

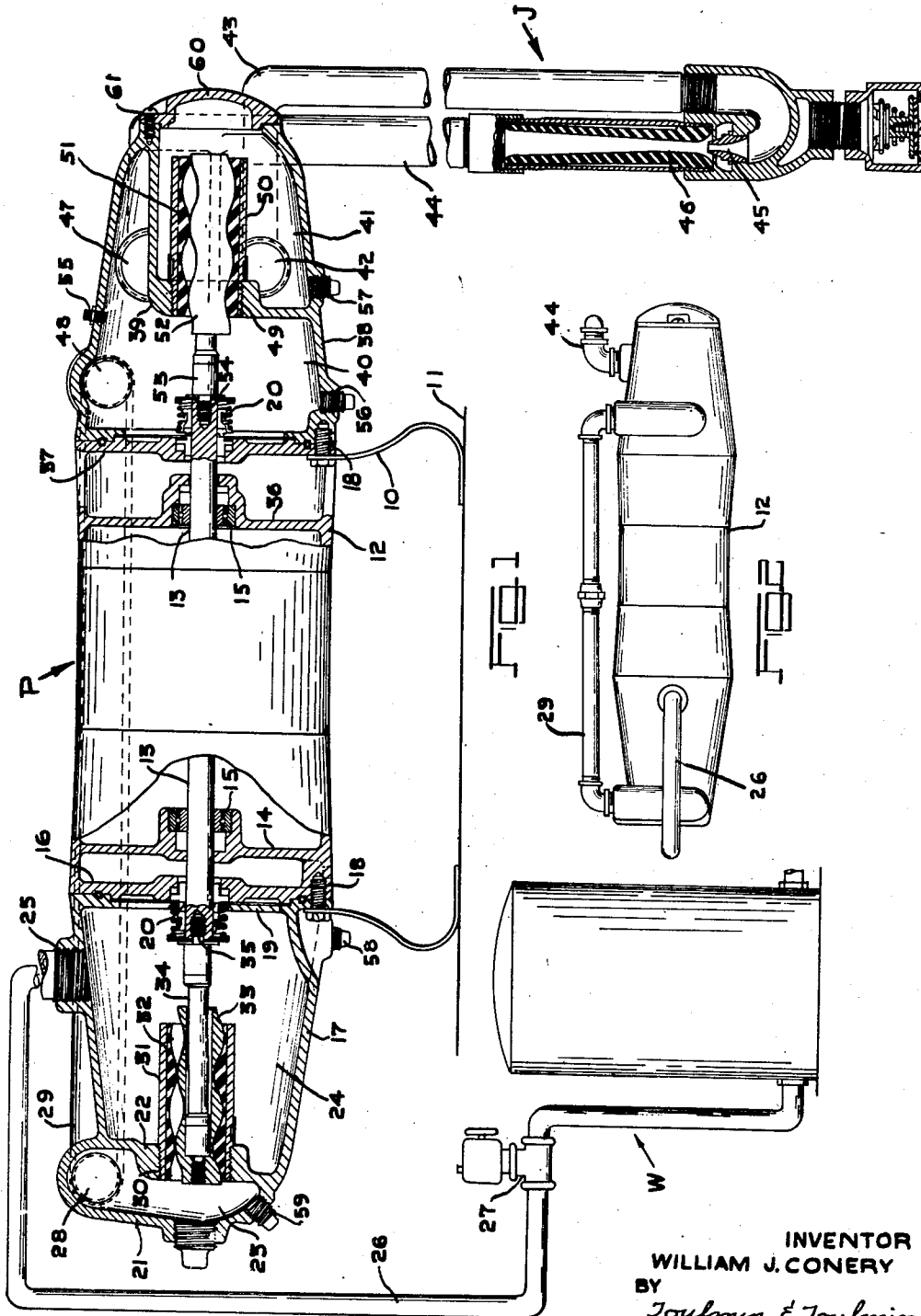
Oct. 12, 1954

W. J. CONERY  
DOUBLE ROTARY FLUID PUMP

2,691,346

Filed Sept. 7, 1948

4 Sheets-Sheet 1



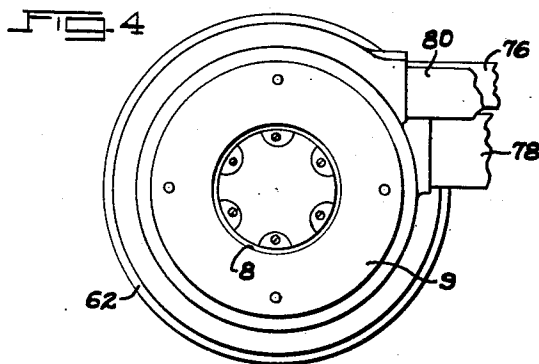
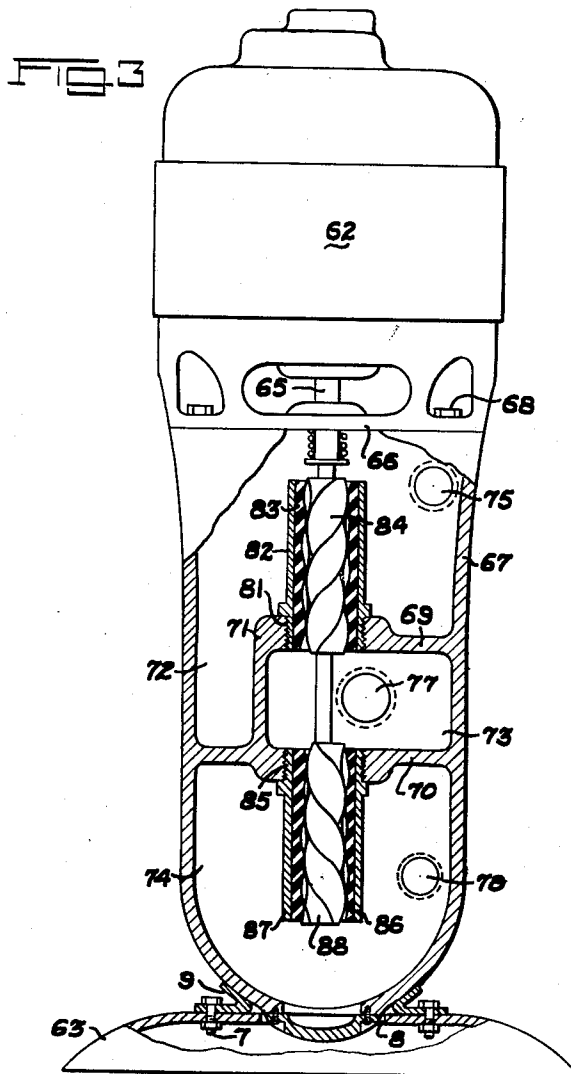
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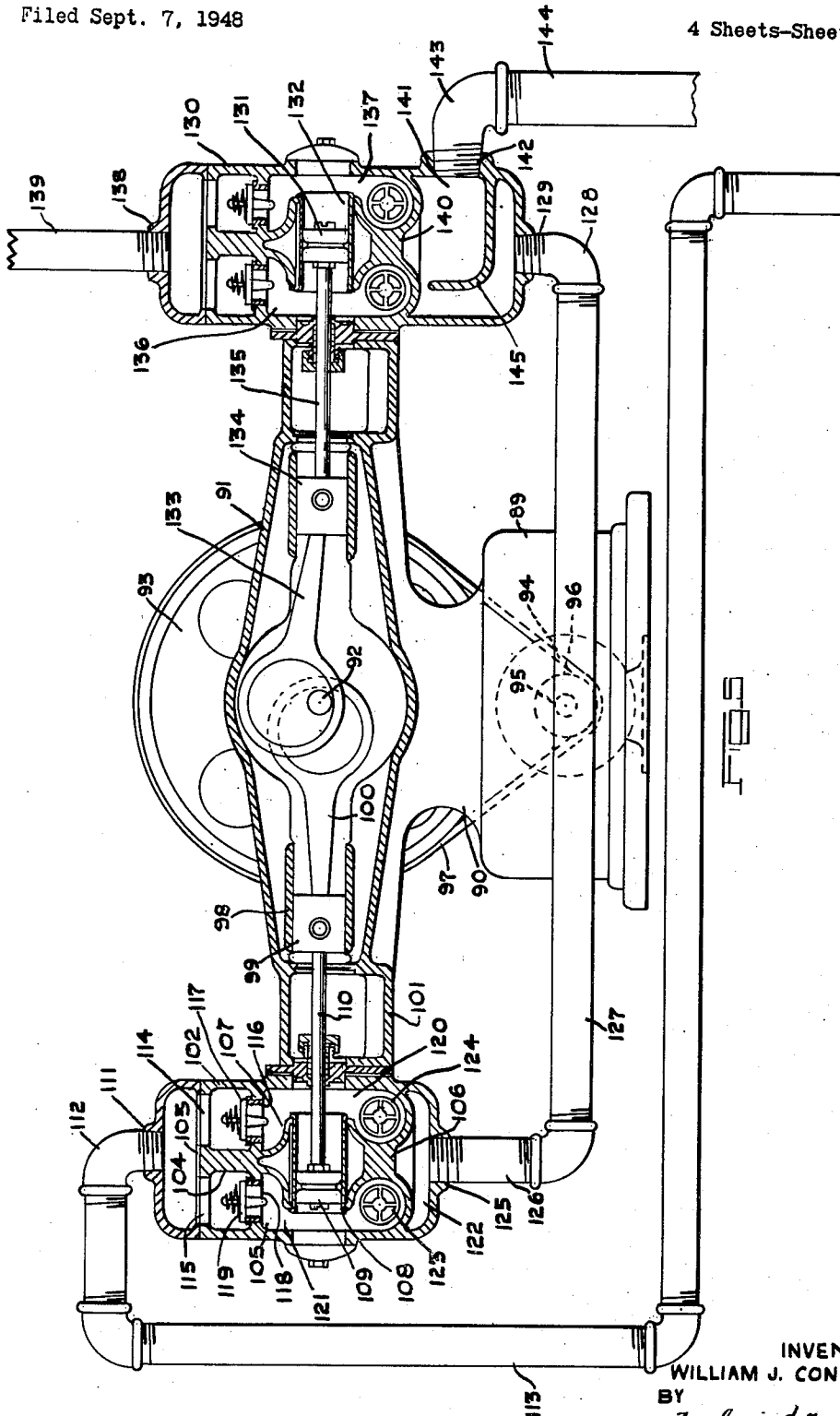
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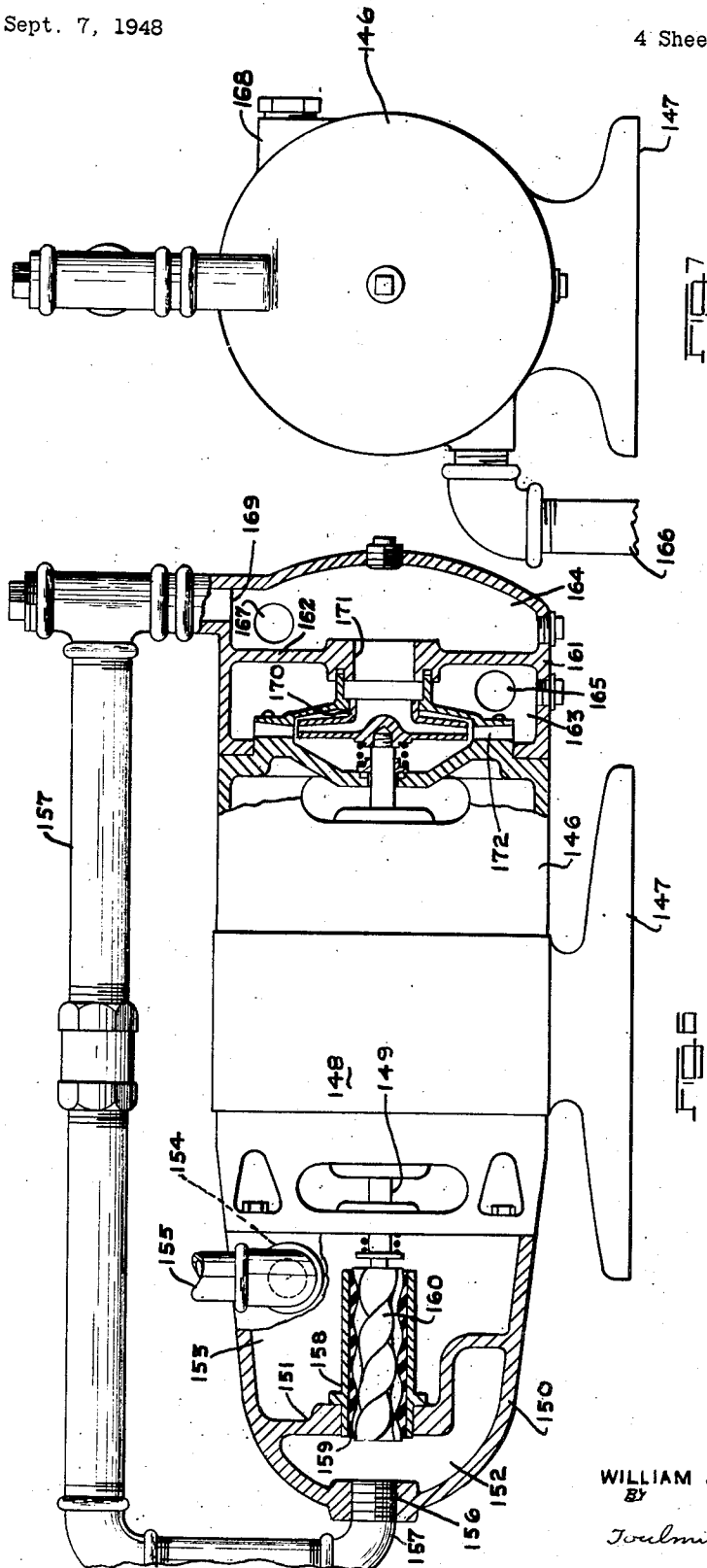
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4 Sheets-Sheet 4



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## UNITED STATES PATENT OFFICE

2,691,346

## DOUBLE ROTARY FLUID PUMP

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Application September 7, 1948, Serial No. 47,985

1 Claim. (Cl. 103—5)

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This invention relates to pumps, and is concerned primarily with a pump designed for deep well operation.

At the present time the arrangement of raising water from a well and delivering it to a pressure tank in a dwelling or other building has followed certain more or less standardized lines.

Thus, it is common practice to employ a jet which is located at or beneath the well level and which is included as a part of a jet system. This jet entrains water from a well and delivers it through a pump into an air separation chamber. From the air separation chamber water and air are pumped under pressure to the pressure tank.

There have been proposed so-called double or dual pump arrangements. Such arrangements generally follow the pattern of providing a jet supply pump for a jet system and a discharge pump for delivering the water under pressure to the tank. Both of these pumps are usually driven from a power source such as an electric motor.

Heretofore it has been the practice to employ centrifugal impellers as the pumps and particularly use such an impeller on the discharge side. Many disadvantages attend the use of such a centrifugal impeller, and these disadvantages are intended to be greatly minimized, if not completely eliminated, by the present invention, which has, as its foremost objective the provision of a double rotary pump of the type indicated which includes a positive displacement pump on the discharge side.

With a positive displacement pump on the discharge side, it is possible to constantly pump air and water to the pressure chamber. Thus, there is definite assurance that there is always sufficient air in the storage tank to supply the water under the volume required for its service dispensing.

In this connection it is noted that another highly important object is the provision in a pump of the type indicated of an air separation chamber on the suction side which has an air inlet communicating with atmosphere together with the positive displacement pump on the discharge side.

With such an arrangement assurance is had that there is always sufficient air in the chamber to be pumped together with the water and delivered to the pump on the discharge side. With an adequate supply of air present at all times in the chamber the latter functions as a cushion and holds noise down to a minimum. Moreover, it eliminates any tendency of the positive dis-

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placement pump on the discharge side from drawing more water than it should from the jet system, which would cause hammering and chattering.

In a pump of the type with which this invention is concerned it is common practice to provide an air separation chamber. As the name implies the chamber is provided for the purpose of separating air from the water, as it is desirable that only water go back to the jet system.

In the co-pending application of William J. Conery, issued on July 15, 1952 as U. S. Patent 2,603,157 there is illustrated and described a pump of this type in which the air separation chamber is located on the suction side of both the jet and discharge pumps. This arrangement provides good separating action which is further enhanced by locating the discharge port from the air separation chamber at the uppermost level of the chamber.

The present invention has as a further object the provision of such an arrangement in combination with positive displacement pumps both on the jet supply and discharge sides.

When the positive displacement pumps are so included many decided advantages are achieved. In the first place high efficiency may be obtained for low capacity operations as compared to such operations when carried out with centrifugal impellers. This high efficiency may be attributed to the fact that with the positive displacement pumps the system may be operated at very high pressures, which permits the use of small bore tubing, thus reducing the size and cost of installations and also operating losses due to friction. Moreover, the power performance requirement of the motor depends on the pressure on the discharge side. If the system be for small capacities, then a relatively small motor may be used.

Another advantage of employing positive displacement pumps as above indicated is that the system will remain in operation even though leaks should develop in the jet system. This is definitely not true when a centrifugal impeller pump of the conventional single pump system is used as the jet supply pump and with a positive displacement pump at this point, the efficiency of operation is only slightly impaired with the pump remaining in substantially full operation.

Another advantage in employing the arrangement of air separating chamber above referred to in connection with the co-pending application, together with the positive displacement pump, is that no air is delivered in the jet system going to the well. Air in the jet system is an undesirable

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factor which is definitely to be avoided as it reduces the efficiency of operation, and this end is attained by this arrangement. Moreover, any gas which is in the well is accommodated because it is separated from the water in the air separation chamber. Thus, when a double rotary jet pump includes this arrangement of the air separation chamber, together with the positive displacement pumps, it will function regardless of any well conditions, such as falling off of the level of water, the subsequent restoration, and the like.

As above explained, one of the big advantages of employing a positive displacement pump on the discharge side is that it provides for a constant delivery capacity to the pressure tank at all pressures. This is not possible of achievement with a centrifugal impeller, and with this constant delivery there is assurance that the jet efficiency will remain constant and unimpaired, because the condition will never be created in which the water necessary to operate the jet supply system is drawn therefrom, that is, the jet supply system is never deprived of any of the water necessary for its operation. This is particularly true in view of the fact that the jet supply pump is at all times completely flooded.

A double rotary pump including the arrangement for the air separation chamber as above indicated, together with the positive displacement pumps, is particularly adapted for deep well use, and when so used there is no need for any control valve, either manual or automatic. The pump is adapted for use with the jet located at any depth without necessitating any pressure regulating valve. This is true because the jet supply pump is always flooded.

While the objects of the present invention may be achieved by employing any type of positive displacement pumps the invention has particularly in mind the use of the so-called "Moineau" pump, which is a gear type of pump that is fully illustrated and described in the patent to Moineau 2,028,407 of January 21, 1936. Such a pump is particularly adapted for use when both the jet and discharge sides of a double rotary pump are arranged as contemplated by this invention.

Various other more detailed objects and advantages of the invention, such as arise in connection with carrying out the above noted ideas in a practical embodiment, will in part become apparent and in part be hereinafter stated as the description of the invention proceeds.

The invention, therefore, comprises a double rotary pump including a positive displacement pump on both the jet supply and discharge sides with an air separation chamber located on the suction side of both pumps and with the discharge therefrom located at the uppermost level thereof.

For a full and more complete understanding of the invention reference may be had to the following description and accompanying drawings wherein:

Figure 1 is a side view partly in section and partly in elevation and somewhat diagrammatic in nature showing a pump designed in accordance with the precepts of this invention;

Figure 2 is a top plan view of the pump shown in Figure 1;

Figure 3 is a side view with parts broken away and shown in section of one modification;

Figure 4 is an end elevation of the pump shown in Figure 3 with the base removed;

Figure 5 is a side view partly in elevation and partly in section of another modification; in which the positive displacement pumps are of the plunger type;

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Figure 6 is a side view partly in elevation and partly in section of a modification in which there is a positive displacement pump on the discharge side only; and

Figure 7 is an end elevation of the pump shown in Figure 6.

#### *Preferred embodiment*

Referring now to the drawings, and first more particularly to Figures 1 and 2, a preferred embodiment of the invention which is therein illustrated will be described.

Figure 1 embraces a representation of the essential elements of the entire system. Thus, the jet system is identified in its entirety by the reference character J, the pump assembly at P, and the water tank at W.

The pump P is shown as supported by a base 10 which may take any form desired and which rests on a suitable supporting surface such as indicated at 11. Supported by the base 10 is a casing 12 which houses an electric motor providing a motor drive shaft 13 that projects from opposite ends thereof.

Referring now more particularly to the left hand side of Figure 1, the motor drive shaft 13 is shown as journaled in a partition 14 by a bearing assembly 15. The casing 12 has an end wall 16 formed with a central opening through which the shaft 13 extends. An end casing member 17 is clamped on the end wall 16 in abutting relation with respect thereto in any preferred manner such as by the screw bolts shown at 18. This end casing 17 has an inner end wall 19 formed with an opening that aligns with the corresponding opening in the end wall 16 and through which the shaft 13 passes. A seal referred to as 20 serves to provide a fluid tight seal where the shaft 13 passes into the casing 17. Seals of this type are old and well known and are available to the public as such. The particular type of seal employed is not a part of the invention and its details are therefore not herein described.

The casing 17 has an outer end wall 21 and a substantially vertical partition 22 which is spaced therefrom so as to define an inlet chamber 23 and a discharge chamber 24. The casing 17 is provided at the top with a threaded port 25 which communicates with the discharge chamber 24 and into which is screwed the threaded end of a conduit 26 that goes to the water tank W. A pressure operated automatic discharge valve 27 may be included in this conduit 26 at any convenient location and is provided for the purpose of relieving pressure after it has reached a certain predetermined limit. The overflow through valve 27 is merely wasted into the atmosphere and the usual practice is to spill such overflow into a drain.

The casing 17 is formed with a port 28 which communicates with the inlet chamber 23 and a pipe 29 has one end anchored in this port in a well known manner. The other end of the pipe 29 communicates with the air separation chamber as will be later described.

The partition 22 has a central thickened portion which, as illustrated, is formed with a threaded bore 30 that is substantially coaxial and in alignment with the motor shaft 13. A tubular sleeve 31 has one end threaded and screwed into the bore 30. This sleeve 31 carries a stator 32 of a Moineau pump which may consist of a rubber element, as illustrated, formed with helical passages therein.

The rotor of the Moineau pump is represented at 33 and is rotatable within the stator 32. This

member 33 is relatively non-yielding and is drivably mounted on a shaft 34 which is, in turn, drivably connected to the motor shaft 13 as represented by the connection at 35.

It is evident that with the motor 13 rotating in the proper direction water is drawn from the inlet chamber 23 and affected by the Moineau pump comprising stator 32 and rotor 33, to be delivered to the discharge chamber 24 under increased pressure. From the chamber 24 the water passes through port 25 and conduit 26 to the water tank W.

Referring now to the disclosure at the right hand side of Figure 1 it will be noted that the motor shaft 13 is journaled in bearings 15 corresponding to the similarly designated bearings at the other end. These bearings are carried by a partition 36 that is spaced inwardly from an end wall 37. An end casing 38 is clamped to this end wall 37 in abutting relation by the screw bolts 18. Another seal 28 is employed to seal the connection between the shaft 13 where it extends into the end casing 38.

The end casing 38 carries a partition structure 39 which defines an air separation chamber 40 and a pressure chamber 41. The casing 38 is formed with a port 42 which communicates with the pressure chamber 41 and in which is anchored a conduit 43 that constitutes the pressure supply side of the jet system J. The return side of the jet system is represented at 44 with the nozzle being shown at 45 and a venturi at 46. The casing 38 is formed with a port at 47 which communicates with the air separation chamber 40 and in which is anchored the free end of the jet return 44. The casing 38 is also formed with another port 48 at substantially the uppermost level thereof and this port 48 communicates with the air separation chamber 40 at the top. The conduit 29 has one end anchored in the port 48.

The partition structure 39 has a thickened part formed with a threaded bore 49 that is in coaxial alignment with the motor shaft 13. A sleeve 50 has one end screwed into this threaded bore 49 and extends into the pressure chamber 41. The sleeve 50 carries a stator 51 of a Moineau pump, while the rotor 52 of this pump is drivably carried by a shaft 53 which is drivably connected to the motor shaft 13 as shown at 54. This rotor 54 is rotatable within the stator 51 and serves to take water from the air separation chamber 40 and deliver it under increased pressure to the pressure chamber 41.

The end casing 38 is formed at the top with an opening in which is fitted an air inlet 55. The air inlet is included for the purpose of insuring an adequate supply of air for the air separation chamber 40 and the pressure tank. A drain for the air separation chamber is shown as closed by a plug 56, while a drain for the pressure chamber 41 is shown as closed by a plug 57. Likewise, a drain for the discharge chamber 24 is shown as closed by a plug 58, and a drain for the inlet chamber 23 is shown as closed by a plug 59. It will be noted that the pressure chamber 41 is closed at its outer extremity by an end closure 60 which is secured in position on the end casing 38 by screw bolts shown at 61.

#### Operation preferred embodiment

In describing the operation of the apparatus depicted in Figures 1 and 2, it will be assumed that the electric motor drives the shaft 13 in the proper direction and at a required speed. As the shaft 13 rotates it drives the Moineau pump

made up of stator 51 and rotor 52, and it will be remembered this is a positive displacement pump. This builds up pressure on water in the pressure chamber 41 and the water is thereby forced downwardly through port 42 and pipe 43 to the nozzle 45 of the jet system.

This nozzle 45 which cooperates with the venturi 46 entrains water from the well and all of the water passes upwardly through the return pipe 44 from which it is admitted through port 47 into the air separation chamber 40. As much of this water as is required for the jet system will be drawn back by the Moineau pump and delivered to the pressure chamber 41. However, the additional water which is entrained from the well, together with air which has come either from the well or from the inlet 55 is withdrawn from the port 48 and conducted through the conduit 29 to the inlet chamber 23 at the other end of the pump assembly P.

The Moineau pump comprising stator 32 and rotor 33 now takes water from the inlet chamber 23 and delivers it under increased pressure to the discharge chamber 24. The water, together with air, is delivered from the latter to the water tank W through the port 25 and conduit 26.

The above described pump presents the following advantages:

(a) Air is constantly pumped by the positive displacement pump 32-33 on the discharge side and there is, therefore, definite assurance that there will always be sufficient air delivered to the tank W to maintain the required air supply therein.

(b) There is always an adequate supply of air in the chamber 40 and this air acts as a cushion which holds noise down to a minimum.

(c) The pump will operate at high efficiency for low capacity operations as compared with centrifugal impellers. This may be attributed to the fact that the pump may be operated at high pressures to reduce friction losses and also the size of the pipe.

(d) The pump will remain in operation even though leaks should develop at any place in the jet system.

(e) The arrangement of the air separation chamber definitely eliminates any air in the jet system that goes to the well. Any gas in the well or other well conditions are definitely accommodated.

(f) The delivery to the tank W is constant for all pressures which is not possible of achievement with a centrifugal impeller. Moreover, the jet efficiency is constant due to the elimination of air therein.

(g) There is no need for any control valve in the jet supply system as it is effective at any depth.

(h) In the old single centrifugal impeller pump types the air and water from the jet pump must go through the impeller. This is not so in the present arrangement in which the air separation chamber is on the suction side of the jet supply pump.

All of these features add up to the fact that with the arrangement illustrated and described it is possible to provide a pump for deep well use which will operate at a high degree of efficiency.

#### First modification

Referring now more particularly to Figures 3 and 4, a motor is shown at 62 as carried by a casing 67. The latter is provided at its lower end with an annular supporting flange 9 which

may be secured thereto in any preferred manner as by welding. A base 63 is formed with a central opening 8 which receives the lower end of the casing 67 with the flange 9 resting on the upper surface of the base 63 about the opening 8. Bolts 7 may be employed to anchor the flange 9 to the base 63. Extending downwardly from one end of the motor is a motor shaft 65 that passes through an opening in an end wall 66. Clamped to this end wall 66 is the casing 67, the anchorage being effected by headed screw bolts shown at 68.

The casing 67 carries horizontal partitions 69 and 70 and a vertical partition 71. These partitions define a discharge chamber 72, an air separation chamber 73, and a discharge chamber 74. The casing 67 is formed with a port 79 which communicates with the pressure chamber 74 and also with a conduit 76 that extends to the pressure side of the jet system and also with the discharge chamber 72. The casing 67 is also formed with another port 77 that communicates with the air separation chamber 73 and a pipe 78 that constitutes the return side of the jet system. The casing 67 is formed with another port 75 which communicates with the discharge chamber 74 and at which is anchored one end of a conduit 80 that goes to the water tank.

The partition 69 has a thickened wall structure formed with a threaded bore 81 that is in coaxial alignment with the motor shaft 65. A sleeve 82 has one end screwed into the threaded bore at 81 and carries a stator 83 of a Moineau pump. The rotor for the Moineau pump is shown at 84 and is drivably mounted on a reduced extension of the shaft 65. The Moineau pump made up of the stator 83 and rotor 84 serves to deliver water pressure from the air separation chamber 73 to the discharge chamber 72.

The partition 70 is also formed with a thickened wall structure having a threaded bore 85 in which is anchored one end of a sleeve 87. The latter carries a stator 86 of a Moineau pump with the rotor of the pump which is indicated at 88 being mounted on the shaft 65. The Moineau pump made up of stator 87 and rotor 88 delivers water under increased pressure from the air separation chamber 73 to the discharge chamber 74.

#### Operation Figures 3 and 4

As the shaft 65 is driven by the motor 62 both the Moineau pumps are driven. The pump 86—88 takes water from the air separation chamber 73 and delivers it under increased pressure to the discharge chamber 74. This forces water out of the port 79 downwardly through the conduit 76 to the pressure side of the jet system in the well. The jet of this system entrains water from the well and the combined water is passed upwardly through the return pipe 78 and port 77 into the air separation chamber 73. As much water as is needed to operate the jet system is again returned thereto by the pump 86—88. However, the surplus water which is that water which has been entrained by the jet is delivered by the pump 83—84 to the discharge chamber 72 and from the latter through port 75 and conduit 80 to the water tank.

#### Second modification

Referring now more particularly to Figure 5, a modification involving plunger type pumps will now be described.

Upstanding from a base 89 is a pedestal 90 which carries a housing 91 having oppositely directed conical ends. A shaft represented at 92 extends into the housing 91 at a transverse axis

and drivably mounted on this shaft is a pulley 93. A motor represented by broken lines at 94 is mounted within the base 89 and has a drive shaft 95 carrying a pulley 96. A drive belt 97 extends over the pulleys 93 and 96 and serves to drive the shaft 92 from the motor 94.

Referring now more particularly to the left hand side of Figure 5, the end of the conical casing 91 carries on the interior thereof a sleeve 98 in which is drivably mounted a crosshead 99. A pitman 100 establishes the driving relation between the shaft 92 and the crosshead 99.

Connected to the casing 91 by a cylindrical section 101 is a vertically disposed casing 102. This casing 102 has an internal partition construction comprising an upper horizontal partition 103, vertical partition 104, horizontal partition 105, and lower horizontal partition 106. Between the partitions 105 and 106 there is a supporting structure 107 which supports a cylinder 108. A plunger 109 is slidably mounted in the cylinder 108 and connected to the crosshead 99 by a rod 110.

The top wall of the casing 102 is formed with a threaded port 111 in which is anchored a fitting 112. A conduit 113 connects this fitting 112 with the pressure side of the jet system in the well. The upper partition 103 is formed with openings 114 and 115. The partition 105 is formed with a port 116 which is in alignment with port 114. A one-way valve 117 controls communication through the port 116.

The partition 106 is also formed with another opening 118 which is in alignment with the opening 115. A one-way valve 119 controls communication through the opening 118. The partitions 105 and 106 together with the walls of the casing define pumping chambers 120 and 121. Below the partition 106 there is an inlet chamber 122. A valve 123 provides communication between the chamber 122 and pumping chamber 121, while another valve 124 provides communication between the chamber 122 and pumping chamber 120.

At this point it is well to note that reciprocation of the plunger 109 will cause water to be drawn from the inlet chamber 122 and alternately be pumped through chambers 120 and 121 through openings 116 and 118 to the port 111 under increased pressure.

The bottom wall of the casing 102 is formed with a threaded port 125 into which is screwed a fitting 126. A conduit 127 is connected to this fitting 126 and its other end is connected by a fitting 128 to a threaded port 129 formed in a casing 130. The upper portion of the casing 130 houses a plunger type pump mechanism which is exactly the same as that described for the left hand part of Figure 1.

Without referring to all of the various elements in detail, it is noted that a plunger 131 reciprocates in a cylinder 132 and is driven from the shaft 92 by a pitman 133, crosshead 134 and rod 135. Reciprocation of this pump alternately builds up pressure in the pumping chambers 136 and 137.

The top wall of the casing 130 is formed with a threaded port 138 to which is anchored a conduit 139 which goes to the water tank. The lower partition structure for the casing 130 is represented at 140 and this partition, together with the casing, defines an air separation chamber 141. The casing 130 is formed with a threaded port 142 which communicates with the air separation chamber 141 and in which is anchored a fitting 143. The return pipe of the jet system is shown

at 144 and is connected to the fitting 143. A baffle 145 is positioned in the air separation chamber 141 between the ports 142 and 129.

#### Operation Figure 5

As the shaft 92 is driven by the motor 94 the plunger type pumps at each side are driven through the pitmans 100 and 133. As the pump at the left hand side of Figure 5 is operated water is drawn from the inlet chamber 122 and alternately passed upwardly through the pumping chambers 120 and 121 through openings 116 and 118 to the port 111 at the top under increased pressure. The water is thereby forced through the conduit 113 down to the pressure side of the jet system in the well. The jet of this system entrains additional water from the well and the combined water passes upwardly through conduit 144 to the air separation chamber 141. From the latter sufficient water is drawn through port 129 and conduit 127 to operate the jet system. The remainder of the water is pumped by the plunger 131 alternately through chambers 136 and 137 to the port 138 from whence it passes through conduit 139 to the water tank.

#### Third modification

Referring to Figures 6 and 7, a motor casing is shown at 146 as being supported by a base 147. Mounted within the casing is a motor 148 from which projects at opposite sides a motor shaft 149. Mounted on the left hand side of the casing 146 is an end casing 150 having a partition 151 which defines an inlet chamber 152 and a discharge chamber 153. The casing 150 is formed with a port 154 which communicates with the discharge chamber 153 and in which is anchored one end of a conduit 155 that goes to a water tank. The end of the casing 150 is also formed with a port 156 which communicates with the inlet chamber 152 and to which is anchored one end of a conduit 157. The partition 151 has anchored therein one end of a sleeve 158 and this sleeve 158 carries a stator 159 of a Moineau pump. The rotor of this pump is shown at 160 and is drivably mounted on one end of the shaft 149. At the other end of the casing 146 there is mounted an end casing 161 having a partition 162 which defines a pressure chamber 163 and an air separation chamber 164. The casing 161 is formed with a port 165 which communicates with the pressure chamber 163 and with a conduit 166 going to the pressure side of the jet system. The casing 161 is also formed with another port 167 that communicates with the air separation chamber 164 and with a conduit 168 on the return side of the jet system. The casing 161 at the top is formed with a port 169 that communicates with the air separation chamber 164 and the pipe 157 has one end anchored in this port 169.

A centrifugal impeller is represented at 170 and is shown as being drivably mounted on the shaft 149. The impeller 170 has a suction port at 171 which communicates with the air separation chamber 164 while the passages 172 communicate between the impeller 170 and the pressure chamber 163.

#### Operation Figures 6 and 7

As the motor 148 operates it drives both ends of the shaft 149. The centrifugal impeller 170 draws water from the air separation chamber

164 and delivers it under increased pressure to the pressure chamber 163. From the latter the water is forced through port 165 to the pressure side of the jet system. The jet in this system entrains water in the well and the combined water is returned through the conduit 168 and the port 167 to the air separation chamber 164. As much water as is needed for the jet supply system is returned to the impeller 170 through the suction port 171. However, the additional water which has been entrained by the jet is drawn out through port 169 and passes through conduit 157 and port 156 to the inlet chamber 152. The Moineau pump 159—160 delivers water from the inlet chamber 152 to the discharge chamber 153 under increased pressure. This water is passed through port 154 and conduit 155 to the water tank.

It is evident that the form of invention shown in Figures 6 and 7 denotes that a positive displacement pump of the Moineau type is on the discharge side only. However, definite advantages attach to this arrangement in that there is constant delivery to the water tank for all pressures.

While preferred embodiments of the invention are hereinbefore set forth, it will be clearly understood that the invention is not to be limited to the exact apparatus, devices and mechanisms illustrated and described, because various modifications of these details may be provided in putting the invention into practice within the purview of the appended claim.

#### I claim:

A pumping system comprising in combination, a pair of pumps each having a suction inlet and a discharge outlet, said pumps consisting of rotary positive displacement pumps of the Moineau type, drive shafts for actuating said pumps, said drive shafts being mounted on a common axis, means for driving said shafts, a casing defining therein an air separation chamber, said chamber being in communication with said inlets, an air inlet in the upper portion of said air chamber, a jet pump having a nozzle and a diffuser, a conduit extending from the inlet side of the nozzle to the discharge outlet of one of said pumps, a conduit extending from the discharge side of the diffuser to said air separation chamber which is common to each of said pumps, and a discharge pipe to service extending from the discharge outlet of the pump other than the pump to which the nozzle of the jet pump is connected.

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