

[54] **SHAFT-TURNING DEVICE FOR STEAM TURBINES**
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[22] **Filed:** Aug. 23, 1973
[21] **Appl. No.:** 390,940

1,634,894	7/1927	Allen	60/704
1,678,067	7/1928	Lamb	415/1
2,232,852	2/1941	Hemenway	415/20
2,245,175	6/1941	Bany	415/20
2,303,190	11/1942	Anderson	415/120

FOREIGN PATENTS OR APPLICATIONS

189,292	1922	United Kingdom	60/718
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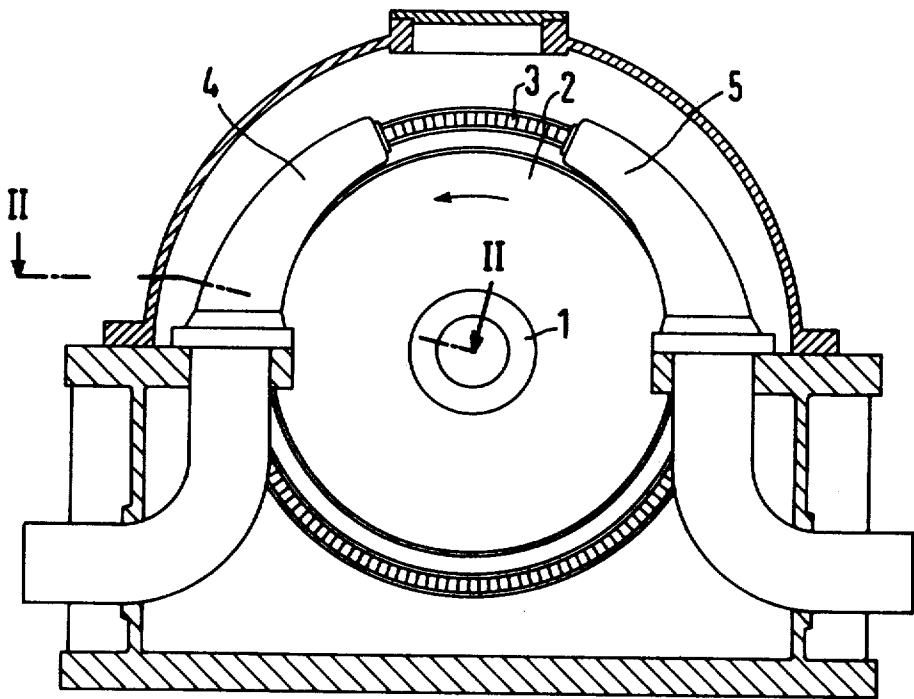
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Attorney, Agent, or Firm—Herbert L. Lerner

[30] **Foreign Application Priority Data**
Aug. 25, 1972 Germany..... 2241788
[52] **U.S. Cl.** 415/20; 60/704; 415/198
[51] **Int. Cl.** **F01b 25/02**
[58] **Field of Search** 415/193, 194, 1, 178, 20; 60/646, 656, 657, 718, 704; 290/52

[56] **References Cited**
UNITED STATES PATENTS
814,423 3/1906 Belluzzo..... 415/194
910,266 1/1909 Belluzzo..... 415/193

[57] **ABSTRACT**
Shaft-turning device for a steam turbine includes an oil turbine having a rotor mountable on the shaft of a steam turbine, and stationary nozzle means for supplying driving medium to the rotor for revolving the same, the rotor having at the outer periphery thereof at least two rows of rotor blades disposed relative to the stationary nozzle means so as to be engageable successively by the driving medium, and guide vane means located between the rows of rotor blades.

4 Claims, 4 Drawing Figures



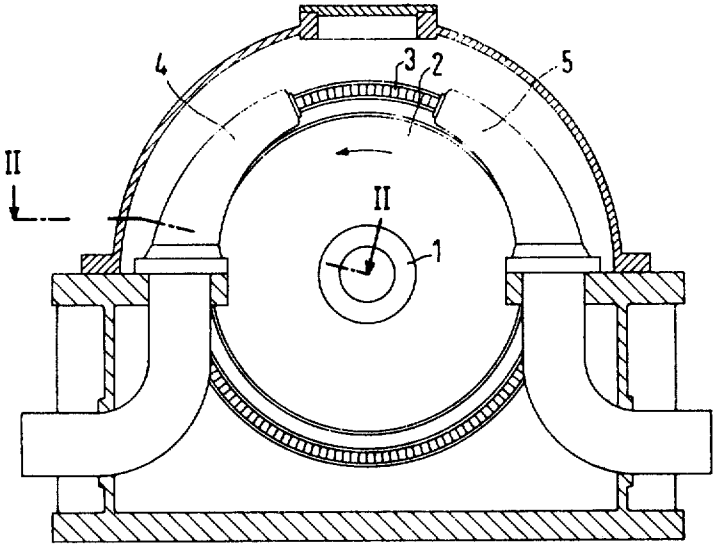


Fig.1

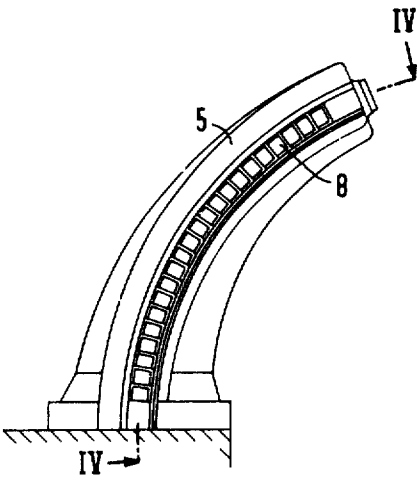


Fig.3

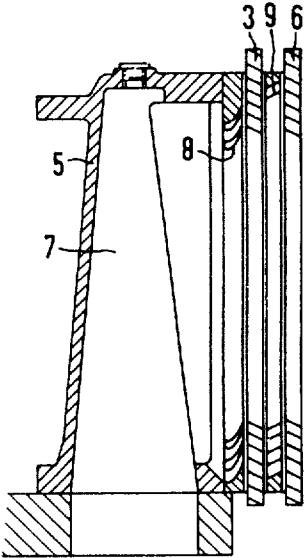


Fig.4

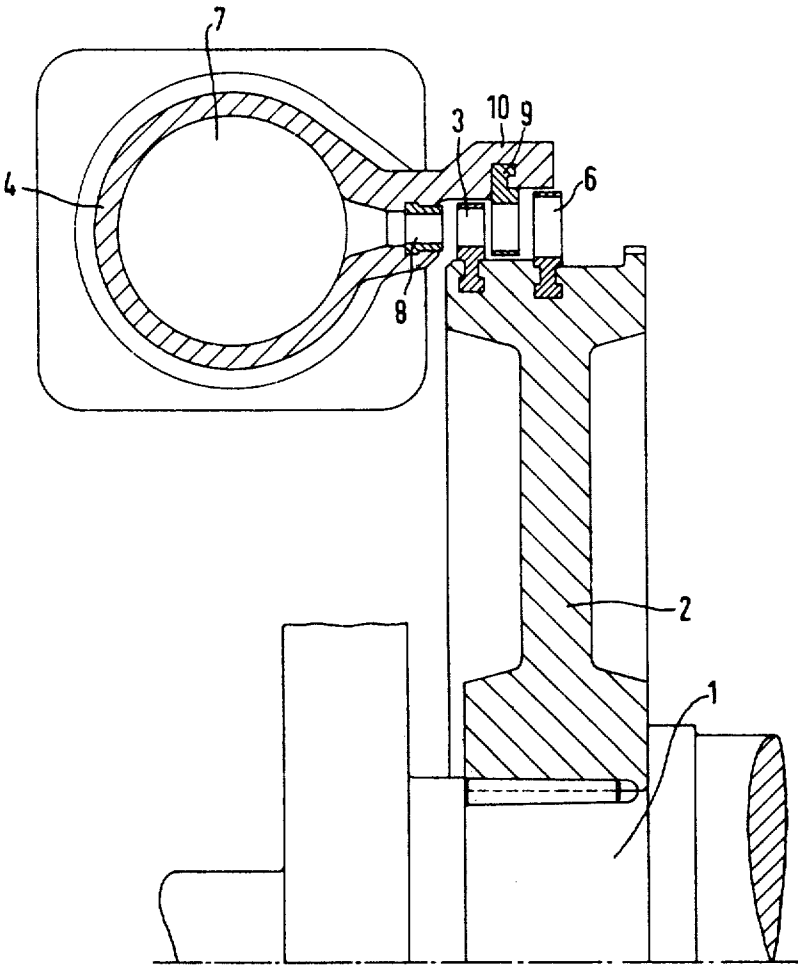


Fig.2

SHAFT-TURNING DEVICE FOR STEAM TURBINES

The invention relates to a shaft-turning device for steam turbines, and more particularly to such device having an oil turbine with a rotor secured to the shaft of the steam turbine, and stationary nozzles for supplying propellant or driving medium to the rotor.

The present invention is not a turbine as such, but is a shaft-turning device for steam turbines, i.e. a device which is used to continue turning the steam turbines slowly in order to prevent a distortion of the rotor and an uneven cooling after the turbine is shut off. This turning device comprises, primarily, two rows of rotor blades separately mounted on the turbine shaft and an intermediately disposed row of rotor blades, whereby from a segment-shaped nozzle box, which is arranged in front of the first row of rotor blades, oil which is used as the driving medium, is supplied to the rows of rotor blades, which starts and/or respectively keeps, the turbine shaft turning, depending on the force of the mass flows.

Such shaft-turning devices have become known heretofore from German Pat. Nos. 975,646 and 1,011,897 wherein there is described a rotor securely mounted on the shaft of the turbine and having rotor blades at the outer circumference thereof while, in axial direction forward of the rotor blades, nozzles for supplying the driving or propellant oil are disposed. With a shaft device of this type, shafts of great weight can be accelerated from standstill and possibly turned or rotated for extended periods of time. To turn the shaft and, in particular, to start turning it from a standstill position, however, considerable mass flows or flow quantities, i.e. large amounts of pressurized oil, are required in such a shaft turning device, in order to provide the necessary torque.

It is therefore an object of the invention to provide a shaft-turning device operating with a markedly improved efficiency over that for the heretofore known devices of this general type and which can therefore also manage with smaller flow quantities.

With the foregoing and other objects in view, there is provided, in accordance with the invention, a shaft-turning device for a steam turbine comprising an oil turbine including a rotor mountable on the shaft of a steam turbine, and stationary nozzle means for supplying driving medium to the rotor for revolving the same, the rotor having at the outer periphery thereof at least two rows of rotor blades disposed relative to the stationary nozzle means so as to be engageable successively by the driving medium, and guide vane means located between the rows of rotor blades. Due to this multi-state construction, a substantial improvement in the efficiency of the shaft-turning device is provided, because a considerably smaller mass flow or flow quantity is required for the same torque. This means a substantial reduction in the size of the oil tank, the full-load oil pumps on the oil tank with the associated electric motors, smaller inner diameters for the oil lines and a reduction of the number of nozzles in the nozzle housing.

In accordance with another feature of the invention, the shaft-turning device includes driving medium supply housing means carrying the nozzle means and having a part extending in axial direction of the rotor across the width of the rows of rotor blades, the guide vane means being secured to the part of the supply housing means.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in shaft-turning device for steam turbines, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is an elevational view of the shaft-turning device;

FIG. 2 is an enlarged partial cross sectional view of the rotor and the nozzle housing of FIG. 1 taken along the line II—II in the direction of the arrows;

FIG. 3 is an elevational view of a nozzle housing with nozzle guide vanes as seen from behind the plane of the drawing of FIG. 1, and

FIG. 4 is a developed longitudinal sectional view of FIG. 3 taken along the line IV—IV in the direction of the arrows, and including the rotor blades and guide vanes.

Referring now to the drawing and first, particularly, to FIG. 1 thereof, there is shown in a side elevational view of the shaft-turning device of the invention, a rotor 2, which carries a row of rotor blades 3 at the outer periphery thereof, and is mounted on a turbine shaft 1. Driving oil, which drives the rotor, is supplied through two oppositely disposed nozzle housings 4 and 5, each of which extends over a peripheral angle of about 60° of the row of rotor blades and is provided in this region with nozzle guide vanes (FIGS. 3 and 4). The nozzle housings 4 and 5 are connected by feed lines to a non-illustrated oil tank, and to drive pumps.

In the cross-sectional view of FIG. 2, the construction of the rotor 2 and the nozzle housing 4 is shown in greater detail. Thus, the rotor 2 carries, at the outer periphery thereof, two rows of rotor blades 3 and 6, that are disposed in axially spaced relationship to each other. The nozzle housing 4 has an inner supply duct 7 and corresponding nozzle outlets provided with guide vanes 8. Between the two rows of rotor blades 3 and 6, there is further disposed a row of guide vanes 9. These guide vanes 9 are secured to a part 10 of the nozzle housing 4, which extends in axial direction of the rotor 2 over the width of the rows of rotor blades 3 and 6, the guide vanes 9 extending respectively only over the same peripheral distance as the nozzle outlets 8. The other nozzle housing 5, not shown in the cross sectional view of FIG. 2, is constructed in the same manner as the nozzle housing 4.

Due to the disposition of two rows of rotor blades in tandem, as shown in FIG. 2, a considerably greater torque can be obtained with the same mass flow, or flow quantity and the same torque can be obtained with a considerably smaller mass flow or flow quantity. Suitable tests have shown that, with such a twostage construction, torque can be increased by about 84 percent over a single-stage construction, at the same mass flow or flow quantity.

In FIG. 3, a side elevational view of the nozzle housing 5 is provided as seen from the rows of rotor blades.

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The individual nozzle outlet vanes 8, which extend over the entire length of the nozzle outlet are particularly apparent in FIG. 3.

FIG. 4 shows a developed longitudinal sectional view of FIG. 3 taken along the line IV—IV which passes through the nozzle outlet duct or channel 7 and the corresponding following rows of vanes 3 and 6. The oil is thus supplied through the duct 7 of the nozzle housing 5 to the nozzle outlet with the guide vanes 8 and flow therefrom initially into the row of rotor blades 3. After the oil flows through the row of guide vanes 9 secured to the nozzle housing 5, it engages the second row of rotor blades, so that a considerably improved utilization of the mass flow or flow quantity is realizable. In this connection it is obvious that, in the nozzle housing 4 on the opposite side, the guide vanes 8 must be curved in opposite direction, so as to attain the same direction of flow onto the first row of rotor blades.

In the embodiment illustrated in the drawing, it is also possible that only one nozzle housing may serve to supply the oil, while the other may be closed.

In the illustrated embodiment, a construction with two rows of rotor blades is provided. However, it is also possible within the scope of the invention to provide more than two such rows of rotor blades in order to obtain an even higher efficiency under the prevailing conditions.

We claim:

1. Shaft-turning device for a steam turbine for continuing to turn the steam turbine slowly after the steam turbine is shut off, comprising an oil turbine including a rotor mountable on the shaft of a steam turbine, and stationary nozzle means for supplying driving medium to said rotor for revolving the same, said rotor having at the outer periphery thereof at least two rows of rotor blades disposed relative to said stationary nozzle means so as to be engageable successively by said driving medium, and guide vane means located between said rows of rotor blades, and nozzle means to supply pressurized oil to said rotor blades.

2. Shaft-turning device according to claim 1 including oil driving medium supply housing means carrying said nozzle means and having a part extending in axial direction of said rotor across the width of said rows of rotor blades, said guide vane means being secured to said part of said supply housing means.

3. Shaft-turning device according to claim 2, wherein said supply housing means extends arcuately over a given angle of the periphery of one of said rows of rotor blades, and carries said guide vanes along at least part of the length thereof.

4. Shaft-turning device according to claim 3, wherein said supply housing means comprises a plurality of nozzle housings located at the periphery of said rotor.

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