May 4, 1948. J. R. PARKER 2,440,912

JET MOTOR PUMP UNIT

Filed Oct. 19, 1946 4 Sheets-Sheet 1

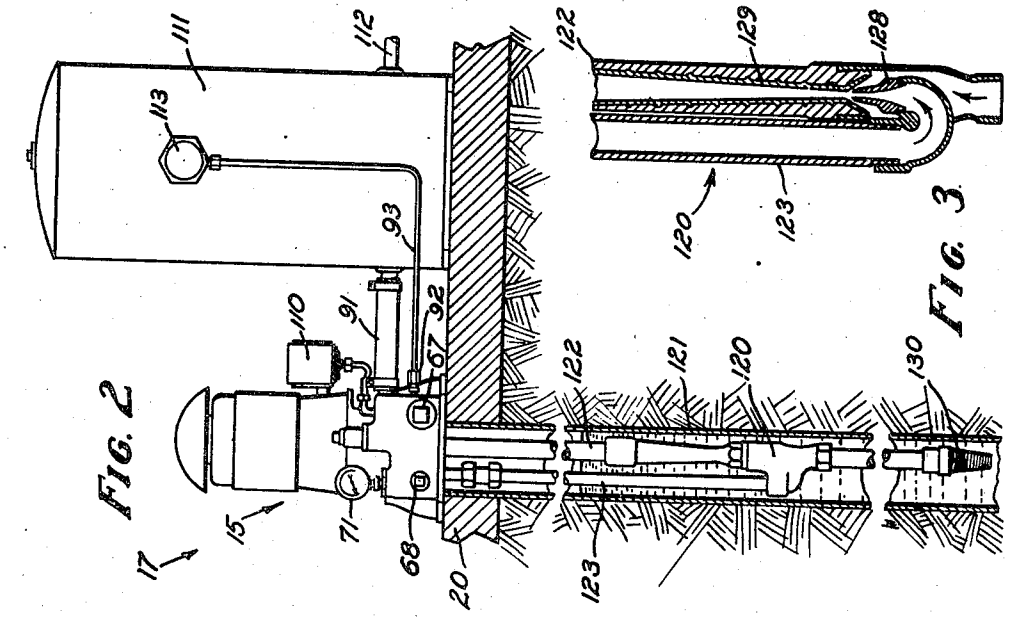

FIG. 2

FIG. 3

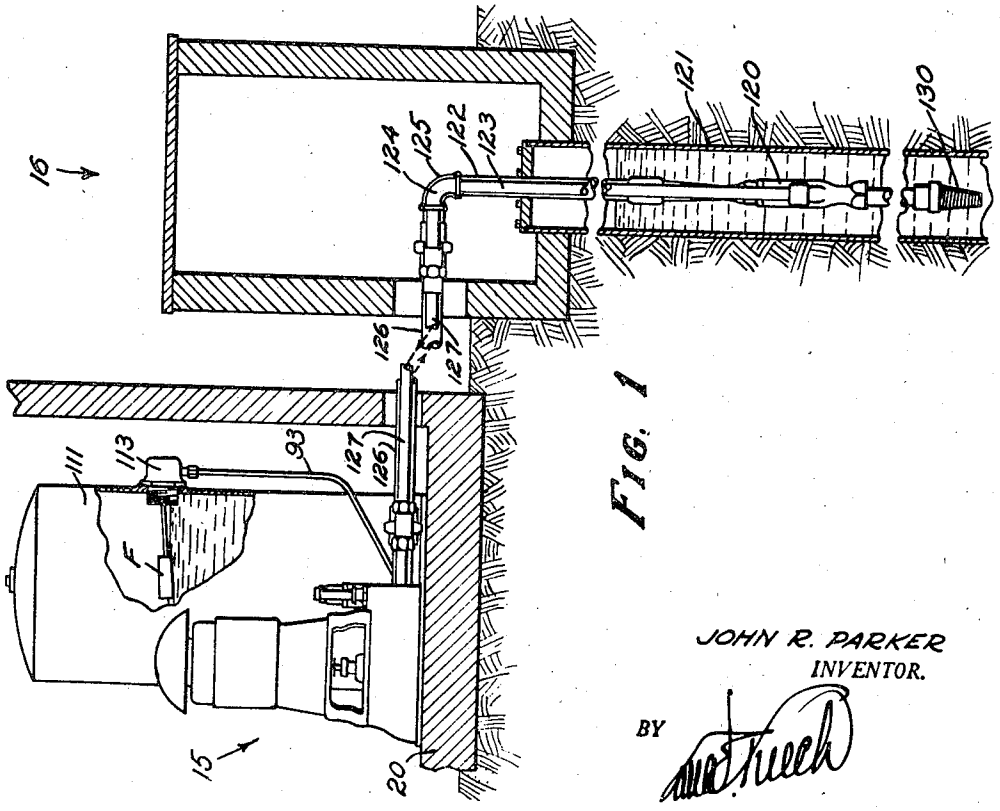

FIG. 1

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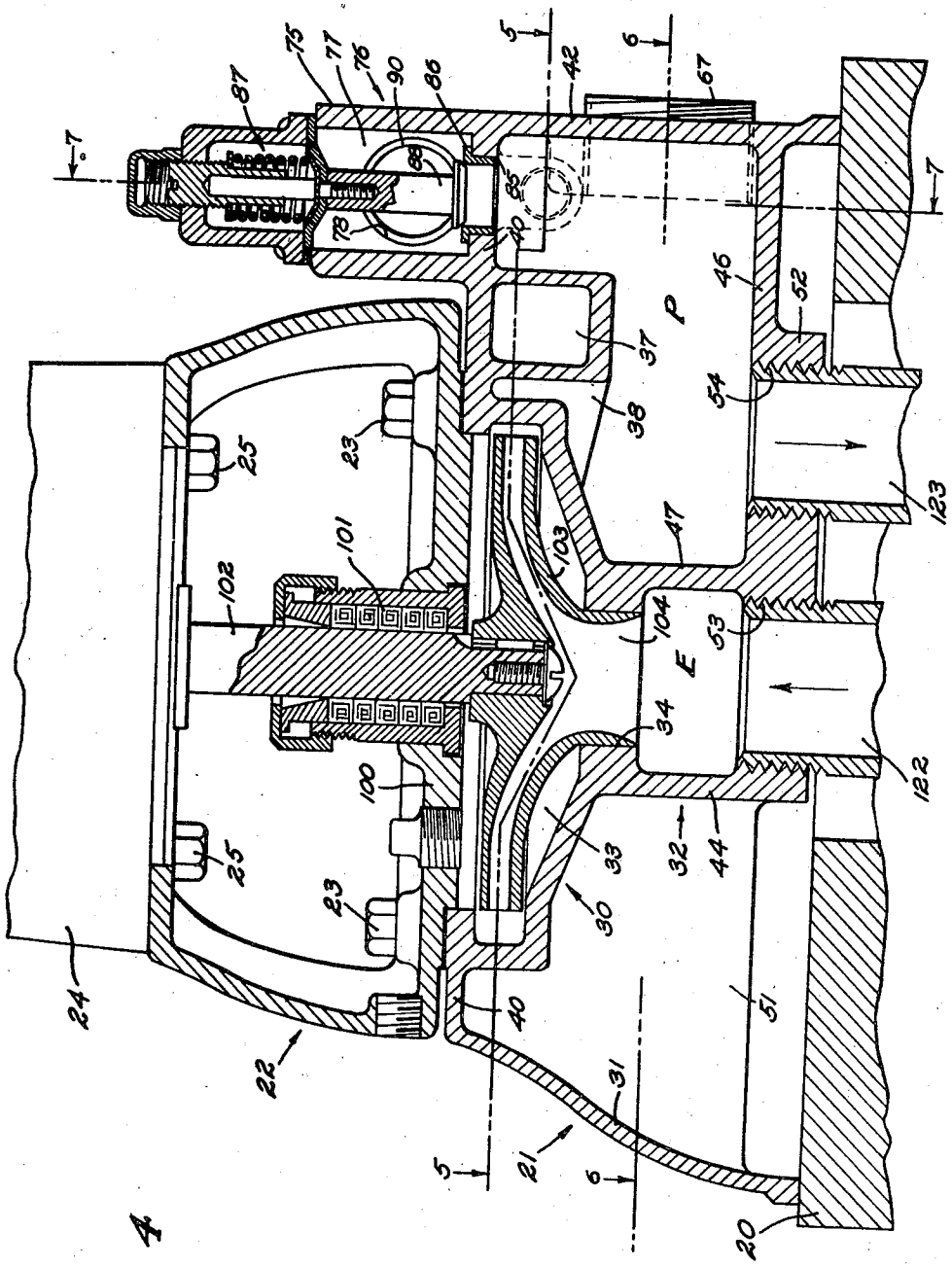

FIG. 4

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4 Sheets-Sheet 3

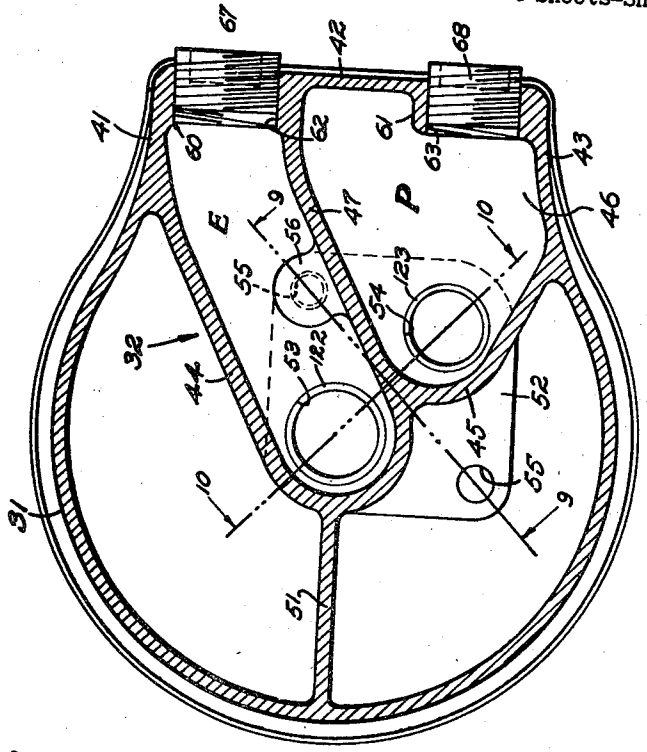

FIG. 5

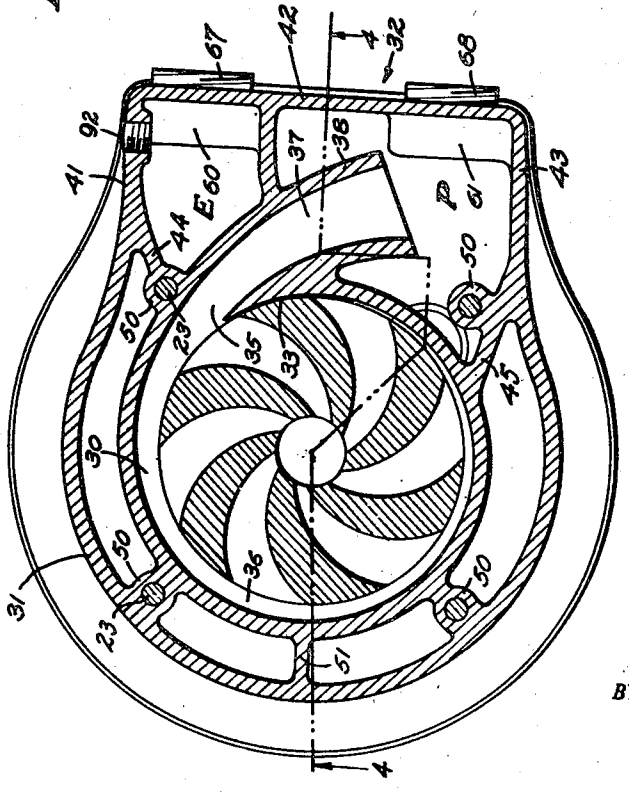

FIG. 6

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4 Sheets-Sheet 4

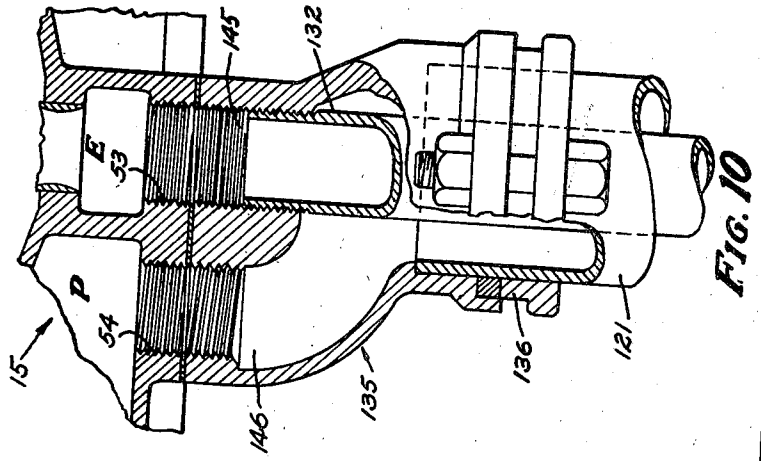


FIG. 10

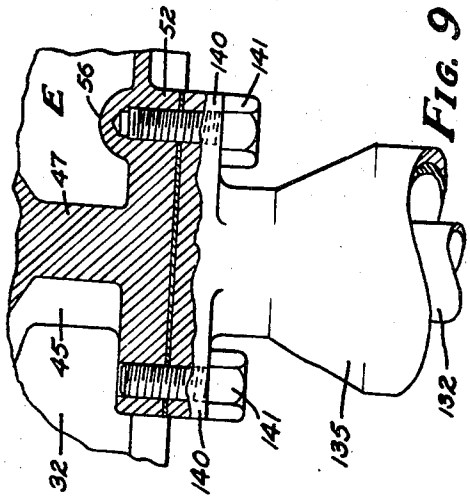


FIG. 9

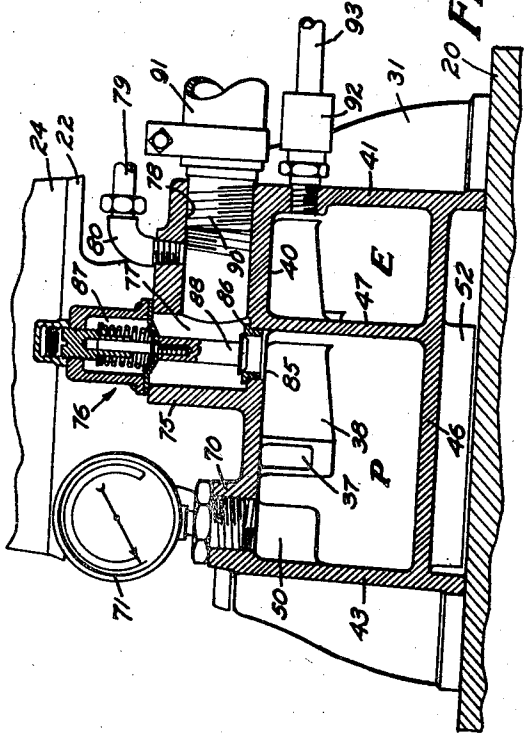


FIG. 7

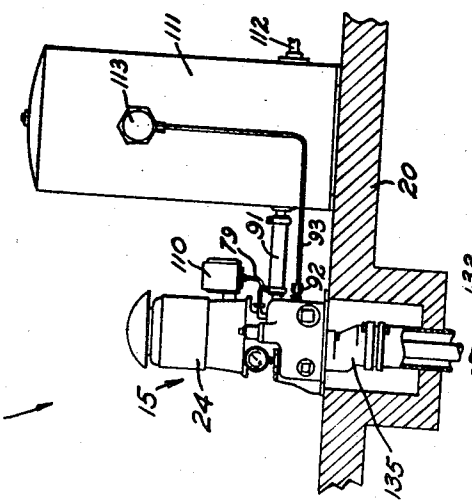
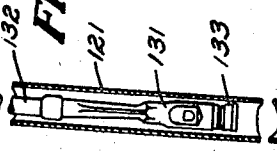


FIG. 8



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Patented May 4, 1948

2,440,912

UNITED STATES PATENT OFFICE

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JET MOTOR PUMP UNIT

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Application October 19, 1946, Serial No. 704,520

5 Claims. (Cl. 103—5)

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This invention relates to well pumps and particularly jet well pumps.

Jet pumps are commonly used for pumping water from wells up to 120 feet in depth. The installation of this type of pump includes a motor pump unit located at the surface of the ground, a jet unit generally located below the water level in the well, an eduction pipe leading from the jet unit to the pump unit and a pressure pipe leading from the pump unit to the jet unit and supplying water from the pump under pressure to the jet unit to operate the latter to assist in lifting water up to the pump through the eduction pipe.

It is common practice to make an offset connection between the motor pump unit and the eduction and pressure pipes in the well. In many instances, however, the pump house is provided directly over the well and here it is much more efficient to have the motor pump unit directly over the well. Heretofore separate types of pump units have been provided for these two different kinds of installations.

It is an object of the invention to provide a jet motor pump unit which is adapted without modification to either and offset or over-the-well installation without any compromise of efficiency.

The manner of accomplishing the foregoing object, as well as further objects and advantages will be made manifest in the following direction taken in connection with the accompanying drawings in which:

Fig. 1 is a sectional view of an offset jet motor pump installation showing a preferred embodiment of the motor pump unit of the invention in side elevation.

Fig. 2 is a sectional view of an "over-the-well" jet motor pump installation including said motor pump unit and showing the latter in front elevation.

Fig. 3 is an enlarged diagrammatic fragmentary sectional view of the jet unit shown in the installations of Figs. 1 and 2.

Fig. 4 is an enlarged sectional view of the motor pump unit of the invention taken on the line 4—4 of Fig. 5.

Fig. 5 is a horizontal sectional view at reduced scale taken on the line 5—5 of Fig. 4.

Fig. 6 is the horizontal sectional view taken at reduced scale on the line 6—6 of Fig. 4.

Fig. 7 is a vertical sectional view of reduced scale taken on the line 7—7 of Fig. 4.

Fig. 8 is a sectional view illustrating an "over-the-well" installation of the motor pump unit of the invention employing a packer type jet unit.

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Fig. 9 is an enlarged fragmentary detail sectional view of the connection between the packer jet unit and the motor pump unit and is taken on the line 9—9 in Fig. 6.

Fig. 10 is a similar sectional view taken on the line 10—10 of Fig. 6.

Referring specifically to the drawings, the invention is therein shown as embodied in a motor pump unit 15 which may be employed as part of a jet pump installation 16 shown in Fig. 1 or in an installation 17, shown in Fig. 2, or in an installation 18, shown in Fig. 8.

The motor pump unit 15, see Figs. 4, 5, 6 and 7, includes a pump base 21 which is adapted to rest on a pump house floor 20 of any of these three installations, and a motor base 22 which rests on the base 21 and is secured thereto as by cap screws 23, and a motor 24 which rests on the motor base 22 and is secured thereto as by cap screws 25.

The pump base 21 is formed of a single casting in which are integrally incorporated an impeller bowl 30, a skirt 31, and a box 32. The bowl 30 provides an impeller chamber 33 from which a central intake hole 34 opens downwardly and a discharge hole 35 opens peripherally. The chamber 33 has a spiral channel 36 formed radially therefrom (substantially throughout the periphery of said chamber) this channel connecting with the discharge hole 35. The hole 35 opens into a passage 37 of a discharge nozzle 38, the passage 37 being spirally shaped and constantly increasing in cross section.

The skirt 31 is, for the most part, concentric with the axis of the bowl 30 and is connected at its upper level to this bowl by a horizontal wall 40. At one side, the skirt 31 extends laterally out of concentric relation with the bowl 30 to provide vertical walls 41, 42 and 43, which are part of the skirt but which also are part of the box 32.

The box 32 is formed within and partly by the skirt 31 and besides the walls above mentioned includes a vertical wall 44, which extends from the wall 41 and, curving about the axis of the bowl 30, it unites with a wall 45 which extends to and unites with the vertical wall 43. The box 32 has a horizontal bottom wall 46 which is located near the lower level of the skirt 31 and unites with the walls 41, 42, 43, 44 and 45.

The space within the box 32 is divided by a vertical internal wall 47 which extends between the wall 42 and the juncture of the walls 44 and 45, at its side edges, and between the walls 40 and 46, at its top and bottom edges. The upper edge of wall 47 also conforms to and is integral

with the nozzle 38 so that the nozzle passage 37 extends through this wall.

The internal wall 47 thus divides the space within the box 42 into an eduction chamber E and a pressure chamber P. The intake hole 34 in the impeller bowl 30 connects the impeller chamber 33 with eduction chamber E. The discharge end of the nozzle 38 lies at a central point in the pressure chamber P so that the peripheral discharge hole 35 and the spiral passage 37 of the nozzle 38 connects the impeller chamber 33 with the pressure chamber P.

Bosses 50 in the upper wall 40 which extend downwardly and unite with other structural elements as shown in Fig. 5, provide threaded apertures for receiving the cap screws 23.

To strengthen the pump base 21, a reinforcing web 51 is cast integral with and connects the skirt 31, the bowl 30 and the box wall 44.

Cast integral with the wall 46 is a heavy plate 52 which is approximately square with rounded corners, this plate having formed therein a vertical threaded eduction pipe hole 53 and a vertical threaded pressure pipe hole 54. The holes 53 and 54 are in opposite corners of the plate 52 and the other two corners of the plate have provided therein threaded holes 55 one of which is opposite the eduction chamber E and is kept from opening into this chamber by a boss 56 formed integral with the bottom wall 46 and extending upwardly therefrom into the eduction chamber E.

The outside vertical flat box wall 42 is provided with bosses 60 and 61 in which are formed respectively a horizontal eduction pipe hole 62 and a horizontal pressure pipe hole 63. The holes 53 and 62 are of the same diameter and similarly threaded so that an eduction pipe may be screwed into either of these. The holes 54 and 63 are of the same diameter and similarly threaded so that a pressure pipe may be screwed into either of these. A screw plug 67 is provided for closing one of the holes 53 and 62. Another screw plug 68 is provided for closing one of the holes 54 and 63.

A horizontal wall 40 which forms the top of the box 32 is thickened where it covers this box and has a boss 70 with a threaded aperture therein for receiving a pressure gauge 71, this gauge indicating the pressure of fluid in the pressure chamber P.

Also cast integrally with the wall 40 and extending upwardly therefrom is the body 75 of a pressure regulator 76. The body 75 has a cylindrical chamber 77 from which a threaded hole 78 opens horizontally. Screwed into the body 75 so as to connect a pressure switch tube 79 with the chamber 77 is a terminal fitting 80. Formed in the wall 40 coaxially with the chamber 77 is a hole 85 having a valve seat 86 pressed therein. The regulator chamber 77 opens upwardly and an adjustable spring actuated diaphragm unit 87, carrying a valve 88 and yieldably pressing the latter into closing relation with seat 86, is suitably secured to an upper face of the body 76 so as to close the open upper end of the chamber 77.

The hole 78 receives a threaded nipple 90 which connects a hose 91 to the regulator valve chamber 77. Screwed into a suitable threaded hole provided in the wall 41 is a terminal air check valve 92 which connects the eduction chamber E to an air line 93.

The motor base 22 includes a horizontal cover plate 100 which is secured by the cap screws 23 to the pump base 21 to cover the

impeller chamber 33. This plate 100 has a seal 101 which is located concentrically with respect to the impeller chamber 33 and may be of the stuffing box type as shown in Fig. 4, or it might be of any of the other well-known types of liquid seals for rotating shafts. The motor 24 has a shaft 102 which extends through the seal 101 and has fixed on its lower end, within the impeller chamber 33, a pump impeller 103. This impeller has an intake neck 104 which extends downwardly into the intake hole 34 of the pump.

The pipe 79 is connected to a suitable pressure switch 110 which is adapted to be set so as to start the motor 24 whenever the pressure in the regulator chamber 77 decreases below a given minimum value and stop the motor 24 when this pressure rises above a given maximum value.

In each of the installations of the motor pump unit 15 the hose 91 connects to a closed water storage tank 111, from which water is adapted to be withdrawn through a service pipe 112.

The tank 111 has a float type of air volume control unit 113 to which the air line 93 connects.

As above noted, the motor pump unit 15 is adapted to be employed in either of three types of jet pump installations 16, 17 and 18. Installation 16 is what is known as an offset jet pump installation and installations 17 and 18 are what are known as "over-the-well" installations. The motor pump unit 15 is adapted to be employed in any of these three installations of these two types with equal facility, without a change in the motor pump unit and without any impairment of the efficiency of the latter.

In an offset installation such as the installation 16 shown in Fig. 1, the motor pump unit 15 is connected with a jet unit 120 in a well casing 121 by means of an eduction pipe 122 and a pressure pipe 123. These pipes make quarter turns through elbows 124 and 125 respectively and are screwed respectively into the horizontal eduction pipe hole 62 and pressure pipe hole 63 of the motor pump unit 15. Before connecting up the motor pump unit 15 with the jet unit 120 in installation 16 therefor the plugs 67 and 68 are removed from the holes 62 and 63 and are screwed respectively into the holes 53 and 54.

The jet unit 120 is of a type well known in the art and it is believed the structure and operation of this is clear from the sectional view thereof in Fig. 3. This unit functions by water being supplied under pressure through the pressure pipe 123 to a jet nozzle 128 from which a jet of water is discharged into a Venturi tube 129 the upper end of which connects with the eduction pipe 122. The jet unit 120 is usually below the surface of the water in the well so that water flows in through a strainer 130 and normally surrounds the nozzle 128.

When the installation 16 is operating, therefore, water from the well is constantly sucked upwardly into the Venturi tube 129 by this jet and the high velocity of the jet is converted into sufficient pressure, by the expanding cross section of the Venturi tube, to lift the water up the eduction pipe 122 into the eduction chamber E of the pump unit 15 from which it is withdrawn by the pump's rapidly rotating impeller 103.

Water thus drawn into the impeller chamber 33 is discharged through the channel 36, hole 35 and passage 37 of the nozzle 38 into the pressure chamber P. Until the pressure builds up in this chamber sufficiently to open the valve 88, the water thus delivered to the pressure chamber P is all returned through the pressure pipe 123 to

the jet unit 120. As this unit continues to function and the pressure and eduction pipes and the chambers E and P of the motor pump unit 15 become filled with water, an amount of water must be expelled upwardly through the valve 88 which is equivalent to the amount sucked in from the well by the jet unit 120. The water thus passing the valve 88 flows through the hose 91 into the tank 111.

As the level of water in the tank rises, it compresses the air in the tank thus placing the water under increasing pressure. When this pressure has reached a desired maximum, the pressure responsive switch 110 shuts off the motor 24.

Drawing water from the tank 111 through the pipe 112 decreases pressure and the switch 110 starts the motor 24 to build up the supply of water in the tank 111.

Where the pump house is directly over the well and an "over-the-well" installation of the motor pump unit 15 is desirable, this is effected by using the plugs 67 and 68 to close the holes 62 and 63, and the eduction and pressure pipes 122 and 123 are screwed directly into the vertical holes 53 and 54 in the box 52. The operation of the installation 17, with the unit 15 connected with the eduction and pressure pipes in this manner, and with the plugs 67 and 68 transferred to the holes 62 and 63, as shown in Figs. 4 and 6, is exactly the same as in the installation 16 described herein above.

The "over-the-well" installation 18 shows the motor pump unit 15 assembled with what is known as a "single pipe over-the-well" assembly. This assembly, which makes it possible to employ the jet principle in wells otherwise too small in diameter, includes the well casing 130 itself and a jet unit 131 which is suspended in the casing 130 at the lower end of an eduction tube 132. Provided on the lower end of the unit 131 is a rubber packer 133 which closes off the space between the unit 131 and the casing 130 so that the space between the two may be used as a pressure pipe. An adapter 135 receives the upper end of the casing 130 and has a stuffing box 136 which makes a liquid tight connection with the casing.

This adapter has connecting flanges 140 at its upper end by which it is secured to the plate 52 of the motor pump unit 15 by cap screws 141 (see Fig. 9). The adapter 135 has a threaded hole 145 which is concentric with the packing gland 136 and into which the upper end of the eduction pipe 132 screws. The adapter also has an offset hole 146 which connects the pressure hole 54 of the motor pump unit 15 with the upper end of the well casing 130 when the adapter 135 has been secured to the plate 52 as shown in Figs. 9 and 10. Assembling the adapter on the pump unit in this way also connects the hole 145 of the adapter with the hole 53 of the pump unit. Thus the eduction chamber E of the pump unit is connected with the eduction pipe 132 and the pressure chamber P is connected with the well casing 130 which serves in this installation as the pressure pipe.

From the foregoing, it is believed clear that the motor pump unit 15 herein described offers a complete solution to the problem heretofore met with of supplying separate types of motor pump units for "over-the-well" and offset jet pump installations. Without adding to the cost and without requiring any kit of parts and tools for conversion, a single motor pump unit is provided by this invention which can be used without alteration and without compromising in any way the

efficiency of operation of the motor pump unit for either of these types of installation.

The air volume control unit 113 contains a valve which connects with the upper end of the tube 93 and which is opened by float F of this unit when the float is lifted by the water in tank 111 rising above a given maximum level. When this occurs, air is admitted by the unit 113 to the tube 93 and this is drawn by the pump through the check valve 92 and into the water flowing to the pump through the eduction chamber E. When this water is discharged from the pump through the nozzle 38 into the pressure chamber P, the air contained therein separates out from the water, rises to the top of chamber P, and passes out through pressure regulator 76 and into the tank 111. This increases the amount of air in the upper end of the tank and lowers the float F so as to again shut off the valve in the unit 113 thereby closing the upper end of the tube 93.

Heretofore the regulation of the amount of air contained in the tank 111 by this method has not been considered possible except by the provision of a relatively high air separation chamber extending upwardly alongside the pump motor. In this invention it has been found that such a high separation chamber is not necessary and that the provision of an outlet in the upper wall 40 of the pressure chamber P just back of and above the nozzle 38 facilitates the separation of the air from the water in pressure chamber P and the discharge of this air from said chamber through the pressure regulator 76 and into the water tank 111.

The pressure chamber P, although confined within the pump base 21, nevertheless performs the air separating function formerly requiring a high dome.

I claim:

1. In a motor pump unit adapted for use in a jet pump installation by being connected to a jet unit in the well by eduction and pressure pipes, the combination of: an impeller bowl; a skirt integral with said bowl for supporting said bowl; a water passage box integral with said bowl and said skirt, said bowl having an impeller chamber and a central intake hole and a peripheral discharge hole, said holes communicating with said chamber, said box being formed by a bottom wall adjacent the lower level of said skirt, a top wall at the upper level of said skirt, an internal vertical wall and a flattened outer vertical wall formed by extending said skirt laterally from said bowl to form an enlargement of said skirt to one side of said bowl, the interior of said box being divided by a central vertical partition into eduction and pressure chambers; a spiral nozzle formed integral with said box, said nozzle connecting with said discharge hole and extending into said pressure chamber and discharging centrally into the latter, said intake hole connecting said impeller chamber with said eduction chamber, there being a pair of eduction and pressure pipe holes in said bottom box wall and opening downwardly respectively from said eduction and pressure chambers, and a pair of eduction and pressure holes in said vertical box wall and opening laterally respectively from said eduction and pressure chambers; a motor base secured to said bowl and closing said impeller chamber; a liquid seal on said base concentric with said impeller chamber; a motor mounted on said base with its shaft extending through said seal into said impeller chamber; and an impeller mounted on said shaft within said impeller chamber.

2. In a motor pump unit adapted for use in

a jet pump installation by being connected to a jet unit in the well by eduction and pressure pipes, the combination of: an impeller bowl; a skirt integral with said bowl for supporting said bowl; a water passage box integral with said bowl and said skirt, said bowl having an impeller chamber and a central intake hole and a peripheral discharge hole, said holes communicating with said chamber, there being a spiral channel formed radially from substantially the entire periphery of said chamber and connecting with said peripheral opening, there being a spiral passage connecting with said discharge hole and forming a continuation of said channel with a constantly increasing cross-section, a pressure chamber being formed in said box into which said spiral passage opens, an eduction chamber being formed in said box which connects with said central intake hole, vertical pressure and eduction holes being formed in the bottom of said box and opening downwardly respectively from said pressure and eduction chambers, horizontal pressure and eduction holes being formed in an outside wall of said box to open laterally respectively from said pressure and eduction chambers; a motor base secured to said bowl and closing said impeller chamber; a liquid seal on said base concentric with said impeller chamber; a motor mounted on said base with its shaft extending through said seal into said impeller chamber; and an impeller mounted on said shaft within said impeller chamber.

3. In a motor pump unit adapted for use in a jet pump installation by being connected to a jet unit in the well by eduction and pressure pipes, the combination of: an impeller bowl; a skirt integral with said bowl for supporting said bowl; a water passage box integral with said bowl and said skirt, said bowl having an impeller chamber and a central intake hole and a peripheral discharge hole, said holes communicating with said chamber, said box having eduction and pressure holes opening downwardly for an over-the-well installation and eduction and pressure holes opening laterally for an offset installation, there being passage means in said box connecting both of said eduction holes with said intake hole in said bowl, and passage means in said box connecting both of said pressure holes with said peripheral discharge hole in said bowl; a motor base secured to said bowl and closing said impeller chamber; a liquid seal on said base concentric with said chamber; a motor mounted on said base with its shaft extending through said seal into said chamber; and an impeller mounted on said shaft in said chamber.

4. In a motor pump unit adapted for use in a jet pump installation by being connected to a jet unit in the well by eduction and pressure pipes, the combination of: an impeller bowl; a skirt integral with said bowl for supporting said bowl; a water passage box integral with said bowl and said skirt, said bowl having an impeller chamber and a central intake hole and a peripheral discharge hole, said holes communicating with said chamber, said box having eduction and pressure holes opening downwardly for an over-the-well installation and eduction and pressure holes opening laterally for an offset installation, there being passage means in said box connecting both of said eduction holes with said intake hole in said bowl and passage means in said box connecting both of said pressure holes with said peripheral discharge opening in said bowl; a motor base secured to said bowl and closing said impeller chamber; a liquid seal on said base concentric with said impeller chamber; a motor mounted on said base with its shaft extending through said seal into said impeller chamber; and an impeller mounted on said shaft within said impeller chamber.

5. In a motor pump unit adapted for use in a jet pump installation by being connected to a jet unit in the well by eduction and pressure pipes, the combination of: an impeller bowl; a box formed integrally with said bowl; a wall dividing the interior of said box into eduction and pressure chambers said box having a horizontal outside wall and a vertical outside wall common to both of said chambers, said bowl having an impeller chamber and a central intake hole and a peripheral discharge hole, said holes communicating with said impeller chamber, said intake hole also communicating with said eduction chamber, and said discharge hole also communicating with said pressure chamber, there being eduction and pressure pipe connecting holes in said horizontal box wall, opening respectively into said eduction and pressure chambers, and eduction and pressure pipe connecting holes in said vertical wall, opening respectively into said eduction and pressure chambers; a motor base secured to said bowl and closing said impeller chamber; a liquid seal on said base concentric with said impeller chamber; a motor mounted on said base with its shaft extending through said seal into said impeller chamber; and an impeller mounted on said shaft within said impeller chamber.

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