Sept. 6, 1949. E. DA S. ROSA 2,480,969

PUMPING APPARATUS FOR DEEP WELLS

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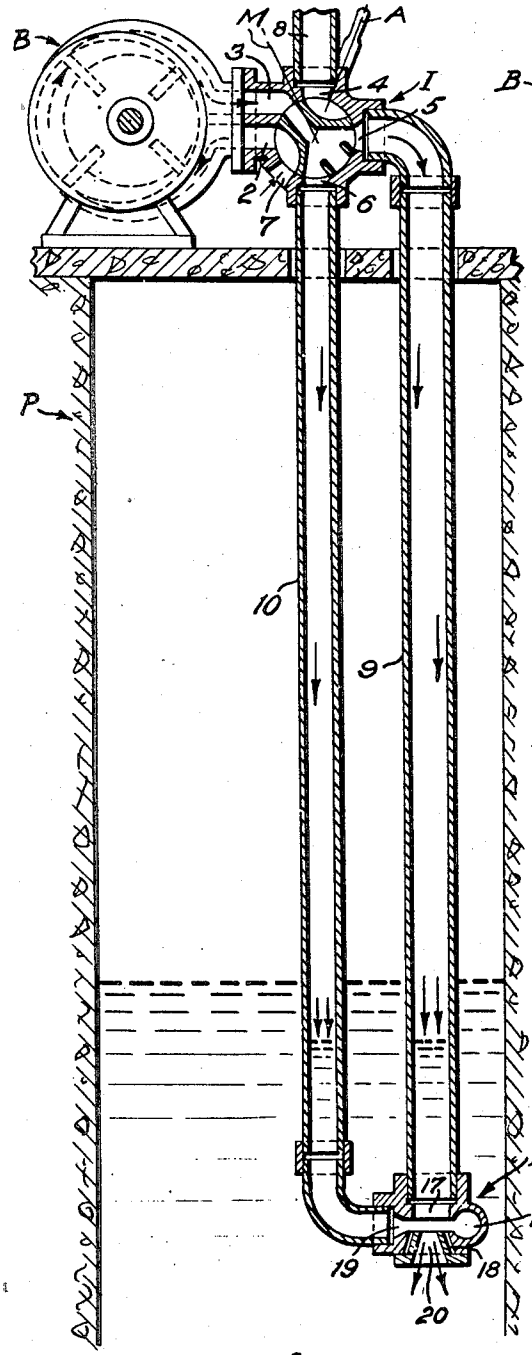


Fig. 1.

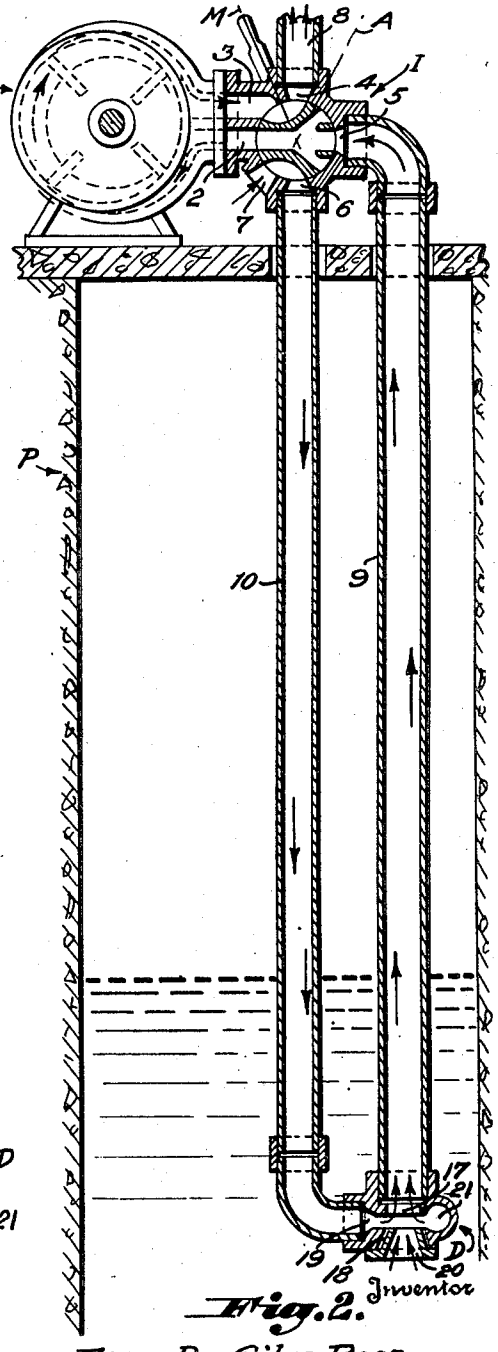


Fig. 2.

Inventor

Eisau Da Silva Rosa

By Glascock Downing & Seebold

Attorneys

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Fig. 3.

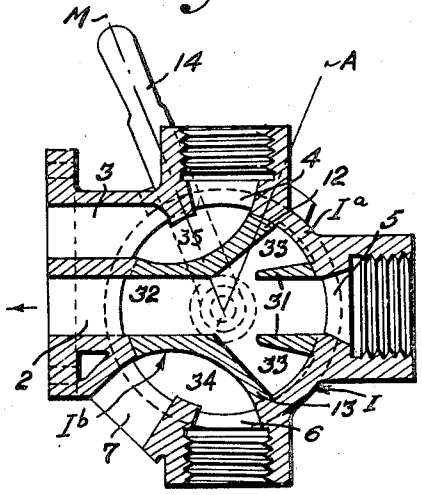


Fig. 4.

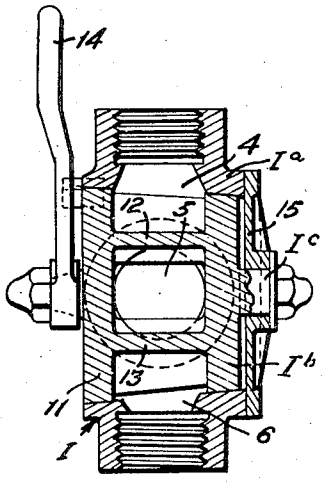


Fig. 5.

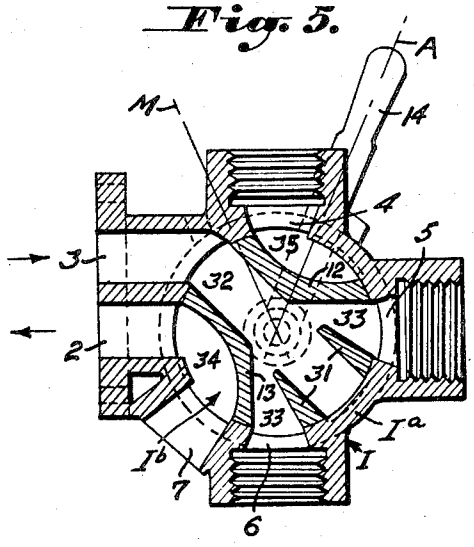
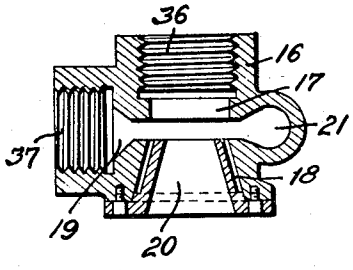


Fig. 6.



Inventor

Esau Da Silva Rosa

By Hascott Dunning & Seibold

Attorneys

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2,480,969

PUMPING APPARATUS FOR DEEP WELLS

Esaú da Silva Rosa, Porto, Portugal

Application October 29, 1946, Serial No. 706,441
In Portugal November 15, 1945

5 Claims. (Cl. 103—260)

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This invention relates to pumping apparatus and has for its object to provide an arrangement for pumping liquid from wells embodying means for mixing air with the ascending column of liquid.

A further object of the invention is to provision of valve means permitting the pump to be utilized for clearing liquid from the mixing device and the pipes connecting therewith so that the mixing action of the mixing device may be initiated.

In the accompanying drawings wherein an approved embodiment of the invention is illustrated:

Figure 1 is a vertical sectional view through the improved pumping apparatus installed in operative position in a well, the valve device being shown in one position.

Figure 2 is a view similar to Figure 1 showing the valve device in the other position.

Figure 3 is an enlarged sectional view through the valve device removed and showing the valve plug in one position.

Figure 4 is a transverse sectional view of Figure 3.

Figure 5 is an enlarged view similar to view 3 showing the valve plug in the other position.

Figure 6 is an enlarged detail view of the mixing device removed.

Referring to the drawing in detail, B indicates a preferred type of pump and I designates the valve which is secured in position on the casing of the pump. The valve consists of a casing Ia and plug Ib rotatably mounted by means of a stem Ic rotatably mounted in the cover plate 15. The casing Ia is formed with six substantial radial ports 2, 3, 4, 5, 6 and 7 of which the ports 2 and 3 are in permanent communication with the inlet and outlet ports of the pump B and the port 7 is in permanent communication with the atmosphere. The port 4 constitutes an outlet and communicates with a pipe 8 for the delivery of the mixture of air and liquid while depending pipes 9 and 10 communicate with the two remaining ports 5 and 6.

The valve plug Ib is provided with two diverging partitions 12 and 13 and two spaced parallel partitions 31 arranged between the diverging extremities of the partitions 12 and 13 thus forming at one side of the plug a passage 32 having divergent extremities 33 at the opposite side of the plug. The external surfaces of the diverging partitions 12 and 13 provide additional passages 34 and 35.

The valve plug is conveniently movable to either of the two positions shown in Figures 3 and 5 by a

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handle 14 attached to the stem Ic and in the position shown in Figures 2 and 3 communication is established between the pump outlet port 3 and the port 4 by the passage 35; the pump inlet port 2 communicates with the port 5 by the passage 32, 33 and the port 6 communicates with the atmospheric port 7 by the passage 34. In the position shown in Figures 1 and 5 the valve plug is so adjusted so that communication between the outlet port 4 and the pump is interrupted and instead the pump outlet 3 communicates simultaneously with both of the ports 5 and 6. In this position the pump inlet 2 communicates with the atmosphere through the passage 34 and port 7 and consequently the pump operates to induce a flow of air through the port 7 and into the pipes 9 and 10.

The lower extremities of the pipes 9 and 10 are connected with an air and liquid mixing device designated at D and consisting of a casing 16 having a port 36 in the upper extremity thereof communicating with the pipe 9 and a lateral port 37 communicating with the pipe 10. The lower portion of the casing 16 is formed with a port 18 removably receiving an upwardly tapering nozzle 20. The purpose of making the nozzle 20 removable is to permit it to be interchanged with other nozzles having diameters of different bore to suit varying pumping conditions. The port 37 communicates by a passage 19 with a circular mixing chamber 21 located between the port 36 and the discharge end of the nozzle 20.

In use the pump B and valve I are mounted on a suitable support as shown in Figures 1 and 2 in such position that the pipes 9 and 10 extend into and below the surface of water in a well P, the mixing device D being located a suitable distance below the liquid level. During inactive periods the water in the well rises into the pipes 9 and 10 a substantial distance above the mixing device D and to condition the apparatus for operation the valve handle 14 is turned to the position indicated at A as shown in Figures 1 and 5. When the pump is operated air is admitted through the port 2 and passage 34 and is discharged through the port 3 and passages 32 and 33 into both pipes 9 and 10. Thus the liquid standing in the pipes and also contained within the casing 16 of the mixing device is discharged through the nozzle 20. While the pump remains in operation the handle 14 is swiftly moved to the position indicated at M and shown in Figures 2 and 3. Thus the pipe 10 and port 6 are put in communication with the atmospheric port 7 through the passage 34, the port 5 and pipe 9

are put in communication with the pump inlet 2 by the passages 32 and 33 and the pump outlet 3 is connected with the port 4 and the delivery pipe 8 by the passage 35. The suction thus created in the pipe 9 and mixing chamber 21 by the pump B aspirates water through the nozzle 20 and air through the pipe 10, the air and water being mixed in the chamber 21 and eventually being drawn upwardly through the pipe 9, through the passages 32 and 33, pump B and being discharged through the delivery pipe 8. The mixing effect of the device D aerates the column of liquid rising in the pipe 9 and reduces the weight of the liquid standing between the mixing device and the pump so that the load on said pump is reduced and the latter may be operated with the expenditure of less energy.

What I claim is:

1. In a pumping apparatus, an air and liquid mixing device having an inlet port for the admission of liquid to be pumped, a pump having inlet and outlet ports, a pipe for supplying air to said device, a mixture conducting pipe connected with the mixing device, and valve means operable in one position to conect both of said pipes with the pump outlet port and operable in another position to establish communication between the mixture conducting pipe and the pump inlet port and to simultaneously establish communication between the air supply pipe and the atmosphere.

2. An apparatus as claimed in claim 1 provided with a delivery pipe, the pump outlet port being connected with the delivery pipe in the second mentioned position of the valve means.

3. An apparatus as claimed in claim 1 wherein said valve means in the first mentioned position thereof is operative to connect the pump inlet port with the atmosphere.

4. A pumping apparatus as claimed in claim 1 wherein said mixing device is provided with a circular mixing chamber communicating laterally with the air supply pipe and communicating axially with the inlet port of the mixing device and mixture conducting pipe.

5. A pumping apparatus as claimed in claim 1 wherein said valve means includes a valve plug having divergent and parallel partitions arranged to form opposed peripheral passages and a passage having divergent extremities, said passage and the divergent extremities thereof connecting both of said pipes with the pump outlet port in said first position of the valve means, said passage and one of the divergent extremities thereof connecting the mixture conducting pipe with the pump inlet port and one of said peripheral passages connecting the air supply pipe with the atmosphere in the second position of the valve means.

ESAÚ DA SILVA ROSE.

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