

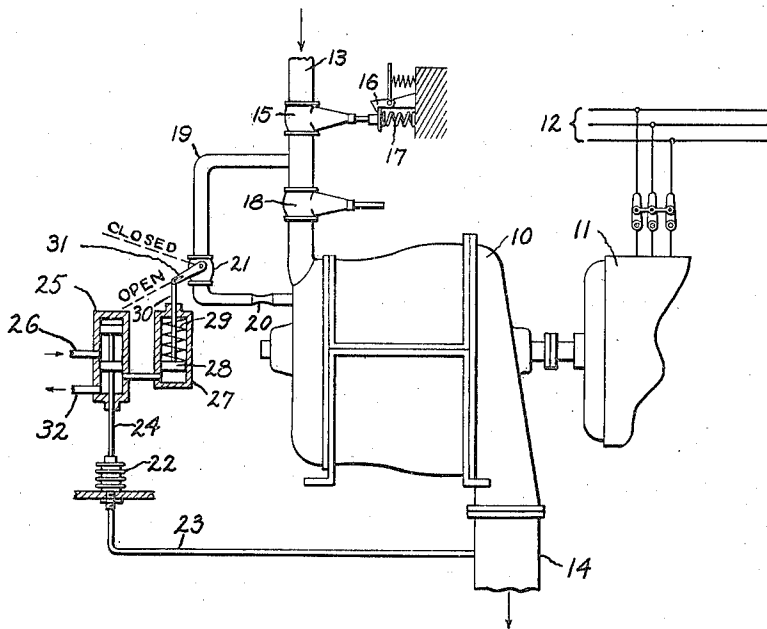
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ELASTIC FLUID TURBINE ARRANGEMENT

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ELASTIC FLUID TURBINE ARRANGEMENT

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This invention relates to elastic fluid turbine arrangements and more particularly to means for controlling the flow of elastic fluid to a non-condensing turbine during no-load operation thereof.

With non-condensing pressure governed turbines, means are usually provided for supplying a limited quantity of elastic fluid to the turbine independently of the regular admission valves. This is desirable for preventing overheating of the internal turbine parts due to the windage losses occurring therein in the event that the turbine is motored from the generator end of the set. The cooling elastic fluid is usually bypassed around the admission regulating valves and introduced into the first stage shell or, in some cases, through an individual nozzle in order to reduce the temperature of the elastic fluid a maximum amount in the first stage. The amount of elastic fluid introduced to the turbine through the by-pass connection is usually of the order of about one half no-load flow which is generally sufficient for maintaining the internal temperature of the turbine within safe limits. In the case of a non-condensing turbine installation with the turbine normally operating at a relatively high back pressure, this amount of cooling elastic fluid introduced through the by-pass connection is sufficient that if the back pressure were suddenly reduced to atmosphere or below the turbine would over-speed and cause the tripping of the emergency stop valve. Such over-speeding and tripping of the stop valve is, in most instances, undesirable.

It is an object of this invention to provide a new and improved arrangement for controlling the flow of elastic fluid supplied for cooling a non-condensing turbine during no-load conditions.

It is a further object of this invention to provide a new and improved arrangement for regulating the flow of elastic fluid supplied for cooling the non-condensing turbine during no-load conditions in response to predetermined exhaust pressure of the turbine.

For a consideration of what I believe to be novel and my invention, attention is directed to the following description and the claims appended thereto taken in connection with the accompanying drawing.

The single figure of the drawing is a diagrammatic representation of an elastic fluid turbine arrangement embodying my invention.

In the drawing, 10 is an elastic fluid turbine coupled for driving a generator 11 which nor-

5 mally supplies electric energy to the network 12. The turbine, which receives operating fluid through the supply conduit 13, is of the non-condensing type and exhausts through the conduit 14 to other elastic fluid consuming apparatus (not shown). The elastic fluid supply conduit includes a stop valve 15 which is normally retained in the opened position by a suitable restraining mechanism 16. This mechanism is adapted to be released upon the occurrence of some abnormal condition of the power plant, such as excess speed of the turbine, permitting the valve to be actuated to the closed position by a biasing spring 17. An elastic fluid admission valve 18, of any suitable type, is arranged for regulating the admission of elastic fluid to the turbine in accordance with any desired function. For example, the valve 18 may be regulated by suitable means (not shown) so as normally to maintain substantially constant the pressure in the exhaust conduit 14.

Upon the occurrence of certain abnormal conditions, such as the faulty operation of the admission valve 18 resulting in the closure thereof, the turbine may be motored through the generator end of the set by a reversal of power flow from the network 12 to the generator. To preclude consequent overheating of the internal turbine parts due to the windage losses occurring therein, provision is made for supplying a predetermined quantity of elastic fluid to the turbine independently of the admission valve 18. A by-pass conduit 19 extending from the conduit 13 after the stop valve 15 and around the admission valve 18 communicates with the first stage shell of the turbine. The conduit 19 is provided with a fixed orifice 20 for normally limiting the flow of elastic fluid passed through the by-pass connection. The flow of elastic fluid passed through the by-pass connection may be of the order of about one half no-load flow with normal back pressure existing in the conduit 14. Should the back pressure drop for some reason below a predetermined value, such as to atmosphere or below, the quantity of elastic fluid passed through the by-pass connection may be sufficient for causing over-speeding of the turbine and the tripping of the stop valve 15.

In accordance with this invention, I provide a valve 21 in the by-pass conduit which is adapted to be controlled in accordance with the pressure of the elastic fluid exhaust of the turbine 10, that is, the pressure existing in the conduit 14. A suitable pressure responsive device 22, in communication by connection 23 with the con-

duit 14, is arranged for actuating the stem 24 of a pilot valve 25 of a well-known form. The pilot valve is adapted to control the flow of operating fluid from a suitable source of supply through the connection 26 to an operating motor 27. The piston 28 of the motor, biased downwardly by the spring 29, is connected by the stem 30 to the operating arm 31 of the valve 21. The valve 21 is normally in the opened position but upon a predetermined decrease in the pressure in conduit 14, the pilot valve 25 is so adjusted as to pass operating fluid into the hydraulic motor 27 for moving the valve 21 to a predetermined closed position. The flow of elastic fluid through the by-pass connection will be thereby decreased to a value not likely to cause overspeeding of the turbine. Upon the normal condition of pressure being reestablished in the conduit 14, the pressure responsive device 22 will again be expended to move the pilot valve heads upwardly so as to allow drainage of the operating fluid from the motor 27 through the drain connection 32 and the reopening of the valve 21.

The pressure responsive device 22 and the pilot valve 25 may obviously be so arranged that the valve 21 will be adjusted or throttled in accordance with the percentage drop in pressure in the conduit 14 so that a sufficient quantity of elastic fluid will always be passed through the by-pass connection for maintaining the internal temperature of the turbine within safe limits. If desired, the by-pass valve 21 may be so arranged that even in its entirely closed position a fixed amount of cooling steam is allowed to pass through it by a slot provided in its seat or a hole drilled through its disk.

Having described the principle of operation of my invention together with the apparatus which I now consider to represent the best embodiment thereof, I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The combination comprising an elastic fluid non-condensing turbine, an elastic fluid admis-

sion valve for said turbine, conduit means including a by-pass valve for supplying elastic fluid to the inlet of said turbine independently of said admission valve, and means including a pressure governor for automatically controlling the bypass valve and arranged to hold the bypass valve open during idling operation of the turbine and normal back pressure condition and to move the bypass valve towards closing position in response to a predetermined drop in turbine discharge pressure to prevent overspeeding of the turbine during idling operation.

2. The combination comprising an elastic fluid non-condensing turbine, conduit means for supplying elastic fluid for said turbine, elastic fluid admission valves for said turbine, a stop valve in said conduit means for controlling the flow of elastic fluid to said admission valves, a by-pass conduit extending from said supply conduit after said stop valve and around said admission valves to said turbine, a fixed orifice in said by-pass conduit for limiting the flow of elastic fluid therethrough, a valve in said by-pass conduit, and means responsive to the exhaust pressure of said turbine for normally holding the last mentioned valve in open position and for closing said valve upon a predetermined decrease in exhaust pressure.

3. The combination comprising an elastic fluid turbine having an inlet conduit with an admission valve and an exhaust conduit, a bypass conduit with regard to the admission valve for supplying elastic fluid to the turbine while the admission valve is closed, a restriction to flow of fluid in the bypass, a throttle valve in the bypass ahead of the restriction as regards the direction of flow of fluid therethrough, a hydraulic motor connected to the throttle valve normally to hold the throttle valve in open position, a pilot valve for the motor, and a device responsive to pressure changes in the exhaust conduit for positioning the pilot valve, the pilot valve being arranged to effect movement of the motor and closing of the throttle valve only upon drop of the exhaust pressure to a predetermined low value.

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