O. JUNGGREN & E. D. DICKINSON.

GOVERNING MECHANISM FOR TURBINES.

APPLICATION FILED JAN. 3, 1911.

1,023,319. Patented Apr. 16, 1912.

2 SHEETS-SHEET 1.

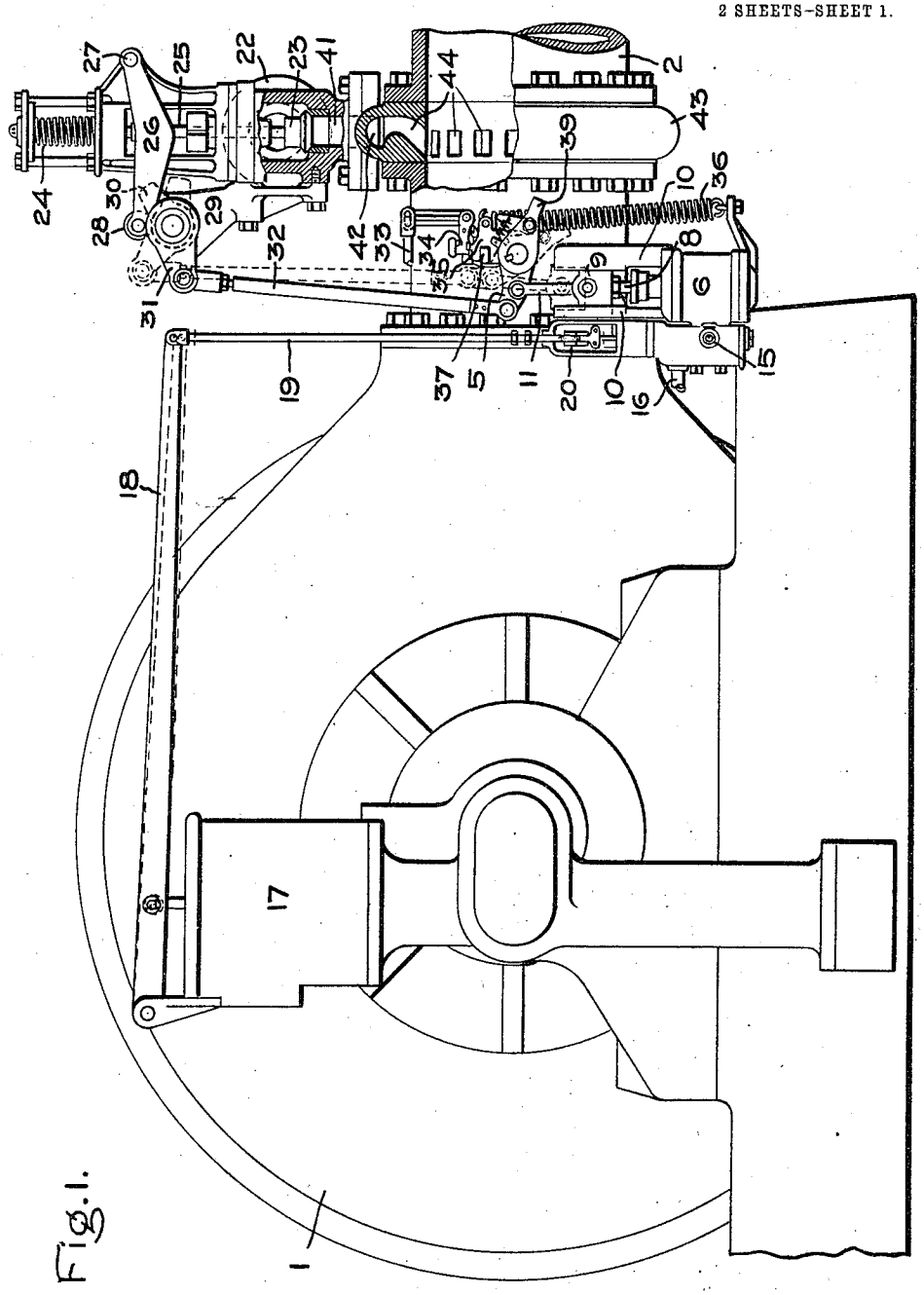

Fig. 1.

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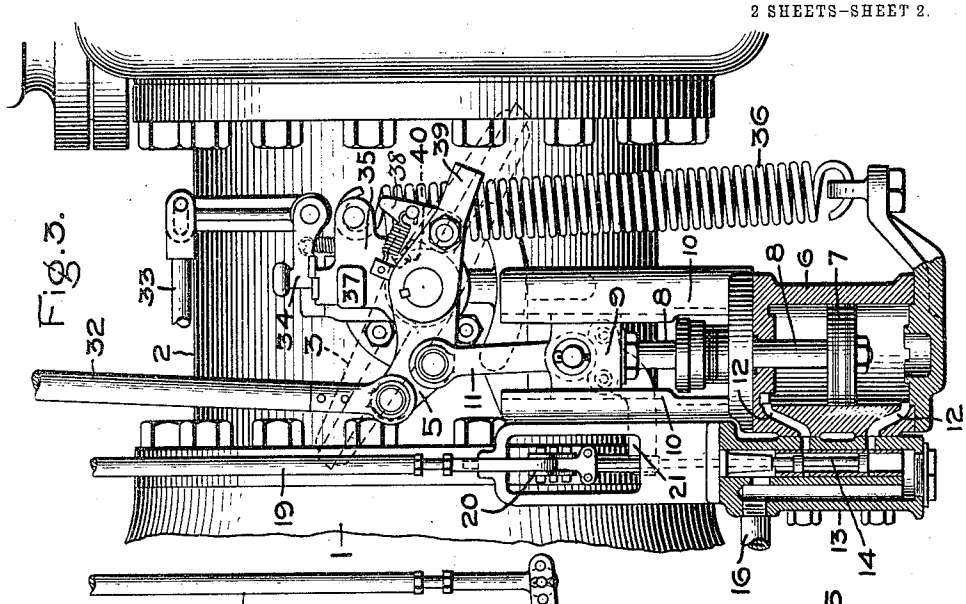
2 SHEETS-SHEET 2.

Fig. 3.



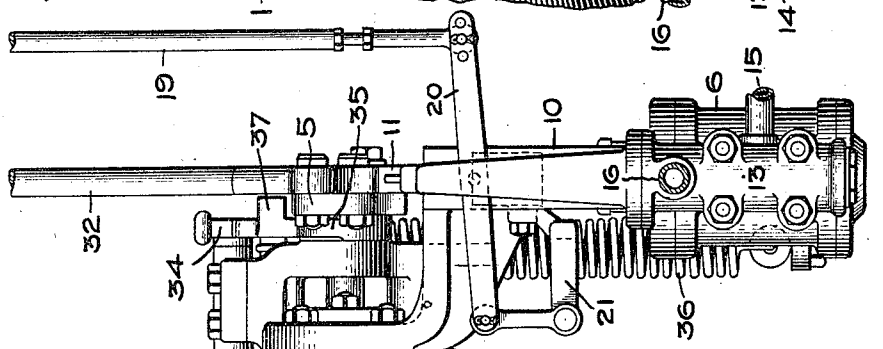
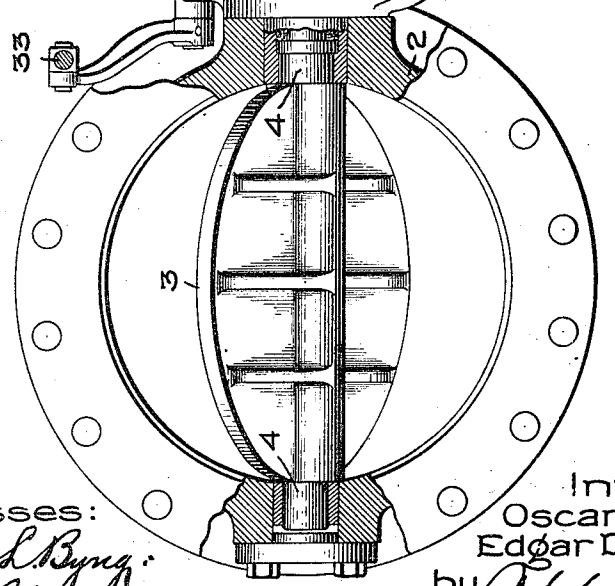


Fig. 2.



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UNITED STATES PATENT OFFICE.

OSCAR JUNGGREN AND EDGAR D. DICKINSON, OF SCHENECTADY, NEW YORK, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

GOVERNING MECHANISM FOR TURBINES.

1,023,319. Specification of Letters Patent. Patented Apr. 16, 1912.

Application filed January 3, 1911. Serial No. 600,439.

To all whom it may concern:

Be it known that we, OSCAR JUNGGREN and EDGAR D. DICKINSON, citizens of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Governing Mechanism for Turbines, of which the following is a specification.

This invention relates to elastic-fluid turbines which are normally actuated by low-pressure or exhaust steam, but which are also provided with means for supplying steam from a source at high pressure, such as a boiler, in order to carry the load when there is a deficiency of the supply of low-pressure steam.

The object of our invention is to enable high-pressure steam to be used to supplement the exhaust steam supply, when necessary, by means of simple and inexpensive mechanism. To this end, we provide means for admitting said high-pressure steam directly into the low-pressure supply main, so that it passes to the same nozzles as the low-pressure steam.

Our invention contemplates such an arrangement of valves and valve-controlling mechanism as to cause the low-pressure admission valve or valves to be opened almost, if not quite, to fullest extent before the high-pressure steam is admitted, and to shut off said high-pressure steam before the low-pressure valve appreciably closes the low-pressure supply main.

In the accompanying drawings, Figure 1 is an end elevation of a turbine equipped with our improved mechanism; Fig. 2 is an elevation of the valve which controls the low-pressure steam main in connection with the mechanism by means of which the high-pressure steam is admitted to said main; and Fig. 3 is a side elevation of said mechanism, partly in section.

The turbine casing is shown at 1 and the low-pressure steam main 2 is connected with it at any convenient point. The main is provided with a relief valve of any approved construction (not shown) to safeguard the apparatus against damage by any rise of pressure above the designed amount. In said main is a suitable valve for controlling the flow therethrough. We have illustrated a butterfly valve 3 mounted on trunnions 4, one of which extends out through a bearing, but the invention is not limited to the particular type of valve illustrated. Rotatably mounted on the projecting end of said trunnion is a crank 5 by means of which the valve can ordinarily be opened and closed under the control of the governor 17. Keyed to the end of the trunnion 4, Fig. 3, is an arm 39 on which is pivoted a locking device 40 that normally engages a notch in the hub of the crank 5 and causes movements of the crank to be transmitted to the valve 3. When the locking device is drawn out of the notch, the trunnion and valve can move independently of the crank. The crank is preferably operated by a hydraulic motor, comprising a cylinder 6 in which works a piston 7 whose rod 8 is attached to a crosshead 9 sliding in ways 10 rising from the upper head of the cylinder. A connecting rod 11 is pivoted to said crosshead and to the crank 5. Ports 12 connect the ends of the cylinder with a valve chest 13 in which works a pilot valve 14 provided with two pistons. Hydraulic or other pressure is admitted between said pistons through a pipe 15, the exhaust being through the pipe 16. The stem of this piston or pilot valve is connected to a rod arranged to be operated by the speed governor 17 of the turbine, preferably through a lever 18, Fig. 1, rod 19 and floating lever 20, the latter being pivotally connected with the valve stem and also with an arm 21, Fig. 2, projecting from the crosshead 9, thereby constituting a "follow-up" device.

The high-pressure steam pipe 22 is connected with the low-pressure main 2 at any convenient point. It is controlled by a valve 23. The passage 41 leading from valve enters an annular chamber 42 in the fitting 43. The steam passes from the chamber into the main through a series of passages 44 inclined toward the direction of flow in the main. The valve 23 is normally held closed by suitable means, such as the spring 24 acting upon its stem 25. A lever 26, fulcrumed at 27 to the frame of the valve, engages with said stem, and is operated from the crank 5 through a lost-motion device. We have shown the free end of this lever preferably provided with an antifriction roller 28 which rests normally upon a cylindrical hub journaled in a bracket 29 and provided with a cam or wiper 30 adapted to engage with and lift the lever and the valve 23,

Said hub is also provided with a rock-arm 31 which is connected by a rod 32 with the crank 5 of the butterfly valve.

The operation is as follows: During the normal movement of the butterfly valve in turning from its closed position to one in which it is at or near its wide open position (as shown in full lines in Fig. 2, and in Fig. 3 in dotted lines), the roller 28 merely rests upon the hub and is not affected by the rotation thereof. But as soon as the piston 7 of the hydraulic motor moves below the position in which it appears in Fig. 3, the consequent downward movement of the crank 5 pulls down the rod 32 to such an extent that the cam 30 lifts the lever 26 and opens the valve 23, thus admitting steam from the high-pressure source to the main 2. The turbine will thus be operated by the low-pressure steam until the supply of such steam with the butterfly valve open to the extent shown in Fig. 2 is insufficient to carry the load. Beyond this point, the high-pressure valve 23 will begin to open and admit high-pressure steam to supplement the low-pressure fluid and enable the turbine to meet the demand upon it. As soon as the supply of exhaust steam again becomes normal or the load falls off to a point where the more or less diminished supply of low-pressure steam can cope with it, the high-pressure valve will close under the action of the hydraulic motor controlled by the speed governor, and the regulation will thereafter proceed with reference to the butterfly valve only. While the high-pressure valve is opening, the butterfly valve will oscillate to its wide open position or a little beyond, returning to the position shown when the high-pressure valve closes again.

The drawings illustrate an emergency cut-off which forms no part of this invention, but which is an essential part of the apparatus as actually installed. This forms the subject matter of a separate application for a patent. For the purposes of the present application, it is sufficient to say that the rod 33 is under the control of an emergency governor (not shown) which, if the speed of the turbine becomes excessive, acts to trip the latch 34 and release the tumbler 35 which is freely rotatable about the spindle of the butterfly valve. The spring 36 instantly turns this tumbler, causing its lug 37 to strike the tail 38 of the lock 40, that normally connects the valve 3 and the crank 5, and thereby release the valve from the crank so that said valve is closed by the further movement of the tumbler under the action of the spring 36, thus shutting off all the steam and stopping the turbine.

In accordance with the provisions of the patent statutes, we have described the principle of operation of our invention, together with the apparatus which we now consider to represent the best embodiment thereof; but we desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What we claim as new and desire to secure by Letters Patent of the United States, is,—

1. The combination with an elastic fluid turbine, of a low pressure steam main, a rotary valve controlling the main, means for rotating the valve, a high pressure steam pipe connected with the main, a valve controlling the high pressure pipe, a device for operating the high pressure valve, a governor, and mechanism controlled by the governor for actuating said means and device.

2. The combination with an elastic fluid turbine, of a low pressure steam main, a valve controlling the main, means for operating the valve, a valve chest mounted on the low pressure main, a high pressure steam pipe connected to the chest, a valve that controls the flow from the chest to the main, a cam for operating the high pressure valve that opens said valve after the low pressure valve has been opened, a governor, and mechanism controlled by the governor for actuating said means and cam.

3. The combination with an elastic fluid turbine, of a low pressure steam main, a rotary valve controlling the main, a crank for moving the valve, governor controlled means for actuating the crank, a high pressure steam pipe connected with the low pressure main, a valve controlling said pipe, means for operating the high pressure valve, and a connection between the crank and said means.

4. The combination with an elastic-fluid turbine, of a low-pressure steam main, a valve controlling the main, a high-pressure steam pipe connected with said low-pressure main, a valve controlling said pipe, a cam for operating the high pressure valve, means for operating said low-pressure valve, and a connection between said means and the cam, said cam being inoperative with respect to the high-pressure valve until the low-pressure valve is at or near its wide open position.

5. The combination with an elastic-fluid turbine, of a low-pressure steam main, a butterfly valve controlling said main, a high-pressure steam pipe connected with said low-pressure main, a valve controlling said pipe, a crank for actuating said butterfly valve, a lever for actuating said high-pressure valve, means for actuating the crank, and a lost-motion device between the crank and said lever.

6. The combination with an elastic-fluid turbine, of a low-pressure steam main, a butterfly valve controlling said main, a

high-pressure steam pipe connected with said low-pressure main, a valve controlling said pipe, a crank on the shaft of the butterfly valve, a lever for actuating said high-pressure valve, a rock-arm and wiper for operating said lever, and connections between said crank and rock-arm permitting the butterfly valve to be opened to or near to its wide open position before the wiper acts upon the lever of the high-pressure valve.

7. The combination with an elastic-fluid turbine, of a main normally supplying the turbine with low-pressure steam, a fitting in the main having an annular chamber and passages leading from the chamber to the main, a high-pressure steam pipe connected to the chamber, a valve for regulating the flow through the high-pressure pipe, and a governor for controlling the valve that opens it to supplement the supply of low-pressure steam under certain conditions.

In witness whereof, we have hereunto set our hands this 30th day of December, 1910.

OSCAR JUNGGREN.
EDGAR D. DICKINSON.

Witnesses:
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HELEN ORFORD.