July 14, 1931. H. J. HANZLIK 1,814,629

ELASTIC FLUID TURBINE

Filed Oct. 12, 1928

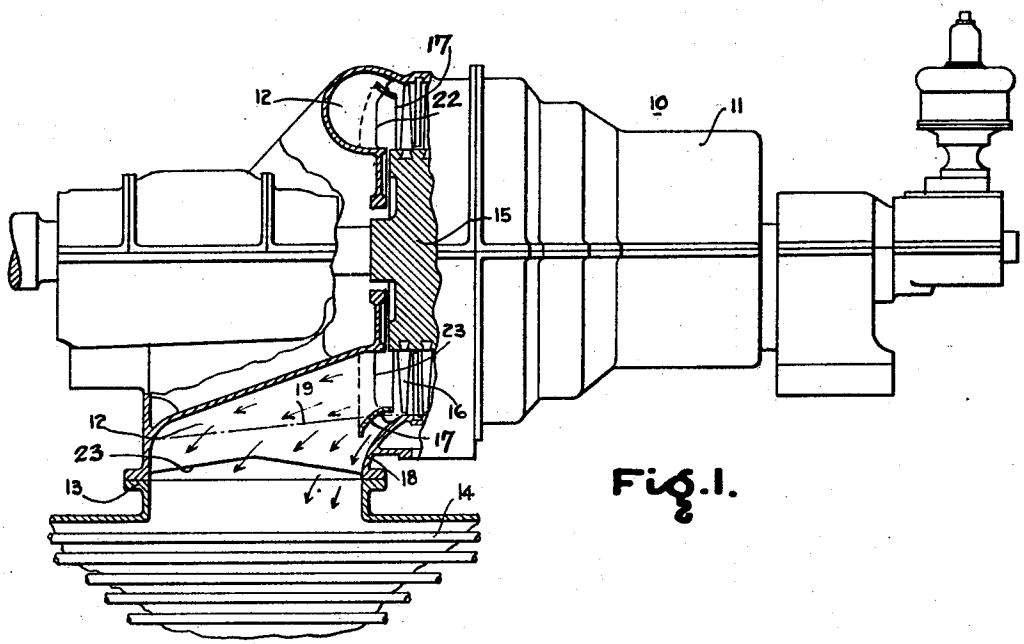


Fig. 1.

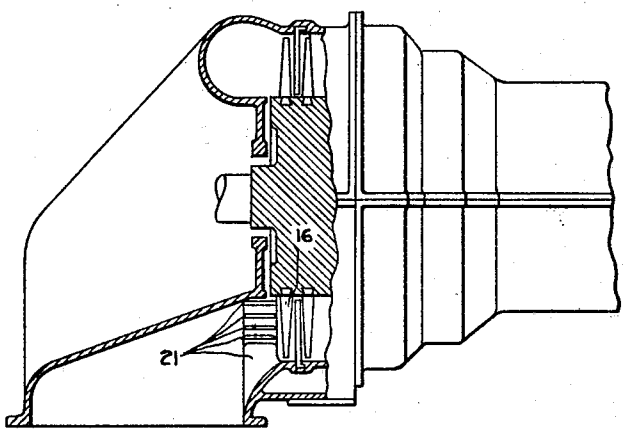


Fig. 2.

WITNESS

E. Lutz.

INVENTOR

H.J. Hanzlik

BY

A. B. Davis

ATTORNEY

Patented July 14, 1931 1,814,629

UNITED STATES PATENT OFFICE

HENRY J. HANZLIK, OF SWARTHMORE, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

ELASTIC FLUID TURBINE

Application filed October 12, 1928. Serial No. 312,131.

My invention relates to an elastic fluid turbine, more particularly to one of the axial flow type, and it has for its object to provide improved construction and operation thereof.

Another object is to reduce the size and weight of the low pressure end of the turbine.

A further object is to increase the efficiency of the elastic fluid turbine.

I have found that a turbine, of the axial flow type in which the exhaust chamber receives expanded fluid from the last row of blades and directs the same to a condenser, has rust marks in the exhaust chamber on the side opposite the last row and approximately in line with the outer periphery of the blades in said row. It appears, therefore, that the moisture in the blade sections, which is directed to the outer periphery thereof by centrifugal force, is projected axially from the last blade row across the exhaust chamber in a tubular sheet of conico-cylindrical form. The expanded uncondensed fluid must pass through this tubular sheet to pass to the condenser, and its flow thereto appears to be impeded by the moisture.

In accordance with my invention, I place a deflector adjacent the outer periphery of the last blade row to deflect the moisture, thereby permitting the uncondensed fluid to pass freely through the exhaust chamber. I preferably form the deflector to direct the moisture radially outwardly or against the adjacent wall of the exhaust chamber. A smaller exhaust chamber is, therefore, required to pass the expanded fluid to the condenser, thereby greatly decreasing the size and mass of the casing. The efficiency is also increased, as the drop in pressure otherwise required to break through the sheet of moisture is available for power development in the turbine blades.

The above and other objects are effected by my invention, as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a side elevation of a turbine and condenser embodying my invention, the low pressure end of the turbine and the condenser being shown in section; and

Fig. 2 is a similar view of a turbine having a modified form of deflector.

Referring to the drawings more in detail, I show a turbine 10 having a casing 11 formed with an exhaust chamber 12 at the low pressure end thereof, the latter being connected at 13 with the inlet of a condenser 14. The turbine also includes a rotor 15 disposed within the casing, and cooperating blades carried by the casing and the rotor. The last row of blades 16 is carried by the rotor and discharges the expanded motive fluid to the exhaust chamber 12.

An annular deflector 17 is disposed within the exhaust chamber adjacent to the last blade row 16. The deflector may be supported in the casing in any suitable manner, for example, it may be carried by or attached to webs in the exhaust chamber. Two of such webs, lying in the vertical plane of the axis, are shown on the drawings at 22 and 23, respectively. This deflector is curved in cross section, the forward edge thereof being disposed slightly radially inwardly from the outer periphery of the blade row 16 and pointing toward the blades so as to divide the stream of fluid discharged by the blades. The other edge points radially outwardly and directs the diverted fluid out of the path of the motive fluid and against the radial wall 18 of the exhaust chamber.

The operation of the above described embodiment is as follows:

The motive fluid admitted to the turbine is expanded by the blades therein, and discharged by the last row 16 in a substantially axial direction. The exhaust chamber 12, by reason of the form of its walls, diverts the expanded motive fluid from its axial direction and directs it downwardly to the condenser 14, the path thereof at the lower side of the annulus being indicated by the arrows. A substantial portion of the motive fluid is condensed in the blades to form moisture, which moisture, being heavier than steam, is thrown radially outwardly by centrifugal force. The moisture is discharged around the outer periphery of the last row

of blades at rather high velocity in a direction substantially axial but slightly radially outward. It would form, in the absence of the deflector 17, an annular or tubular sheet of substantially cylindrical or conico-cylindrical form. The projected direction of the moisture, in the vertical plane in which the section of Fig. 1 is taken is indicated by the dot and dash line 19. The annular sheet of moisture presents an obstructing wall directly across the path of the uncondensed fluid flowing to the condenser, naturally impeding its flow and raising the back pressure on the discharge side of the last blade row. The annular deflector 17, however, intercepts the annular stream of moisture directed across the path of the uncondensed fluid. The deflector divides the stream of fluid discharged by the last row 16 into an outer annulus, which includes all of the moisture, as well as a small portion of uncondensed fluid, and an inner annulus comprising the major portion of the uncondensed fluid but substantially no moisture. The outer annulus is directed by the deflector 17 to a radial direction away from the axis, or against the adjacent wall 18. The moisture is thus deflected from the annular path indicated by the line 19, and the uncondensed fluid is free to flow through the exhaust chamber to the inlet of the condenser 14.

In Fig. 2, I show a modified form of deflector. The annulus of moisture discharged by the last blade row has a rotary motion, as well as an axial motion, due to the rotation of the blade row 16. That is, the particles of moisture travel in a substantially helical path. The annulus of moisture may also be broken up, therefore, by a plurality of radial deflectors 21, disposed in a circular path along the outer periphery of the last blade row 16. The moisture strikes against the sides of the deflectors 21, which break up the sheet-like form and velocity of the moisture, so that the uncondensed fluid may readily carry the particles of moisture to the condenser. The deflectors 21 may, as shown in Fig. 2, be provided only along the lower half of the blade row 16.

It will be apparent from the above description that I have provided a deflector for diverting the moisture from the path of the uncondensed motive fluid, thereby permitting free flow of said uncondensed fluid to the condenser. Such a free flow permits a smaller exhaust chamber, thereby decreasing the size of the casing required to pass the fluid to the condenser. Efficiency is also increased inasmuch as no pressure drop is required to overcome the resistance offered by particles of moisture in its path.

An advantageous feature of my invention is that it is very simple and may be added to an installed turbine very easily without making any changes in the turbine itself. It is obviously very inexpensive to make.

While I have shown my invention in two forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. In an elastic fluid turbine, the combination of a casing having an exhaust chamber therein, a rotor within the casing, cooperating rows of blades carried by the casing and the rotor and discharging the motive fluid flowing therethrough into said exhaust chamber, the casing being formed to divert the elastic motive fluid discharged by said rows of blades from the path in which it is discharged, and means for diverting the moisture in the motive fluid from a path across the path provided for the motive fluid by the exhaust chamber comprising means for separating and deflecting fluid adjacent the last row of blades and at the outer periphery of the path in which it is discharged.

2. In an elastic fluid turbine, the combination of a casing having an exhaust chamber formed to direct expanded motive fluid in a path at an angle to the axis of the turbine, a rotor in the casing, cooperating blades carried by the casing and the rotor and discharging expanded motive fluid in an axial direction into the exhaust chamber in the form of a stream annular in cross-section, and means for diverting the stream of moisture from across said path comprising means disposed adjacent the last row of blades for deflecting the fluid at the outer periphery of said annular stream substantially radially outwardly from the axis of the turbine.

3. In an elastic fluid turbine, the combination of a casing having an exhaust chamber formed to direct expanded motive fluid in a path at an angle to the axis of the turbine, a rotor in the casing, cooperating blades carried by the casing and the rotor and discharging expanded motive fluid in an axial direction into the exhaust chamber in the form of a stream annular in cross-section, and means for diverting the moisture in the motive fluid from a path across the path provided for the motive fluid by the exhaust chamber comprising means disposed adjacent the last row of blades for deflecting the fluid at the outer periphery of said annular stream from the path in which it is discharged.

4. In an elastic fluid turbine, the combination of a casing having an exhaust chamber, a rotor in the casing, cooperating blades carried by the casing and the rotor and discharging expanded fluid therefrom in an axial di-

rection into said exhaust chamber, and means for deflecting moisture discharged from said blades from the path of said discharged expanded fluid in the exhaust chamber.

5. In an elastic fluid turbine, the combination of a casing having an exhaust chamber formed to direct expanded motive fluid in a path at an angle to the axis of the turbine, a rotor in the casing, cooperating blades carried by the casing and the rotor and discharging expanded motive fluid in an axial direction into the exhaust chamber in the form of a stream annular in cross-section, and means for separating the fluid discharged by said last row of blades into a small outer annulus containing the moisture contained in the discharged fluid and a larger inner annulus, and for directing the outer annulus of fluid away from the path of the inner annulus of fluid.

6. In an elastic fluid turbine, the combination of a casing having an exhaust chamber formed to direct expanded motive fluid in a path at an angle to the axis of the turbine, a rotor in the casing, cooperating blades carried by the casing and the rotor and discharging expanded motive fluid in an axial direction into the exhaust chamber in the form of a stream annular in cross-section, and deflecting means disposed adjacent the last row of blades and adjacent the outer periphery thereof for diverting the moisture from traversing the path of the expanded motive fluid through the exhaust chamber.

In testimony whereof, I have hereunto subscribed my name this 5th day of October, 1928.

HENRY J. HANZLIK.