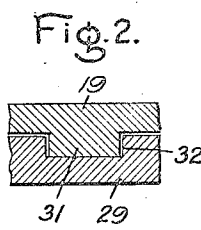
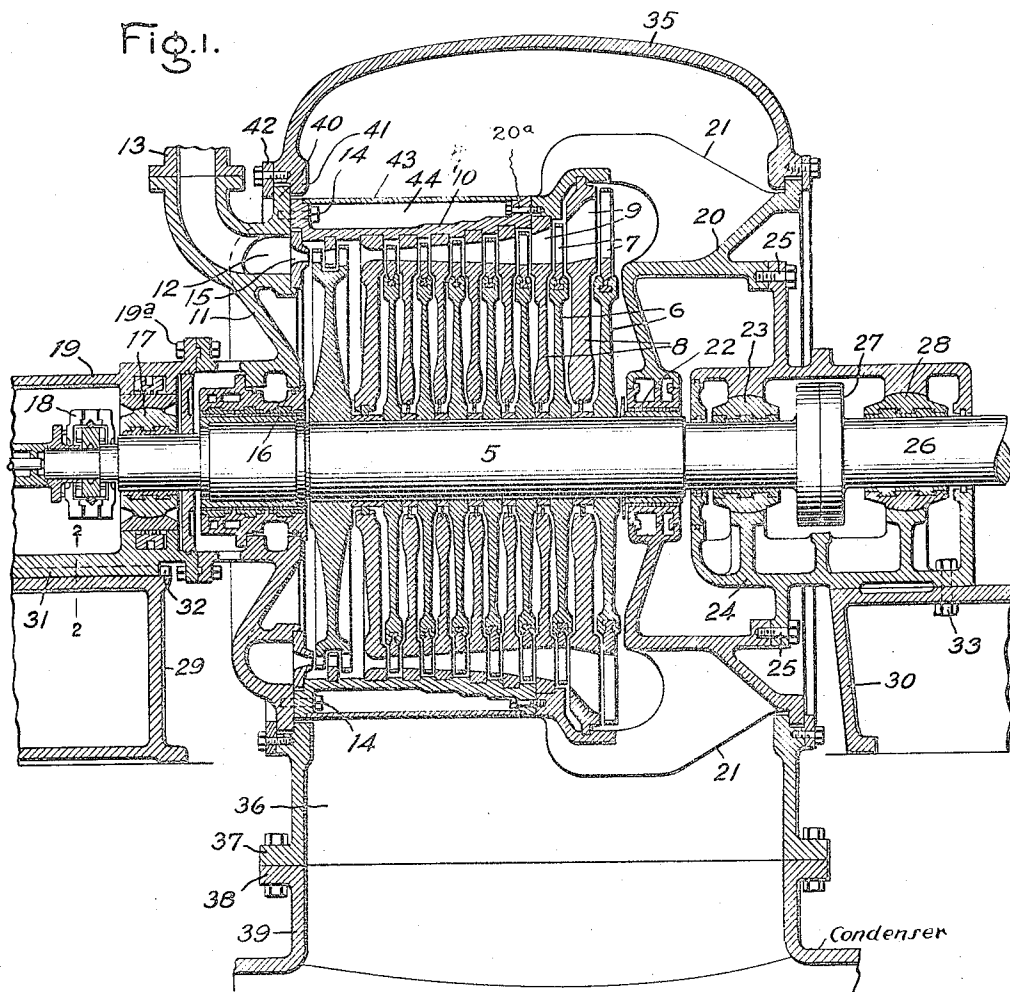


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O. JUNGREN
ELASTIC FLUID TURBINE
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Inventor:
Oscar Junggren,
by *Albert G. Davis*
His Attorney.

UNITED STATES PATENT OFFICE.

OSCAR JUNGREN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELASTIC-FLUID TURBINE.

Application filed January 15, 1921. Serial No. 437,536.

To all whom it may concern:

Be it known that I, OSCAR JUNGREN, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification.

The present invention relates to elastic fluid turbines and has for its object to provide an improved structure and arrangement in a machine of this character. The improvements, while adapted to turbines of any size, are more particularly intended for use in large turbines utilizing elastic fluid of high pressure and superheat.

In the operation of such turbines, large variations in temperature occur, and more specifically the object of my invention is to provide an improved structure and arrangement wherein all parts of the turbines are free to expand and contract in all directions without imposing strains upon other parts and without affecting the alignment.

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

In the drawing, Fig. 1 is a sectional view of an elastic fluid turbine embodying my invention, and Fig. 2 is a sectional view of a detail, the section being taken on line 2-2, Fig. 1.

Referring to the drawing, 5 indicates a turbine shaft and 6 bucket wheels which are fixed to the shaft and carry rows of buckets 7. Between the bucket wheels are nozzle diaphragms 8 having nozzles 9 which direct elastic fluid to the buckets. In the present instances the first stage wheel is shown as carrying two rows of buckets with a row of intermediates between and the other stages are shown each with a single row of buckets. It will be understood, however, that this is only by way of example, and is to be taken as typical of any suitable arrangement.

Now, according to my invention, the diaphragms are carried in a shell 10 in the form of a cylinder and closing the high pressure end of such shell is a head 11 having an annular chamber 12 to which elastic fluid is supplied by a conduit 13. Head 11

may be bolted to shell 10 by bolts 14, or it may be otherwise fastened thereto and it carries a ring of nozzles 15 for directing elastic fluid to the first stage bucket rings. At the center of head 11 is an opening through which shaft 5 passes and between the shaft and head is a suitable packing 16. Beyond packing 16 is a shaft bearing 17 and a thrust bearing 18 both carried by a support 19 which is fastened to head 11 by bolts 19^a. At the low pressure end of shell 10 is a head 20 which dishes outwardly away from the last bucket wheel and is fastened to shell 10 by a number of spaced ribs 21. The space between the ribs form passages for the exhaust elastic fluid. Shaft 5 passes through an opening in head 20, a packing 22 being provided to prevent leakage, and is mounted in a bearing 23 carried by a support 24. Support 24 is fastened to head 20 by bolts 25. At 26 is indicated an end of a driven shaft fastened by a coupling 27 to shaft 5 and mounted in a bearing 28. Shell 10 increases slightly in diameter from its high pressure end to its low pressure end and it will be noted that it terminates about flush with the last stage wheel. For structural reasons, the low pressure end of shell 10 is shown as being cast integral with ribs 21 and head 20 and bolted to the remainder of the shell as indicated at 20^a.

The foregoing structure comprising shell 10, heads 11 and 20 and bearing supports 19 and 24 form a unitary structure comprising the essentials of the turbine, that is the parts which run with close clearances and must be maintained in alignment, and I support this structure on two pedestals or foundations 29 and 30, one at each end of the machine. At one end, for example, the high pressure end, support 19 rests on foundation 29 and is free to slide axially thereon, transverse and twisting movements being prevented by a suitable tongue and groove connection as shown in Fig. 2. In the arrangement shown the bottom wall of support 19 has a tongue 31 which slides in a groove 32 in foundation 29. At the low pressure end of the turbine support 24 is bolted rigidly to foundation 30 as indicated at 33. It will thus be seen that this unitary structure, which may be termed the turbine proper, is free to expand and contract

in all directions, axial expansion being permitted due to the sliding connection between support 19 and foundation 29. Thrust bearing 18 holds the rotor from movement relatively to the shell and defines the clearances.

Surrounding shell 10 is an exhaust housing 35 having a discharge opening 36 surrounded by a flange 37 which bolts directly to a flange 38 surrounding the inlet opening of a condenser 39. In this manner the exhaust housing is supported directly by the condenser and quite independently of the other parts of the turbine. I preferably support it directly on the condenser as this is usually a convenient and advantageous arrangement. I may, however, when found desirable, support it in any other suitable manner, the primary essential being that it be supported independently or substantially independently of the other turbine parts. Exhaust housing 35 is connected to turbine heads 11 and 20 by yieldable connections which, while forming a tight joint, permit the exhaust housing and shell to expand and contract radially independently of each other. Such yieldable connections may take various forms. In the present instance I have shown the heads and exhaust housing provided with overlapping flanges 40 and 41 held in engagement with each other by rings 42 bolted into place. This forms in substance a tongue and groove connection. The exhaust housing is formed with an arched or rounded peripheral wall as shown in Fig. 1, and the curvature is sufficient to give enough resiliency to the exhaust housing that when shell 10 expands and contracts the exhaust housing will give or bend to permit the movements of the shell. To protect the exhaust housing from the temperature of shell 10, an annular shield 43 is provided which surrounds shell 10, or at least the high temperature end of it, and provides an annular air space 44 which acts to prevent the transfer of heat from shell 10. As a result of this arrangement exhaust housing 35 is not subjected to great variations in temperature, and in any event is free to expand and contract. Furthermore, it will be clear that any warping or twisting of the exhaust housing does not in any way affect the remaining parts of the turbine, which may be considered the vital parts. The exhaust housing has nothing to do with the turbine except that it functions as a cover and forms a casing for the exhaust steam. Any relative movement between the exhaust housing and the turbine proper will not affect the alignment or impose any strains on the turbine. In the arrangement shown it will be noted that the entire turbine proper is located within the exhaust housing. This protects it from the outside temperature. At the same time it means that the entire

exposed turbine length is relatively cool. Also the arrangement gives the minimum over-all length to the machine.

In assembling, the turbine proper, i. e., the rotor, shell 10, and the end heads, may be assembled and the parts aligned after which the exhaust housing may be bolted into place. In this connection it will be understood that the various parts are split horizontally in the usual manner to facilitate assembling.

By my invention it will be seen that I provide a turbine in which all parts are free to expand in all directions without imposing strains upon other parts to which they are attached. The turbine therefore maintains its alignment under all temperature conditions. Also, the arrangement enables me to make the exhaust housing from cast iron while the shell 10 will preferably be made from cast steel.

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 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 a rotor, a shell in which it rotates, and an exhaust housing, characterized by the fact that the exhaust housing is supported independently of the other parts of the turbine and is connected to them by yieldable joints.

2. An elastic fluid turbine comprising a rotor, a shell in which it rotates, and an exhaust housing, characterized by the fact that the exhaust housing is supported independently of the other parts of the turbine and is connected to them by yieldable joints, and that the exhaust housing is so shaped that it can yield axially.

3. In an elastic fluid turbine, the combination of a rotor, a shell within which it rotates, bearings for the rotor carried by said shell, supports for said bearings, and an exhaust housing which surrounds said shell and is connected thereto by yieldable joints.

4. In an elastic fluid turbine, the combination of a rotor, a shell within which it rotates, bearings for the rotor carried by said shell, supports for said bearings, and an independently supported exhaust housing which surrounds said shell and is connected thereto by yieldable joints.

5. In an elastic fluid turbine, the combination of a rotor, a shell within which it rotates, bearings for the rotor carried

by said shell, supports for said bearings, a condenser, an exhaust housing surrounding said shell and supported on said condenser, and yielding joints connecting said housing to said shell. 45

6. In an elastic fluid turbine, the combination of a rotor, a shell within which it rotates, bearings for the rotor carried by said shell, supports for said bearings, a condenser, an exhaust housing surrounding said shell and supported on said condenser, yielding joints connecting said housing to said shell, said housing being arched so it may give in an axial direction. 50

7. In an elastic fluid turbine, the combination of a rotor, a shell within which it rotates, bearings for the rotor carried by said shell, supporting means for said bearings, one of said bearings being slidably mounted for movement axially relatively to its supporting means, and an independently supported exhaust housing which surrounds said shell and is connected at its two ends. 55

8. In an elastic fluid turbine, the combination of a rotor, a shell within which it rotates, bearings for the rotor carried by said shell, supporting means for said bearings, one of said bearings being slidably mounted for movement axially relatively to its supporting means, and an independently supported exhaust housing which surrounds said shell and is yieldably connected thereto at its two ends. 60

9. In an elastic fluid turbine, the combination of a shell, nozzle diaphragms dividing it into stages, a rotor, bucket wheels on said rotor and located between the diaphragms, heads closing the ends of said shell, bearings for the rotor carried by said heads, supporting means for said bearings, at least one of said bearings being slidable axially on its supporting means, an independently supported exhaust housing 65

ing which surrounds said shell, and yielding joints connecting said housing to the exhaust heads. 45

10. In an elastic fluid turbine, the combination of an exhaust housing, and a turbine proper mounted entirely within said housing, means for independently supporting said exhaust housing and turbine proper, and a yieldable connection between said housing and turbine proper. 50

11. In an elastic fluid turbine, the combination of an exhaust housing, a turbine proper mounted entirely within said housing, and a shield surrounding the turbine proper and spaced therefrom to provide an annular air space to prevent transfer of heat from the turbine proper to the exhaust housing. 55

12. In combination, a turbine proper comprising a shell with heads at its two ends, an exhaust housing surrounding said turbine proper and connected to said heads by yieldable joints, and means for independently supporting said turbine proper and said exhaust housing. 60

13. In an elastic fluid turbine the combination of a shell, heads at the ends of said shell, a rotor in said shell, bearings for said rotor, supporting means for the ends of said shell, and an independently supported exhaust housing surrounding said shell. 65

14. In an elastic fluid turbine, the combination of a shell, heads at the ends of said shell, a rotor in said shell, bearings for said rotor, supporting means for the ends of said shell, upon at least one of which said shell may slide axially, and an independently supported exhaust housing surrounding said shell, said housing being adapted to yield axially. 70

In witness, whereof, I have hereunto set my hand this 13th day of January, 1921. 75

OSCAR JUNGREN.