Aug. 30, 1932. G. S. COATS 1,874,450

DEEP WELL TURBINE PUMP

Filed Nov. 5, 1930 2 Sheets-Sheet 1

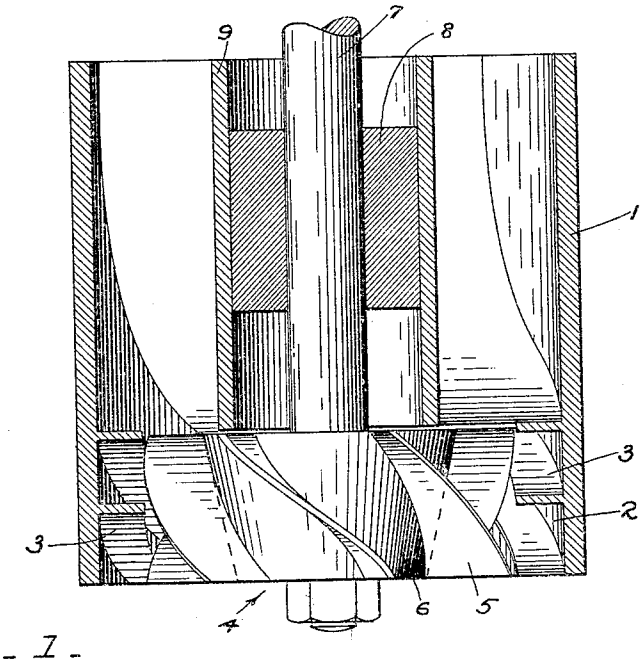

Fig. 1.

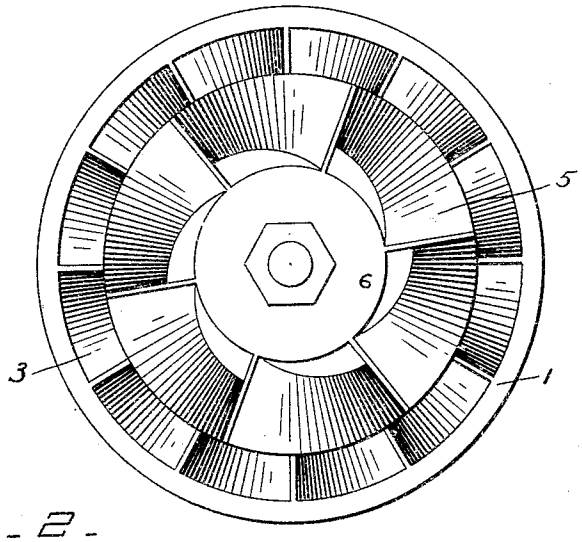

Fig. 2.

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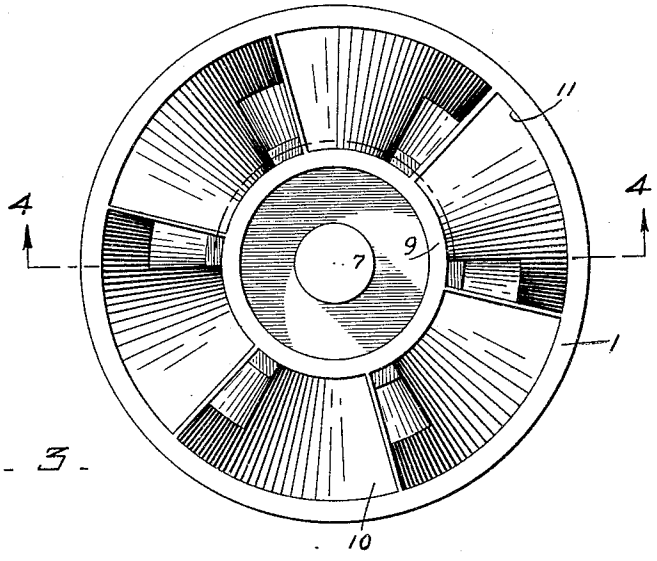

Fig. 3.

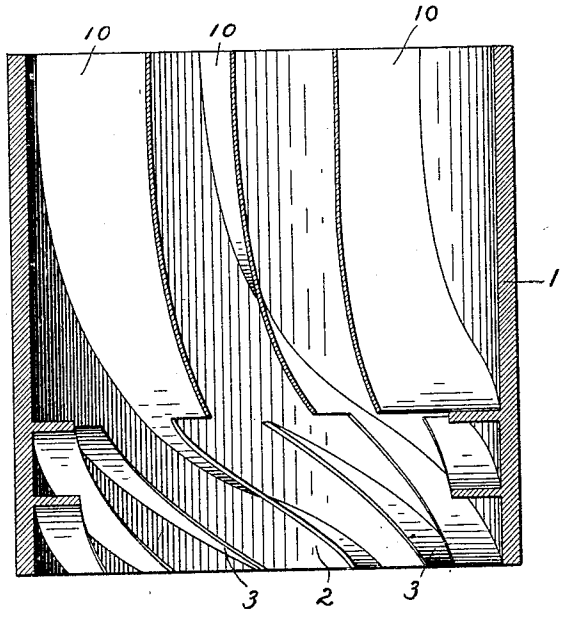

Fig. 4.

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DEEP-WELL TURBINE PUMP

Application filed November 5, 1930. Serial No. 493,664.

My invention relates to improvements in deep-well turbine pumps, and it consists in the combinations, constructions and arrangements hereinafter described and claimed.

An object of my invention is to provide a deep-well turbine pump in which the propeller is designed to rotate at a high speed, the propeller carrying blades which are inclined oppositely to blades carried by the bowl housing the impeller. The high speed of the impeller throws the water against the bowl blades by centrifugal force, and this materially increases the efficiency of the pump.

The device may be used submerged in the well water, or it may be disposed at the top of the well and function like a turbine in sucking the water up from the well.

Each device will lift the water approximately fifteen feet, and therefore if it is desired to raise water sixty feet, four devices can be placed one above the other and all be actuated by the same shaft. The impeller of each device is placed a short distance away from the adjacent propellers, and the inclined vanes in each device are gradually curved so as to extend longitudinally of the well and thus direct the water into the next higher impeller without whirling the water. In this way the next higher impeller can act upon the water more efficiently than is possible when the water is whirling as it enters the impeller.

A further object of my invention is to provide a device of the type described which is extremely simple in construction and which is durable and efficient for the purpose intended.

My invention is illustrated in the accompanying drawings, in which:

Figure 1 is a vertical section through the device showing the impeller in elevation,

Figure 2 is a bottom plan view of the device,

Figure 3 is a top plan view of the device, and

Figure 4 is a section along the line 4—4 of Figure 3.

In carrying out my invention I provide a casing 1 which is designed to enter a well and to be lowered to the desired place. The casing has a bowl portion indicated generally at 2 in which a plurality of inwardly extending and inclined blades 3 are disposed. The shape of these blades is clearly shown in Figure 4.

Within the bowl 2 I rotatably mount an impeller 4 that has vanes 5 inclined in an opposite direction to that of the vanes 3. I have further found that the device will operate more efficiently when the blades on the impeller are inclined from five to ten degrees more sharply than the blades on the bowl. In other words, the blades 3 are more horizontal than the blades or vanes 5.

The impeller 4 has a conical-shaped hub 6 as clearly shown in Figures 1 and 2, and the vanes or blades 5 will therefore be wider at their bottoms than at their tops. This provides a larger water inlet at the bottom and a smaller water outlet at the top, which results in the water being speeded up as it is forced through by the impeller.

The impeller 4 is secured to a driving shaft 7, and this shaft extends to the top of the well where it is connected to a power source (not shown) such as a motor or engine. The shaft 7 rotates in a bearing 8 which in turn is disposed in an inner casing 9. The inner casing is connected to the outer casing 1 by alternate vanes 3 that are extended above the bowl 2 as indicated at 10 and shown in Figure 4. The vanes 3 which extend above the bowl 2 are gradually curved so as to be extended in a vertical direction near the tops of the portions 10. These portions 10 direct the water vertically and stop it from whirling.

If more than one pump is used, the impeller 4 of the next pump is placed at the top of the portions 10 and receives the water from the channels formed by the portions 10 and the casing 1. A new set of vanes 3 are associated with the new impeller, and they will function in the same manner as the impeller 4, and vanes 3 and 5.

It will be noted from Figure 4 that the portions 10 of the blades 3 are wider at a point directly above the top of the hub 6. The wider portions 10 extend over the blades or vanes 5 and receive the water from the vanes 5.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood.

When the device is submerged in water and the shaft 7 is rotated, the impeller 4 will cause the vanes 5 to suck the water into the casing 1 and to throw this water by centrifugal force against the vanes 3. The impeller is designed to rotate at a high speed, for example, from 1100 R. P. M. to 3600 R. P. M. or higher. The travel of the peripheral edge of the impeller at these speeds will range from 1600 to 2000 feet per minute. This is sufficient to throw the water by centrifugal force against the vanes 3, and these vanes cooperate with the vanes 5 to lift the water vertically and at the same time whirl the water.

The water thus lifted enters the passages formed by the portions 10 of the casings 1 and 9, and the force of the water entering these passages will be sufficient to move it throughout the lengths of the passages, and the portions 10 will change the whirling action of the water to a direct vertical movement of the water. If more than one pump is used, the passages 11 formed by the portions 10 will deliver the water to the next higher impeller. In this way the water is lifted from impeller to impeller until it is given the necessary speed and force to move vertically through the remainder of the casing disposed between the pumps and the top of the well.

When the device is used on top of the well, it is first primed and then it will create sufficient suction to pull the water from the well at a depth up to twenty-five feet.

In practice, the runners or impellers 4 are placed approximately six inches apart when more than one impeller is used, and all are driven from the same shaft 7. If a greater lift and less volume is desired, the blades or vanes 3 and 5 are inclined at a greater angle from the horizontal. The opposite is true when less lift and greater volume is desired.

I have found that the pump will operate more efficiently when the height of the runner 4 is one-third to two-thirds its outside diameter. I have further found that the best results are obtained when the hub 6 of the runner at its top face is approximately two-thirds the diameter of the runner. Tapering of the bottom of the hub 6 provides a larger water inlet which also increases the efficiency of the device. The alternate vanes 3 (see Figure 4) which are extended as at 10 continue in an inclined plane for approximately one-sixth of the circumference of the bowl 2 and then are gradually curved so as to extend vertically. The portions 10 act as spiders between the runners and support the inner casing 9, which in turn carries the bearing 8 for the shaft 7.

The great simplicity of construction makes the cost of production low, the replacement of parts economical, and gives the device a long and efficient life. The device will pump liquids of any density, including thick oils and sand in heavy percentage to water content. If the pump is stopped while pumping large percentages of sand, it will not choke or "sand up", but can be readily started again.

The device will operate successfully in the event a lowering water-table leaves the installation above the water lever of its supply. Other turbines must have their units submerged at all times in order to operate.

The only wear taking place will be between the impeller blades and the casing blades. A close fit is not necessary at these points to secure economical operation because the centrifugal action of the runner or impeller will bridge any reasonable gap.

The device lends itself to single or multiple installations of units to operate effectively over a wide range of duty heads and to combine suction with lift.

The extension of the vanes in the casing or bowl above the runner or impeller, together with the shape of such vanes or blades which changes the rotary motion of the pumped liquids to a vertical motion, is very vital to efficient operation. This has been proved by experiment, and such straightening members, i. e. the portions 10, are often called "spiders" and are to be installed between each runner-bowl unit and also above the highest unit.

Although I have shown and described one embodiment of my invention, it is to be understood that the same is susceptible of various changes, and I reserve the right to employ such changes as may come within the scope of the claims hereto annexed.

I claim:

1. A deep-well turbine pump comprising a bowl having inclined and inwardly extending blades, an impeller having blades disposed opposite the bowl blades and inclined in the opposite direction to the first-named blades and at a greater angle from a plane extending at right angles to the longitudinal axis of the impeller.

2. A deep-well turbine pump comprising a casing having inclined, inwardly extending blades, an impeller having inclined blades extending in the opposite direction to the first named blades and being disposed opposite the first named blades, certain of said casing blades being extended beyond the impeller and being straightened out to extend parallel with the axis of the impeller.

3. A deep-well turbine pump comprising a casing having inwardly extending and inclined blades, a runner having blades inclined in the opposite direction and being disposed opposite the first named blades, means for rotating said runner at a high speed, alternate blades of the casing extending beyond the runner and being gradually

curved for extending in a straight line paralleling the axis of the runner.

4. A deep-well turbine pump comprising a casing having inwardly extending and inclined blades, a runner having blades inclined in the opposite direction and being disposed opposite the first named blades, means for rotating said runner at a high speed, alternate blades of the casing extending beyond the runner and being gradually curved for extending in a straight line paralleling the axis of the runner, said extending casing blades projecting over the hub of the runner, and a bearing for the runner carried by the casing blades.

5. A pump comprising a spirally vaned revolving runner mounted within a stationary bowl having spiral vanes extending in a reverse direction to the first vanes and being disposed opposite the first vanes, certain of the bowl vanes extending above the runner vanes and being gradually curved for extending in a straight line paralleling the axis of the runner.

6. A deep-well turbine pump comprising a casing having inwardly extending and inclined blades, a runner having blades inclined in the opposite direction, means for rotating the runner, certain of the casing blades extending above the runner and projecting over the hub of the runner, and a bearing for the runner carried by the casing blades.

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