H. A. FEE.

TURBINE PUMP OR BLOWER.

APPLICATION FILED NOV. 21, 1908.

916,427. Patented Mar. 30, 1909.

Fig. 1.

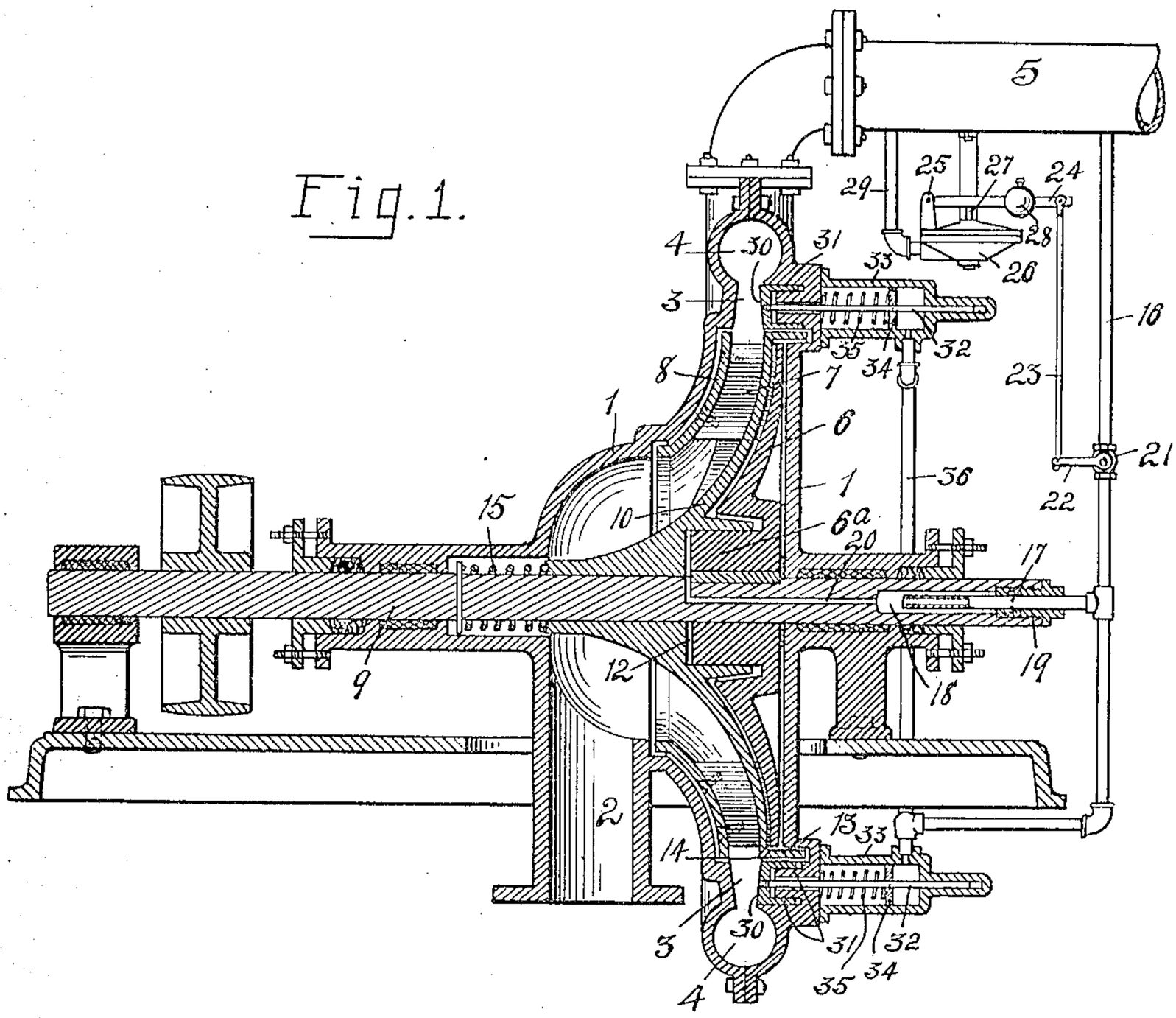


Fig. 2.

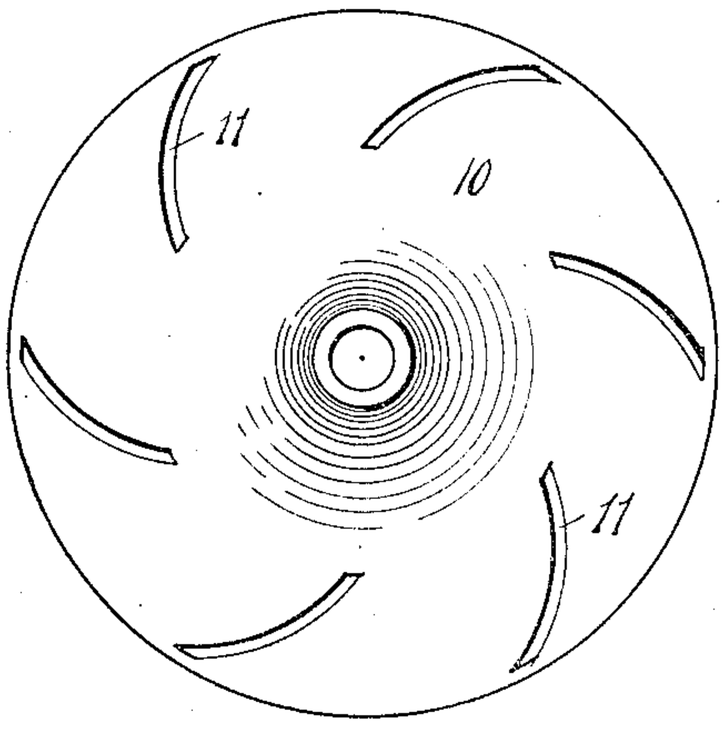
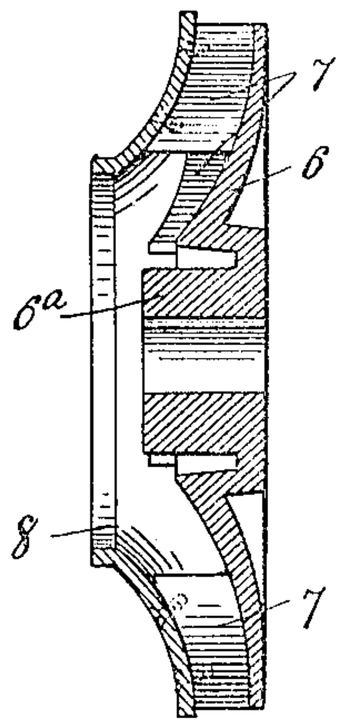


Fig. 3.



WITNESSES:

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UNITED STATES PATENT OFFICE.

HARRY A. FEE, OF ADRIAN, MICHIGAN.

TURBINE PUMP OR BLOWER.

No. 916,427. Specification of Letters Patent. Patented March 30, 1909.

Application filed November 21, 1908. Serial No. 463,850.

To all whom it may concern:

Be it known that I, HARRY A. FEE, a citizen of the United States, and a resident of Adrian, in the county of Lenawee and State of Michigan, have invented certain new and useful Improvements in Turbine Pumps or Blowers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to pumps or blowers of the centrifugal or turbine type, and while the present instance contemplates its use more particularly in connection with the handling of water, it may be as advantageously employed for acting on air or other fluids.

Owing to the fact that the turbine pumps or blowers at present constructed are not well adapted to give a variable flow at an approximately constant head and at the same time maintain their full efficiency, they being designed to have a fixed output for a fixed speed to obtain the maximum efficiency under a fixed head, it has not been found practical to employ them for supplying fluid under an approximately constant head where the demand for the same varies, as a throttling of the discharge would materially reduce the efficiency of the same. Up to the present the only way of regulating such devices to suit a varying demand has been to either throttle the discharge of the pump or to throttle the discharge openings of the impeller by moving it laterally with respect to the casing or the diffusion-chamber. This, however, has been found to materially affect the efficiency of the pump. It is for this reason that reciprocating pumps have been used almost exclusively in water-works plants and the like where the demand for the fluid varies, as the speed of the same is made to change with the variation of the demand, the pressure being thereby maintained approximately constant.

The object of my invention is to overcome these difficulties by the provision, in a device of this character of simple means for varying the size of the passage-ways therethrough as the demand varies, whereby the flow of the fluid may be regulated and its pressure maintained approximately constant without materially impairing the efficiency of the device.

The invention is fully described in the following specification, and while in its broader aspect it contemplates a construction which will permit the area of the passage-ways through the impeller or impellers and also in the diffusion-chamber to be varied, either manually or automatically, while the pump or blower is in service, and is applicable to either a single or multiple stage pump or blower, a preferred form thereof is shown in the accompanying drawings, in which,—

Figure 1 is a central vertical section of a turbine pump embodying the same. Fig. 2 is a face view of the adjustable lining of the impeller removed therefrom, and Fig. 3 is a central transverse section of the impeller with the adjustable lining removed.

Referring to the drawings, 1 designates the pump-casing, having the usual inlet 2, annular diffusion-chamber 3 and outlet passage 4, which latter opens into a discharge-pipe 5. The casing 1 incloses an impeller 6 of the inclosed type, having the guides or vanes 7 projecting laterally therefrom and carrying at their outer ends the side-wall ring 8, which is removably secured thereto by screws, or otherwise. The impeller is keyed to the drive-shaft 9, which is suitably journaled in the casing 1.

10 designates a movable lining member, which has one face fashioned to form the side-wall of the impeller passage-way opposed to the side-wall 8 thereof, and is provided with slots 11 through which the guides or vanes 7 project. This lining is loosely mounted on the shaft 9 for longitudinal movements thereon relative to the impeller 6 and has its hub portion provided with a chamber 12, the walls of which are intended to have a close sliding fit over a registering hub portion 6^a of the impeller 6. The lining also has its periphery formed with the annular outwardly projecting flange 13, which incases the periphery of the impeller and works into a registering channel in the contiguous casing side. A plurality of small openings 14 are provided around the outer edge of the lining to permit a discharge of any matter which enters the space between impeller 6 and lining 10.

The lining 10 may be influenced to move to restrict the passage-ways through the impeller due to the admission of fluid to the chamber 12 from the discharge conduit 5

and has such movement resisted by a compression-spring 15, which encircles the shaft 9 with one end in abutment with the end of the lining hub opposed to said chamber. A pipe 16 is tapped into the conduit 5 and has a branch 17 projecting into a longitudinal chamber or bore 18 in one end of the shaft 9 through a stuffing-box 19, said chamber 18 being in communication with the lining-chamber 12 through the channel 20 in the shaft, as shown. The pipe 16 is provided with a valve 21, the lever-arm 22 of which is connected by a link or rod 23 to the free end of a lever-arm 24, which is pivoted to a boss 25 rising from the top of a diaphragm-chamber 26 at one side thereof. This chamber is provided with the usual diaphragm (not shown), which has a rod 27 projecting upward from its center through the chamber casing and bearing at its upper end against the under side of the lever-arm 24, whereby to effect an oscillation of said arm to open the valve 21 when the diaphragm is raised. A weight 28 is carried by the lever 24 to normally maintain it in lowered position. A pipe 29 opens communication between the discharge conduit 5 and the interior of the chamber 26 at the side of the diaphragm opposed to the rod 27, thus causing a change of pressure in the conduit to effect a movement of the diaphragm. It is thus apparent that any increase of pressure of the fluid in the discharge-conduit 5, due to a partial throttling of the discharge, will cause the diaphragm to raise and lift the lever-arm 24 against the influence of the weight 28 which effects an opening of the valve 21 to permit fluid to flow to the lining-chamber 12, which fluid causes a movement of the lining 10 to restrict the passage-way through the impeller, thereby maintaining the pressure approximately constant without affecting the efficiency of the pump or blower.

In addition to providing the impeller with a movable lining whereby its passage-ways may be restricted or enlarged as the demands on the fluid may require, it is also found to be desirable to provide the diffusion-chamber 3 with a movable lining, forming one wall thereof, to permit its passage-way to be restricted or enlarged in the same proportion that the size of the impeller passage-way is varied. This is accomplished by providing the side of the diffusion-chamber 3 contiguous to the edge of the impeller lining 10, when in normal position, with a laterally movable lining 30, which is in the form of a ring and provided at its edges with the rearwardly projecting flanges 31, which work in registering channels in the casing 1 and serve to guide the movements of the lining. A plurality of piston-rods 32 project rearwardly from the lining 30 through the casing 1 and into cylinders 33, which are attached to the casing and in which pistons 34 carried by the rods 32 work. Compression-springs 35 encircle the rods 32 within the cylinders and have their opposite ends thrust against the pistons 34 and inner ends of the cylinders to normally maintain the lining 30 in full retracted or open position. The pipe 16, which taps into the discharge-conduit 5, has communication below the valve 21 with the several cylinders 33 through a pipe 36, which admits fluid to the cylinders on the outer side of the pistons 34 to effect an inward movement of the pistons and connecting lining-ring against the tension of the springs 35 and a consequent reduction of the area of the passage-way through the diffusion-chamber. If desired the impeller lining 10 and diffusion-chamber lining 30 may be controlled manually, or automatically in any other manner than that shown and described, as the essential features of my invention reside in the provision of means within the pump or blower for varying the area of the impeller passage-ways and the area of the diffusion-chamber, or either, rather than in the means employed for affecting the movements of such area varying means.

The operation of the invention is as follows:—When the pump or blower is running at its full capacity the impeller lining 10 and lining-ring 30 of the diffusion-chamber stand in full open position, as shown, due to the influence of the springs 15 and 35, respectively, thereon and the absence of pressure on the inner sides thereof. Should the fluid discharge be now partially throttled by a stopping of a portion of the discharge at any point or points in the line, it is evident that the fluid pressure will increase, thus affecting a movement of the diaphragm in the chamber 26 to raise the lever-arm 24 through the medium of the rod 27, and a consequent movement of the valve arm 22 to open the valve 21 in the pipe 16. The opening of the valve admits fluid to the chamber 12 between the lining 10 and impeller 6 and also to the several cylinders 33 to the rear of the pistons 34, which fluid acts on said parts to move the lining 10 to partially restrict the passage-way through the impeller and to move the lining-ring 30 to restrict the passage-way through the diffusion-chamber 3 to the same extent, thus reducing the capacity of the pump to suit the demand on the fluid and at the same time maintaining the pressure in the discharge-conduit approximately constant. When the plant is again taxed to its full capacity the fluid supply to the chambers 12 and 33 is cut off by a closing of the valve 21, thus permitting the lining parts 10 and 30 to move, under the influence of the springs 15 and 35, to open their respective passage-ways to their full extent. As the lining parts 10, 30 move in this

manner the fluid in the chamber 12 is permitted to slowly escape therefrom by leaking between the impeller 6 and lining 10 out into the fluid passage-way, while the fluid in the cylinders 33 leaks past the pistons, around the piston-rods and between the lining-rings 30 and casing into the fluid passage-way of the pump or may slowly escape in any other suitable manner. It is thus apparent that the area of the impeller passage-ways and also the area of the diffusion-chamber 3 are automatically increased or diminished to regulate the quantity of flow of fluid therethrough as the demands on the fluid may require without materially lessening the efficiency of the pump or blower.

I desire it to be understood that my invention is not limited to any specific form or arrangement of parts except in so far as such limitations are specified by the claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is,—

1. In an apparatus of the class described, the combination of an impeller, a member movable to vary the area of the passage-ways through the impeller, means acting on said member to normally maintain it in one position relative to the impeller, and means for moving the member in opposition to said first means.

2. In an apparatus of the class described, the combination of an impeller, a shaft carrying the impeller, a member loosely carried by the shaft for movement longitudinally thereof to vary the area of the passage-ways through the impeller, a spring acting on the impeller to yieldingly retain it in one position relative to the impeller, and fluid-pressure means for moving the member in opposition to the spring.

3. In an apparatus of the class described, the combination of an impeller, and mechanism automatically controlled by the pressure of the discharging fluid to regulate the area of the impeller passage-ways.

4. In an apparatus of the class described, the combination of an impeller, a movable wall for the passage-ways of the impeller, and fluid pressure means which is automatically controlled by a change of pressure of the fluid discharging from the apparatus to move said wall to vary the area of the impeller passage-ways.

5. In an apparatus of the class described, the combination of the diffusion-chamber, a movable lining forming one wall of said chamber, and fluid pressure means which is automatically controlled by a change of pressure of the fluid discharging from the apparatus to move said lining to vary the area of said chamber.

6. In an apparatus of the class described, the combination of the impeller, a movable lining forming one wall of the passage-ways therethrough, a diffusion-chamber, a movable lining forming one wall of the diffusion-chamber, and means for moving said linings to vary the area of the passage-ways through the impeller and said chamber.

In testimony whereof I have hereunto signed my name to this specification in the presence of two subscribing witnesses.

HARRY A. FEE.

Witnesses:
C. W. Owen,
Hazel B. Hiett.