June 12, 1923.

1,458,489

H. B. LEE

STEAM PACKING

Filed March 13, 1920 2 Sheets-Sheet 1

Fig. 1.

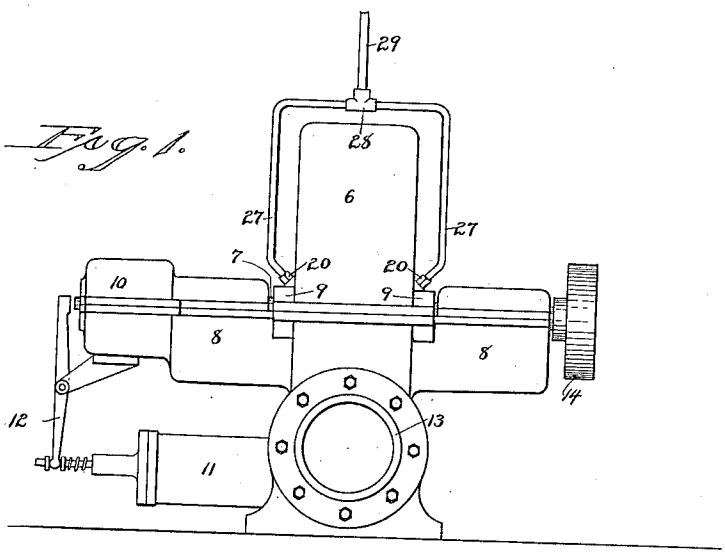


Fig. 3.

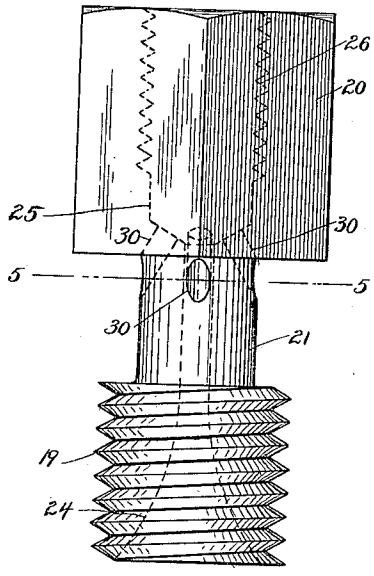


Fig. 4.

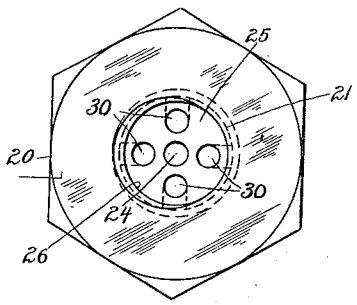
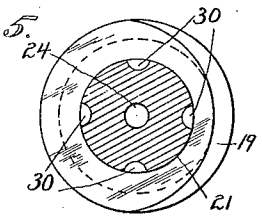


Fig. 5.



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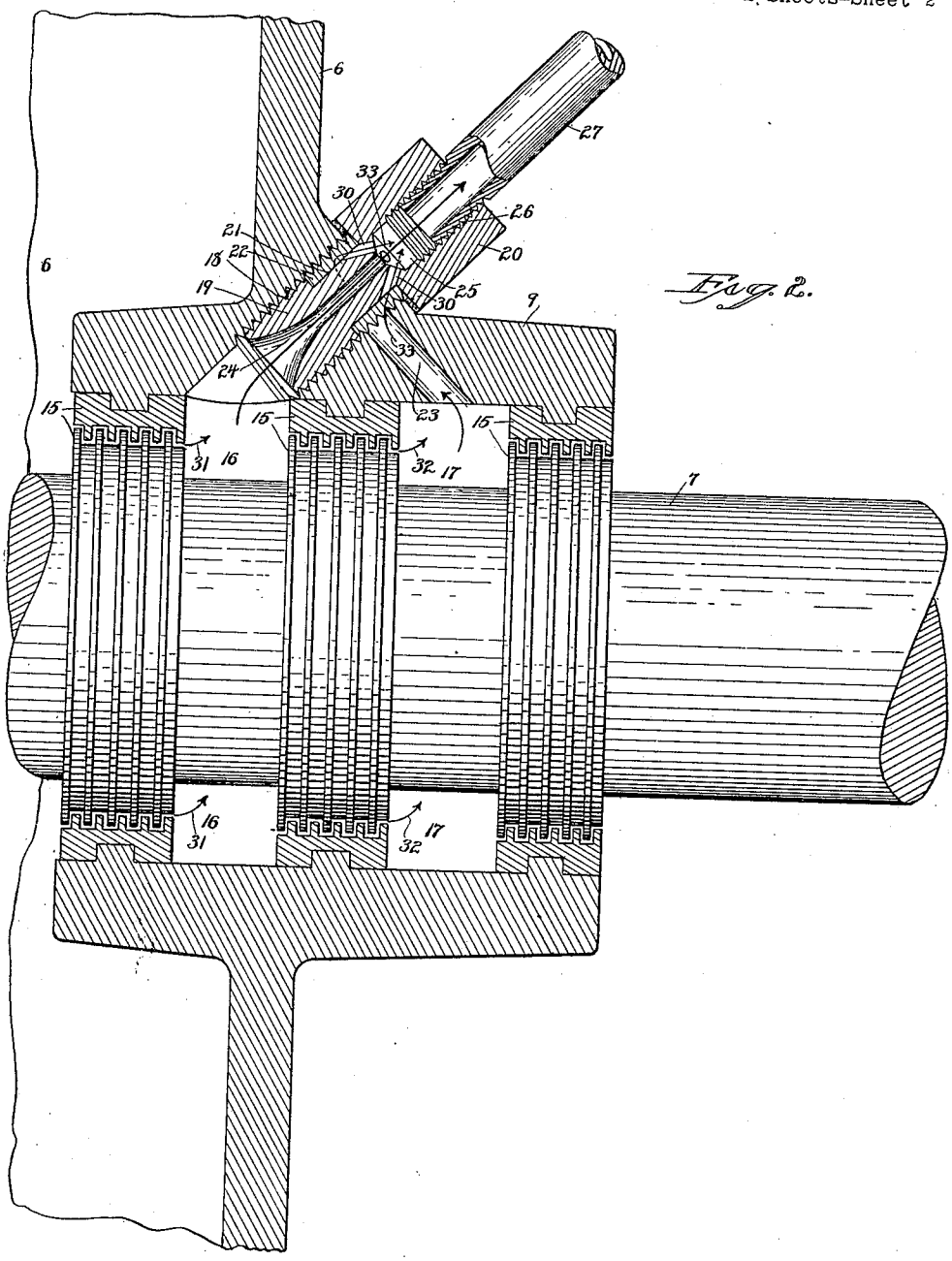


Fig. 2.

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UNITED STATES PATENT OFFICE.

HENRY B. LEE, OF NEW LONDON, CONNECTICUT, ASSIGNOR TO THE D. E. WHITON MACHINE COMPANY, OF NEW LONDON, CONNECTICUT, A CORPORATION.

STEAM PACKING.

Application filed March 13, 1920. Serial No. 365,671.

To all whom it may concern:

Be it known that I, HENRY B. LEE, a citizen of the United States, residing at New London, in the county of New London and State of Connecticut, have invented a new and useful Improvement in Steam Packings; and I do hereby declare the following, when taken in connection with the accompanying drawings and the characters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this application and represent, in—

Fig. 1, a view in side elevation of a steam turbine, the main shaft of which is provided with my improved steam-packings.

Fig. 2, an enlarged broken view in vertical section of the right-hand packing as applied to the turbine shaft.

Fig. 3, an enlarged detached view in side elevation of the ejector-plug of my improved packing.

Fig. 4, a detached plan view of the plug.

Fig. 5, a view thereof in transverse section on the line 5—5 of Figure 3.

My invention relates to an improved steam-packing designed with particular reference to use in steam turbines, but not so limited, since it is equally applicable to the piston-rods of reciprocating engines or to valve-stems; nor is it limited to use as a steam-packing, since it may be used also as a packing for other elastic fluids, the object of my invention being to provide a simple and effective packing by which the escape of any steam at the atmospheric end of the packing is prevented.

With these ends in view, my invention consists in a packing operating on the principle of an ejector and having certain details of construction as will be hereinafter described and pointed out in the claims.

For the illustration of my invention, I have shown it as applied to a steam turbine for which it is particularly adapted, as already stated. As herein shown, the turbine comprises a casing 6, a shaft 7, bearing-housings 8, packing-bushings 9 interposed between the said casing and bearing-housings, a governor-housing 10, a steam inlet-valve casing 11, a governor-lever 12, an exhaust-pipe 13, and the turbine half 14 of the shaft-coupling, all of these parts being of familiar construction and needing no description.

The two packing-bushings 9 through which the shaft 7 passes, are provided with my improvement, and as they are exactly the same, a description of the right-hand packing will suffice for both. The right-hand bushing 9 contains three independent standard annular packings 15 spaced apart to form what for convenience I shall designate as annular primary and secondary expansion-chambers 16 and 17 surrounding the turbine-shaft. The said packings 15, as shown, are of the double labyrinth type, but any other packings of standard construction might be employed in their place.

At the junction of the casing 6 with the top of the right-hand bushing 9, I locate an outwardly inclined opening 18, the inner end of which intersects the primary expansion-chamber 16 and the outer portion of which is threaded for the reception of the threaded stem 19 of an ejector-plug having at its outer end a hexagonal head 20 separated from the said stem 19 by an annular groove 21 forming when the plug is installed in the opening 18, an annular vacuum-chamber 22 communicating through an inclined port or passage 23 with the secondary expansion passage 17.

The said ejector-plug is virtually converted into a nozzle by its provision with a concentric passage 24 the inner end of which is funnel-shaped and the outer end of which opens into the bottom of a suction-chamber 25 formed by the inner end of a concentric threaded bore 26 in the head 20 of the plug, the said bore receiving the threaded lower end of an upstanding exhaust-pipe 27 connected by a T 28 (Fig. 1) with a common vent-pipe 29 opening into the atmosphere.

The outer end of the funnel-shaped passage 24 aforesaid, is surrounded by four inclined suction-passages or ports 30 leading from the vacuum-chamber 22 into the suction-chamber 25 aforesaid.

In the operation of my improved steam-packing, there will be leakage from the interior of the casing 6 into the primary expansion-chamber 16, as indicated by the arrows 31 in Fig. 2. This leakage is measurably predetermined or gauged in amount by the clearance between the elements of the packing-rings 15, provided to accommodate the vibration or "whip" of the shaft. Some of the steam thus escaping into the expansion-chamber 16 will find its way, as at 32,

into the secondary expansion-chamber 17 which is, so to speak, at the atmospheric end of the packing.

The steam present, by such unavoidable leakage, in the expansion-chamber 16 is forced under its own pressure into the inner end of the ejector-plug and issues from the funnel-shaped passage 24 thereof into the suction-chamber 25 thereof with sufficient energy to cause so much suction in the four ports 30 as to create a partial vacuum in the annular vacuum-chamber 22 and hence in the passage 23 leading to the secondary expansion-chamber 17 with the effect that all of the steam which escaped from the primary expansion-chamber 16 into the secondary expansion-chamber 17 through the intermediate packing-ring 15, as indicated by the arrows 32, will be extracted from the chamber 17 and ejected, as indicated by arrows 33, through the exhaust-pipe 27 and vent 29. None of this steam will pass outward through the outermost packing-ring 15 owing to the maintenance of a partial vacuum in the secondary expansion-chamber 17 so that the outermost packing-ring functions more to exclude the atmosphere than it does to prevent the leakage of steam.

It will thus be seen that my improved steam-packing is constructed on the ejector principle and characterized by its utilization of the escaping steam for keeping, as it were, the packing pumped dry, whereby the ultimate leakage of any steam through the packing is prevented. This is particularly important in steam turbines in which the two packings of the turbine-shaft are interposed directly between the casing and the bearings in which the shaft runs. Therefore, if steam is allowed to escape through these packings, it finds its way into the oil-wells of the bearings and condenses, and floats the oil out of the same.

I claim:

1. A steam-packing having a casing, a shaft, packing-means therefor, primary and secondary expansion-chambers interposed between the said packing-means, and an ejector-plug connected with the said chambers and operated by the energy of the steam leaking along the said shaft through the said packing-means into the said primary chamber to create a partial vacuum in the said secondary chamber for the exhaustion therefrom of the steam escaping thereinto from the said primary chamber, whereby the bearings from the shaft are protected from condensing steam.

2. A steam-packing having a casing, an expansion-chamber, and an ejector-plug comprising a threaded stem having a funnel-shaped passage, a head containing a suction-chamber intersected by the outer end of the said passage, and a groove located between the said stem and head and formed with inclined passages entering the suction-chamber around the intersection thereof by the said funnel-shaped passage.

3. A steam-packing comprising a casing, a bushing, a shaft passing through the same, three packing-rings spaced apart in the said bushing to form a primary expansion-chamber into which steam from the casing is introduced and a secondary expansion-chamber into which steam leaks from the said primary expansion-chamber through the intermediate packing-ring, and an ejector-plug mounted in the said bushing and connected with both of the said chambers for the exhaustion of the latter through energy derived from the steam entering the former from the said casing.

4. In a steam turbine, the combination with a casing provided with two bearings and with two packing-bushings interposed between it and the said bearings, of a shaft passing through the said casing, bushings, and bearings; packing-rings located within the said bushings and spaced apart to form primary and secondary expansion-chambers; ejector-plugs mounted in the said bushings in which they are connected with the said expansion-chambers for the exhaustion of the secondary expansion-chamber by energy of the steam escaping through the inner packing into the primary expansion-chamber; and means for carrying off the steam thus exhausted from the packing-bushings, whereby the bearings of the shaft are protected from condensing steam.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

HENRY B. LEE.

Witnesses:
M. J. CHANDLER,
EDWARD P. EGGLESTON.