R. H. RICE.

VALVE GEAR.

APPLICATION FILED JUNE 29, 1917.

1,297,249. Patented Mar. 11, 1919.

Fig. 1.

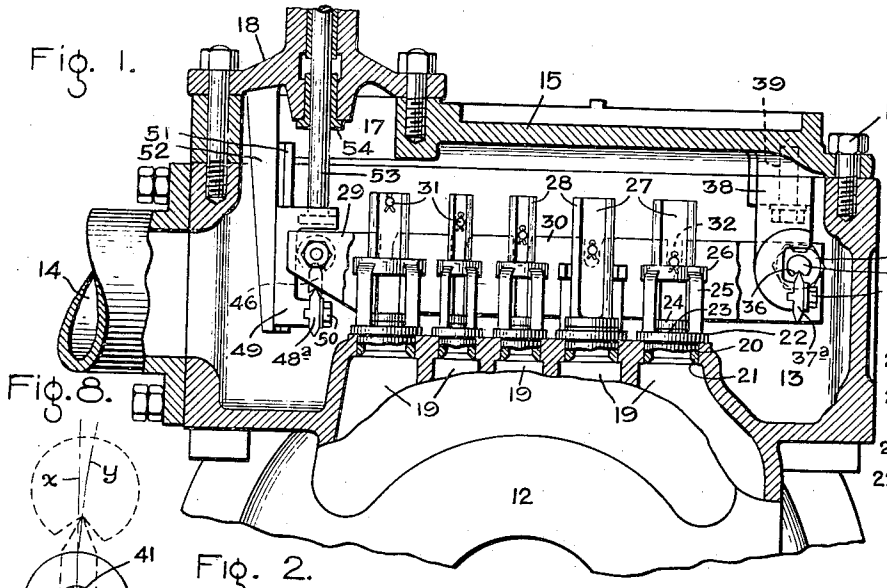


Fig. 11.

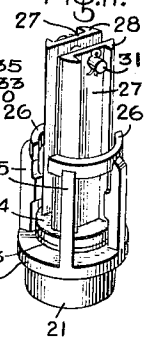


Fig. 8.

Fig. 2.

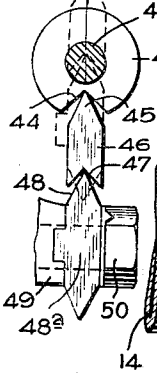
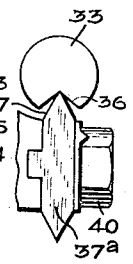


Fig. 9.



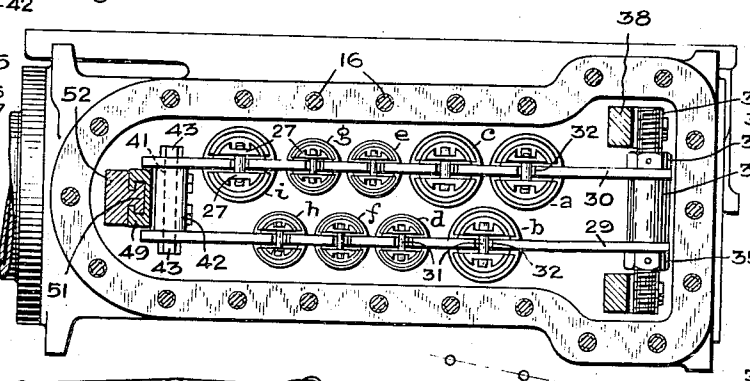


Fig. 7.

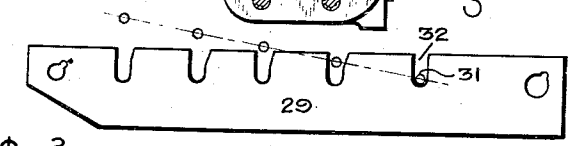


Fig. 3.

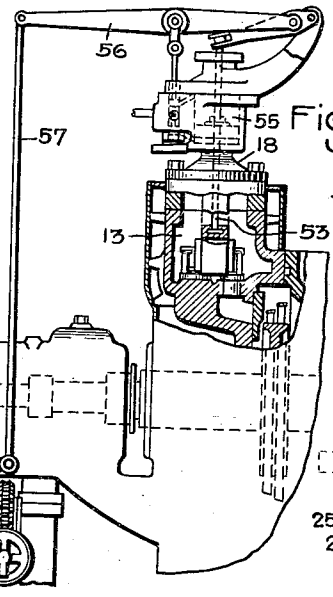


Fig. 10.

Fig. 4.

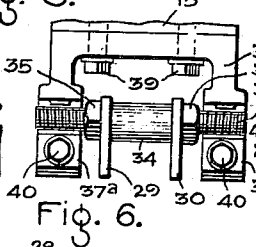


Fig. 6.

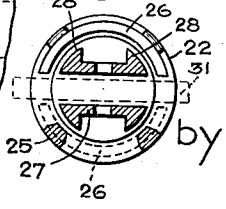
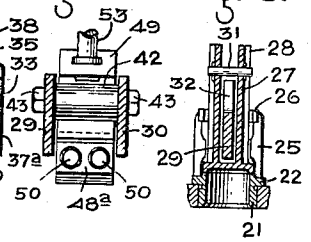


Fig. 5.



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by Albert G. Davis
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UNITED STATES PATENT OFFICE.

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VALVE-GEAR.

1,297,249. Specification of Letters Patent. Patented Mar. 11, 1919.

Application filed June 29, 1917. Serial No. 177,840.

To all whom it may concern:

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

The present invention relates to valve gears such as are utilized for example in controlling and regulating the admission of motive fluid to an elastic fluid turbine, and has for its object to provide an improved structure in an apparatus of this character.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying specification and the claims appended thereto.

In the accompanying drawing which illustrates one embodiment of the invention, Figure 1 is a vertical sectional view through the steam chest of an elastic fluid turbine showing the valve mechanism therein partly in section and partly in elevation and with certain parts broken away; Fig. 2 is a top plan view of the valve mechanism within the steam chest, certain parts being shown in section; Figs. 3 to 9 are detail views of various parts; Fig. 10 shows a portion of a turbine illustrating an arrangement wherein the valve mechanism is actuated by an automatic speed governor, and Fig. 11 is a perspective view of one of the valves.

Referring to the drawing, 12 indicates an elastic fluid turbine and 13 a fluid chest to which elastic fluid is admitted through a conduit 14 and from which it flows to the turbine through a valve mechanism, the construction and arrangement of which forms the subject matter of this invention. The fluid chest has a top plate 15 held in place by bolts 16 and in this top plate is an opening 17 closed by the cover 18. In the head of the turbine of which the valve chest 13 forms a part are a series of passages 19 which convey elastic fluid from the chest to the admission nozzles of the turbine, the passages leading to nozzles at different points around the periphery of the machine, as is well understood. The elastic fluid flows from the chest 13 to the passages 19 through openings 20 which are arranged in two rows and are staggered relative to each other so that close regulation can be obtained, as is explained more fully hereinafter. In each of the openings 20 is fixed a sleeve 21 having a flanged head 22, on the top surface of which is a valve seat 23, and engaging the valve seat 23 is a disk valve 24. Carried by each head 22 is a guide means comprising arms 25, to the free ends of which are connected arcuate strips 26, and engaging with said guide means is a pair of spaced parallel uprights 27 carried by the disk valve 20. The uprights 27 have rounded ridges 28 which engage said guide means. The valves are lifted by means of a lever comprising two parallel arms 29 and 30 which extend between the uprights 27 of each row of valves and engage pins 31 carried by the uprights, the arms being preferably provided with slots 32 adapted to receive the pins. The arrangement is such that the lever arms 29 and 30 engage the pins 31 one after another to successively lift the valves 24 from their seats, and to this end the pins 31 may be arranged at different distances above the lever arms. The lever arms 29 and 30 are fastened together at their right-hand ends by a bolt 33, being held in spaced relation to each other by a sleeve 34 which surrounds the bolt and against the ends of which they are clamped by nuts 35. The ends of bolt 33 project beyond the nuts 35 and are provided with V-shaped grooves 36 (Fig. 9) which engage knife edges 37 on members 37^a carried by a support 38 fixed to the cover plate 15 by bolts 39. The support 38 comprises a U-shaped frame as shown in Fig. 3, and the knife edge members 37^a are detachably connected to the arms of this frame by means of bolts 40 as shown particularly in Fig. 9. By this arrangement the knife edges can be very readily renewed when found necessary. This forms an anti-friction pivotal bearing for the one end of the lever comprising arms 29 and 30. The other ends of lever arms 29 and 30 are carried by a bolt 41, being spaced apart thereon by a sleeve 42 against the ends of which they are held by the nuts 43. The sleeve 42 has a V-shaped groove 44 in it (Fig. 8) with which engages the knife edge 45 on a member 46 in the lower surface of which is a groove 47 engaged by a second knife edge 48 on a member 48^a carried by a frame 49. The knife edge member 48^a is detachably connected to the frame 49 by a bolt 50 so that it may be readily removed for repair or renewal. The frame 49 has a tongue and groove connection, as indicated

at 51, with a guide 52 carried by the cover 18. Suitably connected with the frame 49 is a rod 53 which passes through a stuffing box 54 and a cover plate 18. By means of this rod the frame 49 can be slid vertically on the guide 52 to lift the one end of the lever arms 29 and 30, the other ends pivoting on the anti-friction bearing comprising grooves 36 and knife edges 37. The object of the intermediate piece 46 is to permit the lever arms 29 and 30 to swing in the arc of a circle upon a vertical movement of the frame 49. The action which takes place is clearly illustrated in Fig. 8 where the line x indicates the vertical line upon which the frame 49 moves, and the line y the curved line upon which the ends of lever arms 29 and 30 move.

The rod 53 may be operated by hand or in any other suitable manner. In the present instance it is shown as being connected with a well known type of valve actuating mechanism comprising a fluid actuated motor 55 suitably connected through lever 56, rod 57 and three arm lever 58 to a speed governor 59. The operation of such a valve actuating mechanism is well known and needs no further description.

As best shown in Fig. 2 the valves are arranged in two rows, the valves in one row being staggered relative to those in the other row. This gives a close compact arrangement and one making the most advantageous use of the space available. When the lever arms 29 and 30 are raised the valves are opened in the order a, b, c, d, e, f, g, h, i, and when the lever arms are lowered they are closed in the reverse order. The valves a, b and c and i are larger than the remaining valves and are arranged to admit elastic fluid to a larger number of nozzles. When the turbine is operating at around the normal load, the valves a, b and c are open and the regulating takes place on valves d, e, f, g, and h, depending on the load. As these valves are small a close regulation can be obtained. Such a close regulation is not necessary at light loads as the turbine seldom operates for any length of time at light loads. The first valves to open are accordingly made larger as it effects a saving in the number of valves, and the cost of manufacture. The valve i is an overload valve which only comes into play in case of a heavy overload on the machine. It will be understood, of course, that the arrangement of the valves as to size may be varied for different machines designed for different conditions of operation, the idea maintained being to have the smaller valves at the points where close regulation is desired.

In the above described arrangement, it will be noted that all the valve mechanism is arranged within the steam chest and that the only part passing through the casing is the operating rod 53. This means that only a single stuffing box is required, a matter of considerable importance, particularly where elastic fluid at a high pressure is being dealt with. The use of anti-friction knife edge bearings for the actuating lever for the valves is of advantage in that they are simple to construct and require no lubrication, the latter being of importance on account of the difficulty in lubricating moving parts which are subjected to the destructive action of the live elastic fluid which may be of high temperature.

In operation each valve is lifted separately without interference with the adjacent valves. In case a valve should stick open the lever arms 29 and 30 in moving downward will strike it on the top, thereby loosening it and starting it toward closed position. The valve will then seat due to gravity and the elastic fluid pressure.

In accordance with the provisions of 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. In a turbine having a rotor with buckets thereon, the combination of an elastic fluid chest, passages leading from the chest to the turbine buckets, a series of valves located in the chest for said passages, a lever also located in the chest for successively engaging and lifting said valves, a frictionless pivot for one end of said lever, a rod extending through a wall of the chest for lifting the lever, and a frictionless pivot connecting said rod to the other end of said lever.

2. In a turbine, the combination of an elastic fluid chest, rows of valves in the chest which control the flow of fluid therefrom to the turbine, a lever comprising parallel arms, one for each row of valves, for successively lifting said valves, an antifriction pivot for said lever, an operating rod extending through a wall of the chest, and a connection between it and the lever comprising an anti-friction bearing.

3. In a turbine, the combination of an elastic fluid chest, rows of valves in the chest which control the flow of fluid therefrom to the turbine, a lever comprising parallel arms, one for each row of valves, for successively lifting said valves, said arms extending across the tops of the valves and adapted to engage the valves to force them toward their seats, projections on the valves located above the arms which said arms engage for lifting the valves, and an operating

rod for the lever which extends through a wall of the casing.

4. In a turbine, the combination of an elastic fluid chest, rows of valves in the chest which control the flow of fluid therefrom to the turbine, a lever comprising parallel arms, one for each row of valves, for successively lifting said valves, said arms extending across the tops of the valves and adapted to engage the valves to force them toward their seats, projections on the valves located above the arms which said arms engage for lifting the valves, an operating rod for the lever which extends through a wall of the casing, and guides for directing the movements of the valves.

In witness whereof I have hereunto set my hand this 26th day of June, 1917.

RICHARD H. RICE.