

July 18, 1939.

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2,166,530

FLUID-HANDLING APPARATUS

Original Filed Sept. 18, 1935

4 Sheets-Sheet 1

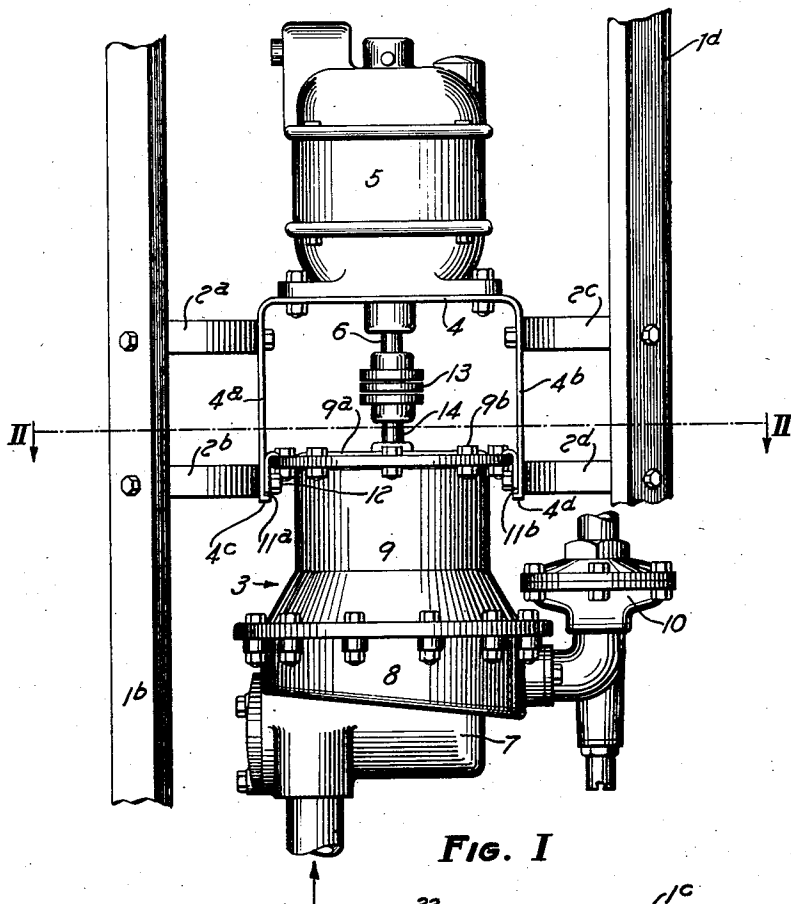


FIG. 1

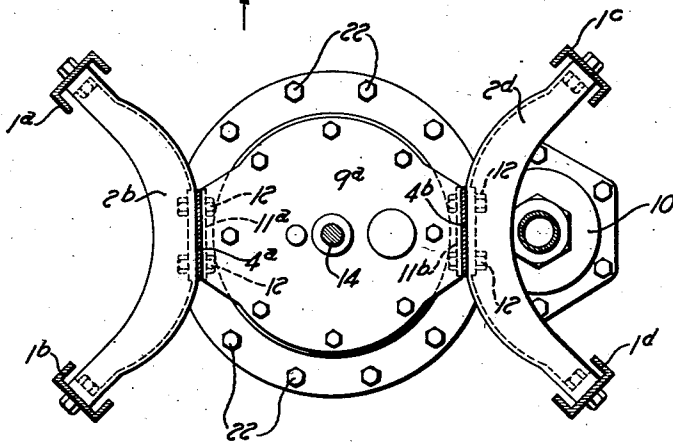


FIG. II

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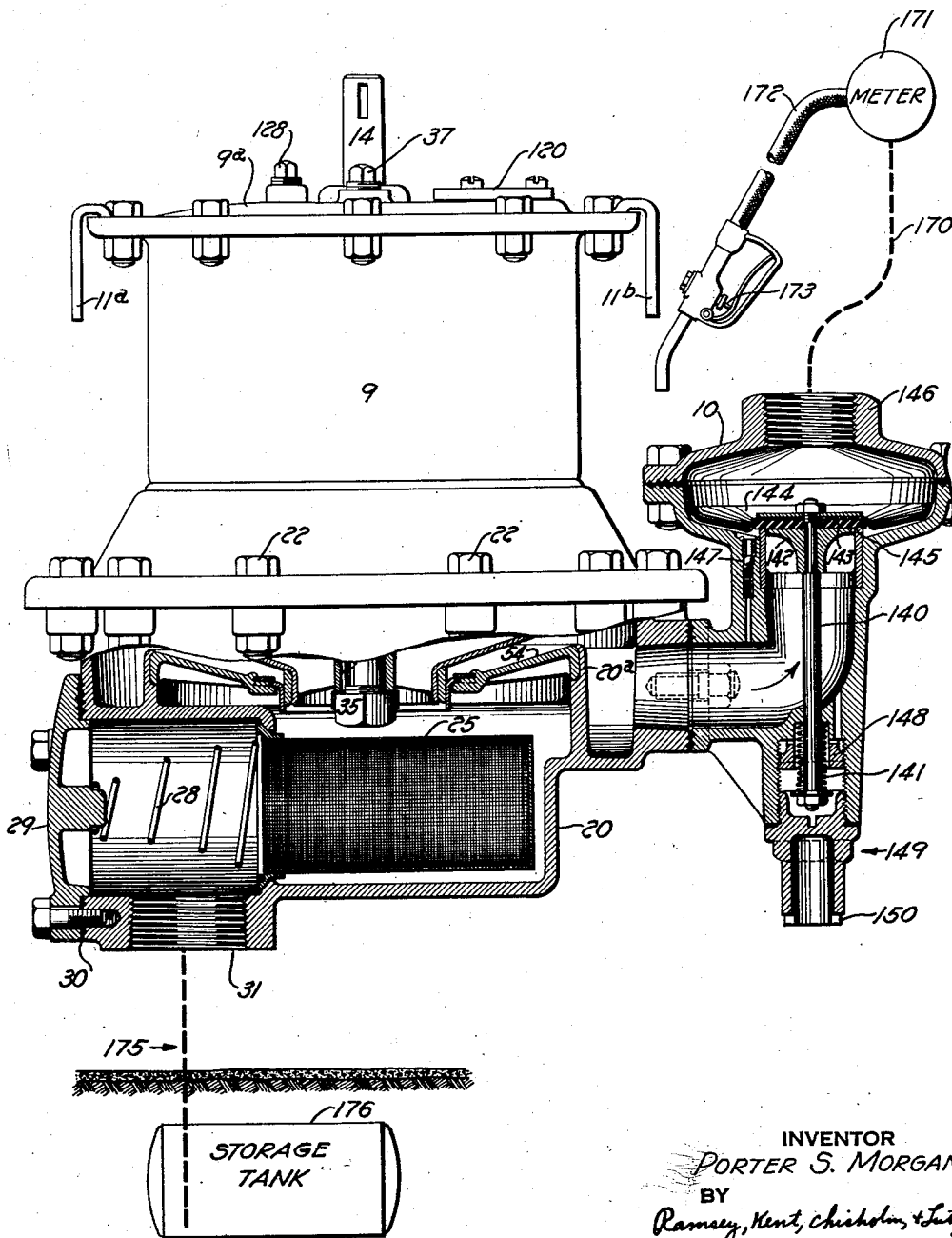
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Original Filed Sept. 18, 1935

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FIG. III



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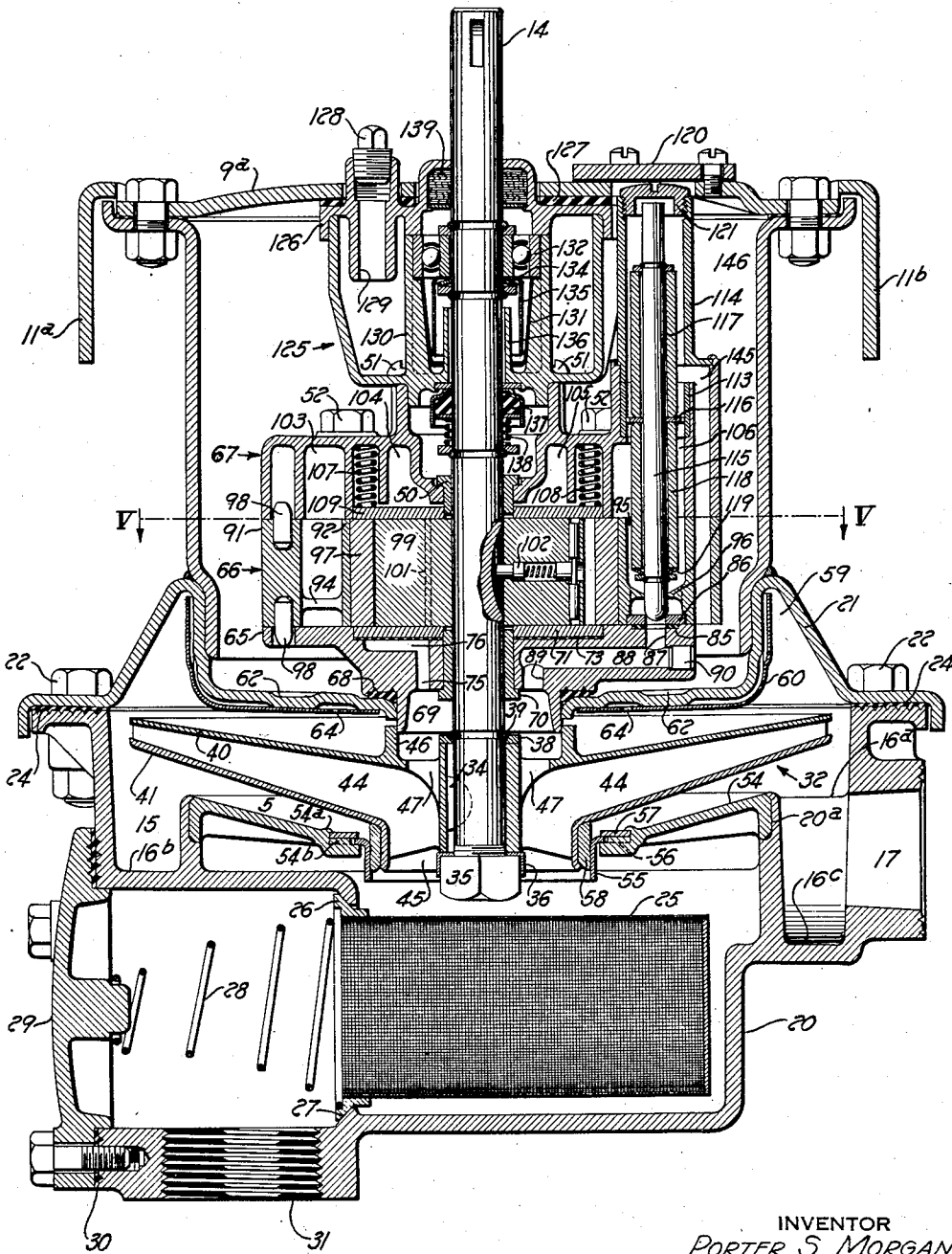
2,166,530

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FIG. IV



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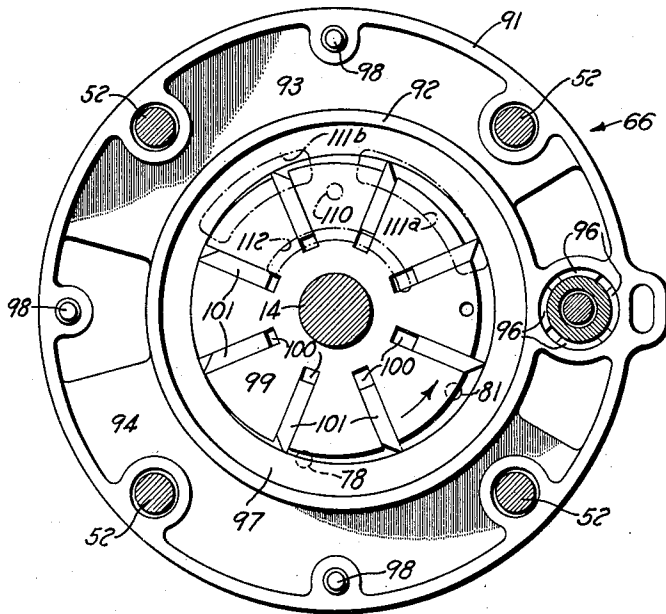


Fig. V

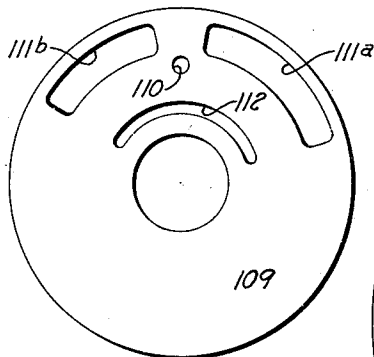


Fig. VI

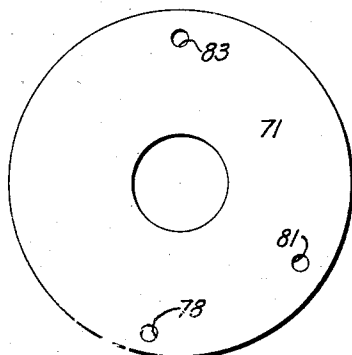


Fig. VII

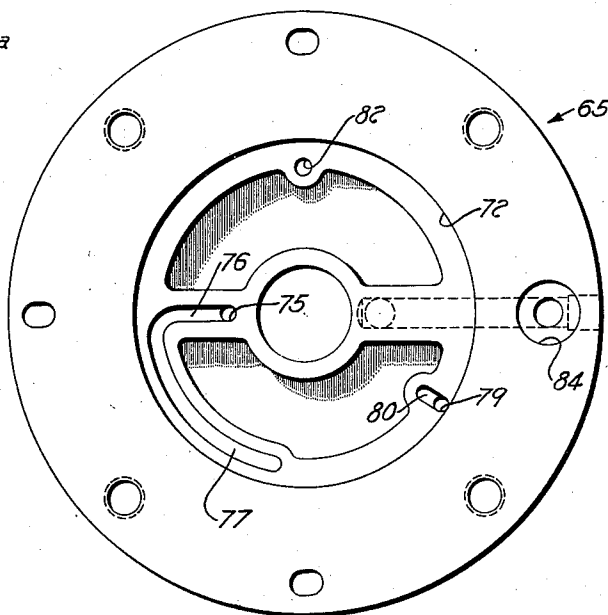


Fig. VIII

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UNITED STATES PATENT OFFICE

2,166,530

FLUID-HANDLING APPARATUS

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mesne assignments, to Böhleber & Ledbetter,
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William Böhleber, James Camrod Ledbetter,
Francis H. Fasset, and John M. Montstream

Application September 18, 1935, Serial No. 41,051
Renewed May 17, 1939

1 Claim. (Cl. 103—113)

This invention relates to pumping apparatus intended primarily for gasoline dispensing systems; and the disclosed apparatus operates both to pump the gasoline as required for dispensing and to separate from the gasoline entrained air or other gas. The invention may, however, be used for pumping other liquids, and various features of the invention relate to pumping apparatus without regard to the air separation feature.

An object of the invention is to provide, for liquid dispensing systems, fluid handling apparatus which pumps the liquid as required for dispensing and effectively separates out entrained air or other gas without requiring the usual air separator unit.

Another object of the invention is to provide such apparatus which satisfactorily lends itself to manufacture on a mass production basis.

Another object of the invention is to provide for ready and convenient mounting of the pump with self-contained air separator upon the various frames of the different manufacturers (or assemblers) of gasoline dispensing systems.

A further object of the invention is to provide a liquid pumping apparatus which will automatically separate out any quantity of entrained air whether large or small.

A still further object of the invention is to provide satisfactory gasoline dispensing apparatus which does not require by-passes or floats.

Fig. I is a fragmentary elevation showing apparatus of the present invention mounted upon the supporting frame of a dispensing system.

Fig. II is a horizontal section taken on the line II—II of Fig. I.

Fig. III is a view showing structurally the portion of the apparatus which will be referred to as the "fluid handling unit". Part of the structure is in elevation and part in central vertical section. Various attached parts of a complete dispensing system are indicated diagrammatically.

Fig. IV is a vertical section of the fluid handling unit with the outlet valve omitted.

Fig. V is a horizontal section of the auxiliary pump taken on line V—V of Fig. IV.

Fig. VI is a plan view of the upper wear plate of the auxiliary pump.

Fig. VII is a plan view of the lower wear plate of the auxiliary pump.

Fig. VIII is a plan view of the lower casting of the auxiliary pump.

GENERAL ORGANIZATION AND MOUNTING

Referring to Figs. I and II, the supporting frame

comprises four vertical channel irons 1^a, 1^b, 1^c, and 1^d, to which are bolted horizontally arranged arcuate brackets 2^a, 2^b, 2^c and 2^d. Bolted, as shown, to the brackets 2^a, etc. is a U-shaped metal support 4 having depending legs 4^a and 4^b, and on the bottoms of the legs are inwardly projecting lips or flanges 4^c and 4^d. Supported on top of the U-shaped member 4 and bolted thereto is an electric drive motor 5 having a vertical shaft 6 which projects downwardly through the member 4. Supported beneath the U-shaped member 4 and designated as a whole by 3, is a fluid handling unit composed of quite a number of internal parts which are housed in various external parts or casings welded and bolted together. Shown in Fig. I is a strainer chamber 7, main pump chamber 8, auxiliary pumping chamber 9, and discharge valve chamber 10. The auxiliary pumping chamber 9 is closed by a cover 9^a, secured by bolts 9^b; and the cover is provided with integral depending stub arms 11^a and 11^b, the ends of which are adapted to engage the lips 4^c and 4^d. Thus in mounting the fluid handling unit 3, it may be supported temporarily by the engagement of arms 11^a and 11^b with the lips 4^c and 4^d. Then bolts 12 (four shown) may be placed to fixedly secure the unit 3. A coupling 13 forms a driving connection between the motor shaft 6 and shaft 14 on which are mounted the driven elements of both the main pump and the auxiliary pump.

With the frames used by different manufacturers (assemblers) of dispensing systems there is a variation in the spacing and form of uprights 1^a, 1^b, 1^c, and 1^d. However, the entire structure shown in Fig. I can be mounted readily on the different frames without any change except the provision of brackets 2^a, etc. suited to the particular frame.

Strainer and main pump

Strainer chamber 7 and main pumping chamber 8 (Fig. I) are formed in an open casting 20 (Fig. IV) which is closed by a stamped metal partition 21. The partition 21 is secured by a series of bolts 22 and is sealed by a gasket 24. A cylindrical strainer 25 is provided with an annular head 26 that is adapted to make substantially fluid tight engagement with seat 27. Normally the strainer is held in the position shown in the drawings by the pressure of spring 28 held by removable cover 29. The cover 29 is sealed by gasket 30; and the cover and strainer can be removed in an obvious manner for the purpose of cleaning the strainer.

A rotary impeller 32 is keyed by key 34 to the lower end of shaft 14 and is clamped against longitudinal movement on the shaft by nut 35, secured by lock washer 36. The clamping pressure of the nut is received by washer 38, which is held against upward movement by spring ring 39 that grips an annular groove in shaft 14. The impeller includes upper shrouding 40, lower shrouding 41, and a series of radially extending blades 44. The lower shrouding 41 merges into a primary intake port 45, and the upper shrouding merges into a secondary intake port 46. An annularly arranged series of holes 47 establish communication between secondary intake port 46 and the bladed area of the impeller. Surrounding the impeller is an annular flow space or impeller chamber 15 having a bottom which descends in the direction of impeller rotation. The bottom may be considered as beginning at 16^a, continuing at 16^b, and terminating at 16^c adjacent to discharge port 17. This configuration facilitates the pumping of large volumes of liquid with no increase in the over-all diameter of the fluid handling unit.

Permanently mounted at 20^a in casting 20 is a funnel shaped bearing support 54. Affixed to this bearing support is a depending bearing sleeve 55, having a notched annular flange 56 which is lightly clamped by ring 57. Ring 57 is secured by metal of support 54 which is swaged over at 54^a; and fins 54^b, integral with support 54, enter the notches of flange 56 and hold the sleeve 55 against rotation. Cooperating with bearing sleeve 55 is a bearing ring 58 which is permanently affixed to the exterior of the impeller intake port 45. While bearing sleeve 55 is held against rotation by fins 54^b, slight sidewise movement of the sleeve is permitted by the clearances provided and the light clamping by ring 57. Thus in assembling the pump, the sleeve 55 is self aligning with respect to bearing ring 58. This avoids the necessity for the troublesome manufacturing accuracy that would otherwise be required to obtain perfect alignment.

The partition 21, which constitutes a cover for the main pumping chamber is so formed that it provides an annular space 59 extending upwardly from the periphery of the impeller 32. Affixed beneath partition 21 is a cup-shaped sheet metal member 60 which provides an annular passageway from the top of space 59 to a zone adjacent the center portion of the impeller 32. The partition 21 is formed with an annularly arranged series of depressions 62, and at these points member 60 is spot welded to partition 21. Near the inner edge of member 60 it is provided with annularly arranged drain holes 64.

Auxiliary pump and associated parts

For these parts refer primarily to Fig. IV and secondarily to Figs. V to VIII.

The auxiliary pump is built up about a lower casting 65, a central casting 66, and an upper casting 67. The lower casting is sealed to partition 21 by a gasket 68 and has a hollow boss 69 which projects through a central aperture in partition 21 and makes a running fit with impeller intake throat 46. Affixed in the casting 65 is a bearing bushing 70 for shaft 14. A metal wear plate 71, which acts as a bearing for the lower edges of the blades of the auxiliary pump, is seated in a recess 72 (Fig. VIII) in the upper surface of casting 65 and is sealed by a gasket 73. The main intake to the auxiliary pump is via vertical passage 75, radial passage 76, arcuate passage 77

(Fig. VIII), and vertical hole 78 (Fig. VII) in wear plate 71. A secondary intake to the auxiliary pump is via vertical passage 79 (Fig. VIII), horizontal passage 80, and vertical hole 81 (Fig. VII) in wear plate 71. In assembly the wear plate 71 is indexed by a dowel 82 (Fig. VIII) which cooperates with a hole 83 (Fig. VII).

The lower casting 65 is recessed at 84 to receive a gasket 85 which seals a drain valve seat 86. From this valve seat a drain passage 87, 88, 89 leads to the upper intake throat of the impeller. A plug 90 merely closes the outer end of passage 88 after drilling.

The center casting and pump rotor are shown in Figs. IV and V. This casting has an outer rim 91 and an interior rim 92, connected together by webs 93 and 94. Also formed in the casting is a vertical valve chamber 95 (Fig. IV) having four lugs 96 (Figs. IV and V) which serve to center the stem of the valve. Pressed inside of the inner rim 92, which is eccentric to shaft 14, is an annular wear member 97 with which the tips of the pump blades engage. A number of dowels 98 project upwardly and downwardly from center casting 66 and serve to index the lower casting 65 and the lower upper casting 67 when the parts are assembled. Bolts 52 (four shown) pass through castings 66 and 67, and are threaded into casting 65 to hold the parts together.

Mounted within the eccentrically positioned annular wear member 97 is a cast pump rotor 99 having eight radial slots 100. Slidably mounted in each slot 100 is a pumping blade 101, preferably of composition material such as a suitable "Bakelite" product. The rotor 99 is adapted to be locked to shaft 14 by spring pressed pin 102 (Fig. IV). It will be seen that this locking arrangement permits pin 102 to be pushed outwardly so that the shaft 14 can be inserted through the hole in the rotor 99. Then when the shaft is so telescoped that the keyway aligns with pin 102, the spring pushes the pin into the keyway and locks the rotor to the shaft.

Upper casting 67 is of more or less skeleton construction with the areas 103, 104, 105, and 106 in communication with one another. A bushing 50 acts as a bearing for shaft 14. Springs such as 107 and 108 press a wear plate 109 (see also Fig. VI) against the upper edges of pump blades 101. This plate is provided with a hole 110 which receives a dowel to index the plate; and it is also provided with a two part outlet slot 111^a, 111^b, and a pressure relieving slot 112 (see Figs. V and VI). As the rotor 99 rotates fluid that is trapped in advance of the blades 101 is forced out through slots 111^a, 111^b into the space 104, 105. In operation the blades 101 are biased outwardly by centrifugal force, but when they are in the discharge phase they are being forced gradually inward by the cam action of ring 97. During this inward movement slot 112 serves to permit the escape of fluid which may be trapped in the roots of blade slots 100. The fluid expelled through slots 111^a, 111^b and 112 is delivered to the space 106 from which gas is expelled and liquid returned in a way which will be described later.

Mounted in casting 67 is a bushing 113, and above the bushing is a tubular extension 114. A valve stem 115 is provided with a washer 116 that has small notches in its periphery and makes a sliding fit with bushing 114. Above and below washer 116 are spacer weights 117 and 118 which are confined longitudinally on stem 115 by washers and spring rings as shown in the 75

drawings. A spring washer 119 biases spacer 118 upwardly to firmly clamp washer 116. For cleaning or other purposes valve stem 115 and its assembly can be removed by opening cover plate 120 and removing plug 121.

Top bearing and lubrication

A reservoir casting 125 is provided with a closure 126 that is sealed by gasket 127 to the outside cover 9*. Casting 125 nests as shown with casting 67 and is secured thereto by screws such as 51. A plug 128 and depending filler tube 129 permit the reservoir to be filled with oil up to the level of the bottom of tube 129. Integral with the reservoir casting is an annular riser 130 which is so perforated that oil can flow into it. Mounted within the riser 130 is a pressed steel metal cone cup 131 and a ball bearing assembly 132. As shown in the drawings, the inner race of the ball bearing is confined longitudinally on shaft 14 by washers and spring rings, and a spring washer 134 exerts a clamping action. An inverted cup 135 is nested within the cone cup 131 and mounted to rotate with shaft 14. During rotation of the shaft the cups 131 and 135 act to elevate the oil the slight distance required to lubricate the ball bearing.

Direct flow of oil downwardly around shaft 14 is prevented by tube 136; and leakage is prevented by a sealing gland comprising packing 137 which is compressed by spring 138. Felt packing 139 provides a sufficient seal where shaft 14 passes through the top of the bearing chamber.

Discharge valve

This is best shown in Fig. III. A valve stem 140 is biased downwardly by spring 141 and is attached to a valve head 142 to which is clamped a valve disk 143. Clamped with disk 143 is a pan-like member 144, but only disk 143 engages valve seat 145. It will be understood that when the pump is incorporated in the usual dispensing system, outlet 146 is connected by piping to a metering device which discharges into a flexible dispensing hose having a cut-off valve at its free end. In Fig. III, these parts are indicated diagrammatically, 170 being the piping, 171 the metering device, 172 the flexible hose and 173 the hose valve. With the system standing idle and valve 143 closed, an increase of temperature will result in pressure being built up in the flexible hose and connecting piping; and check valve 147 permits reverse flow as required to relieve such pressure. An adjustable detent 148 limits the degree of valve opening; and closure 149 has an end formation 150 which permits it to be used as a wrench to adjust the detent.

Operation

When the pump is incorporated in a complete dispensing system ready to operate, inlet 31 is connected by piping with a subterranean storage tank. These are indicated diagrammatically in Fig. III as piping 175 and tank 176. Also an air discharge pipe replaces plug 37 (Fig. III).

Operation of the motor 5 results in rotation of impeller 32 and also in rotation of rotor 99 of the auxiliary pump. Until primed the impeller 32 is ineffective, but the auxiliary pump primes the impeller by withdrawing air through impeller holes 47 into inlet passage 75. As soon as the liquid reaches the impeller 32, the impeller commences to function as a centrifugal pump and delivers liquid under pressure to discharge valve unit 10.

When the valve at the end of the dispensing hose is opened, the pressure of the liquid opens valve 143 and liquid is dispensed. When the dispensing hose valve is closed, the flow is forced to cease and spring 141 closes valve 143, but impeller 32 may be kept in operation without causing any damage. At the instant that the dispensing hose valve is opened, the full static pressure built up by impeller 32 acts on valve disk 143 to open the valve. As soon as flow commences, the resultant pressure on disk 143 diminishes, but the flow is then effective on the entire area of pan member 144. Thus, the valve is held well open, without flutter, as long as the flow continues. As a result this discharge valve offers little flow resistance during dispensing and the impeller is enabled to deliver a copious discharge of liquid.

As the impeller pumps liquid with entrained gas, the gas is centrifugally separated due to the great difference in specific gravity of gas and liquid. The gas tends to stay adjacent to the hub of the impeller and is continuously drawn off (through holes 47) by the auxiliary pump. Under some conditions, the initial centrifugal separation of the gas may not be one hundred per cent perfect, with the result that in such case some gas is discharged by the impeller 32. Any such gas collects in the annular space 59, from which it passes behind shield 60 and out through holes 64. This movement of gas from area 59 is due to the liquid pressure built up by the impeller in the space below area 59, plus the fact that holes 64 are at a low pressure area due to the whirling influence of the impeller 32. The air or gas particles tend to hug the center of the impeller and are forced by the pressure built up by impeller 32 to pass between the running fit of parts 69 and 46 to the low pressure area within port 69. Normally the running fit between parts 69 and 46 furnishes a sufficient passage from the exterior to the interior of throat 46, but if desired special bleeder passages may be provided from the inside to the outside of throat 46. Thus any gas which gets through the impeller is returned to a point where it is under the influence of the auxiliary pump and is drawn off.

Of course, some liquid is also drawn in by the auxiliary pump, so that this pump will eventually fill with liquid and discharge both liquid and gas. From discharge space 106 the gas passes through the notches in washer 116, to passage 145, and thence to space 146 which communicates with the air outlet pipe that is substituted for plug 37 (Fig. III).

The notches in washer 116 can pass a very large quantity of gas, but only a very small quantity of liquid. When liquid accumulates to the point where it is trying to pass washer 116, it raises the washer and lifts the drain valve from its seat 86. This permits liquid to drain back through passageway 87, 88, 89; and the major portion of such returned liquid passes through holes 47 and is added to the liquid stream of impeller 32. If any liquid passes out through passageway 145, it collects on top of partition 21 and is picked up again by the auxiliary pump through secondary intake port 79 (Fig. VIII).

The present invention has been put into practical commercial service and has been found to function very effectively. In pumping liquid the disclosed organization utilizes to advantage the desirable characteristics of a centrifugal pump. It also automatically separates out any quantity of entrained gas with unusual completeness,

though special air separators and all floats have been eliminated. In compliance with the patent statutes I have disclosed the best form in which I have contemplated applying my invention, but as various modifications and mutations are possible, the disclosure is to be considered as illustrative and not limiting.

What is claimed is:

10 Pumping apparatus comprising, an impeller casing having a liquid inlet and a liquid outlet; an impeller mounted on a vertical shaft within said casing; a closure for said casing having an

aperture adjacent to the shaft of the impeller; and an auxiliary pump mounted on the shaft and on top of said closure, the auxiliary pump having an inlet communicating with the impeller casing through said aperture in said closure, and an outlet discharging into a separating chamber, an air outlet port leading to atmosphere from said separating chamber, and a float-valve controlled liquid outlet passage leading from said separating chamber to said impeller casing through said closure aperture.

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