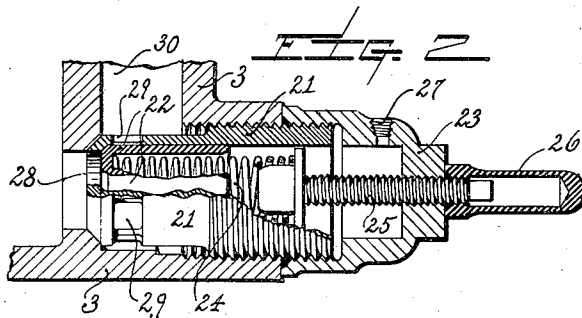
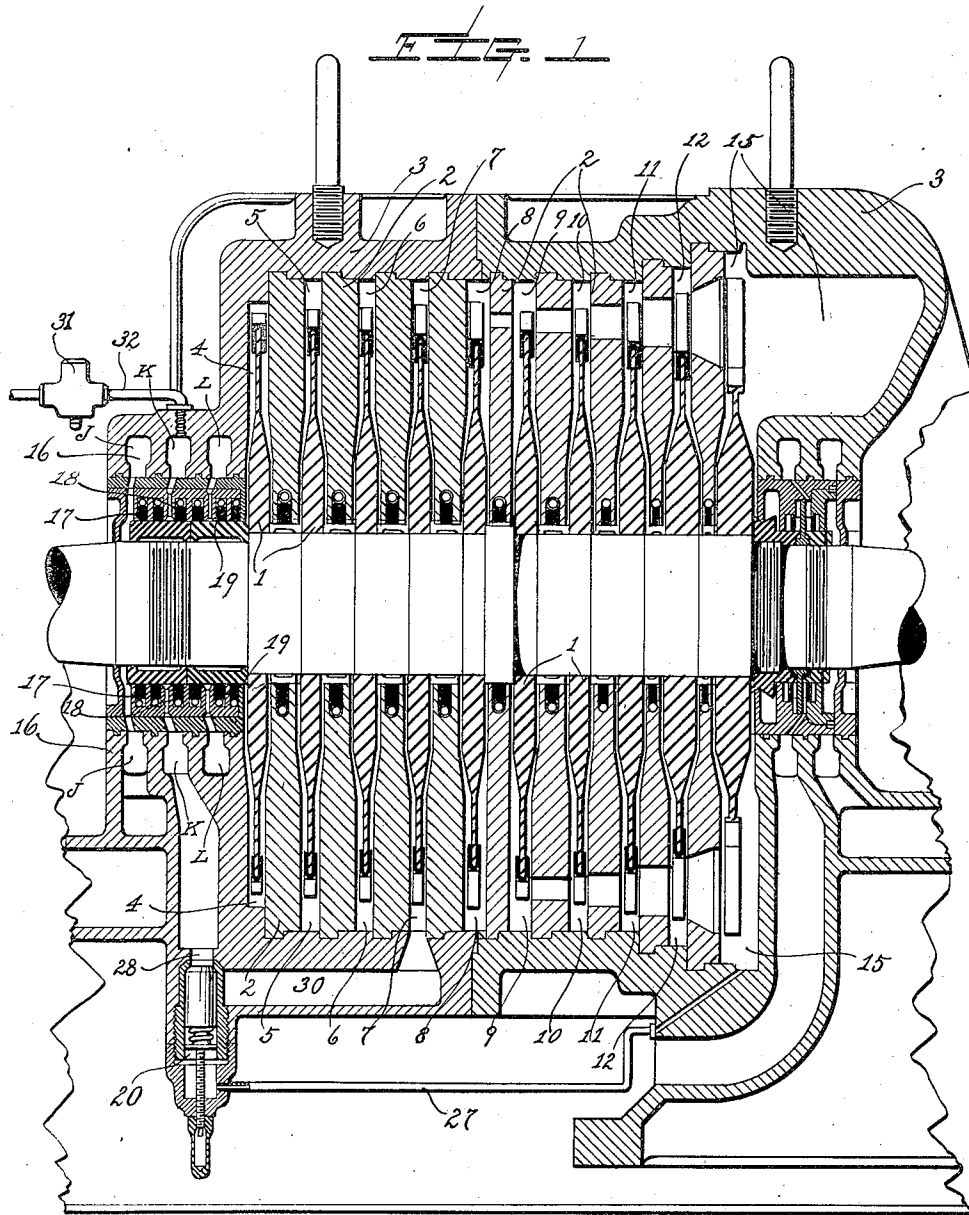


T. HALL.
 FLUID PRESSURE MOTOR.
 APPLICATION FILED DEC. 13, 1919.

1,352,743.

Patented Sept. 14, 1920.



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FLUID-PRESSURE MOTOR.

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Specification of Letters Patent. Patented Sept. 14, 1920.

Application filed December 13, 1919. Serial No. 344,561.

To all whom it may concern:

Be it known that I, THOMAS HALL, citizen of the United States of America, and a resident of Harrisburg, Dauphin county, Pennsylvania, have invented certain new and useful Improvements in Fluid-Pressure Motors, of which the following is a specification.

My invention relates to elastic fluid turbines, particularly steam turbines, and still more particularly to means for reducing to a minimum inflow of air and outflow of working fluid through stuffing boxes of such turbines. My invention comprises means for maintaining a substantially constant low pressure in an intermediate portion of such a stuffing box, and in other features all as hereinafter described and particularly pointed out in the appended claims.

The objects of my invention are to avoid the drawing of air into the turbine through its stuffing box, and also to avoid or reduce to a minimum the escape of steam or other working fluid through such stuffing box, and to accomplish such objects in a simple manner, and by inexpensive means.

I will now proceed to describe my invention with reference to the accompanying drawings and will then point out the novel features in claims.

Figure 1 shows an axial vertical section of a steam turbine of well known type with my invention added thereto, the illustration of such invention being more or less diagrammatic.

Fig. 2 shows a longitudinal section of the regulating valve.

In the drawings 1 designates the motor of the turbine, 2 the stator, of which the casing 3 is a part, 4, 5, 6—12 inclusive designate successive stages of the turbine, and 15 the exhaust chamber of the turbine. 16 designates the high pressure stuffing box; which comprises chambers J, K and L. Between chamber L and the highest pressure stage of the turbine there is a suitable packing 19 bearing against the periphery of the turbine rotor, the nature of which packing it is not necessary to describe here; between chambers L and K there is another similar packing 18, and between chambers K and J there is another similar packing 17. Chamber K is customarily connected by a duct 30 to a suitable low pressure stage of the turbine, so that steam may pass from chamber K into that stage and may be there utilized. Now these packings, while they

greatly reduce leakage of steam outward and flow of air inward, do not altogether prevent such leakage or flow. There may be some leakage of steam from the highest stage of the turbine into chamber L, and thence into chamber K, and thence, particularly when the turbine is working under heavy load, from chamber K to chamber J and thence to the outside air; and, conversely, particularly when the turbine is working condensing, and under light load, there may be leakage of air into chamber J, thence into chamber K, and thence through the said duct 30 connecting that chamber K with a low pressure stage of the turbine, to the condenser into which the turbine exhausts. Such outflow of steam, or inflow of air, may occur (except as prevented according to my invention), because the pressure in J and K depends upon the load carried by the turbine; being higher when the load is heavy, and lower when the load is light.

According to my invention I maintain a substantially constant pressure, usually slightly higher than that of the atmosphere, in chamber K, by interposing between chamber K and the said duct leading from that chamber to a low pressure stage of the turbine, an automatic pressure-regulating relief valve 20 which is loaded with the pressure of the exhaust of the turbine or some other stage of the turbine so low as to be practically a constant pressure under all loads; this loading being increased by a spring or other suitable substantially constant and readily regulable means, to the end that said valve will open to relieve pressure in chamber K whenever the pressure in said chamber exceeds the loading of the valve and will close when the pressure in chamber K falls to the predetermined intended pressure.

The construction of the valve 20 is simple. It comprises a seat-bushing 21, screwed into a suitable aperture in the turbine casing 3; a sliding valve-proper 22 within said bushing 21; a valve bonnet 23, a loading spring 24 and a regulating screw 25, customarily covered by a cap 26. Suitable packings are provided to prevent escape of steam at the base of the cap 26, and at the base of the bonnet 23. At a convenient point in the bonnet 23 there is connected a duct 27 leading to the exhaust chamber of the turbine or, it may be, to one of the lowest stages of the turbine; in any case, leading to

a point such that the pressure is substantially constant whatever may be the load on the turbine.

The valve - proper 22 seats against a suitable seating-portion of the bushing 21, such seating-portion surrounding a port 28 connecting with chamber K; and in the sides of bushing 21 there are ports 29 leading to a relief duct 30 which is the customary duct leading to a suitable low pressure stage of the turbine.

In connection with this automatic relief valve I employ, as is common, a reducing valve 31, in a pipe line 32 leading to chamber K from some source of supply (for example, the main steam line) which may be relied upon for steam pressure greater than that to be maintained in chamber K. The purpose of this reducing valve is, as usual, to maintain in chamber K, a certain definite pressure, above that of the atmosphere. This the reducing valve may do on low loads; but if, when the turbine is running on heavy loads, the leakage from the high pressure side of the turbine through chamber L becomes so great as to maintain in chamber K a higher pressure than that for which the reducing valve is set, then, as before stated, except for this relief valve 20, leakage of steam will occur from chamber K to chamber J and thence to the atmosphere, with the resultant loss of considerable steam. But such loss is prevented by the relief valve 20, which, when the pressure in K is higher than that for which the relief valve is set, will open, discharging to a suitable low pressure stage of the turbine to which duct 30 is connected, in which the steam thus escaping from chamber K is utilized. On the other hand, relief valve 20 closes promptly when the pressure in chamber K falls to that corresponding to the loading of the valve, so preventing entrance of air.

Since the pressure communicated through duct 27 to the loading side of the valve 20 is extremely uniform, the loading of the valve is extremely uniform, and the valve 20 may be relied upon to open promptly when the pressure in K rises above the predetermined pressure, and to close promptly when the pressure in chamber K falls to the predetermined pressure. Since most turbines are operated condensing, the spring 24 is commonly adjusted so that the valve 20 will open only when the pressure in K exceeds some pressure higher than atmospheric pressure—usually about five pounds above atmosphere. When the turbine is run non-condensing, this pressure for which valve 20 is set may be somewhat higher.

What I claim is:

1. The combination with a turbine comprising successive stages of progressively lower pressures, of a packing chamber, a

duct connecting said chamber to a low pressure stage of the turbine, a self-opening relief valve in said duct between said chamber and said low pressure stage, said relief valve having loading means tending to prevent its opening below the pressure to be maintained in said chamber, and to cause it to close when the pressure in such chamber falls to a predetermined pressure, and means for supplying working fluid at a predetermined pressure to said chamber.

2. The combination with a turbine comprising successive stages of progressively lower pressures, of a packing chamber, a duct connecting said chamber to a low pressure stage of the turbine, a relief valve in said duct between said chamber and said low pressure stage, said relief valve having fluid-pressure-actuated loading means connected to a source of substantially constant low fluid pressure, and having also other loading means preventing the opening of said relief valve below a pressure higher than such low pressure, said loading means arranged to cause said relief valve to close when the pressure in such chamber falls to a predetermined pressure, and means for supplying working fluid at a predetermined pressure to said chamber.

3. The combination with a turbine comprising successive stages of progressively lower pressures, of a packing chamber, a duct connecting said chamber to a low pressure stage of the turbine, a relief valve in said duct between said chamber and said low pressure stage, said relief valve having fluid-pressure-actuated loading means connected to the exhaust pressure of the turbine, and having also other loading means preventing the opening of said relief valve below a pressure higher than such exhaust pressure, said loading means arranged to cause said relief valve to close when the pressure in such chamber falls to a predetermined pressure, and means for supplying working fluid at a predetermined pressure to said chamber.

4. The combination with a turbine comprising a stator and a rotor, of a high pressure packing for the joint between the rotor and stator comprising a plurality of chambers, one arranged to receive leaking steam from the turbine, another exposed to indrawn air, and a third chamber exposed to leakage from said previously mentioned chambers, means for supplying to said intermediate chamber working fluid at a predetermined pressure, a duct for conveying working fluid from said intermediate chamber to a suitable discharge point in the turbine, and a relief valve between said intermediate chamber and said point of discharge, said relief valve having loading means tending to prevent its opening below the pressure to be maintained in said inter-

mediate chamber, and to cause it to close when the pressure in such intermediate chamber falls to a predetermined pressure.

5. The combination with a turbine comprising a stator and a rotor, of a high pressure packing for the joint between the rotor and stator comprising a plurality of chambers, one arranged to receive leaking steam from the turbine, another exposed to in-
10 drawn air, and a third chamber exposed to leakage from said previously mentioned chambers, means for supplying to said intermediate chamber working fluid at a predetermined pressure, a duct for conveying
15 working fluid from said intermediate chamber to a suitable discharge point in the turbine, and a relief valve between said intermediate chamber and said point of discharge, said relief valve having fluid-pressure-actuated loading means supplied with
20 working fluid by connection to the exhaust of the turbine, together with supplemental loading means tending to hold said valve closed up to a predetermined pressure
25 higher than the normal exhaust pressure.
6. The combination with a fluid-pressure

engine comprising a chamber in which pressure is to be maintained above a predetermined limit, of a relief passage for said chamber and a relief valve therein comprising fluid-pressure-actuated loading means
30 connected to the exhaust of said engine as constituting an approximately uniform source of low pressure loading fluid.

7. The combination with a fluid-pressure engine comprising a chamber in which pressure is to be maintained above a predetermined limit, of a relief passage for said chamber and a relief valve therein comprising fluid-pressure-actuated loading means
35 connected to the exhaust of said engine as constituting an approximately uniform source of low pressure loading fluid, and comprising also supplemental loading means.
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In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

THOMAS HALL.

Witnesses:

MARY E. RINEARD,
W. M. RUSS.