E. T. WILLIAMS.

SHAFT SEALING DEVICE.

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1,327,003. Patented Jan. 6, 1920.

Fig. 1.

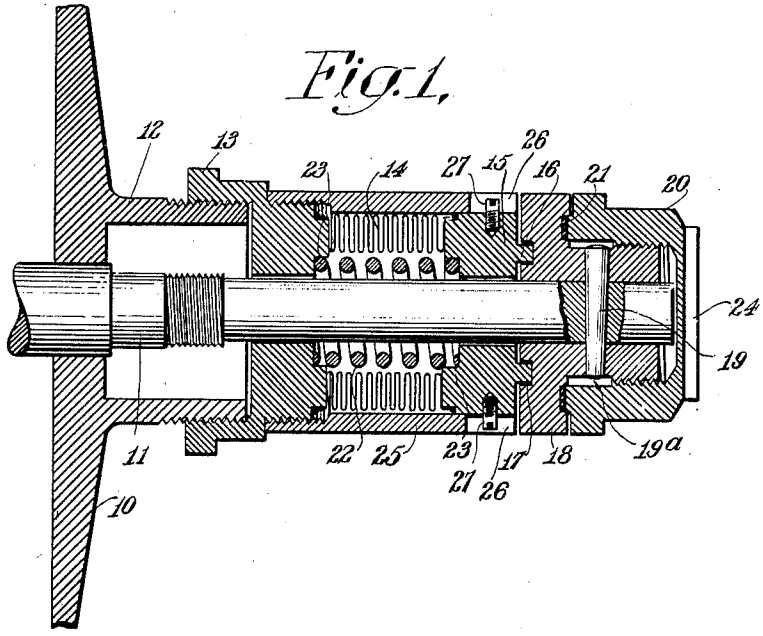
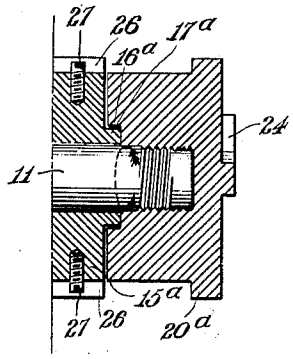


Fig. 2.



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SHAFT-SEALING DEVICE.

1,327,002. Specification of Letters Patent. Patented Jan. 6, 1920.

Application filed January 14, 1919. Serial No. 271,043.

To all whom it may concern:

Be it known that I, EDWARD T. WILLIAMS, a citizen of the United States, residing at New York, county of Kings, and State of New York, have invented certain new and useful Improvements in Shaft-Sealing Devices, of which the following is a full, clear, and exact description.

In machines for handling gases, as for example pumps, compressors, blowers, exhausters, and the like, in which a driving or other rotating shaft extends into the machine, considerable difficulty has been experienced in preventing leakage out of or into the machine along the shaft. In refrigerating apparatus, in which ammonia, ethyl chlorid, or other offensive gas is used, the problem is especially important. It is accordingly the chief object of my present invention to provide an improved seal for the shaft, which will be positively gas-tight under running conditions. A further object is to provide a device of the character indicated, in which the sealing effect will be favored rather than impaired by any wear to which the relatively movable parts are subjected in use. To these and other ends the invention resides in the novel features of construction, arrangements of parts, and combinations of elements, hereinafter described.

Of the various embodiments of which the invention is capable I have selected for illustration and specific description herein the one which at the present time is believed to exhibit the invention in its most convenient and effective form. This embodiment is illustrated in the accompanying drawing, in which—

Figure 1 is a longitudinal section.

Fig. 2 is a detail view also in longitudinal section, of a modification.

Referring to the drawing, 10 indicates the casing of a compressor or other machine having a rotary shaft 11 extending into the same from the outside, for example through a neck 12. The neck is threaded to receive a threaded cap 13 encircling the shaft. Between the neck and the cap a gasket or washer, not shown, may be provided. It will be understood that the cap and neck are stationary relatively to each other and to the shaft, except, of course, that the cap may be rotated on the neck for removal or adjustment.

Encircling the shaft, next to the cap 13, is a flexible sealing element 14, hermetically attached to the cap. This element is preferably a bellows, of thin sheet metal, capable of longitudinal expansion and contraction. At its other end the sealing element or bellows is connected in a gas-tight manner to a collar 15 in which the shaft rotates. On the outer face of the collar is an annular rib 16 coöperating with an annular groove 17 in the adjacent face of a flange on the sleeve 18 fixed non-rotatably on the shaft, so as to revolve therewith, by means of a pin 19 extending through the sleeve at a suitable point in the annular groove 19^a. The sleeve 18 is threaded to receive a cap 20 which serves to compress a solid packing, for example, lead, in a groove 21 in the outer face of the flange. This cap is in the form of a solid cup, which covers the pin 19, so that no leakage can occur through the holes formed in sleeve 18 to receive the pin.

The face of the rib 16 and the bottom of the groove 17 are ground together so that their plane of contact is strictly perpendicular to the axis of the shaft, and inasmuch as these surfaces are in rubbing contact the gas-tight fit thereat is constantly improved rather than impaired when the machine is in operation.

When a fluid pressure is generated in the casing 10 any gas leaking into the bellows tends to expand the latter and hence presses the rib 16 still more firmly into its seat, but at the same time the bellows permits considerable side-play, such as may be due to the shaft not being truly straight or truly cylindrical, without opening the joint at the rib. When the machine is idle the tension of the bellows (which is ordinarily put under slight compression by adjusting the collar 13) holds the sealing rib in its seat with sufficient pressure to prevent slow leakage; but if not, additional pressure may be obtained by means of a coil spring 22. Preferably the spring is seated in grooves 23 to hold it out of contact with the shaft.

The gas-tight cap 20 is an advantageous feature. It screws up firmly against the packing 21 and thus effectually prevents the escape of oil as well as gas, and at the same time it can be used as a coupling member (for which purpose it may, for example, be provided with a transverse rib 24) to connect the shaft 11 with the shaft (not shown) of the driving motor or other prime mover.

The friction between the rotating flange

18 and the non-rotating collar 15 is slight, but nevertheless may put considerable torsional stress on the rather delicate bellows 14, especially when the rotation of the shaft begins. To obviate this drawback I secure to the collar 13, for example by means of screw threads as shown, an outer sleeve 25, which incloses the bellows. The other end of the sleeve is provided with axially extending slots 26, which are engaged by screws 27 threaded in the collar 15. The bellows can therefore expand and contract freely, the collar 15 moving axially on the shaft, but all torsional stresses on the said collar are taken by the sleeve 25 instead of by the bellows. The latter is thus fully protected from twisting stresses, which might rupture it, and is also protected from injury by blows or other accidents.

A simpler construction for the outer end of the shaft, which is particularly useful with shafts of small diameter, is illustrated in Fig. 2. In this form the collar 18 is omitted and the rib 16^a (corresponding to the rib 16 in Fig. 1) is in the form of an axial flange around the opening in collar 15^a. This flange bears against the bottom of a rabbet 17^a around the opening in the cap 20^a to provide a gas-tight joint. The shaft 11 is threaded at its end, and one or more of the threads are turned off. Back of the threads (toward the left in Fig. 2) the opening in the cap makes a smooth, close fit with the shaft.

The friction between the rotating cap 20^a and the non-resisting collar 15^a tends to hold the cap and thus tends to make it rotate more slowly than the shaft. This tendency may be utilized to keep the cap tight on the shaft. Thus if the rotation of the shaft is in the direction of the arrow, a left-hand thread is used, with the result that any movement of rotation of the shaft relative to the cap will screw the cap farther upon the shaft and thus secure it more firmly thereon.

It is to be understood that the invention is not limited to the specific constructions herein described but can be embodied in other forms without departure from its spirit as defined by the following claims.

I claim:

1. In a shaft-sealing device of the class described, in combination, a casing, a shaft extending out of the casing, a non-rotating axially expansible sealing device surrounding the shaft and connected at its inner end with the casing and having an axially expansible portion, and a cap secured over and inclosing the outer end of the shaft to rotate therewith and coöperating with the outer end of the sealing device to prevent leakage.

2. In a shaft-sealing device of the class described, in combination, a casing, a shaft extending out of the casing, a sealing device surrounding the shaft and associated at its inner end with the casing and having an axially expansible portion; and a coupling member secured on the shaft at the outer end thereof to rotate with the shaft and cooperating with the outer end of the sealing device to prevent leakage.

3. In a shaft-sealing device of the class described, in combination, a casing, a shaft extending out of the casing, a sealing device surrounding the shaft and associated at its inner end with the casing and having an axially expansible portion; and a coupling member to rotate with the shaft, comprising a cap secured over the outer end of the shaft and coöperating with the sealing member to prevent leakage.

4. In a shaft-sealing device of the class described, in combination, a shaft, an axially expansible member surrounding the shaft, a sleeve mounted on the shaft at the outer end thereof and coöperating with the outer end of the sealing member to prevent leakage thereat, a pin extending through the side of the sleeve into the shaft to prevent rotation of the collar relative to the shaft; and a cap secured over the outer end of the shaft to cover said pin and coöperating with the sleeve to prevent leakage.

5. In a shaft sealing device of the class described, in combination, a shaft, an axially expansible sealing member surrounding the shaft, a sleeve mounted on the shaft at the outer end thereof and coöperating with the outer end of the sealing member to prevent leakage thereat, means for securing the sleeve on the shaft; and a coupling member comprising a cap secured on the sleeve to rotate the same and the shaft, and covering the outer end of the shaft and cooperating with the sleeve to prevent leakage.

6. In a shaft-sealing device of the class described, in combination, a shaft, a sealing device surrounding the shaft and having an axially expansible portion, and a coupling member comprising an externally ribbed cap connected with and inclosing the outer end of the shaft to rotate the shaft and prevent leakage at its end, and coöperating with the sealing device to prevent leakage between the two.

In testimony whereof I hereunto affix my signature.

EDWARD T. WILLIAMS.