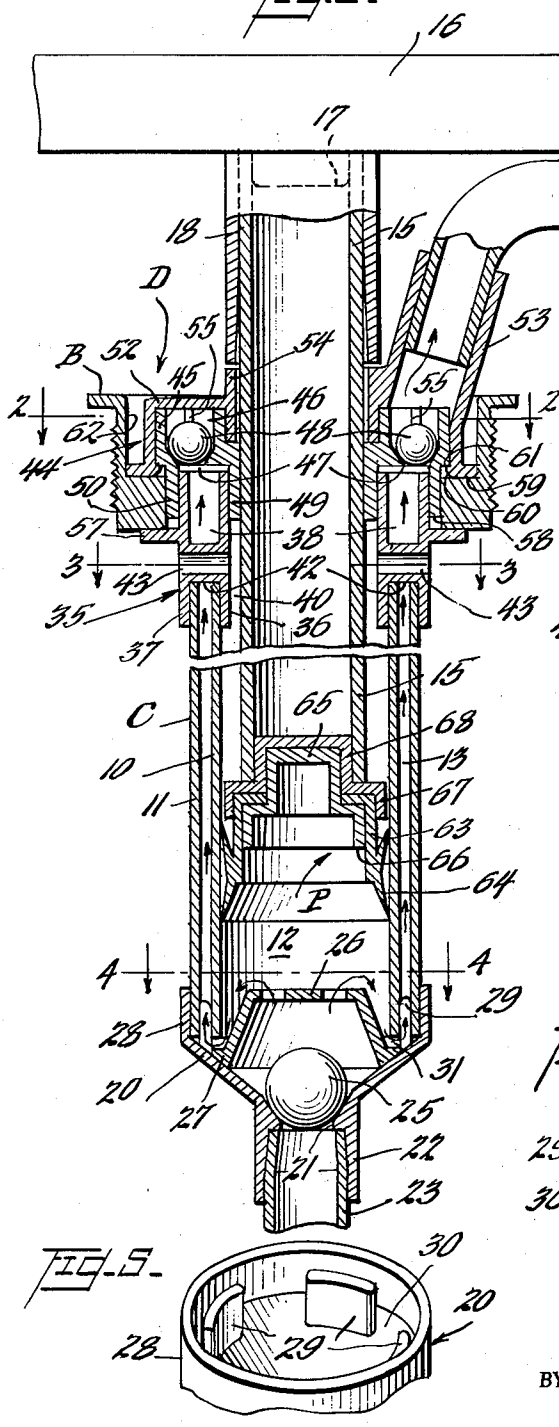


FIG. 2.

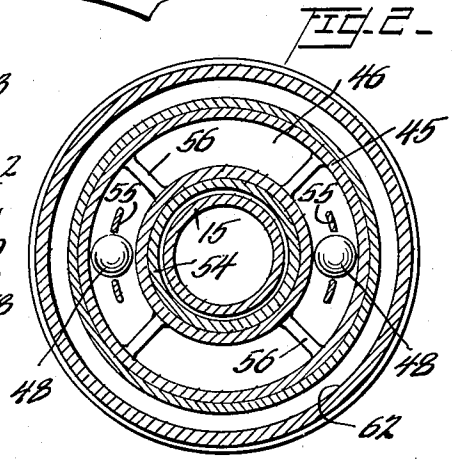


FIG. 3.

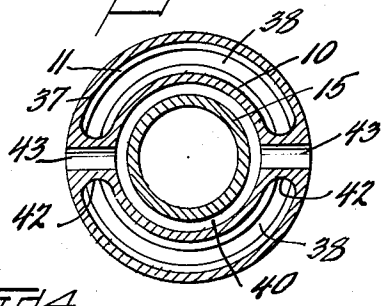


FIG. 4.

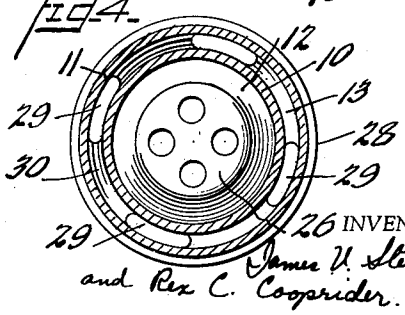


FIG. 5.

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MEASURING PUMP

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6 Claims. (Cl. 103—153)

This invention relates to a fluid pump of the type utilizing concentric tubes arranged to define a double walled pump cylinder including a pump chamber and a discharge chamber encircling the pump chamber. Such a pump is particularly adapted for use as measuring pump for dispensing measured amounts of liquids from their drums or containers, though by no means limited to such use.

It is a particular feature of the invention to provide novel end fittings for concentrically connecting the said tubes and for defining the intake and discharge ports of the pump independently of the tubes to thus facilitate assembly of the several parts of the pump.

More specifically the invention provides a novel arrangement of lower end fitting or intake element for the pump defining a valved intake port for the pump chamber and providing a passage around the lower end of the inner pump tube to place the pump chamber in communication with the discharge passage.

In accordance with an important feature of the invention the upper end fitting is secured over the upper ends of the concentric pump tubes to define an upward axial extension of the discharge passage and to provide one or more radial vent or breather passages above the upper ends of the tubes.

In accordance with a further feature of the invention the upper end or discharge fitting also defines an annular manifold encircling and guiding the piston rod.

A still further feature consists in increasing the capacity of the pump by employing a plurality of valve controlled ports establishing communication between the discharge passage or passages at a plurality of locations around the manifold whereby fluid may flow through the manifold from these several ports to a suitable outlet opening or spout.

A still further feature consists in a novel construction of the discharge manifold in which same is formed of separate sections which interlock through the container bung or closure and are assisted by the bung or closure in maintaining their interlocking relation.

Also in accordance with the invention there is provided a novel construction of the piston which reciprocates in the pump chamber.

The foregoing and other features and advantages of the invention will be apparent from a consideration of the following detailed description in conjunction with the accompanying drawings in which:

Figure 1 represents a fragmentary central vertical cross section through a pump unit incorporating the several features of the invention in their preferred form, and showing certain parts in elevation;

Figure 2 is a section on the line 2—2 of Figure 1;

Figure 3 is a section on the line 3—3 of Figure 1;

Figure 4 is a section on the line 4—4 of Figure 1; and

Figure 5 is a perspective view looking down into the upper end of the lower end fitting, the lower portion thereof being broken away.

Referring now in detail to the accompanying drawings the reference character B designates an externally threaded container bung or closure which is centrally apertured to receive and support the pump unit of the invention. The said pump unit comprises a double walled pump cylinder, generally designated C, having at its upper end a discharge casing D which is disposed in the aperture of the bung B to fixedly support the pump structure. The reference character S designates a suitable discharge spout communicating through the discharge casing D with the discharge passage of the pump cylinder C.

The pump cylinder C comprises the relatively coextensive cylindrical tubes 10 and 11 respectively arranged concentrically to define a pump chamber 12 within the tube 10 and an annular discharge chamber 13 encircling the said pump chamber. Disposed for reciprocation in the pump chamber is a piston P having rigidly affixed thereto a piston rod 15 of lesser diameter than the pump chamber 12 and projecting externally upwardly through the upper end of the pump chamber. An operating handle 16 on the upper external end of the piston rod 15 provides means whereby the piston and piston rod may be manually reciprocated to cause the pump structure to expel fluid through the spout S. In the specific arrangement shown, the handle 16 consists generally of a cross bar having a downwardly projecting medial stud 17 of cylindrical shape which is received and fixed in the upper end of the tubular piston rod 15. A stop sleeve 18 is fixed about the piston rod beneath the handle 16 whereby its lower extremity may engage the discharge casing D to limit the downward stroke of the piston and piston rod structure.

Secured on and concentrically positioning the lower ends of the tubes 10 and 11 is a bottom intake element or lower end fitting 20 of generally conical shape defining an intake port 21 opening into the lower end of the pump barrel 12. Depending from the fitting 20 around the port 21 is an integral sleeve 22 for telescopically receiving and positioning the upper end of a suction tube 23 in communication with the port 21, whereby on the upper stroke of the piston P liquid may be sucked through the tube 23 and port 21 into the pump barrel 12.

For the purpose of preventing back flow of liquid from the pump barrel 12 through the port 21, the port 21 is controlled by an upwardly displaceable ball check valve 25, the upward displacement of which may be limited by a usual perforated valve cage 26 of inverted cup shape supported by a radially projecting flange 27 on the upper conical face of the fitting 20. Formed around the outer periphery of the fitting 20 is an upwardly projecting annular sleeve 28 which telescopically receives the lower end of the outer tube 11. Spaced radially inwardly from this sleeve 28 (as best shown in Figure 5) is an annular series of upwardly projecting studs 29 which receive and extend around the lower end of the inner tube 10 between it and the outer tube 11. These studs 29 are relatively circumferentially spaced as at 30, and it will further be noted that the lower end of the tube 10 is spaced somewhat above the flange 27 of the valve cage 26 as at 31, whereby the communicating spaces 31 and 30 may jointly define passages for fluid around the lower end of the inner tube 10 from the pump chamber 12 into the discharge chamber 13.

In the present preferred embodiment the discharge casing D at the upper end of the double wall pump barrel is formed of several component parts. One of these comprises the annular discharge fitting 35 including inner and outer sleeves 36 and 37, respectively. These sleeves are relatively radially spaced to concentrically receive

and position between them the upper ends of the tubes 10 and 11 and to define an upward extension or continuation 38 of the discharge passage 13 between the tubes 10 and 11. In this arrangement the inner sleeve 36 which depends concentrically within the inner tube 10 is disposed in the path of upward movement of the piston P to limit the upward stroke of the latter and preferably is spaced somewhat from the piston rod 15 to provide a substantially free flow passage 40 for fluid in the upper part of the pump chamber.

Preferably integral radial connectors 42 extend between the respective sleeves 36 and 37 to maintain them in their relatively concentric positions. These connectors 42 may assume the form of conduits of relatively small size extending radially across the extension 38 of the discharge passage to present a minimum obstruction of the upward flow of fluid therethrough. These connectors or conduits 42 provide radial vents or breather openings 43 between the pump chamber and the atmosphere exteriorly of the pump unit, both to permit the ready escape of liquids trapped in the pump chamber 12 above the piston P, as well as to prevent the formation of an air lock above the piston such as might interfere with its free reciprocation. It will be seen that the openings or vent passages 43 extend through both the inner and outer sleeves 36 and 37 and are located below the container bung B whereby any liquids discharged through these openings 43 will be returned directly into the container with which the pump is associated.

The liquid thus moves upwardly through the discharge passage 13 and its extension 38 in the discharge fitting and then is received in an annular discharge manifold, generally designated 44, which encircles the piston rod 15 in guiding, wiping relationship therewith, the fluid being discharged from this manifold 44 through the spout S. The discharge manifold 44 is preferably of composite structure, comprising the upwardly opening channeled bottom member 45 defining the annular manifold chamber 46 and having a plurality of intake ports 47 through the bottom thereof establishing communication with the discharge passage extension 38. Ball valves 48 are seated over and normally close the ports 47 to prevent back flow of liquid or other fluid from the manifold into the discharge passage and its extension. Depending inner and outer skirts 49 and 50, constituting integral portions of the manifold bottom member, concentrically receive the fitting 35, and the inner skirt 49 depends into the upper end of the sleeve 36 of the fitting in wiping and guiding engagement with the piston rod 15.

Cooperating with and closing the upwardly opening channeled bottom member 45 of the manifold is a complementary annular upper member or cover 52. This cover 52 is formed to provide a discharge port or opening for the manifold chamber 46. Such a port is defined by the integral sleeve 53 in which the spout S may be telescopically fitted. The cover 52 may be provided with an upwardly presented stop sleeve 54 which cooperates with the sleeve 18 of the piston rod to limit the downward stroke of the piston as above mentioned. For the purpose of preventing circumferential displacement of the ball valves 48 within the discharge manifold, the cover 52 may be provided with depending positioning lugs such as 55 on opposite circumferential sides of each such ball valve 48. Reinforcing ribs 56 of lesser depth than the manifold chamber may interconnect the opposed walls thereof at suitable points.

For axially positioning the pump unit in fluid tight relation through the centrally apertured bung B, the discharge fitting 35 is provided with an outwardly projecting flange 57 positioned just above the vent passages or openings 43 for abutment with the lower face of the bung, and the discharge manifold also is provided with one or more downwardly presented flanges or shoulders 58 and/or 59 for engagement with the upper surface of the bung B. Thus when the parts 35, 45 and 52 are assembled by insertion from opposite directions into the centrally apertured bung B the bung is clamped and axially positioned between the flange 57 and the shoulders 58 and 59.

In order to securely retain the upper member or cover 52 on the lower portion 45 of the discharge manifold the depending outer skirt of the cover is formed with a radially inwardly projecting retainer flange 60 adapted for locking reception beneath a downwardly presented shoulder 61 on the outer wall of lower manifold portion 45.

The cover 52 is of a suitable somewhat elastic plastic such as a polyethylene resin or other material so that its retainer flange 60 may be expanded for reception of the manifold portion 45 to then resiliently contract beneath the shoulder 61 when these parts are fully assembled.

In order to resist expansion and removal of the cover 52 by fluid pressures within the pump structure, its outer flange 59 may be received and radially confined in a socket 62 in the bung B. Moreover, the bung B may also be formed of a somewhat elastic plastic material capable of yielding to accommodate the flange 59 if necessary. It will be seen that after assembly of the flange 59 within the bung, the subsequent threading of the bung B into a container opening will confine it radially and thus prevent any expansion such as might permit release of the manifold cover 52. Also these parts may be cemented together if desired in order to increase their strength and to render them less susceptible to leaks.

Although the specific structure of the piston P is not an essential feature of the instant invention, the piston structure disclosed by way of exemplification contains certain novel features. In this exemplification the piston is of composite structure comprising an inverted piston cup 63 of resilient material having an integral externally channeled seal 64 in sliding engagement with the inner wall of the pump tube 10. The upper end of the piston cup 63 is centrally apertured for reception of the mounting shank 65 of an interior retaining cup 66. The cup 66 is received within the piston cup but terminates above the bottom thereof to avoid undue interference with radial movement of the seal 64. An external mounting cup 67 fixedly receives the upper end of the piston cup 63 and is provided with a mounting shank 68 which is received and suitably secured in the lower end of the tubular piston rod 15. It in turn receives the shank 65 of the retainer cup 66. The several parts of the piston above mentioned may be cemented together or otherwise fixedly secured in assembled relation. By means of these cups the piston cup is free at its lower end to expand under the influence of the fluid pressure therein. Such expansion will increase the sealing engagement of the seal 64 with the inner tube 10, and the channeled form of the resilient seal is such as will cause it to conform to and snugly engage the walls of the tube 10 at all times.

In the use of the pump above described, when the bung B is threaded into a liquid containing drum, the pump structure will be supported with its suction tube 23 depending into the liquid contents of the container. In order to withdraw such contents the actuating handle 16 of the piston may be manually drawn upwardly from its lowermost position to the full extent of its upward stroke as determined by engagement between the piston and the depending skirt 36. This will result in drawing a measured quantity of liquid from the container upwardly through the tube 23. The pressure of such liquid will unseat the ball check valve 25 whereby the liquid will be drawn upwardly into the pump chamber 12 in a predetermined amount. During such upward or suction stroke of the piston P the ball check valves 48 of the discharge manifold will function to prevent backflow of fluid within the discharge passage 13. On the ensuing downward stroke of the piston P the ball valve 25 will close the intake port 21 and the fluid will be forced around the lower end of the inner tube 10 through the

interconnected sections 31 and 30 of the passage between the pump chamber 12 and the discharge chamber 13. The fluid will then move upwardly through the discharge passage 13, its extension 38 and the check valve controlled ports 47 into the discharge manifold 44 for discharge through the spout S. Any fluid which becomes trapped above the piston P within the discharge chamber 13 will escape through the radial openings or vents 43 and thus return into the container on the next ensuing up stroke of the piston and, of course, on each downstroke of the piston air or vapor from the container is free to enter the breather openings 43 to prevent the formation of an air lock within the pump chamber 13.

It will be seen that the particular construction of the discharge fitting 35 above mentioned and its assembly with the tubes 10 and 11 is such as to form the discharge passage extension 38 and the breather openings 43 in the fitting 35 in a manner whereby these will be properly associated with the pump structure in the assembled relation thereof. This will greatly facilitate the assembly of the pump since it will eliminate the need for forming the breather openings 43 through the concentric pump tubes and assembling these in registering relation or else of forming such openings after the tubes are assembled, as has heretofore been required. Similarly the formation of the lower fitting 20 is such as to provide the necessary passage for the fluid between the concentric chambers of the pump without the necessity for forming such passages through the inner pump tube 10 has has been necessary in prior structures.

Moreover, the features above mentioned make possible the assembling of pump having varying strokes and capacities by utilizing different lengths of tubes 10 and 11 and tubular piston rod 15 while utilizing the other parts of the pump structure without change.

In this application there is shown and described only that form of the invention exemplifying the preferred mode of carrying out the invention; however, it is realized that the invention may assume other forms or embodiments and that its several details may be modified in various ways without departing from the invention. Accordingly, the drawings and description herein are to be construed as merely illustrative in nature and not as restrictive.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A pump comprising inner and outer relatively coextensive cylindrical tubes arranged concentrically and relatively radially spaced to define a pump chamber within said inner tube and a discharge chamber encircling said pump chamber, a piston reciprocable in said pump chamber and having a piston rod of lesser diameter than the chamber projecting externally through the upper end thereof, a bottom intake element secured on and concentrically positioning the lower ends of said tubes, said element including an upwardly projecting annular sleeve receiving the lower end of the outer said tube and further including an annular series of relatively circumferentially spaced studs projecting upwardly between said tubes, the spaces between said studs providing continuous communication between said pump chamber and said discharge chamber, said element being formed with an intake port communicating with said pump chamber, a check valve carried by said intake element for preventing backflow of fluid through said intake port, an annular discharge fitting comprising concentric inner and outer sleeves telescopically associated with and concentrically positioning the upper ends of said tubes, said sleeves being radially spaced and defining between them an upward axial extension of said discharge chambers, said inner sleeve depending concentrically within the pump chamber to limit the upward stroke of the piston, and spaced radially from the piston rod to define a fluid flow passage, relatively circumferentially spaced radial conduits rigidly interconnecting said sleeves across said discharge chamber extension above the said tubes, and defining radial vent passages opening through said sleeves and communicating with said pump chamber to permit escape of fluid trapped above the piston in said pump chamber and to prevent an air lock within said chamber, an annular outlet manifold fixed concentrically on said annular discharge fitting over the upper end of said discharge chamber extension, said manifold defining an annular chamber around the piston rod and having an inner peripheral portion in guiding wiping engagement with said piston rod above said radial vent passages, said manifold having a plurality of ports establishing communication between said chamber extension and said annular chamber, check valves within said manifold operatively associated with said ports for controlling the respective ports for preventing backflow of fluid through said ports toward the said chamber extension, said manifold further being formed with a discharge opening communicating with the atmosphere.

2. A pump comprising inner and outer relatively coextensive cylindrical tubes arranged concentrically and relatively radially spaced to define a pump chamber within said inner tube and a discharge chamber encircling said pump chamber and communicating therewith, a piston reciprocable in said pump chamber and having a piston rod of lesser diameter than the chamber projecting externally through the upper end thereof, a bottom intake element secured on and concentrically positioning the lower ends of said tubes, said element including an upwardly projecting annular sleeve receiving the lower end of the outer said tube and further including an annular series of relatively circumferentially spaced studs projecting upwardly between said tubes, the spaces between said studs providing continuous communication between said pump chamber and said discharge chamber, said element being formed with an intake port communicating with said pump chamber, a check valve carried by said intake element preventing backflow of fluid through said intake port, an annular discharge fitting comprising concentric inner and outer sleeves telescopically associated with and concentrically positioning the upper ends of said tubes, said sleeves being radially spaced and defining between them an upward axial extension of said discharge chamber, said inner sleeve depending concentrically within the pump chamber to limit the upward stroke of the piston, and spaced radially from the piston rod to define a fluid flow passage, relatively circumferentially spaced radial conduits rigidly interconnecting said sleeves across said discharge chamber extension above the said tubes, and defining radial vent passages opening through said sleeves and communicating with said fluid flow passages to permit escape of fluid trapped above the piston in said pump chamber and to prevent an air lock within said chamber, an annular outlet manifold fixed concentrically on said annular discharge fitting over the upper end of said chamber extension, said manifold defining an annular chamber around the piston rod and having an inner peripheral portion in guiding wiping engagement with said piston rod above said radial vent passages, said manifold having a plurality of ports establishing communication between said chamber extension and said annular chamber, check valves within said manifold operatively associated with said ports for controlling the respective ports for preventing backflow of fluid therethrough toward said chamber extension, said manifold further being formed with a discharge opening communicating with the atmosphere.

3. A pump comprising inner and outer relatively coextensive cylindrical tubes arranged concentrically and relatively radially spaced to define a pump chamber within said inner tube and a discharge chamber encircling said pump chamber and communicating therewith, a piston reciprocable in said pump chamber and having a piston rod of lesser diameter than the chamber projecting externally through the upper end thereof, a bottom in-

take element secured on and concentrically positioning the lower ends of said tubes, said element including an upwardly projecting annular sleeve receiving the lower end of the outer said tube and further including an annular series of relatively circumferentially spaced studs projecting upwardly between said tubes, the spaces between said studs providing continuous communication between said pump chamber and said discharge chamber, said element being formed with an intake port communicating with said pump chamber, a check valve carried by said intake element preventing backflow of fluid through said intake port, an annular discharge fitting comprising concentric inner and outer sleeves telescopically associated with and concentrically positioning the upper ends of said tubes, said sleeves being radially spaced and defining between them an upward axial extension of said discharge chamber, said inner sleeve depending concentrically within the pump chamber to limit the upward stroke of the piston, relatively circumferentially spaced radial conduits rigidly interconnecting said sleeves across said discharge chamber extension above the said tubes, and defining radial vent passages opening through said sleeves and communicating with said pump chamber to permit escape of fluid trapped above the piston in said pump chamber and to prevent an air lock within said chamber, an annular outlet manifold fixed concentrically on said annular discharge fitting over the upper end of said discharge chamber extension, said manifold defining an annular chamber around the piston rod and having an inner peripheral portion in guiding wiping engagement with said piston rod above said radial vent passages, said manifold having a plurality of ports establishing communication between said chamber extension and said annular chamber, check valves within said manifold operatively associated with said ports for controlling the respective ports for preventing backflow of fluid therethrough toward said chamber extension, said manifold further being formed with a discharge opening communicating with the atmosphere.

4. In a pump, the subcombination comprising inner and outer cylindrical tubes arranged concentrically and relatively radially spaced to define a pump chamber and a discharge chamber encircling said pump chamber and communicating therewith, a piston reciprocable in said pump chamber and having a piston rod of lesser diameter than the chamber projecting externally through the upper end thereof, a bottom intake element secured on and concentrically positioning the lower ends of said tubes, said element including an upwardly projecting annular sleeve receiving the lower end of the outer said tube and further including an annular series of relatively circumferentially spaced studs projecting upwardly between said tubes, the spaces between said studs providing continuous communication between said pump chamber and said discharge chamber, said element being formed with an intake port communicating with said pump chamber within said inner tube, a check valve carried by said intake element preventing backflow of fluid through said intake port, an annular discharge fitting comprising concentric inner and outer sleeves telescopically associated with and concentrically positioning the upper ends of said tubes, said sleeves being radially spaced and defining between them an upward axial extension of said discharge chamber, relatively circumferentially spaced radial conduits rigidly interconnecting said sleeves across said discharge chamber extension above the said tubes, and defining radial vent passages opening through said sleeves and communicating with said pump chamber, an annular outlet manifold fixed concentrically on said annular discharge fitting over the upper end of said chamber extension, around the piston rod and having an inner peripheral portion in guiding engagement with said piston rod, said manifold communicating with the atmosphere, and means preventing backflow of fluid from said outlet manifold to said chamber extension.

5. In a pump comprising inner and outer relatively coextensive cylindrical tubes arranged concentrically and relatively radially spaced to define a pump chamber within said inner tube and a discharge chamber encircling said pump chamber, the subcombination comprising a bottom intake element secured on and concentrically positioning the lower ends of said tubes, said element including an upwardly projecting annular sleeve receiving the lower end of the outer said tube and further including an annular series of relatively circumferentially spaced studs projecting upwardly between said tubes, the spaces between said studs providing continuous communication between said pump chamber and said discharge chamber, said element being formed with an intake port communicating with said pump chamber, an annular discharge fitting comprising concentric inner and outer sleeves telescopically associated with and concentrically positioning the upper ends of said tubes, said sleeves being radially spaced and defining between them an upward axial extension of said discharge chamber, and relatively circumferentially spaced radial conduits rigidly interconnecting said sleeves across said discharge chamber extension above the said tubes and defining radial vent passages opening through said sleeves.

6. In a pump comprising inner and outer cylindrical tubes arranged concentrically and relatively radially spaced to form a central pump chamber within said inner tube and a discharge chamber encircling said pump chamber, the combination comprising a bottom intake element secured on and concentrically positioning the lower ends of said tubes, said element including an upwardly projecting annular sleeve receiving the lower end of the outer tube and further including an annular series projecting upwardly between said tubes, the spaces between said studs providing continuous communication between said pump chamber and said discharge chamber, said elements being formed with an intake port communicating with said chamber, and an annular discharge fitting secured on and concentrically positioning the upper ends of said tubes, said fitting defining an extension of said discharge chamber and having a check valve therein for preventing backflow of fluid toward said pump chamber.

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