B. JACKSON, Sr. & B. JACKSON, Jr.

BORED WELL PUMPING APPARATUS.

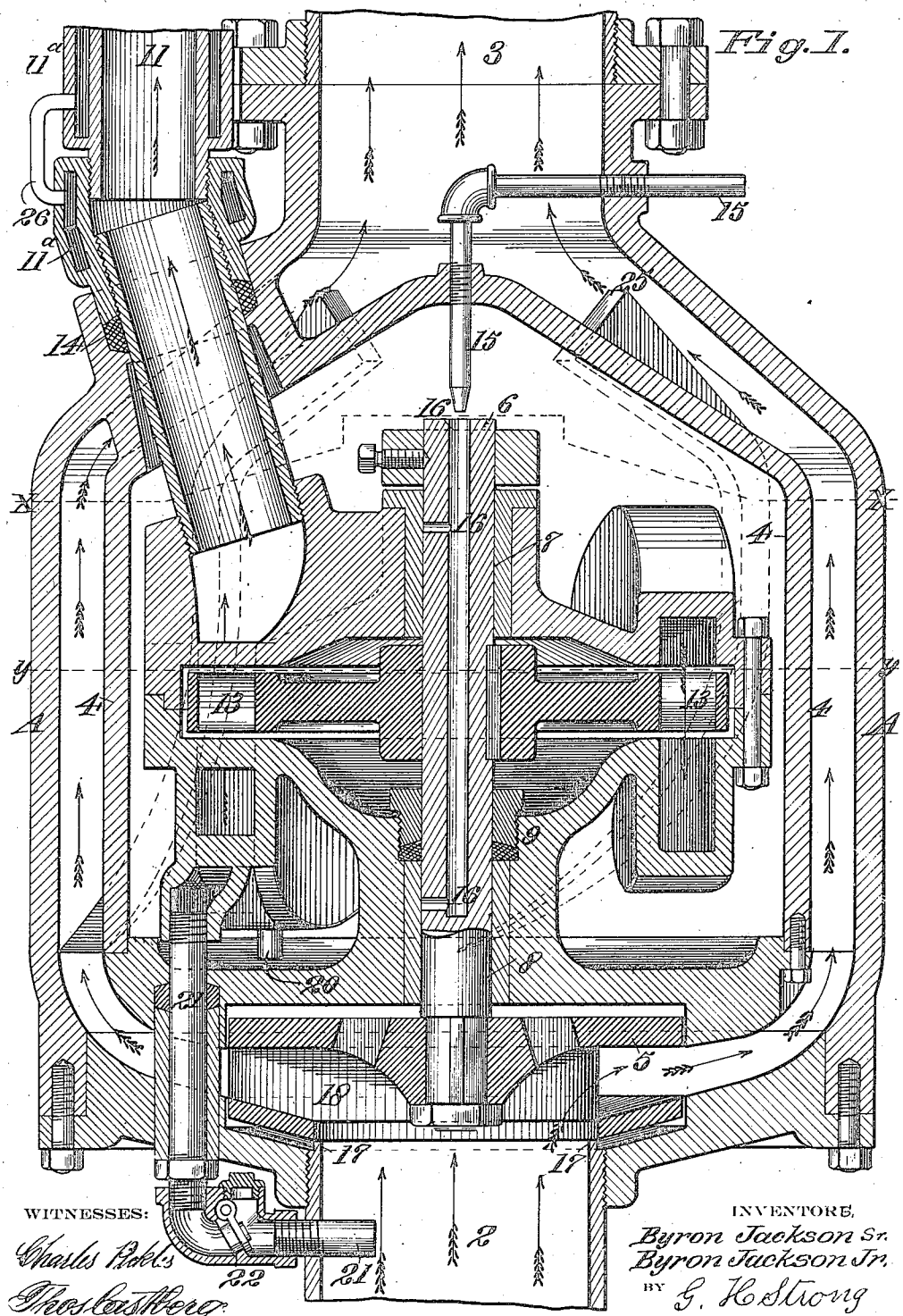
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1,140,828.

Patented May 25, 1915.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

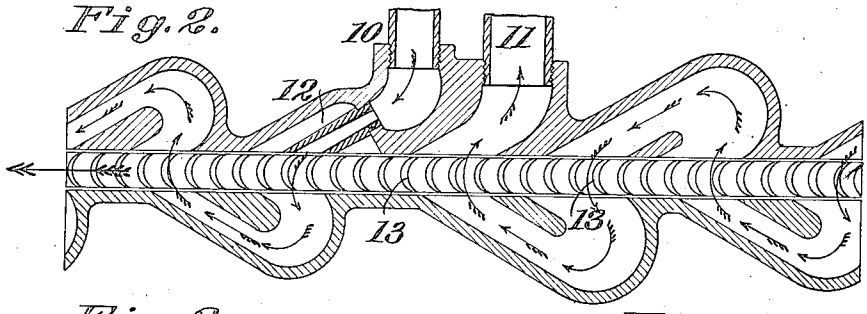


Fig. 3.

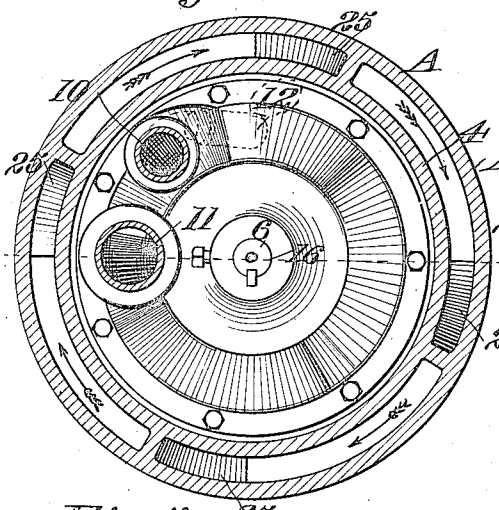


Fig. 4.

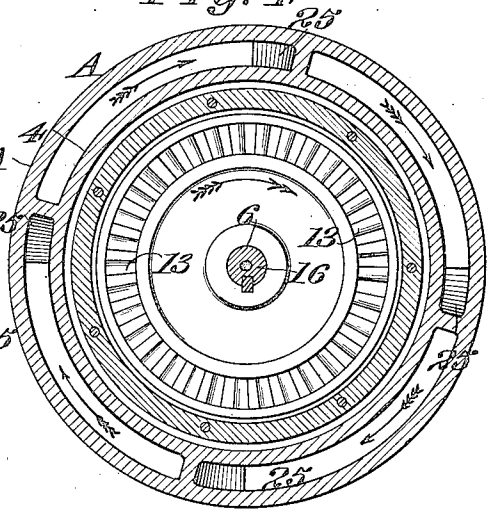


Fig. 5.

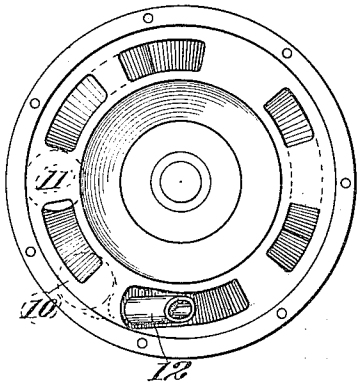
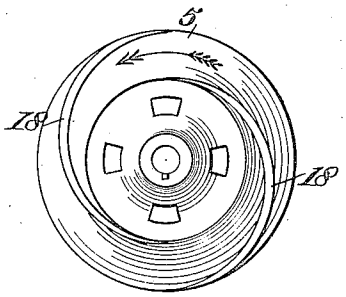


Fig. 6.



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BYRON JACKSON, SR., AND BYRON JACKSON, JR., OF SAN FRANCISCO, CALIFORNIA; SAID BYRON JACKSON, SR., ASSIGNOR TO SAID BYRON JACKSON, JR.

BORED-WELL-PUMPING APPARATUS.

1,140,828. Specification of Letters Patent. Patented May 25, 1915.

Application filed March 23, 1914. Serial No. 826,537.

To all whom it may concern:

Be it known that we, BYRON JACKSON, Sr., and BYRON JACKSON, Jr., citizens of the United States, residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Bored-Well-Pumping Apparatus, of which the following is a specification.

The object of our invention is to provide an improvement in pumping apparatus which is so designed that the pump and the motor therefor are practically integral and are capable of being lowered into a bored pumping well as a single, self-contained structure, having no external shaft, the construction being such that the size may be limited for that purpose.

There are inlet and discharge pipes with suitable connections, and a means for introducing and discharging the steam, or other source of energy, to propel the motor, said supply and discharge passages occupying contiguous positions within the well casing and by the side of the water discharge passage.

The invention also consists of certain details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a vertical section of the apparatus showing its connections. Fig. 2 is a development of the turbine motor. Fig. 3 is a section, transverse to the motor, on line x—x, Fig. 1. Fig. 4 is a similar section on line y—y, Fig. 1. Fig. 5 is a bottom view of the upper steam passage. Fig. 6 is a bottom view of the pump and its curved blades.

The object of our invention is to provide a pumping apparatus and a motor of sufficient strength and so compact in construction that the whole may be lowered into a bored well any distance up to hundreds of feet. The motor may be an electric motor, or a steam turbine, which latter is illustrated in the present description and drawings. The turbine is supplied with steam, or equivalent pressure fluid, from a source of supply at the top through pipes carried down the inside of the well and the water is discharged through a central pipe leading upward. The steam pipes and the motor are suitably jacketed and the apparatus is operated without the use of any shaft or direct connection of that character with the top of the well.

As shown in the drawings, A is a casing, the sides of which may be cylindrical and the top and bottom converged in any suitable manner to suit the interior conditions of the apparatus. The casing is designed of such diameter as to fit the particular well to which it is to be applied, such wells being anywhere from six to eight inches up to twenty-five or thirty inches. Into the bottom of the casing opens inlet 2 which supplies water to the pump, hereinafter to be described. From the top of the casing extends a discharge pipe 3 which is centrally located within the well casing and extends to the point of discharge at the top.

Substantially concentric within the outer casing A is an inner casing 4, between which and the outer casing are formed the water discharge passages. The pump impeller or runner, which is of the combined centrifugal and impact character, is indicated at 5, and the water from the inlet passage 2 passes into this impeller, when in operation, thence up through the exterior passages, being diverted by correctly shaped vanes 25 in such a manner as to change the direction of the water, after it leaves the impeller, and gradually convert its movement into an upward movement through the outlet passage 3. In order to drive this impeller, we have shown a turbine, preferably a steam turbine, which is located directly above the pump, and the lower part practically forms the top of the pump. The turbine is hermetically inclosed and insulated within the inner casing wall 4, which forms a jacket between the turbine chamber and the water passage on the outside. A short shaft 6 carries the turbine and has its two bearings, one at the top, as at 7, and the other is shown at 8, with a suitable packing, as at 9, to prevent leakage. Steam to operate the turbine is admitted from a boiler at the surface, through a pipe, indicated at 10, Fig. 3, and the exhaust takes place close to the point of admission and is carried away through a pipe 11, located on the same side and close to the inlet pipe 10; these pipes, as well as the turbine and pump, being suspended in the well casing.

Fig. 2 shows the turbine opened out or displayed, showing the inlet passage 10 and

exhaust passage 11 and the expanding nozzle 12, through which steam is admitted into the wheel, the runner of which is provided with curved blades, as shown at 13, through which the steam passes a number of times and impels the runner, finally escaping through the exhaust passage 11, as previously described. The turbine, running, as shown, within the inner water-tight casing, is entirely insulated therefrom, and the casing, as before stated, forms the annular channel through which the pump discharges; this pipe serving as a means for suspending the turbine and pump within the well.

A suitable stuffing-box, as at 14, serves to seal the connection where the pipe passes through the annular water passage to the interior steam turbine. The discharge or exhaust pipe need not be longer than enough to reach above the normal level of the water in the well. Oil may be carried from the surface to the bearings of the pump and the turbine through a pipe 15 discharging to the interior of the shaft, as at 16, and thence to the two shaft bearings.

The turbine case is made in two halves, bolted together in the center, and, as previously stated, the lower half may be cast integral with the top cover of the pump. This cover bolts onto the annular water passage which forms a part of the pump case and also an insulator for the turbine.

An adjustable pump-balancing device is located in the lower side of the pump, as indicated at 17. When the pump is running, a pressure is exerted on the lower face of the pump runner which will be sufficient to raise the runner into the casing until a balance is brought about by the leakage of water, under discharge pressure, past the adjustable balance ring and into the suction chamber of the pump. Sufficient end play is left to the shaft for the working of this automatic balance. The end of the suction pipe makes a running joint with the bottom of the pump runner so that the ring can be raised or lowered by screwing the suction pipe in or out and the running position thus changed.

The blades of the pump runner are curved backwardly on geometrical lines, as shown at 18, Fig. 6. There are only two of these blades and each is curved through an arc of almost 180°. The object of this is to use the impact force to a greater extent than the centrifugal, although the latter may also exist. This construction enables the pump to be driven efficiently at a higher speed than with the ordinary runner and thus enables this pumping apparatus to be made small enough in diameter to go in a bored well.

In order to dispose of such water of condensation as may possibly collect in the turbine insulating chamber, we have shown a tube 20, one end of which is placed in one of the passages of the turbine and the other at the lowest point in the insulating chamber. This is designed to drain off the water which might leak or condense therein, and a pipe 21 carries off such water of condensation, delivering it into the inlet passage through a check-valve, as shown at 22. The pipe 21 may also be employed as an alternative to carry part or all of the exhaust steam into the suction of the pump and so discharge the steam turbine into a vacuum, thus forming a condenser. The live steam pipe leading down to the turbine and also the exhaust pipe are surrounded by annular air spaces, as at 11^a, in which a vacuum may be maintained to prevent loss of heat and consequent condensation of steam. Small tubes 26 connect these air spaces, which in turn are connected with a vacuum pump at the surface.

Having thus described our invention, what we claim and desire to secure by Letters Patent is—

1. In a pumping apparatus, a chamber, a turbine hermetically inclosed therein, an outer concentric chamber forming with the inner chamber wall an annular water passage, a pump runner located below and separated from the turbine chamber, a journaled shaft upon which the turbine and the pump runner are fixed, packing joints for said shaft and for steam inlet and exhaust pipes where they enter the chamber, and means for draining the insulating chamber.

2. In a pumping apparatus, an outer casing having a lower inlet and upper outlet, a sealed inner casing in the outer casing spaced therefrom to form a water passage between the casings, a hermetically sealed turbine within the inner casing, means leading from the turbine through both of the inner and outer casings to feed steam to and exhaust same from the turbine, and means connected to the turbine and extending through the inner and outer casings and discharging into the lower inlet for draining the turbine.

3. In a pumping apparatus, an outer casing having a lower inlet and an upper outlet, an inner casing in the outer casing spaced therefrom to form a water passage between the casings, a motor within the inner casing, a pump impeller on the motor shaft located below the inner casing and movable up and down in the space between the lower ends of the inner and outer casings, and means to allow restricted endwise movement of the shaft and thereby corresponding movement of the impeller in the last mentioned space and adjustable means in the inlet to restrict the extent of downward movement of the impeller.

4. In a pumping apparatus, an outer cas-

ing having an outlet and an inlet and an inner casing in the outer casing spaced therefrom to form a water passage, the bottom of the inner casing having a downwardly facing recess on its under face and the bottom of the outer casing having an upwardly facing recess on its upper face which registers with the first named recess, a motor in the inner casing having its shaft extended into said recesses, a pump impeller on said shaft and movable upwardly and downwardly in said recesses and a pipe screwed into the inlet and having its upper end forming a seat for the pump impeller.

5. In a pumping apparatus, an outer casing having an outlet and an inlet and an inner casing in the outer casing spaced therefrom to form a water passage, a turbine hermetically sealed and located within the inner casing, a pump impeller connected to the turbine and located in the space between the lower ends of the inner and outer casings, means leading through both casings and into the turbine for supplying motive fluid to and exhausting same from the turbine, and means leading through both of the casings and into the inlet for draining the turbine.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

BYRON JACKSON, SR.
BYRON JACKSON, JR.

Witnesses:
JOHN H. HERRING,
W. W. HEALEY.