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J. F. JOHNSON

BLEEDER TURBINE

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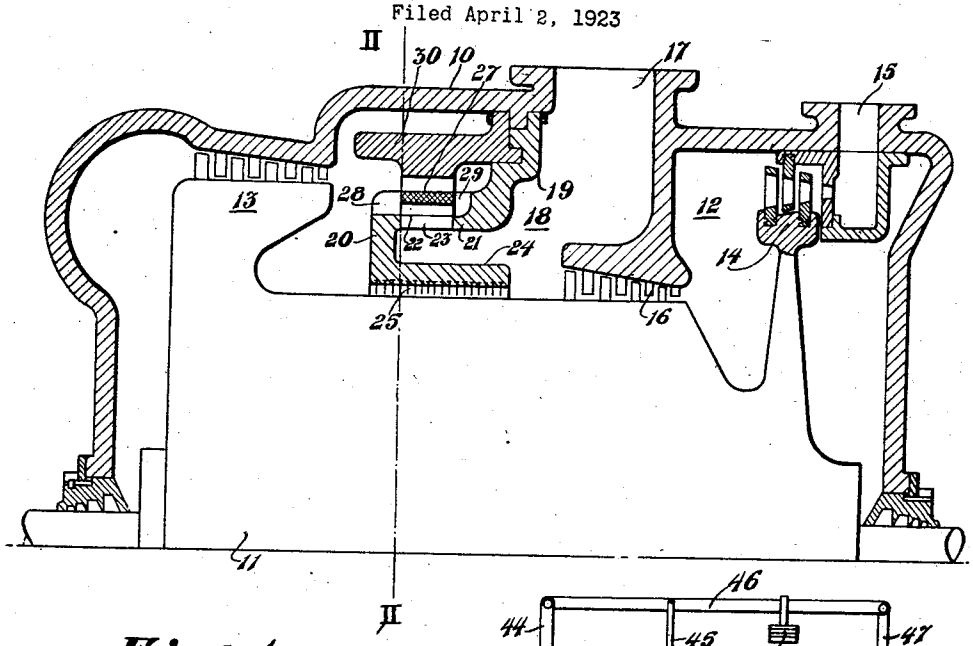


Fig. 1.

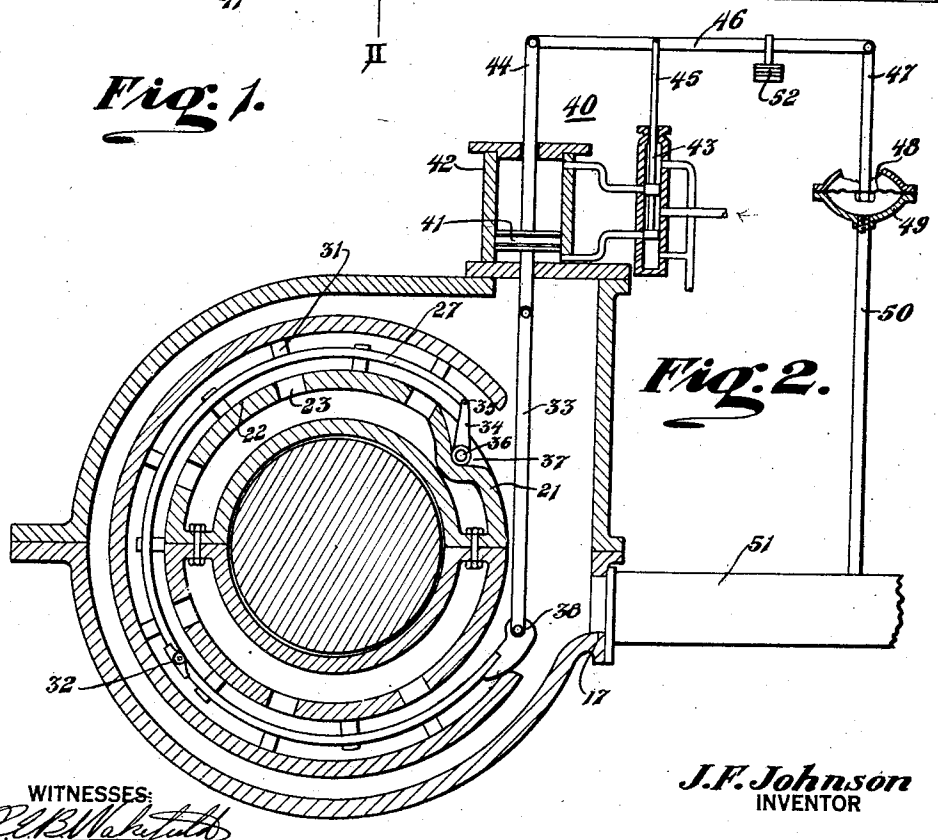


Fig. 2.

WITNESSES:

J. F. Johnson
INVENTOR

BY D. C. Davis
ATTORNEY

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UNITED STATES PATENT OFFICE.

JOSIAH F. JOHNSON, OF SWARTHMORE, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

BLEEDER TURBINE.

Application filed April 2, 1923. Serial No. 629,437.

My invention relates to bleeder turbines and it has for its object to provide, in connection with apparatus of this character, an inter-stage valve of the expansible and contractile type, whereby adequate passage area and economical valve operation may be secured.

Apparatus made in accordance with my invention is illustrated on the accompanying drawings, forming a part of this application, in which, Fig. 1 is a sectional view of a bleeder turbine showing my improved valve mechanism applied thereto; and Fig. 2 is a sectional view taken along the line II—II of Fig. 1.

Inter-stage valve mechanism is ordinarily employed in connection with bleeder turbines where the bleeder connection is made with the turbine between the high and low-pressure sections thereof, the purpose of such valve mechanism being to so control the flow of steam from the high-pressure section to the low-pressure section that as uniform a bleeder pressure may be maintained as possible with variations in load and in bleeder demand. The object of my invention is to provide valve mechanism of this type so as to afford ample communicating area between the high and low-pressure sections and to provide a construction which is economical from the standpoints of construction and of operation.

Referring now to the accompanying drawings for a better understanding of my invention, I show a turbine comprising a casing or cylinder 10 and a rotor 11 carrying the energy-abstracting elements of the high-pressure section, at 12, and of the low-pressure section, at 13. As shown in Fig. 1, the high-pressure section 12 comprises a multi-velocity impulse stage 14, which receives steam from the inlet 15 and which discharges steam to the stages of reaction blading 16. A bleeder connection 17 communicates with the turbine casing between the high-pressure section 12 of the turbine and the low-pressure section 13. Separating means, at 18, is shown between the low-pressure section 13 and the bleeder connection 17 and the high-pressure section 12, said separating means including valve mechanism, which is the subject of my improvement and which will now be described.

The separating means, at 18, includes an annular member 19, which is secured to the turbine casing 10 and which is provided with a hub portion 20 of channel-like formation. The outer side 21 of the hub portion 20 is provided with a valve seat 22, having ports or passages 23 therein and the inner portion 24 of the hub portion is provided with packing 25 of any suitable type cooperating with the rotor 11 to prevent as far as possible the passage of steam to the low-pressure section 13 other than through the ports 23.

A contractile and expansible valve member 27 cooperates with the seat 22 to cover and uncover the ports 23. Lateral guides 28 and 29, preferably carried by the hub portion 20, co-operate with the expansible and contractile valve member to prevent lateral displacement thereof. A retaining member 30 is carried by the casing 10 and it is provided with inwardly-projecting ribs or bosses 31, which serve to limit outward or expansive movement of the contractile and expansible valve member.

The contractile and expansible valve member is preferably made of flexible material, as illustrated in Figs. 1 and 2; however, it will be obvious that the expansible and contractile member may be made up of a plurality of sections hinged together so as to provide for the expansible and contractile movements. The valve member 27 in Fig. 2 is provided with an intermediate hinge 32 in order to permit of more ready expanding and contracting movements.

The expansible and contractile valve member has one end anchored to the wall member 21 and the other end of such valve member is connected to a link 33 operated by any suitable reciprocatory mechanism to secure expanding and contracting movements of the member. The anchoring means for one end of the valve member preferably comprises a link 34, pivotally connected at

35 to one end of the valve member 27 and having its other end pivotally connected at 36 at the bottom of an outwardly-flaring depression 37 provided in the outer wall 21 of the hub portion 20. This pivoted link construction for anchoring one end of the valve member 27 permits of inward and outward movements of that end so that it may be brought in contact with the valve seat and moved away therefrom to fully expose the ports 23. The link 33 is pivotally connected at 38 to the other end of the valve member 27 in order to permit of the necessary inward and outward movements thereof. From the structure described, it will be apparent that the expansible and contractile valve member 27 may be moved inwardy and outwardly substantially uniformly throughout its extent in order to control the passage of steam to the low-pressure section 13.

While I have illustrated a contractile and expansible valve member 27 which extends nearly around the hub portion 20, it is to be understood that any desired extent of the valve member may be used so long as the ends are spaced apart less than 180°, so that the operating forces present may be utilized to secure controlling movement thereof. Insofar as my invention is concerned, therefore, the valve seat may take the form of any suitable curve or combination of curves of finite radius.

Turning now to the reciprocatory mechanism for obtaining expanding and contracting movement of the valve member 27, in Fig. 2, I show a relay, at 40, which includes an operating piston 41, arranged in the operating cylinder 42 and connected to the link 33. A pilot valve 43 serves to control the admission and exhaust of motive fluid to the operating cylinder to secure reciprocatory movements of the piston 41 and expansible and contractile movement of the valve member 27.

The stems 44 and 45 of the operating piston and of the pilot valve are pivotally connected to a floating lever 46 and one end of the latter is pivotally connected to a link 47 carried by the diaphragm 48 of the pressure-responsive device 49, which has a conduit 50 connected to the bleeder line 51, the latter being connected to the bleeder outlet 17. In order to adjust the desired bleeder pressure an adjustable weight 52 is carried by the floating lever 46 so that the force effective above the diaphragm 48 may be varied, thereby securing a variation in the steam pressure effective below the diaphragm through the necessary operation of the valve member 27.

From the foregoing, the operation of apparatus made in accordance with my invention will be apparent. The contractile and expansible valve member is moved inwardly and outwardly to vary the passage of motive fluid to the low-pressure section 13 in order to maintain a substantially constant bleeder pressure with variations in turbine load and in bleeder line requirements. The necessary movement of the valve member to secure this result is effected by means of a pressure-responsive device 49 associated with the bleeder conduit 51 and which acts through the relay 40 to apply reciprocatory movements to one end of the valve member 27. With a reduction in bleeder line pressure, the link 47 and the diaphragm 48 would move downwardly, with the result that the pilot valve 45 would move downwardly and motive fluid would be admitted below the operating piston 41 to move the latter upwardly in order to contract the valve member 27 and to restrict the flow of motive fluid to the low-pressure section 13 which result in a tendency to build up pressure, whereby the bleeder line pressure may be maintained with an increase in bleeder demand or with a decrease in the power requirements of the turbine. On the other hand, with an increase in bleeder pressure, incident to an increase in power requirements or to a decrease in bleeder demand, the pressure-responsive device 49 operates through the relay 40 to move the link 33 downwardly with the result that the valve member 27 is moved outwardly from its seat 22, thereby affording a freer passage for motive fluid to the low-pressure section 13, and consequently limiting the attainable pressure in the conduit 51.

If, at any time, it should be desired to change the bleeder pressure, this may be done by adjusting the weight 52. An increase in weight means a greater force to be overcome by the steam pressure from the conduit 51, with the result that a higher pressure may be maintained in the latter, while a decrease in the weight 52 results in a decrease in the bleeder pressure to be maintained.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In a bleeder turbine having a high-pressure section and a low-pressure section, a dividing member between the sections, a port in the dividing member for affording communication between the sections, and a contractile and expansible member for opening and closing the port.

2. In a bleeder turbine having a high-pressure section and a low-pressure section, a

dividing member between the sections, a plurality of ports in the dividing member for affording communication between the sections, and a contractile and expansible member for opening and closing the ports.

3. In a bleeder turbine having a high-pressure section and a low-pressure section, a dividing member between the sections, a plurality of ports in the dividing member for affording communication between the sections, a contractile and expansible member for opening and closing the ports, and pressure-responsive means for contracting and expanding said member.

4. In a bleeder turbine having a high-pressure section, a low-pressure section and a bleeder connection between the sections, a member for separating the sections located between the bleeder connection and the low-pressure section and having a plurality of ports to afford communication between the sections, a contractile and expansible member for opening and closing the ports, and means responsive to the pressure in the bleeder connection for contracting and expanding said member.

5. In a bleeder turbine having a high-pressure section and a low-pressure section, a member for separating the sections having a valve seat portion provided with a plurality of ports, a contractile and expansible valve member cooperating with said ports, and guides for said valve member.

6. In a bleeder turbine having a high-pressure section and a low-pressure section, a member for separating the sections having a hub portion defining a valve seat with a plurality of ports, a contractile and expansible valve member cooperating with said ports, lateral guides for the valve member, and means for limiting expansible movement of the valve member.

7. In a bleeder turbine having a rotor having a high-pressure section and a low-pressure section, a member for separating the sections having a hub portion defining a valve seat with a plurality of ports therein and having an inner packing portion for cooperation with the rotor, a contractile and expansible valve member cooperating with the valve seat, means for guiding the valve member, and means for limiting the expansible movement of the valve member.

8. In a bleeder turbine having a high-pressure section and a low-pressure section, a member for separating the sections having a circumferentially-extending valve seat with ports therein, a flexible valve member cooperating with the seat, and means for expanding and contracting the flexible valve member.

9. In a bleeder turbine having a high-pressure section and a low-pressure section, an annular member for separating the sections and having a ported valve seat portion curved circumferentially with respect to the turbine axis, and a flexible valve member cooperating with said ported valve seat portion and surrounding the latter.

10. In a bleeder turbine having a high-pressure section, a low-pressure section and a bleeder connection between the sections, a member for separating the sections and having a curved valve seat portion with a plurality of ports therein, a flexible valve member for opening and closing the ports, and means responsive to pressure in the bleeder connection for operating the flexible valve member.

11. In a bleeder turbine having a high-pressure section and a low-pressure section, a member for separating the sections and having a hub portion provided with ports therein for affording communication between the high-pressure section and the low-pressure section, an expansible and contractile valve member for opening and closing the ports, means for anchoring one end of the contractile and expansible member to said hub portion comprising a link pivotally connected to one end of said member and pivotally connected to said hub portion within the normal exterior surface thereof, and reciprocatory mechanism connected to the other end of the contractile and expansible member.

12. In a bleeder turbine having a high-pressure section and a low-pressure section, a member for separating the sections and having a hub portion provided with a plurality of ports and with a pocket or depression, an expansible and contractile member for covering and uncovering the ports, a link pivotally connected to one end of said expansible and contractile member and pivotally connected to said hub portion within the pocket or depression thereof, and reciprocatory mechanism connected to the other end of the expansible and contractile member.

13. In a bleeder turbine having a high-pressure section and a low-pressure section, a member for separating the sections and having a hub portion provided with a plurality of ports and an outwardly-flaring pocket or depression, a flexible member for covering and uncovering the ports, a link pivotally connected to one end of the flexible member and pivotally connected to said hub portion at the bottom of the pocket or depression, and reciprocatory mechanism connected to the other end of the flexible member.

14. In a bleeder turbine having a high-pressure section, a low-pressure section and a bleeder connection between the sections, a member for separating the sections located between the bleeder connection and the low-pressure section and having a hub portion provided with a plurality of ports and

an outwardly-flaring pocket or depression, a flexible member for covering and uncovering the ports, anchoring means for one end of the flexible member and which is pivotally connected to said hub portion at the bottom of the pocket or depression, reciprocatory mechanism connected to the other end of the flexible member, and pressure-responsive means connected to the bleeder connection to control the operation of said reciprocatory mechanism.

In testimony whereof, I have hereunto subscribed my name this 16th day of March 1923.

JOSIAH F. JOHNSON.