

May 5, 1925.

1,536,754

H. F. BENSON

AXIAL FLOW PUMP

Filed Feb. 10, 1921

Fig. 1.

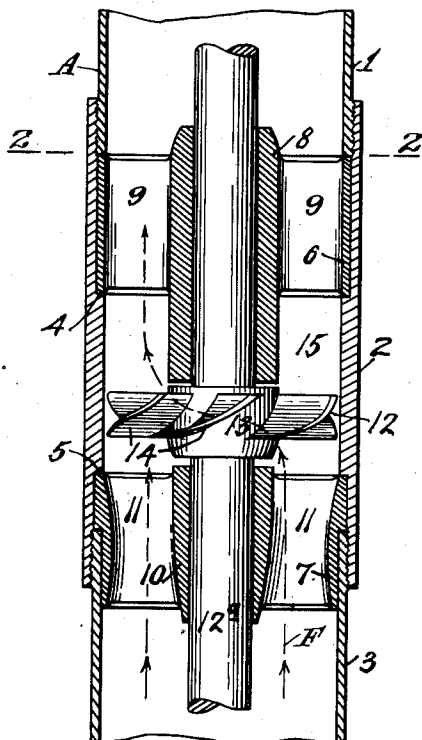


Fig. 3.

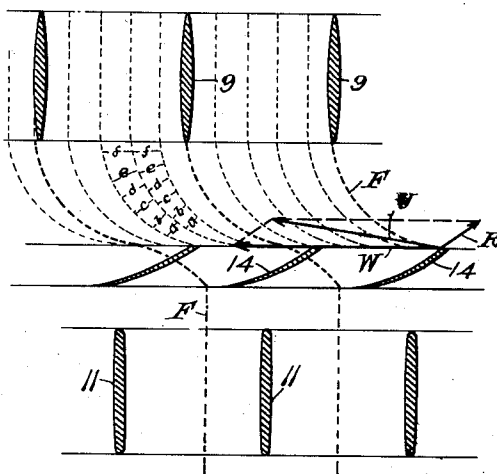
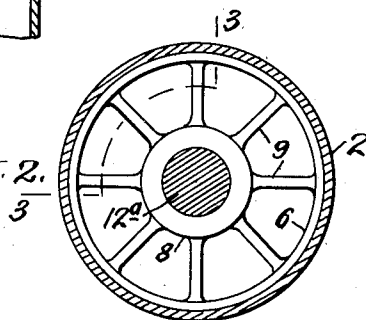


Fig. 2.



INVENTOR

Harvey F. Benson

BY his ATTORNEYS

Philip Sawyer Rice Kennedy

Patented May 5, 1925.

1,536,754

UNITED STATES PATENT OFFICE.

HARRY F. BENSON, OF HOLYOKE, MASSACHUSETTS, ASSIGNOR TO WORTHINGTON PUMP AND MACHINERY CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF VIRGINIA.

AXIAL-FLOW PUMP.

Application filed February 10, 1921. Serial No. 443,830.

To all whom it may concern:

Be it known that I, HARRY F. BENSON, a citizen of the United States, residing at Holyoke, county of Hampden, and State of Massachusetts, have invented certain new and useful Improvements in Axial-Flow Pumps, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to pumps of the type wherein an axial flow impeller is located in a cylindrical housing for the purpose of moving a fluid through such housing.

The present invention has as its object the provision of a pump of this type that shall operate with a higher efficiency than previous pumps, and secures this result by a construction in which conversion or diffusion vanes are spaced from the discharge side of the impeller to form a conversion chamber of such length as to provide space in which the swirling or helical motion of the discharged streams is gradually dissipated and the streams widen out and finally assume a substantially axial direction of movement, the conversion or diffusion vanes being so located that the streams enter the vanes at the time of thus assuming substantially axial direction.

It has been found that the rate of increase in width or breadth of the streams leaving the impeller blades and the distance required in turning to substantially an axial direction with consequent decrease in velocity is controlled by the relative location of the conversion vanes with respect to the impeller, and by the relation between the initial velocity imparted by the impeller and the final velocity at the point of entering the conversion vanes. Consequently, by determining these velocities and their corresponding areas and thus calculating the position of these conversion or diffusion vanes, it is possible to establish a conversion chamber in which the kinetic energy of the fluid leaving the impeller may be effectively converted to its final pressure.

In the drawings:

Figure 1 is a vertical section through a pump embodying this invention.

Figure 2 is a transverse section on the line 2—2 of Figure 1.

Figure 3 is a developed vertical section on the line 3—3 of Figure 2.

Referring to the drawings:

The invention, as herein disclosed for the purpose of illustrating the principle involved, comprises a cylindrical casing A which may be made up of sections 1, 2 and 3, the section 2 being threaded at each end to receive the ends of the other sections and shouldered as at 4 and 5 to seat the conversion or diffusion vane ring 6 and the guide vane ring 7, the former of which carries a hub 8 connected with the ring by radial conversion or diffusion vanes 9 of elliptical cross-section, as shown in Figure 2; while the latter also carries a hub 10 connected with the ring 7 by guiding vanes 11, the said hub 10 being tapered toward the entrance, and the inner wall of ring 7 being crowned or curved to provide passages facilitating entrance of the fluid to the blades of an impeller 12 mounted on a shaft 12^a running in bearings formed by the hubs 8 and 10. This impeller 12 is of the axial flow type having a hub 13 from which the radial screw blades 14 project and which, when developed, appear as in Figure 3, and are shown to have thin entrance edges with curved slightly diverging side walls.

The location of the conversion or diffusion vane ring 6 is such, with respect to the discharge side of the axial flow impeller 12, that a conversion chamber 15 is established therebetween.

When fluid is delivered to the rotating impeller 12 by the guide vanes 11, the blades 14 of the impeller discharge streams having a directional velocity which is the result of the combined action of the impeller speed as represented by W (Fig. 3) and the relative axial velocity R. This directional velocity is represented by U in Fig. 3 and indicates the velocity condition of a stream of fluid thrown out of the impeller into the conversion chamber 15. Also, in Fig. 3, theoretical stream lines F issuing from the impeller into the conversion chamber 15 form between them curving streams of fluid gradually increasing in breadth as shown by a, b, c, d, e, and f, at which latter indication the streams have assumed substantially an axial flow and have decreased from a high to a relatively low velocity and are entering the conversion or diffusion vanes, which

ensure the axially directed fluid column against further agitation by eddies or swirling.

The entrance edges of the conversion or diffusion vanes may be placed slightly nearer the impeller than above set forth, in which case a curved entrance may be provided but the location even then is to be such that the streams of fluid, theoretically illustrated in Fig. 3, enter the vanes at a small angle and at low velocity.

I claim:

1. In a fluid pump, a casing, an axial flow impeller therein, and conversion vanes in the casing and having their entrance positioned at the point where the streams leaving the impeller initiate movement in only an axial direction, whereby a conversion chamber is provided between the impeller and said vanes.

2. In a fluid pump, a casing, an axial flow impeller therein delivering helically moving streams gradually decreasing in velocity until they have only an axial movement, and axially extending radial conversion vanes in said casing receiving said streams at the point where helical movement ceases.

3. In a fluid pump, a casing, an axial flow impeller therein delivering helically moving streams gradually decreasing in velocity until they have only an axial movement, and axially extending radial conversion vanes in said casing and of elliptical cross-section, said vanes positioned to receive the said streams at the point where the helical movement ceases.

4. In a fluid pump, a casing, a screw impeller therein delivering helically moving streams gradually decreasing in velocity until they have only an axial movement, and axially extending radial conversion vanes in said casing and of elliptical cross-section, said vanes positioned to receive the said streams at the point where helical movement ceases.

5. In a fluid pump, a casing, an axial flow impeller therein, conversion vanes in said casing and having their entrance positioned at the point where the streams leaving the impeller initiate axial movement

only, whereby a conversion chamber is provided, and guide vanes on the suction side of the impeller.

6. In a fluid pump, a casing, an axial flow impeller therein delivering helically moving streams of decreasing velocity and increasing stream area, and conversion vanes on the discharge side of said impeller and spaced therefrom to control and maintain the rate of decrease in velocity and increase of stream area and provide a conversion chamber for efficient conversion from velocity to pressure.

7. In a fluid pump, a casing, a screw impeller delivering helically moving streams of gradually decreasing velocity and increasing stream area, and axially extending radial conversion vanes spaced from the impeller discharge to provide a conversion chamber and controlling the rate of decrease in velocity and increase in stream area whereby said streams initiate axial movement only at the movement of entering said vanes.

8. In a fluid pump, a casing, a screw impeller therein delivering helically moving streams gradually decreasing in velocity at a rate required for effective conversion of velocity into pressure and axially extending radial conversion vanes in said casing so positioned as to receive said streams at the point where the streams have only an axial movement occurring at a point dependent on the said decreasing rate of velocity.

9. In a fluid pump, a casing, an axial flow impeller therein, delivering streams gradually decreasing in velocity at a rate required for effective conversion of velocity into pressure, and conversion vanes in said casing so positioned as to receive said streams at the point where the streams have only an axial movement occurring at a point dependent on the said decreasing rate of velocity, whereby a conversion chamber is provided, and guide vanes on the suction side of the impeller.

In testimony whereof, I have hereunto set my hand.

HARRY F. BENSON.