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E. D. DICKINSON ET AL

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VALVE MECHANISM

Filed Feb. 13, 1924

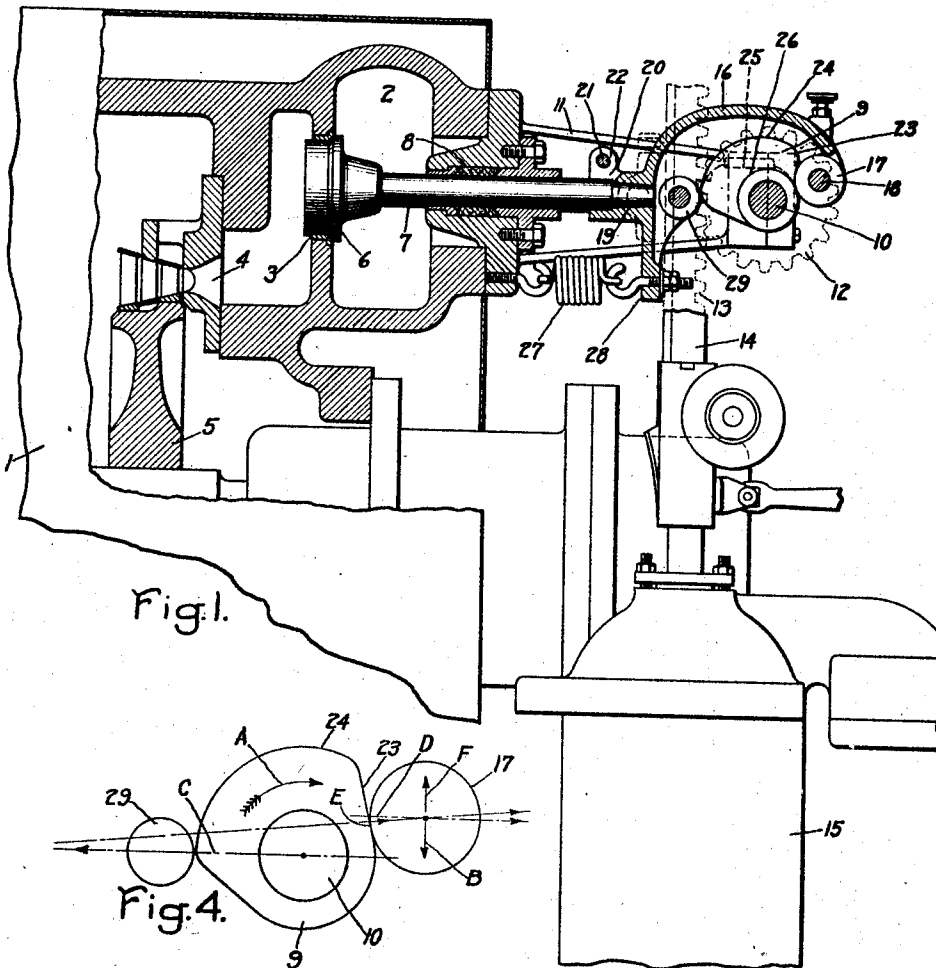


Fig. 1.

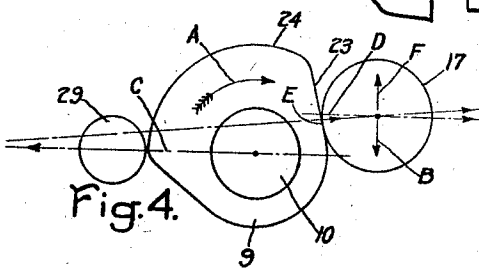


Fig. 4.

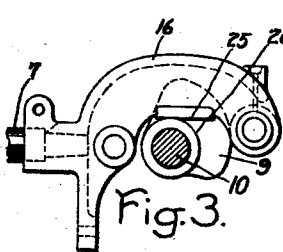


Fig. 3.

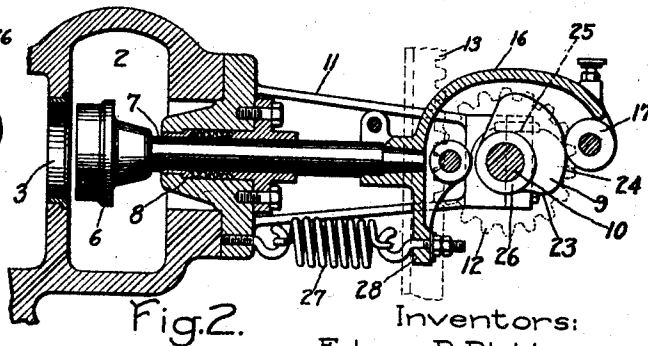


Fig. 2.

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UNITED STATES PATENT OFFICE.

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VALVE MECHANISM.

Application filed February 13, 1924. Serial No. 692,601.

To all whom it may concern:

Be it known that we, EDGAR D. DICKINSON and REGINALD G. STANDERWICK, citizens of the United States, residing, respectively, at Beverly, in the county of Essex, State of Massachusetts, and at Marblehead, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Valve Mechanisms, of which the following is a specification.

The present invention relates to valve mechanisms such as are used to control the admission of elastic fluid to turbines for example, and has for its object to provide an improved mechanism for actuating such valves which is simple in structure, positive in operation, and can be manufactured at a low cost.

For a consideration of what we believe to be novel and our invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing, Fig. 1 is a side elevation of a part of a turbine equipped with a valve mechanism embodying our invention, certain parts being broken away and others being shown in section; Fig. 2 is a detail sectional view of the valve mechanism showing it in open position; Fig. 3 is a detail side view of certain parts, and Fig. 4 is a diagram.

Referring to the drawing, 1 indicates an elastic fluid turbine of suitable structure provided with a chest 2 to which elastic fluid is supplied by a suitable pipe (not shown) and from which elastic fluid flows through one or more ports 3 to the nozzles 4 which direct the elastic fluid to the buckets on the bucket wheel 5. Only the high pressure end of the turbine is shown in the drawing. It will be understood that the arrangement shown is to be taken as typical of any suitable turbine structure. The flow of elastic fluid through each port 3 is controlled by a valve 6, the stem 7 of which extends through a stuffing box 8 to the outside of the turbine casing. In general, in a turbine of the type illustrated, there are

several valves 6 which are opened and closed one after another to control the admission of elastic fluid to the turbine. Each valve is opened by a cam 9 on a cam shaft 10 journaled in bearings in suitable brackets, one of which is shown at 11. Cam shaft 10 is turned by a gear wheel 12 which meshes with a rack 13 on the upper end of a rod 14. The lower end of rod 14 is connected to the piston of the hydraulic motor 15. The hydraulic motor is shown only partially and in outline. It will be understood that it may be of any desired or known type, and may include the usual pilot valve which is moved by the turbine speed governor.

Our present invention relates particularly to the connection between valve stem 7 and cam 9 through which the cam operates the valve. Connected to the outer end of stem 7 is a curved head 16 which encircles cam 9 and carries a roller 17 with which the peripheral surface of the cam engages, the roller being fixed on a pin 18 journaled in suitable bearings in head 16. Head 16 may be fastened to stem 7 in any suitable manner, it being shown in the present instance as being provided with a socket 19 into which the end of the stem fits and with a split sleeve 20 which is tightened around the stem by a bolt 21 which passes through ears 22 on the sleeve. Cam 9 has a lifting surface 23 and a holding surface 24, the center of curvature of the latter being the center of shaft 10. With this arrangement, when shaft 10 turns in the direction indicated by the arrow in Fig. 4, valve 6 is first raised by the lifting surface 23, and after being fully opened is held open by surface 24. Surface 24 has a considerable circumferential extent so that it will hold the valve open while shaft 10 continues to turn to open additional valves.

Referring particularly to Fig. 4, and considering it in connection with Fig. 1, it will be clear that, if roller 17 were in line with stem 7 then when cam 9 turns in the direction indicated by the arrow A to open valve 6 it would place a side thrust on stem 7 in

the direction indicated by the arrow B. To initially lift valve 6 off its seat requires considerable force because of the elastic fluid pressure in chest 2 so that at this time the side thrust may be large. To overcome this, we place the center of roller 17 to one side of the center line of stem 7 and then place the point of contact between surface 23 of cam 9 and roller 17 at a point intermediate between the center line of stem 7 and a line drawn parallel to it through the center of roller 17. This is plainly shown in Fig. 4 wherein C indicates the center line of stem 7, D indicates the center line of roller 17 and E indicates the point of contact. With this arrangement the lifting action of cam 9 produces on stem 7 a force having a component in the direction of the arrow B and also a component in the direction of the arrow F. The component in the direction of the arrow F may be termed a counteracting component and may be given any desired value by varying the position of the point of contact E. Preferably we so locate point of contact E that the side thrust represented by the arrow F just counteracts the side thrust in the direction of the arrow B at the time of maximum lifting force of the cam, i. e., when the valve is being cracked from its seat. After the valve is once off its seat, the pressure on opposite sides of it equalizes rapidly as the valve continues to open so that the force required to continue opening movement of the valve decreases very rapidly and substantially. The side thrusts are exactly equalized only for the one value of the lifting force. At other values there will be a resultant side thrust and to take care of this we provide on the side walls of head 16 flat surfaces 25 which roll along the hubs 26 of cam 9. This serves to prevent bending of the stem by the resultant side thrust, such side thrust being taken by the brackets 11.

The valve is biased toward closed position by a spring 27 which is attached at one end to the head of the turbine and at the other end to a short arm 28 projecting from head 16. Spring 27 holds roller 17 in engagement with the surface of cam 9 and causes the valve to move toward closed position. Between the side walls of head 16 and on the side of cam 9 opposite to that at which roller 17 is located there is pivoted a roller 29. During normal operation there is a slight clearance between roller 29 and the surface of cam 9. In case the valve sticks open, spring 27 proving insufficient to start it toward closed position, cam 9 in moving in a direction to effect closing of valve 6 will strike roller 29 and positively move the valve toward closed position.

By the foregoing arrangement, we are enabled to provide a valve mechanism wherein the cam for opening the valve operates di-

rectly on the valve stem without producing excessive side thrusts. This results in a simple structure and one which can be manufactured at a low cost. At the same time the structure is reliable in operation for the reason, among others, that the side thrusts are substantially equalized and such as do occur are taken by the supporting brackets, thus eliminating any side thrusts on the valve stem which would tend to make it bind.

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 may be carried out by other means.

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

1. In a valve mechanism, the combination of a valve, a stem for the valve, a cam, and a roller carried directly by the stem which roller the cam engages to move the valve, the center of the roller being located to one side of the center of the cam and the point of contact between the cam and the roller being between said centers.

2. In a valve mechanism, the combination of a valve, a stem for the valve, a head connected to the stem, a roller carried by the head, the center of the roller being to one side of the axis of the valve stem, and a cam which engages the roller to open the valve, the point of engagement of the cam with the roller being located between the axis of the valve stem and the center of the roller, and the axis of the cam being on the same side of such point of engagement as the axis of the valve stem.

3. In a valve mechanism, the combination of a valve, a stem for the valve, a head connected to the stem, a roller carried by the head, the center of the roller being to one side of the axis of the valve stem, a cam which engages the roller to open the valve, the point of engagement of the cam with the roller being located between the axis of the valve stem and the center of the roller, and the axis of the cam being on the same side of such point of engagement as the axis of the valve stem, and engaging surfaces carried by the head and cam for transmitting side thrust from the stem to the cam.

4. In a valve mechanism, the combination of a valve, a stem for the valve, a head on the stem, a roller carried by the head, the center of said roller being to one side of the axis of the valve stem, a frame structure, a cam journaled in the frame structure and directly engaging the roller to open the

valve, the point of engagement of the cam serves to transmit side thrust from the stem
with the roller being located between the to the frame structure. 10
axis of the valve stem and the center of the
roller, and the axis of the cam being on the
same side of such point of engagement as the
axis of the valve stem, a hub for the cam, 5
and means providing on the head a flat surface which rides along the cam hub and

In witness whereof, we have hereunto set
our hands this eleventh day of February, 1924.

EDGAR D. DICKINSON.
REGINALD G. STANDERWICK.