Oct. 13, 1936. E. D. DICKINSON 2,057,561

ELASTIC FLUID TURBINE ARRANGEMENT

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Fig. 1.

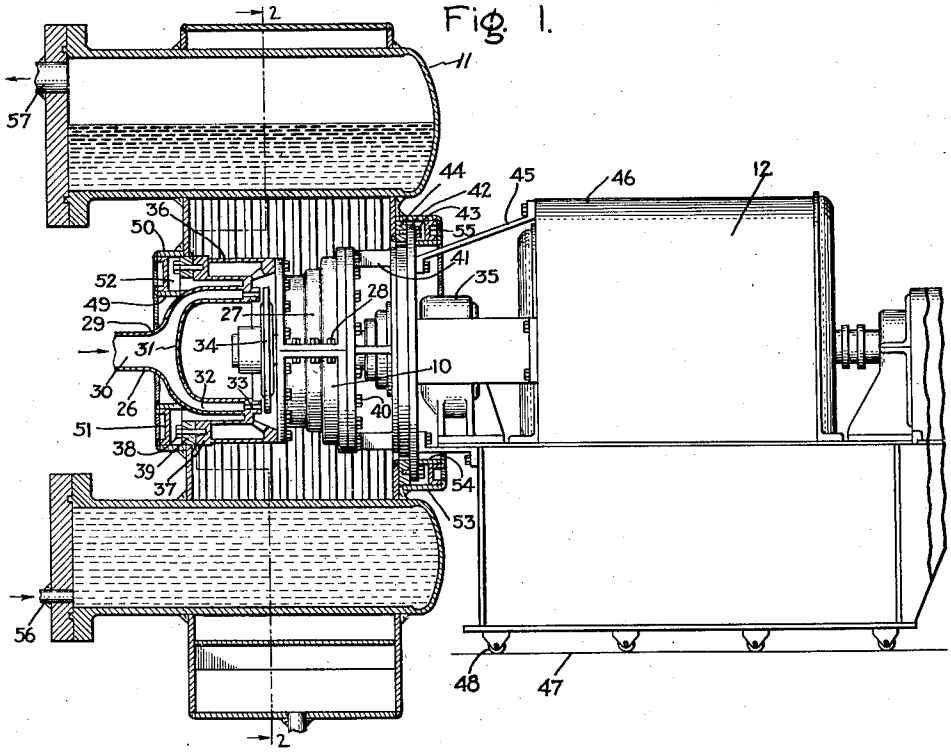
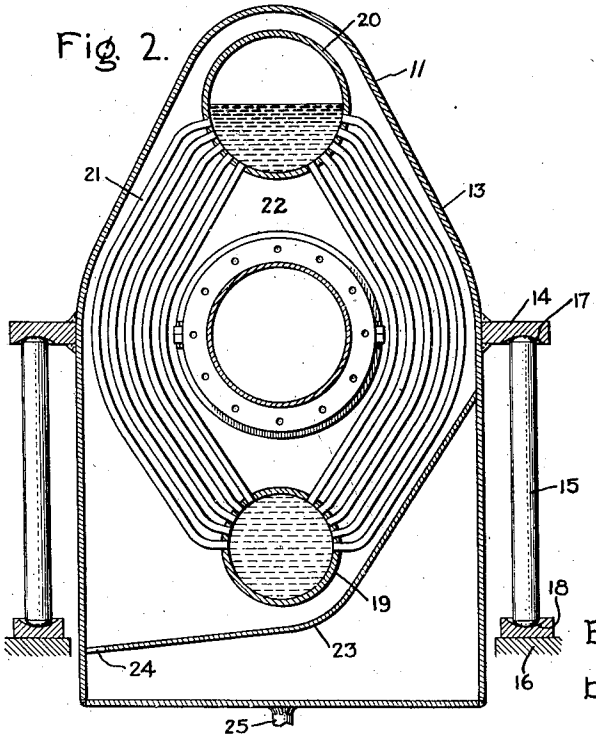


Fig. 2.



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ELASTIC FLUID TURBINE ARRANGEMENT

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4 Claims. (Cl. 290—52)

The present invention relates to elastic fluid turbine arrangements in which the turbine is surrounded by a condenser and coupled with an electric generator or like machine.

The general object of the invention is to provide an improved construction and arrangement of such turbines whereby they may be built more economically and easily assembled and dismantled.

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

In the drawing, Fig. 1 illustrates a turbine arrangement embodying my invention, and Fig. 2 illustrates a sectional view along line 2—2 of Fig. 1.

In the present instance I have shown a mercury vapor turbine arrangement because my invention is of particular significance in connection with this type of turbines in which special attention need be paid to the sealing of the turbine casing and the condenser. In addition, difficulties are often encountered in handling the large amount of vapor exhausted from mercury vapor turbines, necessitating large exhaust hoods or casings connecting the turbines to their condensers. These difficulties are overcome by the provision of an arrangement in which the turbine is disposed substantially entirely within the condenser so that mercury vapor discharged from the last turbine bucket wheel may flow freely; that is, without any obstruction, into the condenser.

The arrangement shown in the drawing comprises a turbine 10 disposed substantially entirely within a condenser 11 and driving a machine, in the present instance an electric generator 12. The condenser 11 forms a box-shaped structure with an outer casing 13 having arms or flanges 14 on each side, loosely engaging supports 15 resting on a foundation 16. The supports 15 are preferably in the form of hollow tubes having ends projecting into depressions 17 and 18 in the arms 14 and the foundation 16, respectively. This form of support permits slight movement of the condenser casing due to expansion and contraction without setting up undesirable stresses. The condenser is of the surface type including a lower header 19 and an upper header 20 disposed within the outer casing and projecting through the front and rear walls thereof. The headers are connected by banks of cooling tubes 21. These tubes are bent outwardly to form a large central space 22 for accommodating the entire or a substantial portion of the turbine structure. A partition 23 separates the condenser space into an upper space in which condensation takes place and a lower or bottom space to which condensate is conducted through an opening or openings 24 in the partition. A conduit 25 is connected to the bottom of the condenser for discharging condensate therefrom.

The turbine structure includes an outer casing with an integrally formed front or inlet section 26 and an exhaust section 27 having an upper and lower half united by means of bolts 28. The inlet portion 26 is funnel-shaped and has an outer wall 29 with a central axial inlet 30 and an inner wall 31 substantially concentrically spaced from the outer wall 29 to form an annular channel 32 for conducting elastic fluid, in the present instance mercury vapor, to an annular row of nozzles 33 disposed ahead of a bucket wheel 34. The turbine rotor is secured to an overhung shaft portion supported on a bearing 35 intermediate the turbine and the generator 12. A cylindrical element 36 provided with a flange 37 surrounds the wall 29 of the inlet casing section and is secured thereto. The flange 37 is fastened by means of bolts 38 to a ring 39, which latter is welded to the outer casing of the condenser. Thus, the flanged cylindrical element 36 represents in substance a means for supporting the front section of the turbine casing. The rear section of the turbine casing is secured by means of bolts 40 to a support 41, which latter has a flange 42 fastened by means of bolts 43 to a ring 44 welded to the condenser casing. The support 41 is also secured through a structure 45 to the casing or outer wall 46 of the generator 12. This is an important feature of the arrangement in that it permits easy assembly and disassembly thereof. After the connection between the condenser and the turbine is removed by disassembling the bolts 38 and 43, the entire turbine weight is supported through the structure 45 by the generator 12. The generator itself rests on a foundation 47. The support is preferably effected through the intermediary of rolls 48 or like friction bearing so that the generator 12 together with the turbine 10 may be easily moved away from the condenser after removal of the bolts 38 and 43.

In order to eliminate any leakage of elastic fluid, in the present instance mercury vapor, along the bolt connections I provide special sealing means around these connections on the front and rear portion of the turbine casing. The means for sealing the connections by the bolts

37 include two concentrically spaced rings 49 and 50 welded to the turbine wall 29 and the condenser casing respectively and having outer edges united by means of a channel-shaped plate 51 welded thereto. The rings 49, 50 with the plate 51 form a space 52 for receiving any leakage along the bolts and along the adjacent surfaces of the flange 37 and the ring 39. The connection between the support 41 and the condenser casing is similarly sealed by means of concentrically spaced rings 53 and 54 welded to the condenser casing and a rear plate of the support respectively. The outer edges of the rings 53 and 54 are united by a channel-shaped member 55 welded thereto. Disassembly of the sealing structure is easily accomplished by cutting the welded edges between the sealing rings and the corresponding channel plates. Thereafter the bolts 38 and 43 may be removed and the turbine moved out of the condenser casing by moving the generator away from the condenser. The condensing itself is very effective in this arrangement in that the last bucket wheel exhausts over its entire area directly into the condenser. The latter forms in the present instance, in known manner, a boiler. The cooling fluid consists preferably of water conducted to the lower header 19 through an inlet conduit 56. The water, as it passes from the lower header to the cooling tubes into the upper header, is heated and partly evaporated, the steam being discharged through an outlet conduit 57 secured to the upper header.

With my invention I have accomplished an improved construction and arrangement of condensing turbines for driving generators or like machines. Certain features of the arrangement described above are covered by the application of A. R. Smith on the same subject matter and filed on the same day as this present application.

Having described the method of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, 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 arrangement including the combination of an elastic fluid turbine, a condenser for the turbine having a casing surrounding the turbine and arranged so that the turbine exhausts directly into the condenser space, a generator driven by the turbine and a supporting structure between the generator casing and the turbine connecting the generator casing to the turbine for separating the turbine and the condenser by moving the generator away from the condenser structure.

2. An elastic fluid turbine arrangement including the combination of an elastic fluid turbine having an outer casing with a funnel-shaped integral inlet portion defining an annular channel and a main casing portion split along a horizontal plane through the turbine center, a condenser for receiving exhaust fluid from the turbine, said condenser being arranged to surround the turbine, means for supporting the turbine on the condenser, a generator driven by the turbine having a casing secured to the turbine to form a support for the latter to facilitate assembly and disassembly.

3. An elastic fluid turbine arrangement including the combination of a turbine having a casing, a condenser for receiving exhaust fluid from the turbine having a casing forming supports for the inlet and the exhaust end of the turbine, a generator driven by the turbine and forming an additional support for the turbine, and means including a plurality of friction bearings for supporting the generator and to facilitate assembly and disassembly of the turbine and the condenser.

4. An elastic fluid turbine arrangement including the combination of a condenser having an outer casing, means yieldably supporting the outer casing, a lower and an upper header with a plurality of cooling tubes connected between them disposed within the casing and arranged to define a central space for accommodating a turbine, a turbine disposed within said space and having inlet and outlet ends normally supported on the condenser casing, a generator driven by the turbine, a structure for supporting the entire turbine weight on the generator during assembly and disassembly, and means facilitating axial movement of the generator and the turbine.

EDGAR D. DICKINSON.