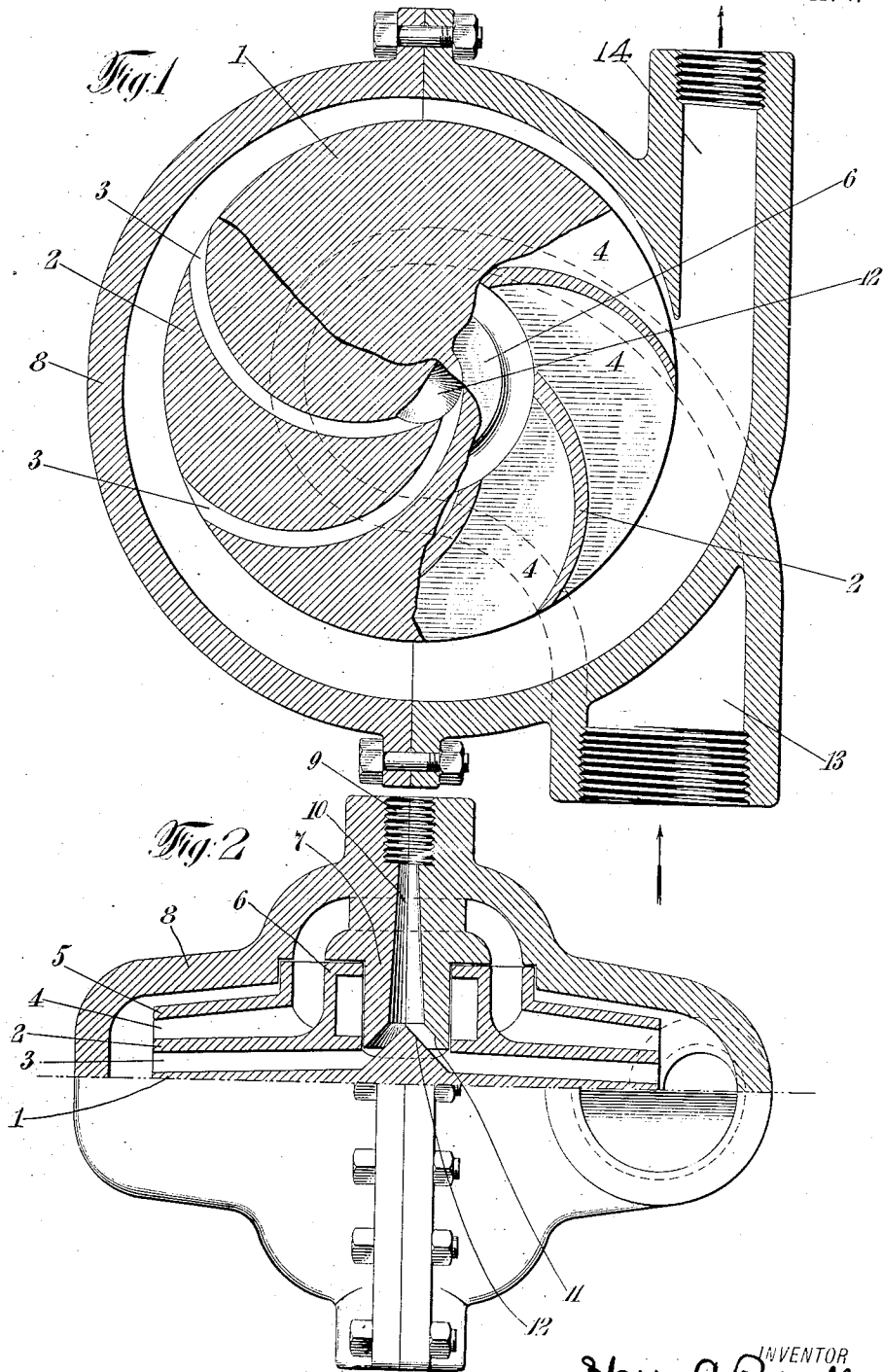


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H. A. PRINDLE.
COMBINED CENTRIFUGAL PUMP AND MOTOR.
APPLICATION FILED AUG. 10, 1915.

Patented Sept. 28, 1920.

2 SHEETS—SHEET 1.



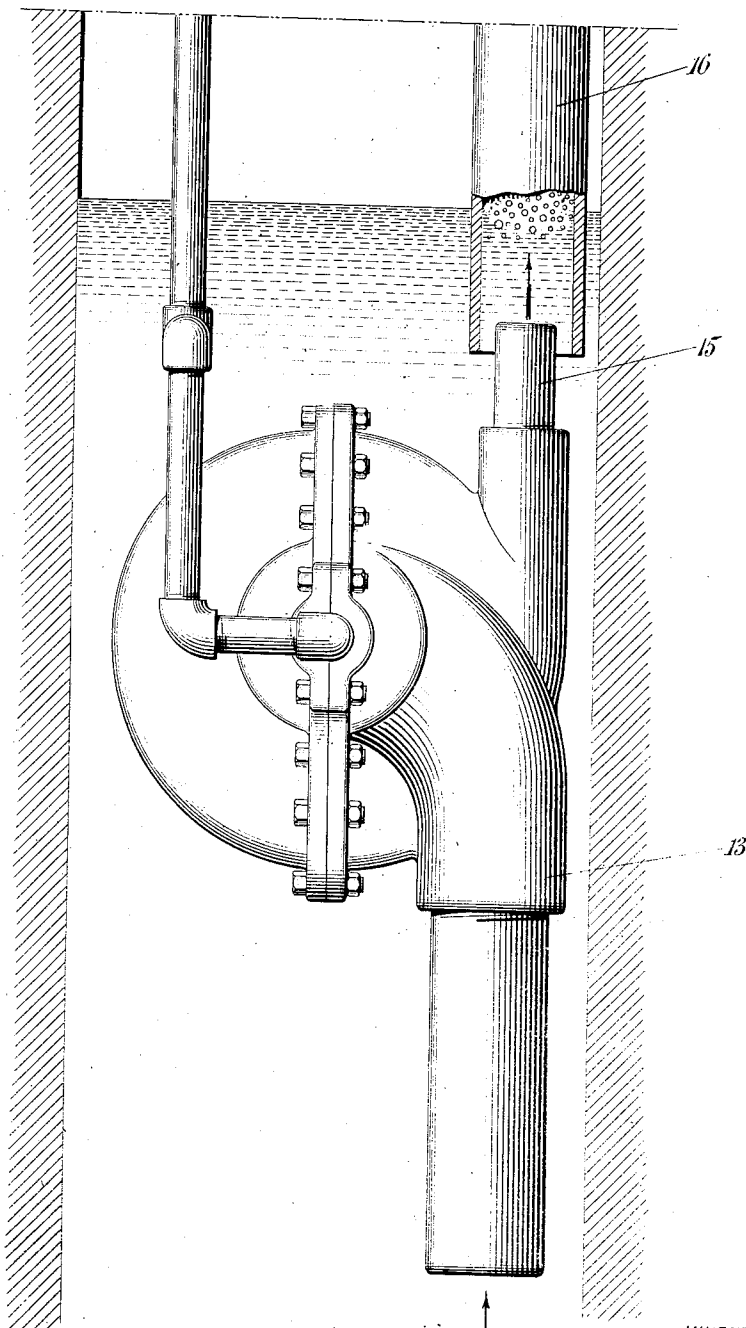
INVENTOR
Harry A. Prindle.
BY
Prindle, Wright & Small
ATTORNEYS

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Fig. 3



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UNITED STATES PATENT OFFICE.

HARRY A. PRINDLE, OF EAST ORANGE, NEW JERSEY.

COMBINED CENTRIFUGAL PUMP AND MOTOR.

1,354,129.

Specification of Letters Patent. Patented Sept. 28, 1920.

Application filed August 10, 1915. Serial No. 44,679.

To all whom it may concern:

Be it known that I, HARRY A. PRINDLE, of East Orange, in the county of Essex and in the State of New Jersey, have invented a certain new and useful Improvement in Combined Centrifugal Pumps and Motors, and do hereby declare that the following is a full, clear, and exact description thereof.

The object of my invention has been to provide a combined centrifugal pump and motor which shall tend to maintain itself, while running, comparatively independent of bearings, and which shall have, among others, the advantages of great simplicity; of requiring only the simplest of bearings; of being capable of being perfectly balanced so as to have no "end thrust," and of being especially adapted for use with steam condensers and air lifts, and to such ends my invention consists in the combined centrifugal pump and motor hereinafter specified.

In the accompanying drawings—

Figures 1 and 2 are, respectively, a central vertical longitudinal section, and a transverse section of a combined centrifugal pump and motor embodying my invention, and—

Fig. 3 is a vertical sectional view of my combined pump and motor used with an air lift.

My invention is capable of embodiment in many different forms and used for many different purposes, and while I shall illustrate it by the best embodiment thereof known to me, such embodiment is to be regarded as typical only of many possible embodiments, and my invention is not to be restricted thereto.

In the illustrated embodiment, I have provided a runner consisting of a single body (which may be composed of assembled parts) having, in the present instance, a central portion 1 upon each side of which are partitions 2, having between them passages 3 of a steam or compressed air turbine. Outside the partitions 2 are partitions 5, and between the partitions 2 and 5 are passages 4 of a centrifugal pump. The outer ends of the passages 3 and 4 are, as usual, in planes substantially perpendicular to the axis, but the inner ends thereof are inclined away from the central plane of the runner, since the water and air are to enter such passages from the side of the runner. The passages 4 thus enter through a face 6 at what might

be termed a hub of the runner, and such hub approximately fits a journal 7 formed on the interior of a pump casing 8. Compressed air enters the boss 9 of the casing through an axial passage 10 that extends through the journal 7, and said passage has a flaring recess 11 forming communication between the passage 10 and the air passages 3. The runner is provided with projections 12 forming tapering trunnions, so to speak, adapted to have bearing when necessary in the flaring recesses 11. Water to be pumped enters through the intake 13, and reaches the water passages 4 of the centrifugal pump, and by centrifugal action is thrown out into the discharge 14.

In order to use my combined centrifugal pump and motor with an air lift, it is only necessary to locate the discharge beneath the lower end of a pipe 15 extending into a well, so that the combined air and water leaving the discharge 15 shall pass up into the pipe 16.

In the operation of my combined centrifugal pump and motor, steam or air is connected to the two bosses 9 of the pump casing, and the intake 13 is connected with a source of supply of the fluid to be pumped. The air is forced through the passages 10 upon opposite sides of the runner and through the flaring recesses 11 into the air passages 3 of the compressed air turbine causing the runner to rotate. The trunnions 12 are supported on the lower surfaces of the flaring recesses 11, thus choking the passage there-through of air to the lower passages of the air turbine. This choked condition of the space between the trunnions 12 and the lower side of the flaring recesses 11 tends to increase the pressure of the air therein as compared with the pressure in the freer space above the trunnions, and this tends to raise the trunnions away from the lower portions of the flaring recesses and to center them in the side opening. The gyroscopic action tends to maintain the runner in the proper plane of rotation perpendicular to the axis of the casing. The rotation of the runner expels the water from the water passages 4 and permits water to enter the suction end resulting in a continuous discharge of the water. The exhaust air leaving the air passages 3 mingles with the water discharge from the water passages 4 and thus air bubbles are discharged into the lower end of the air lift pipe 15. The result is that the

water passes up the pipe 15, not only due to the momentum given it by the centrifugal pump, but to the well-known "air lift" action of the air bubbles and the very efficient pumping action occurs.

My combined motor and centrifugal pump has very great advantages. All the forces about it are balanced, the air (or steam) and water entering from the opposite sides balance each other so that there is no "end thrust" to the apparatus, or tendency to displace the runner lengthwise of the axis upon which it is rotating. The entering air, as described, tends to keep the trunnions in the center of the flaring recesses, so that there is a tendency of the apparatus to run without the friction of bearings, being supported on fluids. This saves the usual expensive and complicated and carefully fitted bearings, and also reduces friction and increases the speed of rotation for a given air pressure. There are no joints between moving points which have to be kept packed to prevent the escape of air or steam. If used to pump water in a steam condenser, or for a boiler feed, the steam used to revolve the runner is most advantageously mingled with the water being pumped, without additional contrivances.

I claim:—

1. In a turbine, a casing, a runner having opposite axial projections mounted in recesses in said casing, opposite gas supply passages communicating with said recesses, and opposite gas turbine passages in said runner communicating with said recesses.

2. In a combined centrifugal pump and motor, a casing, a runner having opposite axial projections mounted in recesses in said casing, opposite gas supply passages communicating with said recesses, opposite gas turbine passages in said runner communicating with said recesses, and opposite water passages upon each side of said runner.

3. In a combined centrifugal pump and motor, a combination of a runner having opposite axial projections, a casing having opposite recesses adapted to receive said projections, gas passages in said runner communicating with said recesses, and radial liquid passages in said runner, the inner ends of said liquid passages extending in a substantially axial direction and communicating with liquid passages in said casing.

4. An air lift comprising a combined centrifugal pump and turbine, means for discharging air from said turbine and water from said pump in an upwardly directed stream, and a substantially vertically arranged air lift pipe adapted to receive said stream.

5. In a device of the class described, a casing having actuating fluid inlets, a rotor within said casing having passages in com-

munication with said inlets, and means whereby the pressure of said fluid supports said rotor during movement of the latter.

6. In a device of the class described, a rotor, a casing having bearings adapted to guide said rotor, said casing being provided with actuating fluid inlets at said bearing points and said rotor having impelling passages leading to said inlets.

7. A combined motor and pump comprising a rotor, an annular casing therefor having bearings for said rotor and actuating fluid inlets leading to said bearings, said rotor having trunnions adapted to obstruct said inlet and impelling passages leading to said trunnions.

8. In a device of the class described, a casing having an actuating fluid inlet, a rotor disposed within said casing having a portion adapted to obstruct said inlet and impelling passages leading to said portion.

9. A pump rotor comprising a disk-like member having opposed central bearing portions, said member being provided with impelling passages symmetrically disposed with respect to the central plane of the disk, and leading respectively to said bearing portions, and having fluid discharging passages leading to the periphery of said disk.

10. A combined centrifugal pump and motor comprising an annular casing having opposed bearings therein, said bearings being provided with actuating fluid inlets, a disk-like rotor disposed within said casing and having trunnions adapted to engage said inlets, and impelling passages leading to said trunnions, said rotor also having fluid discharging passages leading to the periphery of the disk, said above mentioned passages being symmetrically disposed with respect to the central plane of the disk.

11. In combination, a casing having an actuating fluid inlet, a rotor within said casing supported to permit axial movement and having an impelling surface in communication with said inlet, a portion of said rotor being adapted to more or less obstruct said inlet depending upon the amount of axial movement of the rotor.

12. In combination, a casing having opposed actuating fluid inlets, a rotor within said casing supported to permit axial movement and having impelling surfaces in communication with said inlets, portions of said rotor respectively being adapted to more or less obstruct said inlets depending upon the axial position of the rotor.

13. In combination, a casing having an actuating fluid inlet, a rotor within said casing supported to permit axial movement and having an impelling surface in communication with said inlet, a portion of said rotor being adapted to more or less obstruct said inlet depending upon the amount of axial movement of the rotor, said rotor being

also provided with fluid intake and discharging surfaces.

14. In combination, a casing having opposed actuating fluid inlets, a rotor within said casing supported to permit axial movement and having impelling surfaces in communication with said inlets, portions of said rotor respectively being adapted to more or less obstruct said inlets depending upon the axial position of the rotor, said rotor being also provided with fluid intake and discharging surfaces.

15. In combination, an annular casing having a substantially axial fluid inlet, a rotor within said casing having impelling surfaces leading from the center to the periphery thereof and being in communication with said inlet at the center of the rotor, said rotor being axially movable and having a portion adapted to more or less obstruct said inlet depending upon the amount of axial movement of the rotor.

16. In combination, an annular casing having opposed substantially axial fluid inlets, a rotor within said casing having impelling surfaces leading from the center to the periphery thereof and being in communication with said inlets at the center of the rotor, said rotor being axially movable and having portions respectively adapted to more or less obstruct said inlets depending upon the axial position of the rotor.

17. In combination, a casing having an actuating fluid inlet therein, a rotor disposed in said casing, and impelling surfaces for said rotor symmetrically disposed with regard to its axis of rotation whereby the forces exerted upon the rotor by the actuating fluid as the rotor is moved, maintain the same in proper position independently of any bearing for said rotor.

18. In combination, a casing having an actuating fluid inlet therein, a rotor disposed in said casing, and impelling surfaces for said rotor symmetrically disposed with regard to its axis of rotation whereby the forces exerted upon the rotor by the actuating fluid as the rotor is moved, maintain the same in proper position independently of any bearing for said rotor, said rotor also having fluid intake and discharging surfaces.

19. In combination, a casing having opposed actuating fluid inlets in the sides thereof, a rotor bodily movable within said casing, and impelling surfaces for said rotor symmetrically disposed with regard to its axis of rotation in communication with said inlets, whereby the forces exerted upon the rotor by said actuating fluid as the rotor is moved, maintain the same in proper position.

20. In combination, a casing having opposed actuating fluid inlets in the sides thereof, a rotor bodily movable within said

casing, and impelling surfaces for said rotor symmetrically disposed with regard to its axis of rotation in communication with said inlets, whereby the forces exerted upon the rotor by said actuating fluid as the rotor is moved, maintain the same in proper position, and means for varying the axial pressure upon the rotor of the actuating fluid supplied respectively by said inlets according to the position of the rotor therebetween.

21. In combination, a casing having opposed actuating fluid inlets in the sides thereof, a rotor bodily movable within said casing, and impelling surfaces for said rotor symmetrically disposed with regard to its axis of rotation in communication with said inlets, whereby the forces exerted upon the rotor by said actuating fluid as the rotor is moved, maintain the same in proper position, said rotor also having fluid intake and discharging surfaces.

22. In combination, a casing having opposed actuating fluid inlets in the sides thereof, a rotor bodily movable within said casing, and impelling surfaces for said rotor symmetrically disposed with regard to its axis of rotation in communication with said inlets, whereby the forces exerted upon the rotor by said actuating fluid as the rotor is moved, maintain the same in proper position, and means for varying the axial pressure upon the rotor of the actuating fluid supplied respectively by said inlets according to the position of the rotor therebetween, said rotor also having fluid intake and discharging surfaces.

23. In combination, a casing having an actuating fluid inlet therein, a rotor bodily movable within said casing having balanced impelling surfaces in communication with said inlet and radiating outwardly with respect to the center of rotation of the rotor, whereby the forces exerted upon the rotor by the actuating fluid as the rotor is moved, maintain the same in proper position independently of any bearing for said rotor.

24. In combination, a casing having opposed actuating fluid inlets therein, an axially movable rotor disposed within said casing having balanced impelling surfaces in communication with said inlets and radiating outwardly with respect to the center of rotation of the rotor, and means for varying the axial pressure upon the rotor of the actuating fluid supplied respectively by said inlet according to the position of the rotor therebetween, whereby the forces exerted upon the rotor by the actuating fluid as the rotor is moved, maintain the same in proper position independently of any bearing for said rotor.

25. In combination, a casing having opposed actuating fluid inlets therein, a rotor disposed within said casing having balanced impelling surfaces in communication with

said inlets and radiating outwardly with respect to the center of rotation of the rotor, whereby the forces exerted upon the rotor by the actuating fluid as the rotor is moved, maintain the same in proper position independently of any bearing for said rotor.

26. In combination, a casing having opposed actuating fluid inlets therein, an axially movable rotor disposed within said casing having balanced impelling surfaces in communication with said inlets and radiating outwardly with respect to the center of rotation of the rotor, and means for varying the axial pressure upon the rotor of the actuating fluid supplied respectively by said inlets according to the position of the rotor therebetween, whereby the forces exerted upon the rotor by the actuating fluid as the rotor is moved, maintain the same in proper position independently of any bearing for said rotor, said rotor also having

fluid intake and discharge passages radiating outwardly with respect to the center of rotation of the rotor.

27. In combination, a casing having there- 25 in an inlet for compressed air, a rotor disposed within said casing having impelling surfaces in communication with said inlet and radiating outwardly with respect to the center of rotation of the rotor, said rotor 30 also having liquid intake and discharge passages radiating outwardly with respect to the center of rotation of the rotor, and a common discharge pipe for receiving both the air and the liquid discharged by said 35 rotor.

In testimony that I claim the foregoing I have hereunto set my hand.

HARRY A. PRINDLE

Witness:

AGNES F. McLAUGHLIN.