Feb. 16, 1932. H. REICH 1,845,190

ELASTIC FLUID TURBINE

Filed May 14, 1931

Fig. 1.

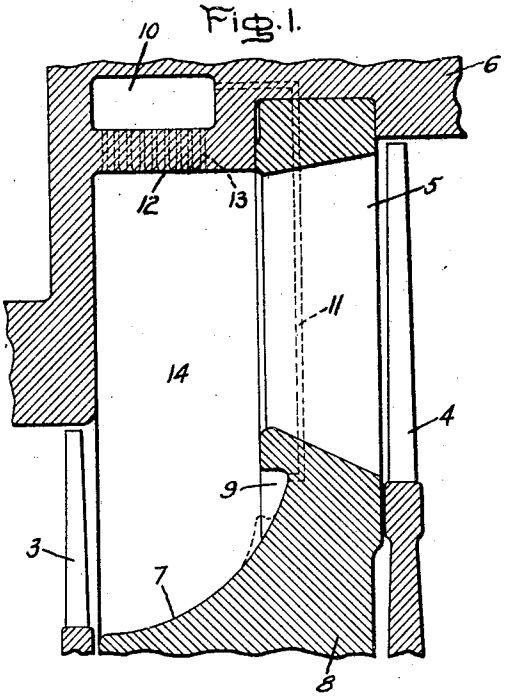
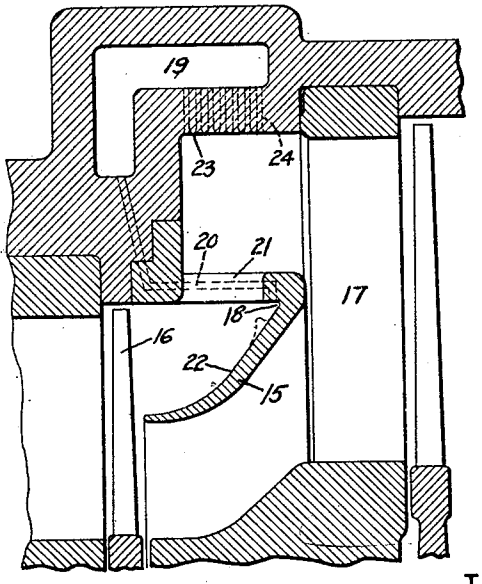


Fig. 2.



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UNITED STATES PATENT OFFICE

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ELASTIC FLUID TURBINE

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The present invention relates to elastic fluid turbines.

In the operation of elastic fluid turbines, liquid particles are formed in the elastic fluid in the lower pressure stages of the machine due to condensation, the particles being water in the case of a steam turbine. The presence of such particles is objectionable in that the particles cause wearing away and cutting of the buckets and also affect adversely the efficiency of the machine.

The object of my invention is to provide an improved construction and arrangement for separating liquid particles from the elastic fluid as it flows through the turbine and for discharging such particles from the turbine.

According to my invention, I provide means for subjecting the stream of elastic fluid to one or more gradual or sharp deflections whereby the liquid particles are separated from the stream due to their greater inertia which is caused by their higher specific weight, and in connection with such means I provide collecting surfaces and conduits for collecting the liquid particles and discharging them from the machine. In carrying out my invention, I may separate the particles from all the elastic fluid or from only the outer or peripheral portion of the elastic fluid, it being known that the major portion of the liquid particles formed in the elastic fluid flowing through the turbine are found in the radially outer strata of the elastic fluid.

For a better understanding of what I believe to be novel and my invention, attention is directed to the following description and the claims appended thereto.

Referring to the drawings, Fig. 1 is a longitudinal section through a portion of an elastic fluid turbine embodying my invention, and Fig. 2 is a modification of the arrangement shown in Fig. 1.

Referring to Fig. 1, 3 and 4 designate two bucket wheels of an elastic fluid turbine which are secured to a rotating shaft, the latter not being shown in the drawings. 5 represents a diaphragm secured to the outer casing 6 of the turbine and positioned between the bucket wheels 3 and 4 so that the stream leaving bucket wheels 3 is properly guided to the next bucket wheel 4.

The construction so far described may be taken as typical of any kind of elastic fluid turbine.

My invention, as shown in Fig. 1, comprises the provision of an intercepting wall 7, in the present instance shown as forming an integral part of the body 8 of the diaphragm 5. The wall 7 is so arranged with respect to the flow of the elastic fluid leaving bucket wheel 3 that it causes a gradual deflection of this fluid with respect to its normal path through the turbine. A part of the heavier particles impinge on the wall 7, owing to their greater inertia, and are discharged into a groove 9 which is connected to an annular chamber 10 in the outer casing by means of one or more conduits 11.

In addition to the wall 7 I may provide also a second wall 12, in the present instance shown as a part of the outer casing 6. This wall causes another more abrupt deflection of the stream of elastic fluid to the effect that the heavier particles thereof impinge on said wall and are drained off through passages 13 leading to the annular chamber 10.

In the operation of the turbine the elastic fluid flowing from bucket wheel 3 to diaphragm 5 is subjected in space 14 formed by said walls 7 and 12 to gradual and abrupt deflections. The gaseous particles follow easily to these deflections, whereas the liquid particles owing to their greater inertia maintain their direction of flow and are gathered at the collecting surfaces of walls 7 and 12 from where they are discharged through the conduits 11 and 13 into chamber 10. Thus it will be readily understood that the heavier particles are separated from the elastic fluid while passing through said space of passage 14.

According to Fig. 2, in which I have shown a modification of my invention, only the external part of the elastic fluid leaving the bucket wheels 3 is deflected as the liquid particles are gathered mainly in said external portion due to the action of their centrifugal force. For the accomplishment of this purpose, I provide a partition 15 located be-

tween the bucket wheels 16 and the diaphragm 17 whereby the stream of elastic fluid is divided into two portions. The inner portion of the stream is guided as smoothly as possible from the bucket wheels 16 to the diaphragm 17 in order to avoid friction losses of the stream. The intercepting surface of partition 15 is provided with a groove 18 which is connected to a chamber 19 by suitable conduits 20. In order to obtain a higher velocity of elastic fluid in a radial direction between partition 15 and the outer wall of the turbine casing I provide said partition with a nozzle-like constricted portion 21. The operation of this arrangement is similar to that shown in Fig. 1. The liquid particles contained in the outer portion of the stream of elastic fluid impinge on surfaces 22 and 23 of the partition and the outer casing respectively from where they are discharged to the annular chamber 19 through conduits 20 and 24 respectively. When only the outer portion of the stream of elastic fluid is deflected and the heavier particles thereof separated an advantage is gained in that the length of the turbine is reduced and the losses due to deflections are diminished.

It will be readily observed that wall 15 and the outer casing in Fig. 2 define a passage or space for separating the heavier particles from the elastic fluid and for conveying the deflected portion of the elastic fluid to the succeeding stage of the turbine.

In accordance with the provisions of the patent statutes I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An elastic fluid turbine comprising an outer casing provided with an annular chamber, a bucket wheel, a diaphragm and means for separating heavier particles from the elastic fluid passed through the turbine, said means comprising a partition, an inner wall which is integrally formed with said diaphragm and an outer wall forming a part of the outer casing, said partition and inner wall defining a smooth passage for the inner portion of the elastic fluid from the bucket wheel to the diaphragm, said partition and outer wall forming a passage for the outer portion of elastic fluid in which said elastic fluid is subjected to gradual and abrupt changes in its direction of flow whereby the heavier particles contained in said fluid impinge on said partition and outer wall, and means for conveying said heavier particles from said partition and outer wall into said annular chamber.

2. An elastic fluid turbine comprising an outer casing provided with an annular chamber, a bucket wheel, a diaphragm and means for separating heavier particles from the elastic fluid passed through the turbine, said means comprising a partition, an inner wall which is integrally formed with said diaphragm and an outer wall forming a part of the outer casing, said partition and inner wall defining a smooth passage for the inner portion of the elastic fluid from the bucket wheel to the diaphragm, said partition and outer wall forming a passage for the outer portion of elastic fluid in which said elastic fluid is subjected to gradual and abrupt changes in its direction of flow whereby the heavier particles contained in said fluid impinge on said partition and outer wall, said partition being provided with a nozzle-like constriction of cross sectional area to the flow of elastic fluid whereby it increases the velocity of said fluid, and means for discharging said heavier particles into said annular chamber.

3. An elastic fluid turbine comprising a bucket wheel, a diaphragm, a wall therebetween for deflecting at least a portion of elastic fluid passed through the turbine, means including the wall for separating the heavier particles from the deflected portion of the elastic fluid and discharging these particles, and means including the wall to define a passage for conveying the remainder of the deflected portion of the elastic fluid to the succeeding stage.

4. An elastic fluid turbine comprising an outer casing, a bucket wheel, a diaphragm, an inclined wall between the bucket wheel and the diaphragm for deflecting elastic fluid passed through the turbine radially outward, whereby liquid particles contained in the fluid impinge on the wall and the outer casing respectively, means for discharging the particles, said means including a groove defined by the wall and passages in the outer casing, the wall and a portion of the outer casing defining a passage for conveying elastic fluid to the succeeding stage.

In witness whereof, I have hereunto set my hand.

HEINRICH REICH.