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O. H. DORER
CENTRIFUGAL PUMP
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Fig. 2.

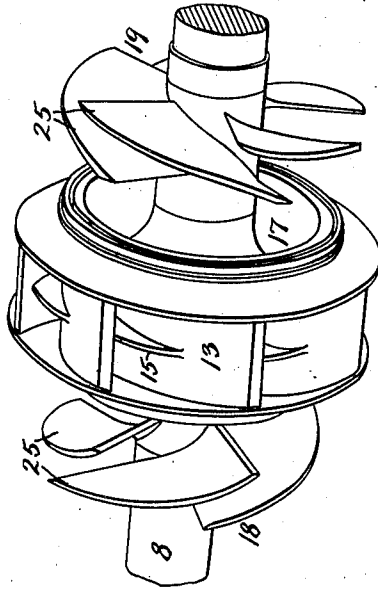


Fig. 3.

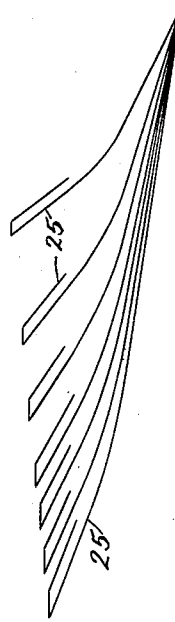
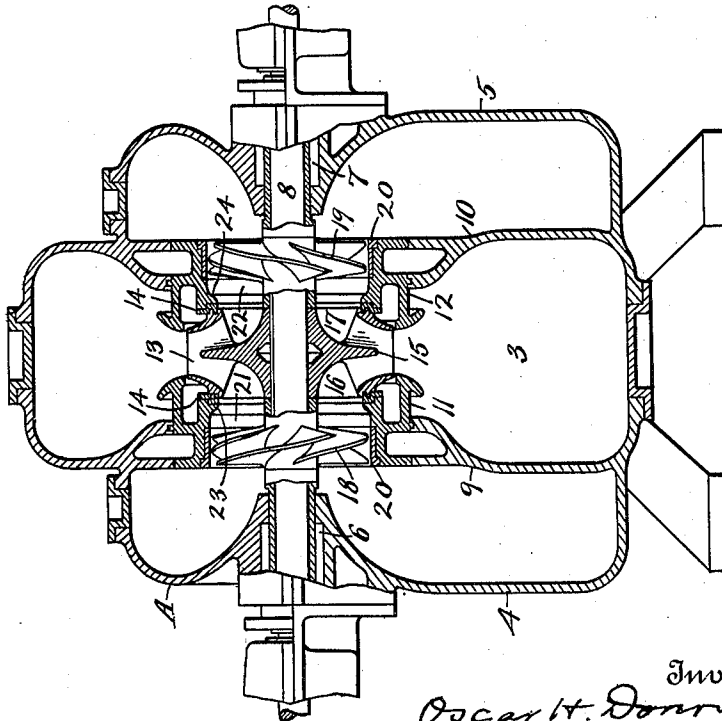


Fig. 1.



Inventor
Oscar H. Dorer
By his Attorneys
Philip M. Sanger, Rice & Keady

UNITED STATES PATENT OFFICE.

OSCAR H. DORER, OF NEWARK, NEW JERSEY, ASSIGNOR TO WORTHINGTON PUMP AND MACHINERY CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF VIRGINIA.

CENTRIFUGAL PUMP.

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This invention relates to a rotary piston fluid pump of the class embodying means for propelling the fluid to the inlet of a radial flow impeller.

Development of the above-mentioned class of fluid pumps has already produced types wherein axial flow propellers deliver fluid to a radial flow impeller, but in such known types the fluid is delivered to the inlet of the impeller with an increase in pressure due to the action of the fluid propelling means, the result of which is, in effect, a two stage pump in which part of the work done on the fluid is accomplished by the propelling means.

However, the present invention provides propelling means delivering fluid to the impeller at practically no pressure but in an axial direction with a rotational velocity, the effect of which, in addition to decreasing the shock-loss upon entrance to the impeller vanes and thereby producing a higher efficiency, is also to permit of a higher operating speed for a given head than is the case where the impeller is used alone.

Furthermore, another contributing factor toward increasing the speed of the impeller for a given size pump resides in the provision of screw propellers of gradually increasing pitch, and of larger diameter than the impeller inlet, so that with a given velocity of inlet flow the impeller may be operated at a still higher speed, regardless of the rotational velocity above referred to, by reason of the fact that inasmuch as the operating head is determined by the peripheral speed, which is directly proportioned to the outside diameter of the impeller, a smaller impeller operating at a higher speed for a given head may be employed.

Also, the axial flow propellers are spaced from the impeller inlet to leave a chamber wherein all the energy of the fluid leaving the propelling means is transformed into rotational velocity in the same direction of rotation as the impeller, prior to entering the impeller inlet.

By reason of the foregoing features, a pump thus constructed is especially desirable for use with hot wells or as a tail pump where low inlet velocities obtain; and, also, the rotation of the fluid at the impeller inlet serves to provide a fluid seal cutting off the vacuum from the impeller inlet with the

result that it prevents pulsations in the impeller as often happens in this class of service where the impeller is used alone.

In the drawings:—

Figure 1 is a vertical longitudinal section of a pump constructed in accordance with the present invention.

Figure 2 is a perspective view of the combined impeller and propellers.

Figure 3 is a developed plan of the axial flow propeller blades.

Referring now to the drawings:—

The pump, as herein shown for the purpose of illustrating the principle of the invention, comprises a casing having the suction chambers 1 and 2 disposed on either side of a discharge chamber 3.

The side walls 4 and 5 of the casing A are provided with the usual packed bearings 6 and 7, respectively, mounting a shaft 8 adapted to be driven rotationally by any suitable prime mover.

The side walls 9 and 10 of the discharge chamber 3 are provided with aligning apertures in which impeller guides 11 and 12 are disposed and which confine a centrifugal impeller 13, which is fixed to the shaft 8 and bears against the usual guide rings 14 carried on adjacent faces of the two impeller guides 11 and 12. The impeller 13 is divided centrally by the web 15 into two sides thus providing the impeller 13 with two inlets 16 and 17, or forming a double impeller.

The shaft 8 carries screw type axial flow impellers 18 and 19 of opposing pitch and working in the guide rings 20 of the impeller guides 11 and 12, but said propellers 18 and 19 are spaced from the impeller entrances 16 and 17, respectively, a sufficient distance to provide conversion chambers 21 and 22 which, as indicated, are tapered as at 23 and 24 toward the impeller inlets 16 and 17, the impeller inlets being of considerably less area than the propellers for reasons hereinafter set forth.

The vanes 25 of the propellers 18 and 19 are of screw form with gradually increasing pitch and, when developed, appear as in Fig. 3, thus doing work upon the fluid as it travels along the blades.

As will be seen from the development of the propeller vanes, the said propellers are of the overlapping vane type, the vanes having variable angle, which principle produces a

quiet, even running pump capable of efficiently handling variable loads.

The vanes 25 are shown clearly in Figs. 2 and 3 as increasing in pitch, or angle to the shaft, from their inlet ends, these vanes therefore being of variable angle. This results in an increase of the rotational velocity of the fluid as it passes through the propeller, but with substantially no increase in pressure. This rotational velocity is substantially maintained in the chambers 21, 22, and as the fluid passes from chambers 21, 22 to the impeller through the inlets 23 and 24, the reduction in size of the inlets relatively to the chambers 21 and 22 secures an increase in axial velocity while maintaining the rotational velocity. The fluid thus passes to the impellers 18, 19 at relatively high rotational velocity and an axial velocity substantially increased over the velocity in the suction.

The operation of the pump is as follows:—

Fluid entering the chambers 1 and 2 of the casing A is acted upon by the propellers 18 and 19 which impart thereto a rotational velocity in the same direction of rotation as that of the impeller 13. The axial velocity of the fluid entering the inlets 16 and 17 of the impeller 13 increases as the fluid passes through the reduced passages 23, 24 to the impeller inlets with the result that the impeller receives the already rotated fluid at increased velocity and in a solid body thus decreasing the shock-loss at the entrance to the impeller vanes and tending to reduce the head generated by the impeller or, in other words, due to the rotational velocity of the fluid on entering the impeller 13 said impeller will run faster to generate a given head than if the fluid did not enter the same with a rotational velocity.

In addition to the above the solid body of fluid produced by such rotational velocity at the impeller inlet acts as a seal to cut off the vacuum from the impeller thereby eliminating pulsations which are likely to occur when the impeller is used alone under conditions of varying load.

The large diameter of the propellers 18 and 19 as compared with the inlets 16 and 17 of the impeller 13 permits of a decrease in outside diameter of the impeller 13 with a consequently increased speed for a given head; the reason for this being that the outside diameter is strictly proportional to the peripheral speed and said peripheral speed determines the head.

I claim:—

1. The combination with a casing having suction and discharge means, of a rotary impeller drawing fluid through the suction means and delivering through the discharge means, and variable pitch screw means in the suction means imparting rotational velocity

and increasing axial velocity to the fluid before entering the impeller.

2. The combination with a casing having suction and discharge means, of a double impeller drawing fluid through the suction means at each side of the impeller and delivering through the discharge means, and variable pitch screw means in the suction means at each side of the impeller for imparting rotational velocity and increasing axial velocity to the fluid before entering the impeller.

3. The combination with a casing having suction and discharge means, of a rotary impeller drawing fluid through the suction means and delivering through the discharge means, and variable pitch screw means in the suction means imparting rotational velocity and uniformly increasing axial velocity at substantially impeller suction pressure, to the fluid before entering the impeller.

4. The combination with a casing having suction and discharge means, of a double impeller drawing fluid through the suction means at each side of the impeller and delivering through the discharge means, and variable pitch screw means in the suction means at each side of the impeller for imparting rotational velocity and uniformly increasing axial velocity at substantially impeller suction pressure to the fluid before entering the impeller.

5. In combination with a casing having suction and discharge means, a rotary impeller delivering fluid to the discharge, and means in the suction imparting rotational and axial velocity to the fluid before entering the impeller and separated therefrom by a conversion chamber.

6. In combination with a casing having suction and discharge means, a rotary impeller delivering fluid to the discharge, and screw means in the suction imparting rotational and axial velocity to the fluid before entering the impeller and separated therefrom by a conversion chamber.

7. In combination with a casing having suction and discharge means, a rotary impeller delivering fluid to the discharge, and variable pitch screw means in the suction imparting rotational velocity and uniformly increasing axial velocity to the fluid before entering the impeller and spaced therefrom by a conversion chamber.

8. In combination with a casing having suction and discharge means, a double impeller connected at each side with said suction, and means in the suction at each side of said impeller and separated therefrom by conversion chambers for imparting rotational and axial velocity to the fluid before entering the impeller.

9. In combination with a casing having suction and discharge means, a double im-

5 peller connected at each side with said suction, and screw means in the suction at each side of said impeller and separated therefrom by conversion chambers for imparting rotational and axial velocity to fluid before entering the impeller.

10. In combination with a casing having suction and discharge means, a double impeller connected at each side with said suction, and variable pitch screw means in the suction at each side of said impeller and separated therefrom by conversion chambers for imparting rotational velocity and uniformly increasing axial velocity to the fluid before entering the impeller.

11. In combination with a casing having suction and discharge means, a centrifugal impeller delivering fluid to the discharge, and fluid propelling means rotating with said impeller and separated therefrom by a conversion chamber and delivering fluid thereto with a rotational velocity in the same direction as the rotation of said impeller.

12. In combination with a casing having suction and discharge means, a centrifugal impeller delivering fluid to the discharge, and fluid propelling means rotating with said impeller and separated therefrom by a conversion chamber and delivering fluid thereto with a rotational velocity in the same direction as the rotation of said impeller and with an axial component.

13. In combination with a casing having suction and discharge means, a centrifugal impeller delivering fluid to the discharge, and screw propelling means rotating with said impeller and separated therefrom by a conversion chamber and delivering fluid thereto with a rotational velocity in the same direction as the rotation of said impeller and with an axial component.

14. In combination with a casing having suction and discharge means, a centrifugal

impeller delivering fluid to the discharge, and variable pitch screw propelling means rotating with said impeller and separated therefrom by a conversion chamber and delivering fluid thereto with a rotational velocity in the same direction of rotation as the rotation of said impeller and with a uniformly increasing axial component.

15. The combination with a casing having suction and discharge means, of a rotary impeller delivering fluid to the discharge, a propeller in the suction having a larger diameter than the eye of the impeller, and a conversion chamber between the propeller and the impeller.

16. The combination with a casing having suction and discharge means, of a rotary impeller delivering fluid to the discharge, a variable pitch screw propeller in the suction having a diameter larger than the eye of the impeller, and a conversion chamber between the variable pitch screw propeller and the impeller.

17. The combination with a casing having suction and discharge means, of a rotary impeller delivering fluid to the discharge, a screw propeller in the suction having a larger diameter than the eye of the impeller, and a conversion chamber between the screw propeller and the impeller having its impeller end contracted.

18. The combination with a casing having suction and discharge means, of a rotary impeller delivering fluid to the discharge, a variable pitch screw propeller in the suction having a diameter larger than the eye of the impeller, and a conversion chamber between the variable pitch screw propeller and the impeller having its impeller end contracted.

In testimony whereof, I have hereunto set my hand.

OSCAR H. DORER.