No. 760,168. PATENTED MAY 17, 1904.

J. WILKINSON.

PACKING DEVICE FOR TURBINE SHAFTS.

APPLICATION FILED MAR. 8, 1904.

NO MODEL.

Fig. 1.

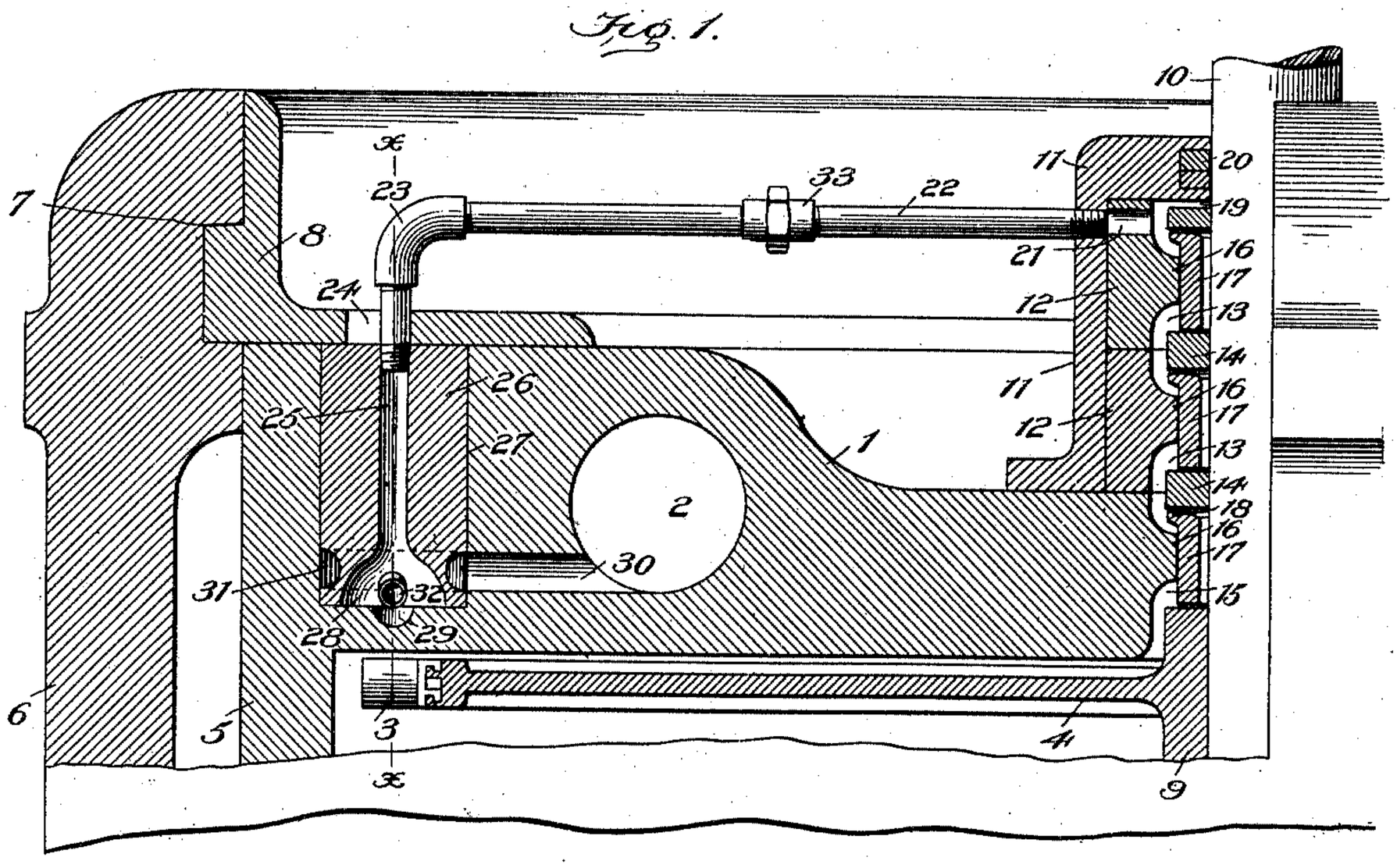


Fig. 2.

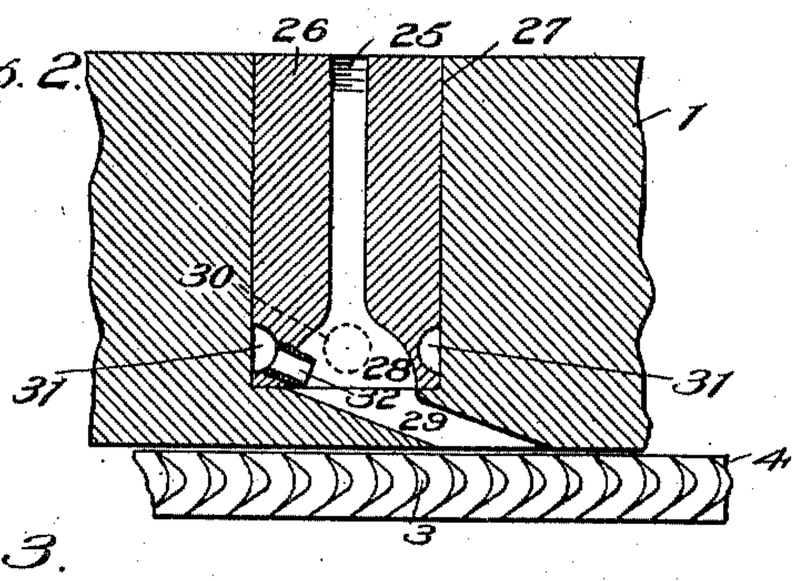
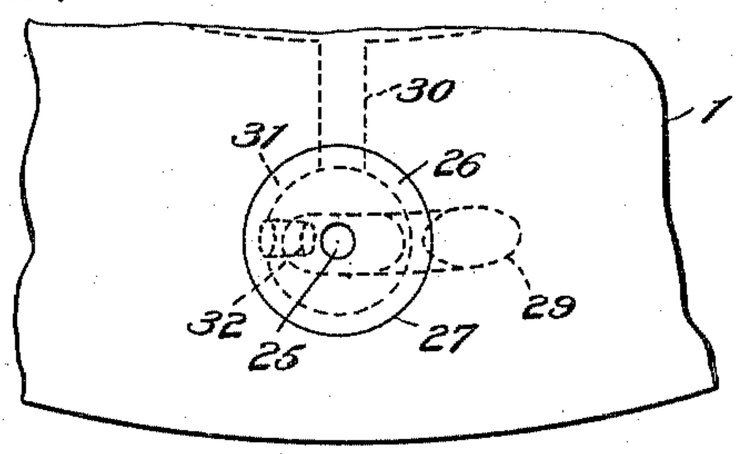


Fig. 3.



WITNESSES:

Edwin L. Bradford

Geo. W. Rea.

INVENTOR.

James Wilkinson

BY Robt. D. Johnston Jr.

ATTORNEY.

No. 760,168. Patented May 17, 1904.

UNITED STATES PATENT OFFICE.

JAMES WILKINSON, OF BIRMINGHAM, ALABAMA, ASSIGNOR TO THE WILKINSON STEAM TURBINE COMPANY, OF BIRMINGHAM, ALABAMA, A CORPORATION OF ALABAMA.

PACKING DEVICE FOR TURBINE-SHAFTS.

SPECIFICATION forming part of Letters Patent No. 760,168, dated May 17, 1904.

Application filed March 8, 1904. Serial No. 197,150. (No model.)

To all whom it may concern:

Be it known that I, JAMES WILKINSON, a citizen of the United States, residing at Birmingham, in the county of Jefferson and State of Alabama, have invented new and useful Improvements in Packing Devices for Turbine-Shafts, of which the following is a specification.

My invention relates to elastic-fluid turbines and rotary motors, and has for its object to provide a stuffing-box surrounding the shaft and provided with means to prevent the escape of pressure which would otherwise leak from the box and discharge it by the injector action of a stream of fluid into the turbine to do useful work.

According to my invention I surround the shaft with any suitable packing disposed in a stuffing-box or chamber, from the outer end of which a pipe leads and enters a nozzle through which motor fluid flows continuously when the turbine is under pressure and is discharged against the buckets on a rotating element. This fluid acts as an ejector to exhaust from the stuffing-box all the leakage-pressure which escapes past the packings and to return it to the turbine, where it acts at full efficiency against the rotating buckets. By these means I avoid the necessity for using packing designed to completely prevent the escape of pressure around the shaft, which packing as now used is complicated and expensive and on account of the pressure to which it is subjected and the speed of rotation of the shaft invariably rubs to such an extent that it not only wears, but acts like a friction-brake in arresting the shaft's rotation. The advantages to be gained by a loose but effective packing are of the greatest importance, since it permits of the oscillating transverse movements of the shaft under high speeds without binding. With this latter point in view I have shown my invention applied to a stuffing-box provided with a plurality of my improved automatic pressure-reducing rings. (Shown and described in Patent No. 739,965.) These rings are designed to leave an ample clearance around the shaft and are intended more particularly to regulate and control the leakage rather than to stop it entirely. The effect of a number of the rings is to greatly reduce the leakage of pressure, and what amount does succeed in making its way to the outer end of the stuffing-box is returned to the turbine through a supply-nozzle passage, so that there is no loss of pressure at all.

My invention further comprises the details of construction and arrangement of parts hereinafter described, and illustrated in the accompanying drawings, in which—

Figure 1 is a partial vertical sectional view of a turbine, showing the packing means surrounding one end of the shaft and my improvement applied thereto. Fig. 2 is a view through the line *x x* of Fig. 1. Fig. 3 is a partial plan view showing the several fluid-conducting passages in dotted lines.

Similar reference-numerals refer to the same parts throughout the drawings.

I have shown my invention applied to a preferred form of turbine comprising a supply-head 1, provided with an annular passage 2 therein which communicates with a suitable source of motor-fluid supply and delivers the same through branch passages and nozzles (not shown) to the rotating buckets 3, peripherally mounted on a rotor-wheel 4, disposed within the first wheel-compartment. The turbine, which is preferably of the multiple-stage expansion type, may be subdivided into stages by diaphragm-partitions. (Not here shown.) The depending flange 5 of the head interlocks with the first diaphragm-partition and forms part of the inner casing, which I preferably surround by a strengthening-shell 6, provided with a recess 7 in its upper end. A flanged locking-ring 8 engages within this recess and secures the head 1 against vertical displacement by internal pressure. The wheel 4 is provided with a flanged hub 9, which is keyed to the shaft 10 in any suitable manner. This shaft 10 leads through a central opening in the head 1 and extends through a stuffing-box 11, secured to the head and provided with an in-

ner chamber in which are disposed two superimposed grooved rings 12, which rest upon said head. These rings and the head are grooved to form chambers 13, within which are disposed collars 14, keyed to shaft 10 and rotating therewith. The under side of the head 1 is cut away around the shaft-opening to form an annular chamber 15, open to the pressure in the wheel-compartment and within which is disposed the upper portion of the flanged hub 9 of the wheel. The recessed portions of the head and rings 12 leave shoulders 16, which surround the shaft, but leave an ample clearance for the interposition of means to regulate the leakage of pressure from the turbine around shaft 10, comprising annular pressure-reducing rings 17, the construction and operation of which is more clearly set forth and described in my Patent No. 739,965.

The top of hub 9 and the several collars 14 serve as rotating seats, between which the rings 17 are automatically moved by the pressure which escapes from the first wheel-compartment through the chamber 15 and between the ring and the shaft into the first chamber 13. This pressure will act automatically upon the flange 18, disposed around the low-pressure end of the ring-valve 17, to adjust the latter between its seats and regulate the escape of pressure around it in a manner more fully described in my patent aforesaid. The rings 17 are designed to fit substantially pressure-tight within the several shoulders 16, and they each act successively to reduce the pressure escaping from one to the other of the chambers 13. Although the leakage will have been greatly reduced by the several valves 17, so that when it reaches the chamber 19 its further escape may be almost entirely prevented by the packing-rings 20 in the end of the stuffing-box 11, it is my intention to prevent altogether the loss by leakage of any pressure from the packing-chamber around the shaft, and with this object in view I utilize the injector action of a stream of fluid to exhaust the pressure from chamber 19 and return it to the turbine, where it will do useful work. To this effect I provide the passage 21 through the upper ring 12, which communicates with an opening in the side of the casing 11, into which a pipe 22 is screwed. This pipe leads over the supply-head to an elbow 23 and thence downwardly through an opening 24 in the flange of locking-ring 8 to a central threaded opening into which it is screwed and which forms the upper end of a passage-way 25, leading through a plug 26, inserted in a chamber 27 in the supply-head. This passage-way 25 continues through the plug to a flaring opening 28 in the lower end thereof, which communicates with a nozzle-passage 29, leading at an angle through the head 1 and designed to discharge fluid-pressure against the row of revolving buckets 3. The opening 24 is elongated, so that the flanged ring 8 may be moved inwardly out of engagement with channel 7 of the shell 6 to permit the latter's removal when it is desired to gain access to the turbine. From the motor-fluid-supply passage 2 a branch passage 30 leads to the lower end of chamber 27 and admits the fluid-pressure to an annular chamber 31, formed by a channel in the plug 26. From this passage 31 an opening into the chamber 28 is provided at a point in alinement with and directly opposite to the induction end of the nozzle 29, and an injector-nozzle 32 is screwed into said opening. This passage 31 surrounds chamber 28 and acts with a steam-jacket effect to superheat the leakage-pressure before it reënters the turbine. I preferably form pipe 22 in two parts connected by a detachable coupling 33. When motor fluid is admitted to the turbine, it will flow through the passage 30, nozzle 32, nozzle-passage 29, and will impinge against the buckets 3. The discharge of the fluid stream by the nozzle 32 directly into the nozzle-passage 29 will cause the pressure to be exhausted by an ejector action from the chamber 28 and passage 25 and through the pipe 22 from the chamber 19. In this manner all pressure which succeeds in leaking past the several rings 17 will be discharged into the nozzle-passage 29 along with the fluid flowing through the nozzle 32 and delivered against the buckets 3 in the first compartment, so that it will act with full efficiency in driving the turbine. It is evident that by these means I not only prevent the loss of fluid-pressure by leakage, but I am enabled to gain the full working power of that pressure, for by discharging it into the first wheel-compartment of a multiple-stage turbine it will expand fractionally with the motor fluid as it passes through the turbine and be entirely converted into energy or *vis viva* before it is discharged into the exhaust or condenser.

When the packing is inserted in a chamber in the turbine-head, the conduit 22 may be formed by boring or channeling in and through the head, and the details of construction may be otherwise varied without departing from my invention.

It is obvious that the constantly-flowing stream of fluid used to eject the leakage-pressure may be used for other purposes than driving the turbine, such as supplying steam to jackets or coils for heating the fluid in the turbine, and I do not desire to limit myself to any particular application of this stream.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an elastic-fluid turbine, the combination with packing means for the shaft thereof, of means to prevent the escape of pressure by leakage around said shaft by returning it into the wheel-compartment from which it escapes.

2. In an elastic-fluid turbine, a shaft, pack-

ing means to reduce the leakage around said shaft, and means to catch and discharge said leakage against a row of impact-surfaces on a rotating element in said turbine.

3. In an elastic-fluid turbine, a shaft, a stuffing-box therefor, a conduit leading from said stuffing-box to a fluid-induction nozzle for the turbine, and means to eject pressure from said stuffing-box into said nozzle.

4. In a turbine, a shaft, packing means surrounding said shaft, a chamber in which said means are disposed, and means utilizing the ejector action of a stream of fluid to draw off the pressure which leaks past said packing means and discharge it into a wheel-compartment.

5. In a turbine, the combination with a shaft and means to prevent the leakage of pressure from said turbine around said shaft, of means to draw off the pressure which leaks around said shaft comprising a conduit, exposed at one end to a chamber adapted to receive the pressure which leaks around said shaft, and at the other end to the ejector action of a constantly-flowing stream of fluid by which the pressure is exhausted from said chamber and discharged into the turbine.

6. In a multiple-stage turbine, a shaft, a stuffing-box surrounding said shaft, a chamber near the outer end of said box into which the pressure, leaking around the shaft, passes, and means to prevent the escape of said pressure from said box by exhausting it into motor-fluid pressure supplied to the first stage of said turbine.

7. In a turbine, a shaft, and means to catch the pressure leaking around said shaft and cause it to be ejected into the turbine with the motor-fluid supply.

8. In a turbine operating by stage expansion, a supply-head, a shaft passing therethrough, and means to return the fluid-pressure, which escapes from the first stage around said shaft, back into said first stage.

9. In a turbine, a shaft, automatic pressure-reducing valves controlling the leakage of pressure around said shaft, and means to discharge the pressure which leaks past said valves back into the turbine.

10. In a turbine, a shaft and packing therefor, and means to prevent the escape to the atmosphere of pressure which leaks around said shaft, comprising means to return said leakage into said turbine, and means to reheat it before it is discharged therein.

11. In a turbine, automatic pressure-controlled means to regulate the leakage of pressure therefrom around the shaft, and means to return the pressure which leaks by said regulating means back into the turbine.

12. In a turbine, a supply-head, a chamber therein communicating with a nozzle-passage, a plug seated in said chamber and having a passage therethrough communicating with said nozzle, a motor-fluid-supply passage in said head which admits fluid to an annular passage formed between the side of said chamber and said plug, a nozzle by which the fluid in said annular passage is injected into said nozzle-passage, a stuffing-box for the turbine-shaft, and a pipe leading from said stuffing-box and entering said passage in said plug.

13. In a turbine, a shaft, packing therefor, and ejector means to draw off by suction the pressure leaking by said packing and discharge it into the fluid-pressure supplied to said turbine.

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

JAMES WILKINSON.

Witnesses:
H. M. HARTON,
R. D. JOHNSTON.