

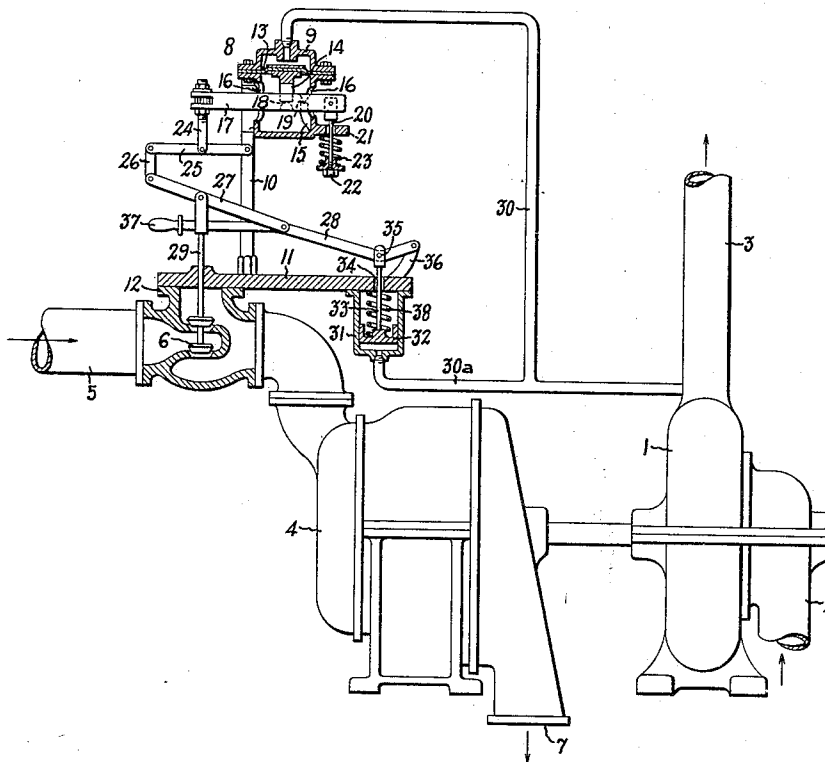
June 14, 1932.

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1,863,406

GOVERNING MECHANISM FOR TURBINE DRIVEN PUMPS

Filed March 9, 1931



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UNITED STATES PATENT OFFICE

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GOVERNING MECHANISM FOR TURBINE DRIVEN PUMPS

Application filed March 9, 1931. Serial No. 521,106.

The present invention relates to governing mechanisms for turbine driven machines, wherein the turbine is governed in terms of an operating condition of the driven machine.

One application of my invention is in connection with turbine driven pumps wherein the turbine is governed in terms of the discharge pressure of the pump, and it is this application of my invention which I have chosen to illustrate and describe.

It is to be understood, however, that the invention is not limited necessarily to this specific application.

When turbine driven pumps are governed in terms of the discharge pressure of the pump the arrangement is such that when the discharge pressure increases above the desired value the turbine control valve means is moved toward closed position to decrease the speed of the turbine to bring the pressure back to the desired value, and when the discharge pressure decreases the turbine control valve means is opened wider to increase the speed of the turbine to bring the discharge pressure back to the desired value. With such an arrangement it will be seen that decrease in discharge pressure effects opening movement of the valve means, and if the discharge pressure decreases to too low a value at a time when the pump is losing its load, a thing which may occur for example due to the pump losing its suction, the turbine will overspeed at a time when it should be shut down.

An object of my invention is to provide an improved governing means which will overcome the above difficulty, and for a consideration of what I believe to be novel and my invention attention is called to the following specification and to the claim appended thereto.

According to my invention I provide a governing means which, in the case of a turbine driven pump controlled by the pump discharge pressure, responds to decrease in pump pressure to effect opening of the valve means within predetermined limits, but which in case the pump discharge pressure decreases below a predetermined value func-

tions automatically to effect closing of the valve means to shut down the turbine.

In the drawing, the figure is a diagrammatic representation, partly in section, of my invention as applied to a turbine driven centrifugal pump.

Referring to the drawing, the centrifugal pump 1 having an inlet conduit 2 and a discharge conduit 3 is directly driven by the elastic fluid turbine 4. The turbine is supplied with operating fluid through a conduit 5, in which there is provided the usual admission valve 6, and also is provided with a suitable exhaust conduit 7. The admission valve is operated in accordance with the pressure in the discharge conduit 3 of the pump, and to this end there is provided a constant pressure regulator, denoted generally by the numeral 8, which is responsive to the pressure in the discharge conduit 3 and which is connected to the admission valve 6 so that variations in the pressure in the discharge conduit result in the admission valve being raised and lowered to increase or decrease the speed of the turbine to maintain the pressure in the discharge conduit constant.

In the form shown, the constant pressure regulator 8 consists of a casing 9 formed of an upper section and a lower section. The casing is suitably supported as by means of the support 10 which is mounted on an extension 11 of the steam chest 12 of the turbine. A flexible diaphragm member 13 is clamped at its edges between the upper and lower sections of the casing 9 while extending from the central portion of the diaphragm into the lower section of the casing is a bifurcated rod 14. Within the lower section of the casing 9, there is provided a bifurcated support 15. The walls of the lower section of the casing are slotted as shown at 16 and through these slots, which are in alignment with the slots in the rod 14 and the support 15, extends a bar 17, the bar being received between the furcations of the rod 14 and the support 15, while the ends of the bar project beyond the walls of the casing 9. Intermediate its length, the bar 17 is formed with upwardly projecting knife edges 18 on which rest the lower ends of the furcations of the

rod 14, and with downwardly projecting knife edges 19 which rest on the furcations of the support 15. At one end the bar 17 is pivotally connected to a rod 20 which is vertically movable in a perforated extension 21 of the casing 9. The lower end of the rod 20 is threaded to receive an adjusting nut 22. A coil spring 23 surrounds the rod 20 and bears at one end against the extension 21 of the casing and at the other end against the nut 22. Movement of the nut along the rod acts to vary the tension of the spring. The other end of the arm 17 is connected to a rod 24 which is pivotally connected to a lever 25 intermediate the ends thereof. One end of the lever 25 is pivotally connected to the support 10 while the other end is pivotally connected to one end of a link 26, the other end of which is pivotally connected to one end of a floating lever 27, while the other end of the lever 27 is pivotally connected intermediate the ends of an arm 28. Intermediate the ends of the floating lever 27 is pivotally attached thereto the stem 29 of the admission valve 6. The upper half of the casing 9 is perforated for the reception of one end of a pipe 30, the other end of which is connected to the discharge conduit 3 of the pump. The arrangement is such that the pressure in the discharge conduit 3 is impressed on the upper side of the diaphragm to force the rod 14 into engagement with the knife edges 18 which tends to swing the left hand end of the arm 17 downwardly about the fulcrum provided by the knife edges 19 and the supports 15. This turning movement of the arm 17 is resisted by the spring 23 which can be adjusted to properly balance the arm 17 for any predetermined value of the pressure in the discharge conduit 3.

With the parts arranged as described and the spring 23 adjusted to properly balance the arm 17 against a predetermined pressure in the discharge conduit 3, it will be apparent that there will be no movement of the admission valve 6 and the speed of the turbine will remain unchanged. If for any reason the pressure in the discharge conduit should increase, it will be seen that the pressure on the upper side of the diaphragm will be greater than the pressure on the lower side imparted by the spring 23, and the admission valve will be lowered to decrease the speed of the turbine which results in a decrease in the pressure in the discharge conduit of the pump until the pressure has been restored to its predetermined value. On the other hand, if the pressure in the discharge conduit decreases, the tension of the spring 23 will overcome the pressure on the upper side of the diaphragm and will cause the left hand end of the arm 17 to move upwardly to raise the admission valve 6, to admit more driving fluid to the turbine. This results in increasing the speed of the turbine which increases

the pressure in the discharge conduit until such pressure is restored to its original value.

If the pressure in the discharge conduit of the pump decreases to a sufficiently low value at a time when the pump is losing its load, (and the decrease in pressure may be due to the fact that the pump is losing its load) it is apparent that the speed of the turbine will tend to rise and that the turbine might over-speed and wreck itself as well as the pump. In order to avoid the possibility of the turbine attaining such a speed I provide means responsive to the pressure in the discharge conduit of the pump which, when the pressure in the pump decreases to a predetermined low value, acts to shut off the supply of driving fluid to the turbine, thereby shutting down the turbine completely. This means comprises a cylinder 31, attached to the extension 11 of the steam chest, in which operates a piston 32. The piston rod 33 extends through a perforation 34 in the extension 11 and has its free end pivotally connected as at 35 to the arm 28. A bracket 36, mounted on the extension 11, serves as a support for one end of the arm 28, while the other end of the arm is formed as a handle 37. The bottom of the cylinder 31 is connected to the pipe 30 by means of a pipe 30a whereby the lower face of the piston 32 is subject to the pressure in the discharge conduit 3. Upward movement of the piston in the cylinder is opposed by a tension spring 38 which surrounds the piston rod and which has one end bearing against the piston and the other end against the extension 11. The tension of the spring 38 is such that when the pressure in the conduit 30a decreases below a predetermined value, the spring acts to force the piston toward the bottom of the cylinder. This movement of the piston results in the left hand end of the arm 28 being pulled downwardly carrying the right hand end of the floating lever 27 with it, which moves the admission valve to closed position to shut off the supply of driving fluid to the turbine. Normally with the parts arranged as shown, the pressure in the discharge conduit 3 will be of a value sufficient to maintain the piston 32 in raised position against the action of the spring 38, while any slight decrease in the pressure will not permit the spring to move the piston downwardly far enough to close the admission valve. Such decreases in the pressure of the discharge conduit up to a predetermined value will result in actuating the constant pressure regulator 8 to open the admission valve to speed up the turbine, to restore the pressure to its original value. However, should the pressure fall below the predetermined value, the tension of the spring 38 will be sufficient to move the piston downwardly far enough to completely close the admission valve and shut off the supply of driving fluid to the turbine, the

tension of the spring 38 being sufficient to maintain the valve 6 closed against the force of the spring 23 tending to raise the valve.

In order to start the turbine it is merely
5 necessary to open the throttle valve (not shown) to admit the driving fluid to the conduit 5 and then to raise the handle 37 which raises the admission valve 6. When the turbine has come up to a speed sufficient to produce the desired pressure in the discharge
10 conduit 3, the pressure in the conduit 30a will raise the piston 32 and the regulation of the admission valve will be taken over by the constant pressure regulator.

15 From the foregoing it will be apparent that I have provided a governing device which is responsive to the pressure in the discharge conduit of the pump and which acts, when the pressure falls below a predetermined value, to shut off the supply of driving fluid to the turbine, thereby providing an emergency protection.

In addition to the governing means described, the turbine may be provided with an
25 emergency speed governor of the usual type for shutting down the turbine in case of excess speed. This is not illustrated, as it is an ordinary part of an elastic fluid turbine and forms no part of my present invention.

30 In accordance with the provisions of the patent statutes I have disclosed what I now consider to represent the best embodiment of my invention, but it is to be understood that the disclosure is merely illustrative and that
35 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,—

In combination, an elastic fluid turbine, a
40 pump driven thereby, a valve controlling the supply of elastic fluid to the turbine, a floating lever, means connecting the valve to the floating lever, means including a movable abutment which forms a fulcrum for the
45 floating lever, means for subjecting said abutment to the discharge pressure of the pump for holding said abutment in fixed position, means for moving said lever on its fulcrum in accordance with the discharge pressure of
50 the pump for regulating said valve, and means for moving said abutment to close said valve when the pump discharge pressure decreases below a predetermined value.

In witness whereof, I have hereunto set
55 my hand.

MAX B. HUDSON.