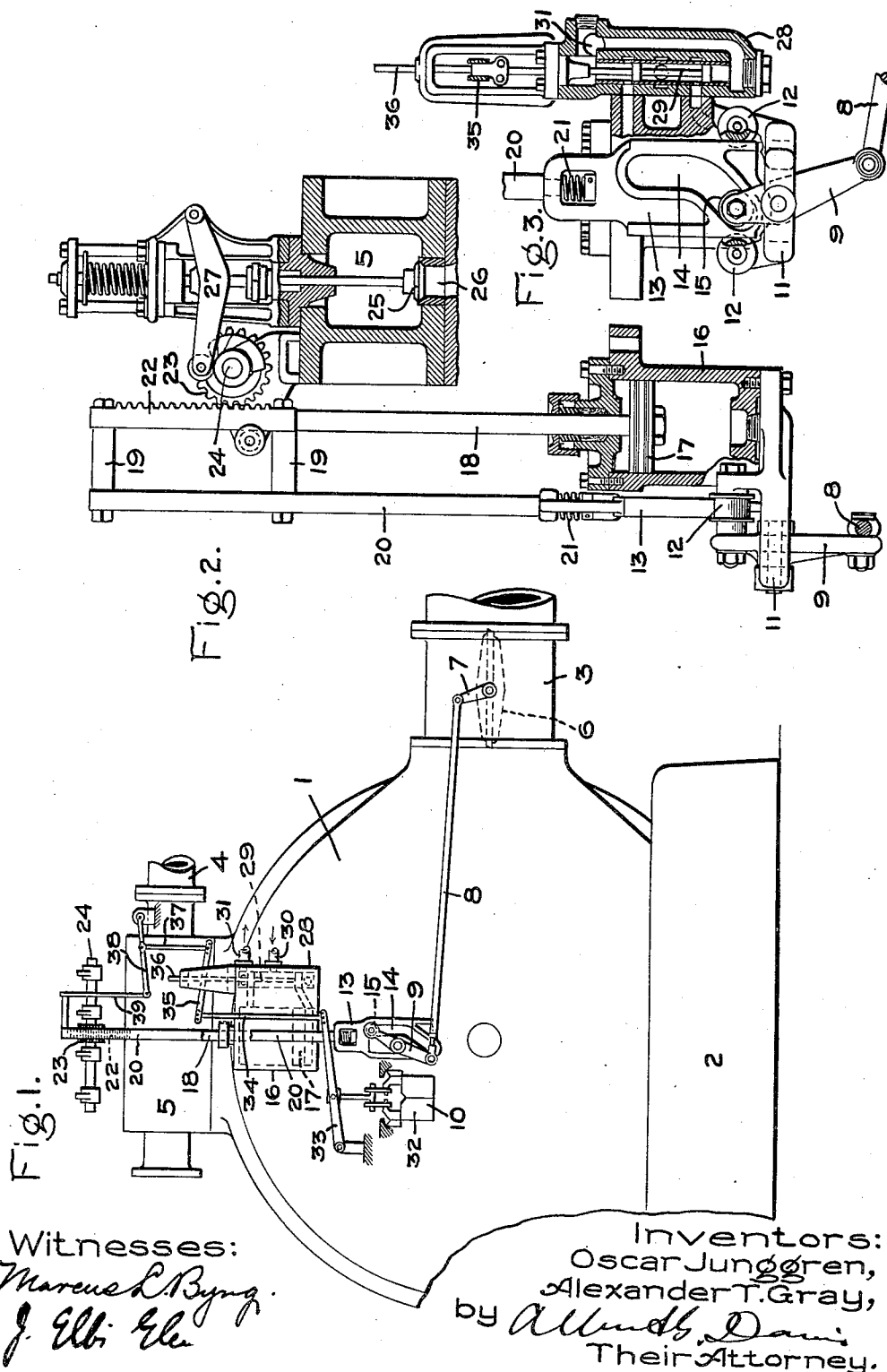


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GOVERNING MECHANISM FOR MIXED PRESSURE TURBINES.
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1,017,555.

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UNITED STATES PATENT OFFICE.

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GOVERNING MECHANISM FOR MIXED-PRESSURE TURBINES.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, OSCAR JUNGREN, a citizen of the United States, and ALEXANDER T. GRAY, a subject of the King of Great Britain, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Governing Mechanism for Mixed-Pressure Turbines, of which the following is a specification.

This invention relates to what are known as mixed pressure turbines, or in other words, elastic fluid turbine engines driven normally by steam or other elastic fluid at a low pressure, but provided with means for admitting steam or other elastic fluid at high pressure whenever it is necessary to supplement the supply of low pressure fluid, in order to carry an increased load or compensate for a falling off in the supply of said low pressure fluid. In such a machine, it is of course necessary that the low pressure valve or valves shall be opened to their full extent, or nearly so, before the high pressure valve or valves begin to open, and on the other hand that the high pressure valve or valves shall be nearly or entirely closed, before the low pressure valve or valves begin to close.

The present invention consists in improved mechanism for accomplishing these objects, as hereinafter set forth and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is an end elevation of a horizontal turbine equipped with our improved valve gear, but diagrammatically rendered to illustrate the relations of the parts more clearly when all the valves are open; Fig. 2 is a side elevation, partly in section, of the high pressure valve-operating devices; and Fig. 3 is a sectional elevation of the pilot valve and adjacent parts.

The turbine shown is of the horizontal type, having a casing 1 supported on a base 2. Certain sets of nozzles are supplied with low pressure steam through a large conduit 3, while another nozzle or set of nozzles receives steam of high pressure through a pipe 4 entering a steam chest 5. The low pressure conduit is controlled by a valve 6, preferably of the butterfly type, which is actuated in its opening and closing movements by a crank arm 7 connected by a rod 8 to a

lever 9 which is arranged to be actuated by the movements of a motor controlled by the speed governor 10. This same motor also actuates the valve or valves controlling the admission of high pressure steam, but its actuation of the low pressure and high pressure valves is not simultaneous but successive, opening the former before the latter, and closing the latter before the former.

The lever 9 is fulcrumed in a bracket 11 forming part of the frame of the motor and carrying antifriction rollers 12 between which is guided a slide 13, adapted to move vertically and containing a cam slot 14 engaging with a roller on a pin 15 projecting from one side of the upper end of the lever 9. The lower portion of the slot 14 is oblique to the line of movement of the slide, so that it will cause the lever to rock on its fulcrum as the slide is forced down. The upper portion of said slot is longitudinal, so as to produce no movement of the lever during the latter part of the downward movement of said slide. The extent and arrangement of the oblique or active portion of the slot are such as to turn the butterfly valve from its closed position to one in which it is wide open, during the time that the lever 9 is being actuated by said slot. The motor is connected both to the slide and to the high pressure valves so that they will be opened in succession as said slide passes downward after having opened the butterfly valve.

The motor is preferably a cylinder 16 containing a piston 17 secured to a rod 18 attached at its upper end to a head 19 to which is also secured the rod 20 whose lower end is connected with the slide. This connection is preferably yielding, as by means of the spring 21, so that the danger of breakage in case the butterfly valve should seat before end of stroke is reached, will be minimized. On one side of the head 19 is a rack 22 which meshes with a pinion 23 mounted on the cam shaft 24 of the valve gear for the high pressure valves. There are several of these valves, four cams being shown in the drawing, but any desired number being within the scope of our invention. The valves are of a well known construction, being puppet valves 25 each controlling the opening 26 from the steam chest 5 to an additional nozzle or nozzles. Each valve is operated by a lever 27, one end of

which rests upon a cam on the cam shaft 24. These cams are so disposed that they operate their valves in succession, and this does not happen until after the slide 13 has moved so far down that the vertical or idle portion of its cam slot has engaged the wrist pin 15 on the lever 9, and locked the butterfly valve in its wide open position.

The piston 17 is actuated by hydraulic pressure admitted to the cylinder 16 through a chest 28 in which is a pilot valve 29 controlling the ports which connect said chest with said cylinder. The hydraulic pressure enters through the pipe 30 and exhausts through the pipe 31. When the pilot valve is moved downward, it admits pressure under the piston 17 to cause it to rise and shut off the steam more or less. Conversely, the upward movement of the pilot valve produces a corresponding downward movement of the piston 17 and a greater admission of steam to the turbine. These movements of the pilot valve are effected by the speed governor 10, whose weights 32 are arranged to actuate a lever 33 connected by a rod 34 with a floating lever 35 pivoted near its middle to the stem 36 of the pilot valve and at its farther end to a link 37 connected to a lever 38, fulcrumed at one end on the frame of the turbine and connected at its other end by link 39 to the head 19 of the motor. Whenever, by reason of a change in the load on the turbine or otherwise, the weights of the speed governor alter their position, they move the system of levers set forth, and produce a longitudinal movement of the stem of the pilot valve, causing it to open a port to admit pressure above or below the piston 17 as the case may be. As soon as the motor has moved far enough to change the admission of steam to correspond with the altered load, the pilot valve will have been brought back to its mid-position by reason of the floating lever and its connection with the head 19. In its mid-position said pilot valve cuts off the pressure from both ends of the motor, whose piston then remains stationary holding the steam valves in their new positions.

It will be seen that as the load falls off, the speed of the turbine tends to increase, so that the motor gradually lifts the slide 13 until finally when all the high pressure valves have been closed, the oblique active portion of the slot 14 begins to operate on the lever 9 to close the butterfly valve. If the reduction of load continues, the butterfly valve will be turned farther and farther toward its closed position, to shut off the low pressure steam until the supply is just sufficient to carry the load. When the load begins to increase, the opposite effect occurs.

Upon reference to Fig. 1 it will be observed that the slide 13 and its actuating

mechanism are arranged at one end of the turbine and approximately in the upright axial plane thereof. This makes a compact arrangement and yet gives easy access to the parts. Moreover, the rod 8 is short, and can be led off to either side of the machine to accommodate itself to the location of the low pressure conduit. The rack 22 which operates the cam shaft 24 engages the pinion 23 at a point midway of said shaft instead of out at one end as heretofore. This particular location of the slide and motor therefore possesses great practical advantages, and has been adopted in a number of installations.

In accordance with the provisions of the patent statutes, we have described the principle 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. In a mixed pressure turbine, the combination with a low pressure valve and high pressure valves, of a motor adapted to operate said valves, and a slide connected to said motor and having a cam groove adapted to actuate the low pressure valve during a part of its movement only.

2. In a mixed pressure turbine, the combination with a low pressure valve and high pressure valves, of a motor, a slide actuated thereby and having a slot containing an oblique portion and a longitudinal portion, and a lever connected to the low pressure valve and engaging with said slot.

3. In a mixed pressure turbine, the combination with a low pressure valve and high pressure valves, of a motor, a slide actuated thereby and having a slot containing an oblique portion and a longitudinal portion, a lever connected to the low pressure valve and engaging with said slot, and a cam shaft geared to said motor and arranged to actuate said high pressure valves during the time that the lever is engaged with the longitudinal portion of said slot.

4. In a mixed pressure turbine, the combination with the low pressure conduit, of a butterfly valve therein, a lever for turning said valve, a slide having a cam slot therein provided with an active portion for actuating said lever and an idle portion for holding said lever locked during the further movement of said slide.

5. In a mixed pressure turbine, the combination with the low pressure conduit, of a butterfly valve therein, a lever for turning said valve, a slide having a cam slot therein provided with an active portion for actuating said lever and an idle portion for holding said lever locked during the further

movement of said slide, and high pressure valve gear operative only during the time that said lever engages said idle portion of said slot.

proximately in the upright axial plane of 10 said turbine.

In witness whereof, we have hereunto set our hands, this 27th day of July, 1911.

OSCAR JUNGREN.

ALEXANDER T. GRAY.

Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."