O. BANNER.

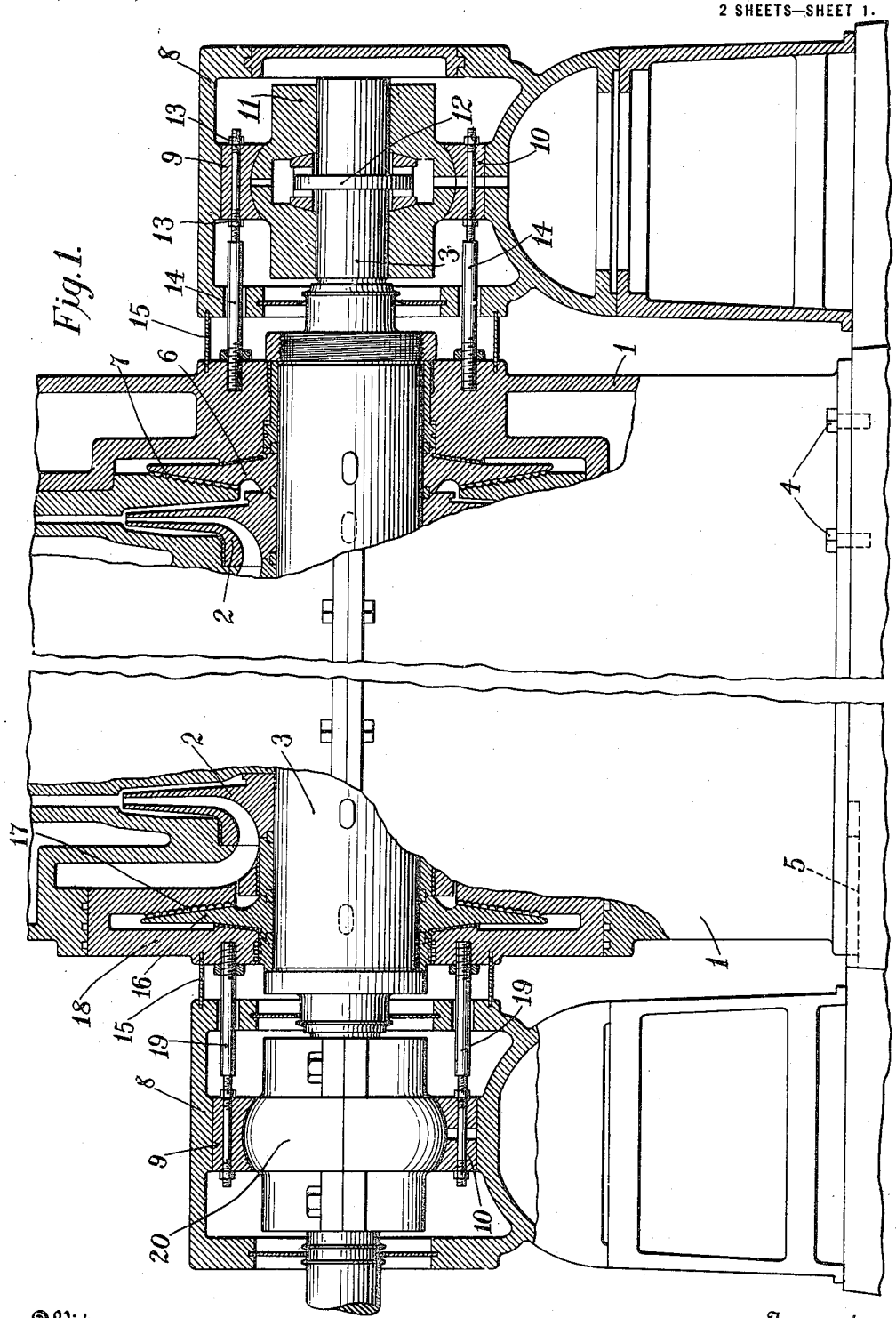
MEANS FOR MAINTAINING CLEARANCES IN ROTARY MACHINES.

APPLICATION FILED MAY 11, 1914.

1,168,273. Patented Jan. 18, 1916.

2 SHEETS—SHEET 1.

Fig. 1.



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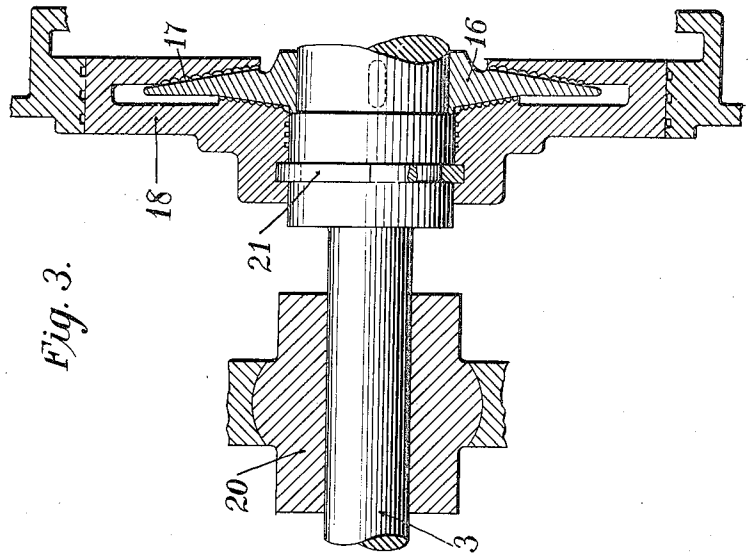


Fig. 3.

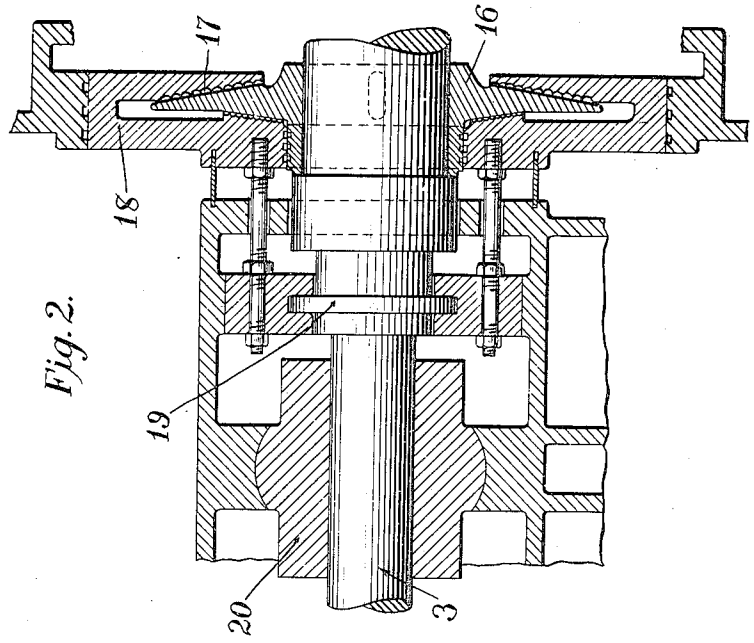


Fig. 2.

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UNITED STATES PATENT OFFICE

OTTO BANNER, OF EASTON, PENNSYLVANIA, ASSIGNOR TO INGERSOLL-RAND COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MEANS FOR MAINTAINING CLEARANCES IN ROTARY MACHINES.

1,168,273. Specification of Letters Patent. Patented Jan. 18, 1916.

Application filed May 11, 1914. Serial No. 837,670.

To all whom it may concern:

Be it known that I, OTTO BANNER, a subject of the German Emperor, residing at Easton, in the county of Northampton and State of Pennsylvania, have invented a certain new and useful Improvement in Means for Maintaining Clearances in Rotary Machines, of which the following is a specification.

This invention relates to rotary pumps or engines and more particularly to means for maintaining proper clearances between the stator and rotor, especially in the packing glands.

In rotary pumps and engines which operate on gases or steam at high temperatures, it has been customary to secure the casing or stator at one end leaving the other end free to move when the casing expands with the increase in temperature. As the shaft is also longitudinally expanded by the heat, it is necessary to provide also for its expansion, as the clearances between portions of the rotor attached to the shaft and the casing or stator are extremely small in some portions of the machine, particularly in the packing glands. To maintain these clearances several methods have been proposed. It has been proposed to fasten one end of the casing allowing the other to move, the shaft at the fixed end being provided with a thrust bearing preventing its movement. This of course maintains the clearances well enough in the fixed end of the casing but unless the shaft and casing expand equally the clearances at the free end are likely to be disturbed. It has also been proposed to secure the movable end of the casing to the shaft by constant length rods attached to a thrust collar, so that the shaft will move coextensively with the casing. In this case however the shaft must be kept at a constant temperature so that its own expansion will not affect the clearances. Neither of these methods moreover allow for any expansion of the shaft between the clearance point and the point of attachment to the casing.

The object of the present invention is to provide a construction whereby clearances in one or both ends of the machine will be automatically maintained with great exactness. This object is accomplished by the invention, practical embodiments of which are shown in the accompanying drawings, in which,

Figure 1 shows a longitudinal section partly in elevation of a turbo compressor, embodying the invention. Fig. 2 and Fig. 3 are detail views of modified constructions of the invention.

In the drawing is shown a turbo compressor of ordinary construction, comprising a casing 1 in which rotate a series of impellers 2 secured to a shaft 3. The casing is secured at one end to the base by dowels 4 and is free to move at its other end, a longitudinal guiding key 5 being provided which slides in a groove in the base plate. Secured to the shaft at the fixed end of the casing is a disk shaped packing flange 6 which rotates in a packing chamber the sides of which are provided with packing projections very closely approaching the surface of the disk 6, and hence affected by a very slight relative longitudinal movement of casing and shaft. As the casing is fixed to the base on the line of the packing chamber it is evident that the casing itself will not move through heat expansion, and it is necessary therefore that this portion of the shaft shall likewise have no movement. Machines of this type have a considerable end thrust however as a rule and this must be balanced at least partially by a thrust bearing, necessarily outside of the casing. It is evident however that if the thrust bearing is fixed, the expansion of the shaft between the packing disk and the thrust collar will force the disk inwardly against the casing, moving the whole shaft lengthwise to a certain extent. This is prevented in the present design in the following manner. Secured to the base plate is a bearing casing 8 on the inner surfaces of which are slidably mounted upper and lower bearing seats 9 and 10 with concave inner surfaces receiving a thrust bearing box 11 such as is described fully in my copending application Serial No. 811,990 filed January 14, 1914, which engages a thrust flange 12 on the shaft 3. These bearing seats are adjustably attached by means of nuts 13 to rods 14 which are threaded or otherwise secured to the casing 1. These rods are so designed and constructed, preferably of a material such as brass with a greater lineal expansion than the steel of the shaft, that they will lengthen coextensively with the shaft.

A casing 15 may be provided between the casing 1 and the bearing casing 8 to prevent

the outside temperature from affecting the expansion of rods 14. It will be seen therefore that the portion of the shaft at the packing flange will be stationary, while under varying heat conditions the portion between the packing flange and the thrust flange will expand and contract. As the thrust bearing box seats are connected to the casing by rods 14 which expand coextensively with the shaft, the thrust bearing box will keep pace with the shaft and not permit its expansion to affect the clearance in the packing chamber. At the other end of the casing, if there is pressure in the casing, a second packing gland must be provided, this being necessary in the high pressure cylinder of a turbo compressor such as shown in the drawing. In this end the packing flange 16 rotates in a packing chamber 17 formed in an annular head 18 slidably mounted in the end of the casing. This is necessary since it is difficult to construct the casing and shaft to expand equally in a longitudinal direction and the arrangement of the head 18 to slide in the casing nullifies any relative movement. The head 18 is connected by rods 19 to a movable bearing box 20 in a manner exactly similar to the bearing box 11 and rods 14, although since the bearing box 20 does not take any thrust and is solely to maintain the relative position of the flange 16 and head 18, a much simpler arrangement might be used to attach the head 18 in a fixed position relative to the flange 17, for instance, as shown in Fig. 2 a simple thrust collar 19 in addition to an ordinary journal bearing 20 or as shown in Fig. 3, a split ring 21 fitting in grooves in the shaft and in the inner bearing surface of the head.

It is to be understood that the present showing and description discloses only certain specified modifications of the invention and other forms and modifications are included in the spirit and scope of the invention as expressed in the claims.

I claim:

1. In a rotary machine, a casing secured at one end, a shaft secured at the same end, a rotor element at the free end of the casing, a movable casing portion having surfaces with slight clearances from said rotor element, and means connecting said shaft and said casing portions to prevent relative movement.

2. In a rotary machine, a casing secured at one end, a shaft having a thrust bearing secured to said casing by a heat expansible connection, a rotor element on the shaft at the other end of the casing, a separate casing portion slidable in the casing and surrounding said rotor element, and means for securing said separate casing portion in a fixed lineal position on said shaft, to prevent the disturbance of clearances between said rotor element and said casing portion.

3. In a rotary machine, a casing secured at one end and free at the other, a shaft, a rotor element on the shaft in the fixed end of the casing having slight clearance therefrom, a movable thrust bearing for the shaft at the fixed end of the casing, heat expansible rods joining said fixed end and said thrust bearing, a second rotor element on the other end of the shaft, a movable head sliding in the casing and having slight clearances from said second rotor element, a flange on the shaft, a movable bearing box engaging said flange and heat expansible rods joining said head and said bearing box.

In testimony whereof, I have hereunto set my hand.

OTTO BANNER.

Witnesses:
PAUL HOFFMAN,
CARL GROSSWENDT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."