R. H. RICE.

THROTTLE VALVE FOR TURBINES.

APPLICATION FILED SEPT. 22, 1909.

1,021,213. Patented Mar. 26, 1912.

Fig. 1.

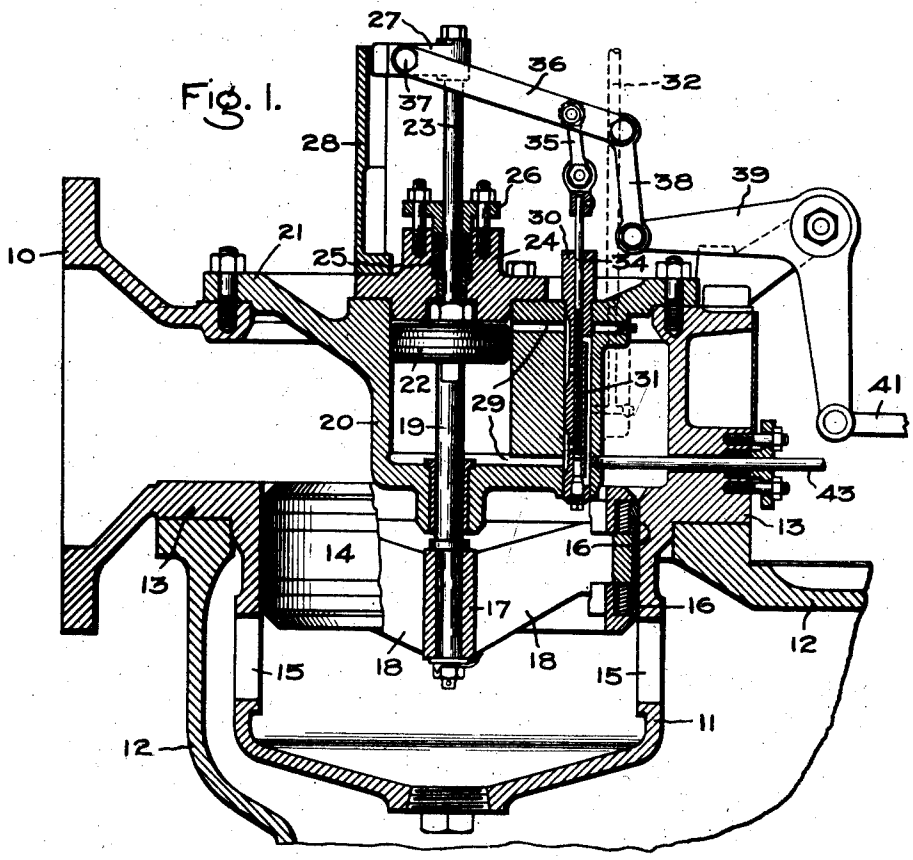
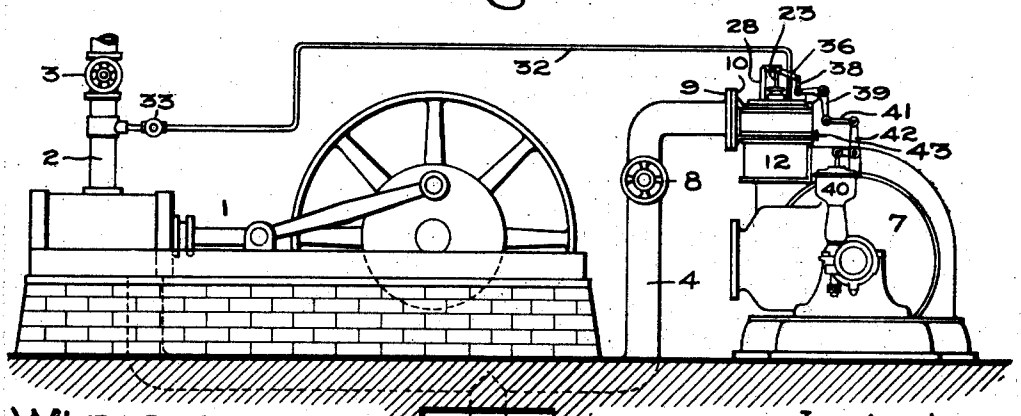


Fig. 2.



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UNITED STATES PATENT OFFICE.

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THROTTLE-VALVE FOR TURBINES.

1,021,213. Specification of Letters Patent. Patented Mar. 26, 1912.

Application filed September 22, 1909. Serial No. 518,926.

To all whom it may concern:

Be it known that I, RICHARD H. RICE, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Throttle-Valves for Turbines, of which the following is a specification.

This invention relates to valves for controlling the supply of motive fluid to elastic fluid turbines and is illustrated as applied to turbines which are driven by the exhaust steam from high pressure reciprocating engines. The turbine is provided with a throttle valve which is controlled by a speed-responsive device. A pilot valve, actuated by said device, governs the flow of fluid pressure to a movable abutment mechanically connected to the throttle valve. Sometimes it is not desirable to use the exhaust steam to actuate said abutment because the pressure and amount of said exhaust steam are subject to wide fluctuations.

My invention therefore provides for a supply of high pressure live steam to the chest of the pilot valve for the purpose of moving the throttle valve but is not limited to that particular fluid. However, by using live steam the operation of the throttle valve can be controlled by a stop valve in the live steam pipe independently of the reciprocating engine.

Another feature of my invention is that the throttle valve and its actuating mechanism constitute a unitary device, which is assembled by itself and is then placed bodily in its position on the turbine casing.

Other points of advantage will appear in the following description, taken in connection with the accompanying drawing, in which:—

Figure 1 is a vertical section of the valve mechanism; and Fig. 2 is a diagrammatic representation of the engine, the turbine and the connecting piping.

Referring first to Fig. 2, the reciprocating engine 1 is supplied with high pressure live steam through the main 2, controlled by the valve 3. The exhaust steam conduit 4 may lead to an escape pipe 5; but I provide this pipe 5 with a stop-valve 6 so that it can be closed, the exhaust conduit being extended to a low pressure turbine 7. The flow of the exhaust steam to said turbine is controlled by a stop valve 8. The conduit 4 has a terminal flange 9 by which it can be attached to the flanged nozzle 10 on the casing of my improved throttle valve. The lower portion 11 of said casing is cylindrical in order to fit into an opening in the upper side of the steam chest 12 of the turbine. This portion of the casing depends into said chest and has a circumferential flange 13 at its upper end which is faced off to make a tight joint with the top of the chest adjacent to said opening. The interior of this portion 11 of the casing is bored out cylindrically to receive the tubular throttle valve 14, which coöperates with ports 15 in the walls of said casing. The rim of the valve is provided with packing rings 16, while the hub 17, which is connected with the cylindrical rim by the spokes 18, is mounted on an upright stem 19. A certain amount of play is allowed between the stem and the walls of the opening in the hub, so that the valve can shift laterally to make up for lack of proper alinement due to distortion or other causes.

The stem 19 passes up through a bushed opening in the bottom of a cylinder 20 which is cast integral with the lid 21 of the casing. A packed piston 22 fits steam-tight in said cylinder, and is secured to the upper end of the stem. A piston-rod 23 extends up through the head 24 of the cylinder, the joint being made steam-tight by packing 25 compressed in a stuffing-box by a gland 26. An arm 27 is secured to the upper end of the piston-rod and engages with a vertical guide-way 28 rising from the head 24.

Ports 29 extend from each end of the cylinder to a valve chest formed in a sleeve 30 inserted in a hole drilled in a thickened portion of the cylinder. A pivot valve 31 plays lengthwise in said sleeve and controls the admission to and exhaust from said ports of suitable fluid pressure, preferably live

steam, which is supplied through a pipe 32 running from the main 2, and controlled by a globe-valve 33. The pilot valve is preferably a double-piston valve, as shown, and its stem 34 is connected by a link 35 with a floating lever 36, pivoted at 37 to the arm 27 and at the other end to a link 38 connected to a bellcrank lever 39. A speed-responsive device 40, driven by the turbine shaft, is connected to said bell crank lever, preferably by the link 41 and elbow lever 42.

The operation of the device is as follows: The parts are shown with the throttle valve wide open, admitting the exhaust steam from the conduit 4 to the steam chest of the turbine. If the speed of the turbine exceeds a predetermined limit, the speed responsive device 40 lifts the pilot valve, the lever 36 fulcruming at 37. This admits steam above the piston 22, which at once descends and causes the throttle valve 14 to partly close the ports 15. The steam below the piston exhausts through the pipe 43. The descent of the arm 27 pulls down the lever 36, which now fulcrums on the link 38. This pushes down the pilot valve, which shuts off the steam and the throttle valve stops. If the turbine continues to gain in speed, this "follow-up" operation will be repeated again and again until the throttle valve has closed to a point at which the turbine resumes its normal speed. Any slowing down of the turbine below its normal speed will produce a contrary effect and open the throttle sufficiently to counteract the drop in speed.

It will be observed that this valve with its casing, operating mechanism, and follow-up mechanism, can be constructed in the shop as a complete device and then mounted upon the turbine. This greatly facilitates its manufacture. Furthermore, the parts are simple, and can be easily assembled. It is unnecessary to pack the stem 19 where it passes from the cylinder 20 into the casing 11 because any steam leaking through will flow directly into the turbine and will be utilized advantageously therein.

In accordance with the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can 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 with a turbine having a steam chest provided with an opening, of a throttle valve, a casing therefor having a cylindrical lower portion depending through said opening and provided with ports a tubular valve movable in said casing a lid for the casing, a cylinder on the lid, a piston in the cylinder, a piston rod which also forms a stem for the valve and projects outwardly from the cylinder, a valve controlling the supply of motive fluid to the cylinder, a lever for operating said valve, and a pivotal connection between the lever and the projecting end of the rod.

2. The combination with a turbine having a steam chest provided with an opening, of a throttle valve, and a casing therefor having a cylindrical lower portion depending through said opening and provided with ports, a tubular valve movable in said casing, a lid for said casing, a cylinder carried by the lid, a piston in said cylinder, and a stem connecting said piston and valve, said valve having a certain amount of lateral play on said stem.

3. The combination with a low pressure turbine, of a throttle valve for controlling the admission of motive fluid to the turbine, a casing for the valve, a cylinder carried by the casing, a piston in the cylinder, a piston rod which is also connected to the turbine valve and forms a stem for the latter, a source of high pressure steam, a valve for controlling the supply of high pressure steam from said source to the cylinder to operate the piston, a lever for operating said cylinder valve, a speed responsive device connected to the lever, and a pivotal connection between the lever and the piston rod.

4. The combination with a turbine, of a throttle valve therefor, a casing for the valve, a cylinder carried by the casing, a piston in the cylinder for operating said valve, a piston rod which also forms a stem for the valve, a pilot valve for controlling the admission of steam to the cylinder to operate said piston, a speed responsive device for operating the pilot valve, and follow-up connections between the pilot valve and the piston rod.

5. The combination with a casing having a flanged nozzle and a cylindrical lower portion provided with ports, of a tubular valve controlling said ports, a lid for said casing having an integral cylinder, a piston in said cylinder connected with said valve, a piston rod, a floating lever pivoted to said rod, a pilot valve for said cylinder connected with said lever, and a bellcrank lever mounted on the casing and pivotally connected with said floating lever.

6. The combination of a casing having a cylindrical lower portion provided with ports and a chamber above said portion, means supplying steam to the chamber, a valve in the cylindrical portion which controls the flow from the chamber through the ports, a lid on the chamber end of the casing, a cylinder carried by the lid, a piston in the cylinder, a piston rod which also

forms a stem for the valve and projects outwardly from the cylinder, a guide for the outer end of the rod, a lever pivoted to the outer end of said rod, a valve for controlling the flow of motive fluid to the cylinder to operate the piston, a stem for said valve arranged parallel to the rod, a link connecting the end of the stem to the lever, a speed responsive device, and a connection between said device and the lever.

In witness whereof, I have hereunto set my hand this 20th day of September, 1909.

RICHARD H. RICE.

Witnesses:
JOHN A. McMANUS, Jr.,
CHARLES A. BARNARD.