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ROTARY PUMP

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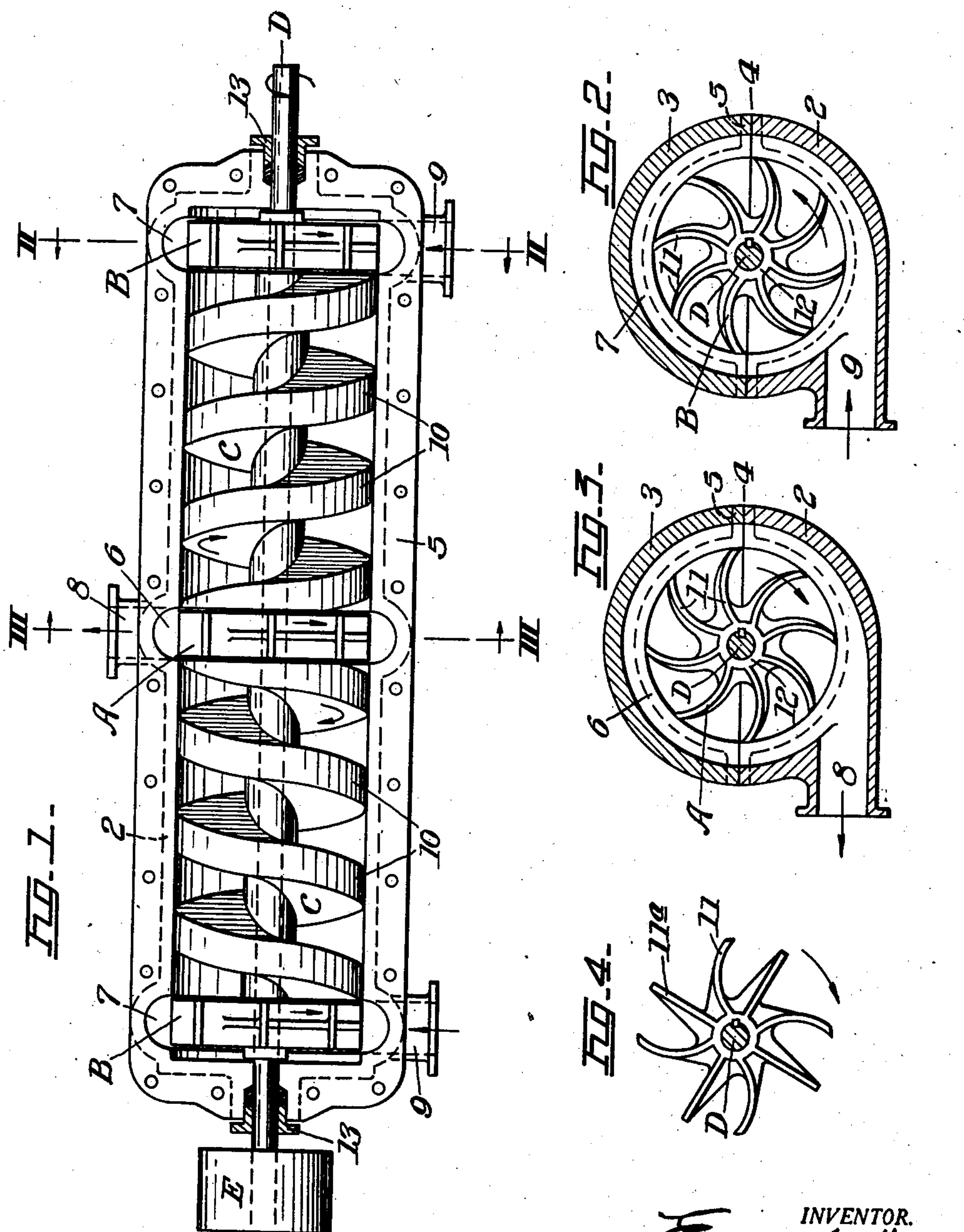

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ROTARY PUMP

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6 Claims. (Cl. 103—88)

This invention is an improvement in the art of rotary pumps designed to force a column of water or other liquid through a delivery conduit, against gravitating or other resistance.

It comprises generally, a middle discharging impeller or rotor; inwardly feeding pressure-generating screw means as spiral conveyors at each side thereof; and outermost suction rotors or impellers communicating with the receiving terminals of the spiral conveyors.

The several impellers and their intermediate spiral conveyors are rotatably mounted on a central drive shaft within a cylindrical casing, provided with supply and discharge conduits, as shall be hereinafter described.

Heretofore rotary pumps have been patented utilizing a middle discharge rotor flanked by a pair of inwardly feeding worms or right and left hand screws communicating with open chambers leading to the worm or screw chambers, and through such open chambers with an inlet conduit or suction pipe, as in Wade et al. No. 367,564; Cooper No. 1,213,461; and Dorer No. 1,586,978.

In my invention I provide means for initially generating an impelling pressure to the liquid in excess of normal pressure in the inlet or suction supply, supplemented or increased by the pressure generating action of the spiral conveyors, and finally further increased by the discharge impeller. In this manner I secure a greatly increased or cumulative discharge pressure, with accompanying rotational and axial velocity, in excess of that possible by use of a mere discharge impeller and its inwardly feeding worms or screws, communicating directly with ordinary supply chambers.

The objects in view are for functionally generating and maintaining cumulating pressure columns of liquid in their oppositely moving paths to the middle discharging impeller, for final discharge thereby, under improved suction and vacuum conditions.

In the drawing showing one preferred form of pump and two forms of impeller therefor:

Fig. 1 is a plan view of the complete pump with the upper portion of the casing removed;

Fig. 2 is a transverse section therethrough on the line II—II of Fig. 1;

Fig. 3 is a similar view on the line III—III of Fig. 1;

Fig. 4 is a similar view of a modified form of impeller, without the casing.

Referring to the drawing, I provide a cylindrical casing consisting of two semi-cylindrical lower and upper halves **2** and **3**, divided on the horizontal plane **4** and secured together by bolts or the like extending through meeting flanges **5**. As thus constructed the interior of the casing provides a continuously cylindrical chamber or cavity of uniform diameter from end to end, in which are mounted the several operating and pressure creating elements, mounted on a drive shaft D, journalled at each end of the casing as shown.

At the middle portion of the casing as thus made, and at each end thereof are annually enlarged generally cylindrical circulation cavities **6** and **7—7**. Cavity **6** communicates with the discharge terminal **8**, adapted to be connected with any suitable conduit leading to a receiving chamber, as a reservoir, boiler, or the like.

Corresponding chambers **7—7** communicate with similarly disposed inlet terminals **9** connected with any source of supply, as a water main or the like. Mounted on shaft D midway of the length of the casing, and in registering relation to annular chamber **6** is the discharge impeller A. Similarly mounted and in the same relation to annular chambers **7** are the outermost, initial, suction generating impellers B and B.

Between the discharge impeller A and outermost initial impellers B and B are mounted screw type axial flow propellers in the form of spiral conveyors C and C, consisting in each case of the spirally arranged vanes **10**, of suitable pitch. These are securely mounted around the shaft D in any convenient manner as by set screws or keys and are of a maximum diameter to fit and revolve within the cylindrical chamber of the casing, with just sufficient clearance for free movement and retention of the conveyed columns of water to be delivered to the middle impeller A.

As shown, each of the spiral conveyors is disposed in a pitch direction opposite to the other whereby rotation of the shaft in one direction will effect inward movement of and rotational speed to the cylindrical column of water from each outer end toward the middle.

In such arrangement the outermost impellers B deliver the liquid under such initially generated pressure to the receiving terminals of the spiral conveyors. Such screw means convey the liquid continuously inwardly in opposite directions, imparting rotational velocity and increasing axial velocity to the liquid before delivery to the middle discharge impeller A.

Discharge impeller A thus receives and delivers under the ultimate maximum pressure the combined oppositely moving columns of liquid and discharges same from the pump at maximum pressure.

The initial impellers B receive their charge of liquid continuously from the inlet suction conduits 9, through annular chambers 7, discharging inwardly with their initially generated pressure to the receiving ends of the oppositely acting conveyors C. These impart a rotational velocity in the same direction of rotation as that of impeller A, and with corresponding axial velocity and decrease of shock loss, upon engaging the vanes of impeller A.

While the invention is not limited to the specific form of construction of either impeller, I illustrate in Figs. 2 and 3 one form designed to give good results in which a series of laterally extending blades or vanes 11 diverge from a hub 12 which is keyed or otherwise secured to shaft D. Vanes 11 are preferably curved as shown, concaved in the direction of movement, operating to engage and annularly propel liquid supplied through inlet conduit 9 and to discharge it laterally inwardly to the receiving vanes of the pressure-increasing supply passing inwardly by the screws C toward the middle discharge impeller A.

The impeller wheel in such construction is preferably made of a single steel casting for ample strength and endurance, and with the spaces between the vanes opening laterally inward, as stated. The same construction as to the wheel of discharge impeller A is utilized for final discharge outwardly of the casing through conduit 8.

In Fig. 4 I show a modified construction of impeller wheel in which similar concaved vanes 11 are alternately located between straight vanes 11a. In such construction the centrifugal action of the impeller is somewhat modified by increasing the centrifugal force, without materially lessening the scooping action of the concaved vanes, and it will be understood that either construction may be utilized with beneficial results.

As thus constructed, the initial suction impellers B upon rotation of shaft D at a comparatively high speed, say 1600 R. P. M. will rapidly absorb and discharge under their compressive action the streams of water supplied through inlet conduits 9 and to the annular chambers 7. Such streams under the pressure of the impellers are supplied to the receiving ends of the spiral conveyors C at their initial pressure; taken up by the conveyors and forced along inwardly under amplified pressure and with rotational velocity; and delivered to the middle discharge impeller A.

Impeller A in the same manner builds up such initial and supplemental pressure by its own action, finally delivering the constant column or stream of water outwardly through discharge conduit 8 at its maximum thus generated and amplified pressure.

By reason of the cumulative action of the several cooperating elements in the combination as thus existing, the ultimate discharge pressure is materially increased, it being understood that all of the several elements are rotating at the same high speed under the driving action of shaft D, rotated by any suitable means as a belt pulley E or the like.

It will be understood that shaft D is rotatably mounted in endmost bearings in the casing and provided with suitable stuffing box glands 13 as shown, for tight packing and free rotation as in standard practice. By making the cylindrical casing in two semi-cylindrical halves, such halves are readily capable of manufacture by foundry and machine shop practice as will be readily understood. Also, that as thus made, the casing and its parts are to be constructed in such a manner as to secure accurate placement and continuous functional operation, in the manner described.

The pump may be made of various suitable sizes and properly proportioned dimensions to meet the expected requirements and may be changed or varied in detail construction by the skilled mechanic within the scope of the following claims.

What I claim is:

1. An impeller wheel having a central hub and a series of annularly spaced curvingly disposed concaved vanes and alternating radially disposed flat face vanes extending from the hub providing alternating liquid engaging and centrifugally discharging faces.

2. The combination with a cylindrical casing having endmost suction inlets, a middle discharge opening, a longitudinally extending central bore, annularly enlarged circulation cavities surrounding said bore and registering with said inlets and discharge opening, and a central longitudinal drive shaft mounted in the ends of the casing beyond the suction inlet cavities, of a pair of rotary intake impellers on the shaft each provided with a series of alternating annularly spaced curved concaved vanes and radially disposed flat face vanes, said impellers being aligned with the endmost circulation cavities for drawing liquid through the suction inlets and the endmost cavities into said bore, a rotary impeller on the shaft delivering liquid through the middle surrounding cavity and discharge opening, and helical liquid propelling means on the shaft rotating with said impellers and delivering liquid from the intake impellers to the discharge one thereof with a rotational velocity in the same direction as the rotation of said impeller and imparting uniformly increasing axial velocity to the liquid before entering the discharge impeller.

3. The combination with a cylindrical casing having endmost suction inlets, a middle discharge opening, a longitudinally extending central bore, annularly enlarged circulation cavities surrounding said bore and registering with said inlets and discharge opening, and a central longitudinal drive shaft therein, of a pair of rotary impellers on the shaft each having a series of spaced apart curved blades and alternating annularly spaced radially disposed flat face vanes extending from a central hub, said impellers being aligned with the endmost circulation cavities for drawing liquid through the suction inlets and the endmost cavities into said bore, a rotary impeller on the middle portion of the shaft having similar blades delivering liquid through the discharge opening, and screw propelling means on the shaft in receiving communication with the inlet circulation cavities rotating with said impellers and delivering liquid from the pair of suction inlet impellers to the discharge impeller and thence through the discharge opening circulation cavity with a rotational velocity in the same direction as the rotation of said impeller.

4. In combination with a cylindrical casing having a longitudinal central bore, a middle outlet conduit and endmost inlet conduits each provided with an annularly enlarged circulating cavity extending radially beyond and communicating with the bore of the casing, a middle rotary impeller delivering through such enlarged cavity to the outlet conduit, an outer rotary impeller

having a series of spaced apart curved blades and alternating annularly spaced radially disposed flat face vanes in receiving relation through such enlarged cavity to each inlet conduit, an accelerating spiral conveyor between the middle impeller and each outer impeller, and means for rotating the impellers and conveyors together.

5. In combination with a cylindrical casing having a longitudinal central bore, a middle transverse annularly enlarged outlet chamber and delivery conduit and endmost transverse annularly enlarged inlet chambers each communicating with an inlet conduit and the bore of the casing, a middle rotary impeller delivering to the outlet conduit through its annular chamber, outer rotary impellers each having a series of spaced apart curved blades and alternating annularly spaced radially disposed flat face vanes in receiving relation to the inlet conduits and delivering to their annular chambers, a pressure generating and accelerating spiral conveyor between the middle impeller and each outer impeller in communication with the annular chamber surrounding each, and means for rotating the impellers and conveyors together.

6. The combination with a cylindrical casing having a longitudinal central bore, endmost suction inlet chambers and a middle discharge chamber, said casing having endmost, and a middle, annularly enlarged circulation cavities registering with and forming annular extensions of said inlet and discharge chambers beyond the bore diameter, a central longitudinal drive shaft mounted in the ends of the casing beyond the suction inlet chambers, a double member opposed pitch inwardly feeding helical liquid propeller on the shaft extending at each side of the middle discharge chamber to and terminating at the inner side of the circulation cavities of the endmost suction inlet chambers, a rotary discharge impeller on the shaft midway between the helical propeller members concentrically located within the circulation cavity of the middle discharge chamber, a pair of rotary intake impellers on the shaft each concentrically located within one of the endmost circulation cavities and provided with series of annularly spaced vanes, the spaces between the impeller vanes being in open circulating communication with the annular circulation cavities of the endmost suction inlet chambers and with the adjacent terminals of the helical propeller members.

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