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ELASTIC FLUID TURBINE

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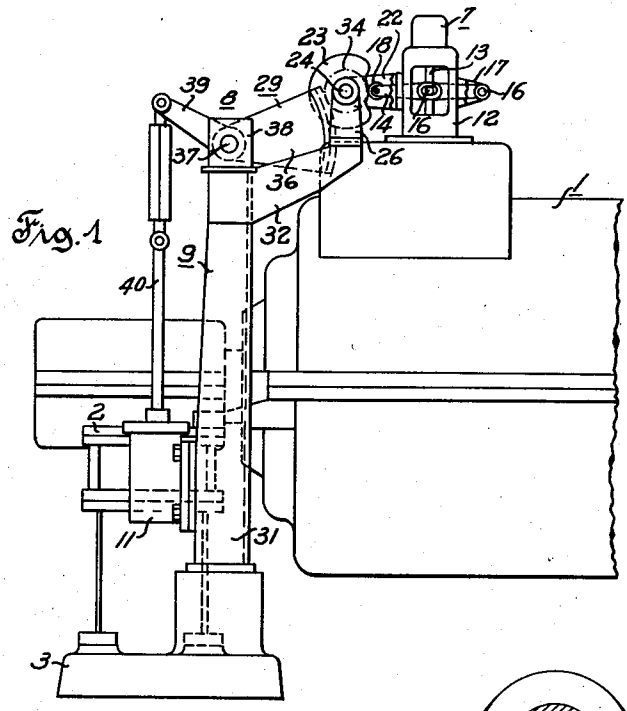


Fig. 1

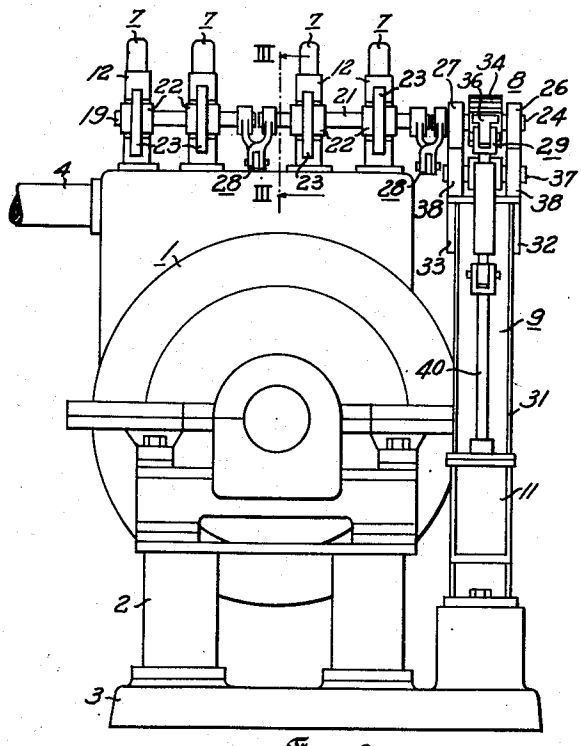


Fig. 2

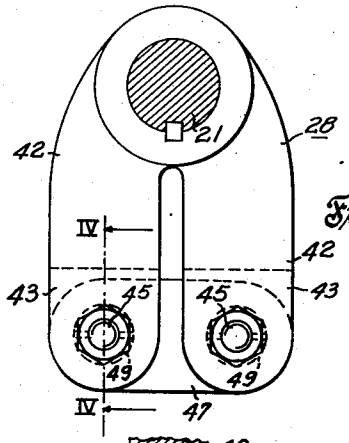


Fig. 3

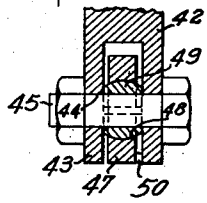


Fig. 4

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ELASTIC FLUID TURBINE

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8 Claims. (Cl. 137—16)

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The present invention relates to elastic fluid turbines and has for its principal object the provision of new and improved apparatus of this type.

A more specific object of the invention is to provide new and improved valve gear for operating the inlet valves of a steam turbine.

As the size of turbines has increased, the valve gear has been made heavier and the force required to move it has become correspondingly larger. This has made the old practice of mounting the valve gear on the turbine casing undesirable since the relatively large forces transmitted from the actuating mechanism to the valve gear act directly on the casing and result in excessive stresses in the turbine cylinder. This problem has been solved by others by making the valve chest and valve gear as a separate unit and connecting the valve chest and nozzle chamber by conduits. Such a solution is unsatisfactory from a space saving standpoint. It is therefore an object of this invention to provide an arrangement whereby the inlet valves of a relatively large steam turbine may be mounted on the turbine casing without danger of overstressing the casing.

Another object of this invention is to provide a valve gear including a camshaft which may be mounted on a turbine casing and which will obviate the possibility of the camshaft binding in its bearings when the turbine casing expands unevenly.

Other objects will appear hereinafter as the description of the invention proceeds.

The novel features of the invention and how the objects are attained will appear more fully from this specification and the accompanying drawings showing one embodiment of the invention and forming a part of this application, and all of these novel features are intended to be pointed out in the claims.

In the drawings:

Fig. 1 is a fragmentary elevation of a turbine embodying this invention;

Fig. 2 is an end view of the turbine shown in Fig. 1;

Fig. 3 is an enlarged section taken on the line III—III of Fig. 2 looking in the direction of the arrows and

Fig. 4 is a section taken on the line IV—IV of Fig. 3 looking in the direction of the arrows.

The turbine herein illustrated as embodying this invention comprises a turbine casing 1 slidably supported by a pedestal 2 provided with a base 3. Motive fluid is supplied to the turbine

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through a conduit 4 and is controlled by valve means, here shown as cam operated inlet valves 7 of a type well known in the art. The inlet valves 7 are operated by a valve gear 8, which is supported by a supporting member 9 and actuated by actuating means, here shown as a fluid servomotor 11, cooperating with the base 3.

The inlet valves 7 are identical and each may comprise a valve casing 12 carried by the turbine casing 1 and enclosing a valve body (not shown) biased toward closed position by means of a spring (not shown) and carried by a rod 13 slidably mounted in the valve casing 12. One end of a lever 14 is pivotally connected at 16 to a lug 17 formed on the valve casing 12; the medial portion of the lever slidably engages the rod 13 and the other end of the lever carries a roller 18 which is movable under the influence of the valve gear 8.

The valve gear 8 is here shown as including camshaft means which may comprise shafts 19, 21, 24. The shafts 19 and 21 are journaled in bearings 22 carried by the valve casings 12 and are provided with cams 23 of any suitable shape which engage the rollers 18 of the levers 14 and act to move the levers 14 about the pivots 16 and open or close the inlet valves 7 when the shafts 19, 21 are rotated. The shaft 24 is journaled in bearings 26 and 27 carried by the supporting member 9 secured to the base 3. The shafts 19, 21 and 24 are connected by flexible torque transmitting connection means, here shown as flexible couplings 28, and are adapted to be rotated by gearing 29 carried by the supporting member 9 as will more fully appear.

The supporting member 9 is here shown as a column 31 bolted to the base 3 and provided with two laterally extending brackets 32, 33. The brackets 32, 33 are here shown as welded to opposite sides of the column 31 and extending in parallel planes toward the inlet valves 7. The bearings 26, 27 which carry the shaft 24 are carried by the outboard ends of the brackets 32 and 33, respectively.

The gearing 29 for rotating the shafts 19, 21, 24 may comprise a pinion 34 secured to the shaft 24 and meshing with a gear segment 36 carried by a shaft 37 journaled in bearings 38 which are secured to the top of the column 31. A lever 39 integral with the gear segment 36 is pivotally connected at its free end to a piston rod 40 of the fluid servomotor 11, here shown as bolted to the column 31. Control means (not shown) control the movements of the servomotor 11.

The flexible torque transmitting connection

means 28 for connecting the shafts 19, 21 and 24 may be of any suitable construction and are here shown as comprising a pair of levers 42 keyed to the respective ends of the shafts to be coupled, each lever having a bifurcated offset end portion 43 provided with a hole 44 to receive a bolt 45. The levers 42 are mounted on the shafts to be coupled in such a manner that the bifurcated ends 43 of both levers 42 lie in a common plane perpendicular to the axis of the shafts to be coupled. A link 47, formed with a spherical socket 48 near each end and having a ball 49 disposed in each socket 48 in articulating relation with the link 47, is disposed in the notches 50 formed by the bifurcation of the ends 43 of the lever 42. The balls 49 are held rigid relative to the levers 42 by means of the bolts 45 and the link 47 is permitted to move relative to the balls 49 and the lever 42 within limits determined by the clearance between the link 47 and the sides of the notches 50.

In operation, the piston rod 40 of the fluid servomotor 11 will move the lever 39 up or down thus rotating the gear segment 36 about the shaft 37 and causing the pinion carrying shaft 24 to turn. The shaft 24 drives the shafts 19, 21 through the couplings 28 and causes the inlet valves 7 to be opened or closed as hereinbefore described. It will be apparent that vertical forces exerted by the servomotor 11 on the gearing 29 will be carried by the supporting member 9 and that torque will be transmitted to the shafts 19, 21. The shafts 19, 21 will transmit to the bearings 22 a force the magnitude of which is equal to the torque carried by the shafts divided by the effective radius of the coupling 28. Since the bearings 22 are carried by the valve casings 12, each valve 7 and its associated bearing will act as a unit and the force transmitted therefrom to the turbine casing will be determined by the magnitude and direction of the force exerted by the shaft on the bearing. It will be apparent that this force will be relatively small as compared with the force exerted by the servomotor 11. Thus large actuating forces can be utilized without danger of overstressing the turbine casing 1.

It will also be apparent that the journaling of each of the shafts 19, 21, 24 in independent sets of bearings 22, 26, 27 and the connection of the shafts with the flexible couplings 28 will prevent uneven expansion of the turbine casing 1 from causing binding of the shafts 19, 21, 24 in their respective bearings and will permit relative movement, due to expansion and contraction between the casing 1 and the supporting member 9 to take place with no binding of the shafts 19, 21, 24 in the bearings 22, 26, 27.

From the foregoing, it will be obvious to those skilled in the art that the illustrated embodiment of the invention provides a new and improved elastic fluid turbine and accordingly accomplishes the objects of the invention. On the other hand, it will also be obvious to those skilled in the art that the illustrated embodiment of the invention may be variously changed and modified, or features thereof, singly or collectively, embodied in other combinations than those illustrated, without departing from the spirit of the invention, or sacrificing all of the advantages thereof, and that accordingly the disclosure herein is illustrative only and the invention is not limited thereto.

It is claimed and desired to secure by Letters Patent:

1. In an elastic fluid turbine, the combination comprising: a turbine casing; a base supporting said casing; valve means carried by said casing for controlling the admission of motive fluid thereto; camshaft means having at least a portion rotatably mounted on said casing in operating relation with said valve means for causing valve opening and closing movement upon rotation thereof; supporting means cooperating with said base for supporting at least one end of said camshaft means; and operating means cooperating with said base for rotating said at least one end of said camshaft means.

2. In an elastic fluid turbine, the combination comprising: a turbine casing; a base supporting said casing; cam operated valve means carried by said casing for controlling the admission of motive fluid thereto; camshaft means including a plurality of substantially coaxially arranged camshafts rotatably mounted on said casing in operating relation with said valve means for causing valve opening and closing movement upon rotation thereof and flexible torque transmitting connection means between said camshafts; supporting means cooperating with said base for supporting an end portion of said camshaft means; and operating means cooperating with said base and with said end portion for rotating said camshafts.

3. In an elastic fluid turbine, the combination comprising: a turbine casing; a base supporting said casing; valve means carried by said casing for controlling the admission of motive fluid thereto; supporting means carried by said base, a shaft having a first portion rotatably mounted on said casing in operating relation with said valve means for causing valve opening and closing movement upon rotation thereof and a second portion rotatably mounted on said supporting means; operating means cooperating with said base for rotating said second portion of said shaft; and flexible torque transmitting connection means for connecting said first and second portions of said shaft.

4. In an elastic fluid turbine, the combination comprising: a turbine casing; a base supporting said casing; cam operated valve means carried by said casing for controlling the admission of motive fluid thereto; camshaft means comprising a plurality of substantially coaxially arranged shafts, at least one of said shafts being rotatably mounted on said casing in operating relation with said valve means and another of said shafts being rotatably supported by said base; flexible connection means between said shafts; and means cooperating with said base for rotating said camshaft means.

5. In an elastic fluid turbine, the combination comprising: a turbine casing; a base supporting said casing; cam operable valve means carried by said casing for controlling the admission of motive fluid thereto; camshaft means comprising a plurality of shafts rotatably mounted on said casing in operating relation with said valve means for causing valve opening and valve closing movement upon rotation thereof and flexible torque transmitting connection means between said camshafts; supporting means cooperating with said base for supporting at least one end portion of at least one of said shafts; and operating means cooperating with said base for rotating said at least one end portion.

6. In an elastic fluid turbine, the combination comprising: a turbine casing; a base supporting said casing; cam operated valve means

carried by said casing for controlling the admission of motive fluid thereto; a supporting member carried by said base; a plurality of shafts, at least one of said shafts being rotatably mounted on said casing in operating relation with said cam operated valve means for causing valve opening and valve closing movement upon rotation thereof and another of said shafts being rotatably supported by said supporting member; flexible torque transmitting connection means between each of said shafts; gearing carried by said supporting member for rotating at least one of said shafts; and means cooperating with said base for actuating said gearing.

7. In an elastic fluid turbine, the combination comprising: a turbine casing; a base supporting said casing; cam operated valve means carried by said casing for controlling the admission of motive fluid thereto; camshaft means comprising a plurality of substantially coaxial shafts; at least one of said shafts rotatably mounted on said casing in operating relation with said valve means for causing valve opening and valve closing movement upon rotation thereof; a supporting member carried by said base; gearing carried by said supporting member for rotating said camshaft means; flexible torque transmitting connection means between each of said shafts; and means cooperating with said base for actuating said gearing.

8. In an elastic fluid turbine, the combination comprising: a turbine casing; a base supporting said casing; cam operable valve means carried by said casing for controlling the admission of motive fluid thereto; camshaft means comprising a plurality of substantially coaxially arranged camshafts rotatably mounted on said casing in operating relation with said valve means for causing valve opening and valve closing movement upon rotation thereof, an actuating shaft coaxial with said camshafts, and flexible connection means between said shafts; a supporting member carried by said base; at least one bearing carried by said supporting member for carrying said actuating shaft; gearing carried by said supporting member for rotating said actuating shaft and means cooperating with said base for actuating said gearing.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
545,085	Mannesmann	Aug. 27, 1895
1,411,992	Doran	Apr. 4, 1922
1,684,919	Keyser	Sept. 18, 1928