M. B. CARROLL.

VALVE CONTROL SYSTEM.

APPLICATION FILED SEPT. 13, 1910.

991,950.

Patented May 9, 1911.

Fig. 1.

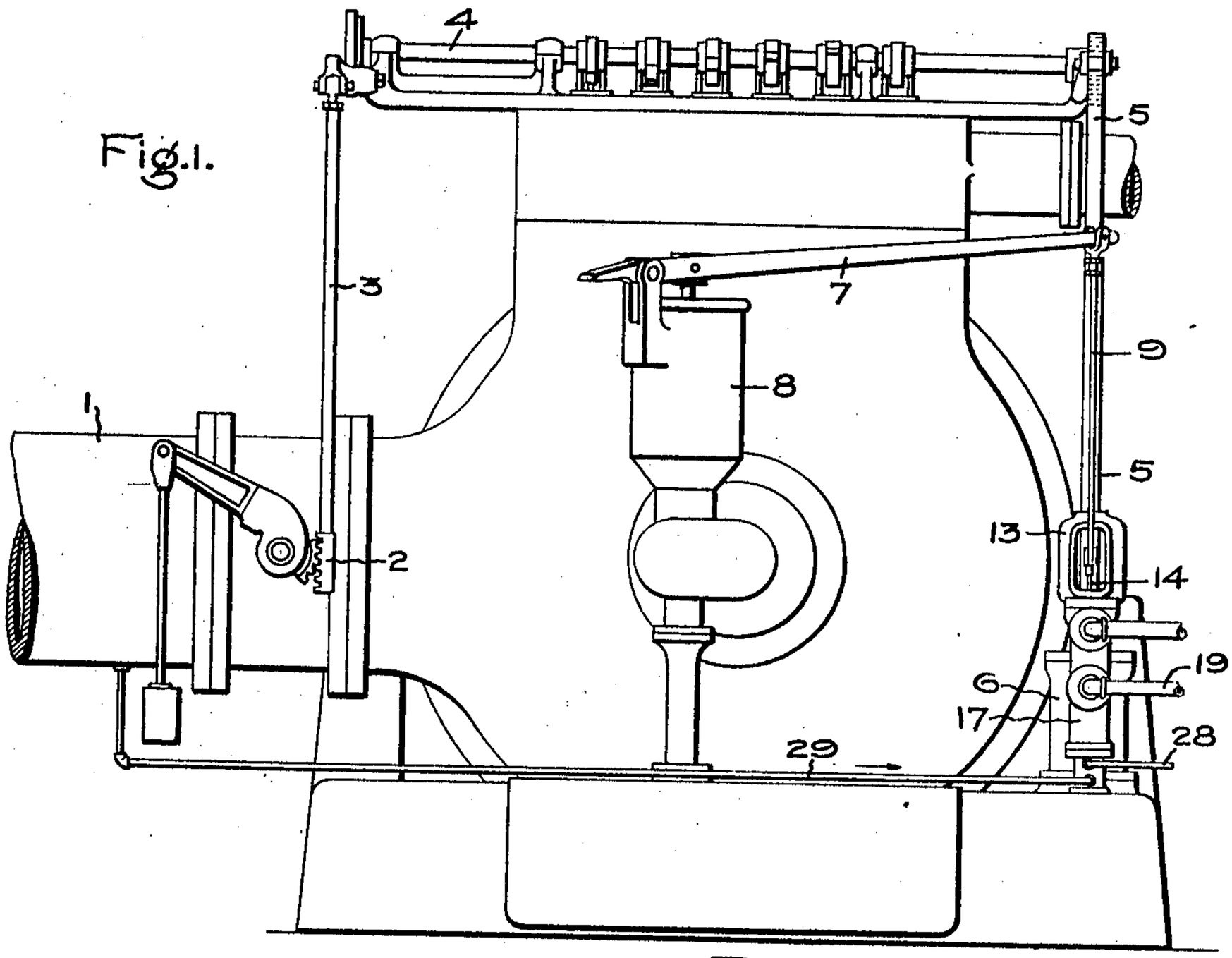
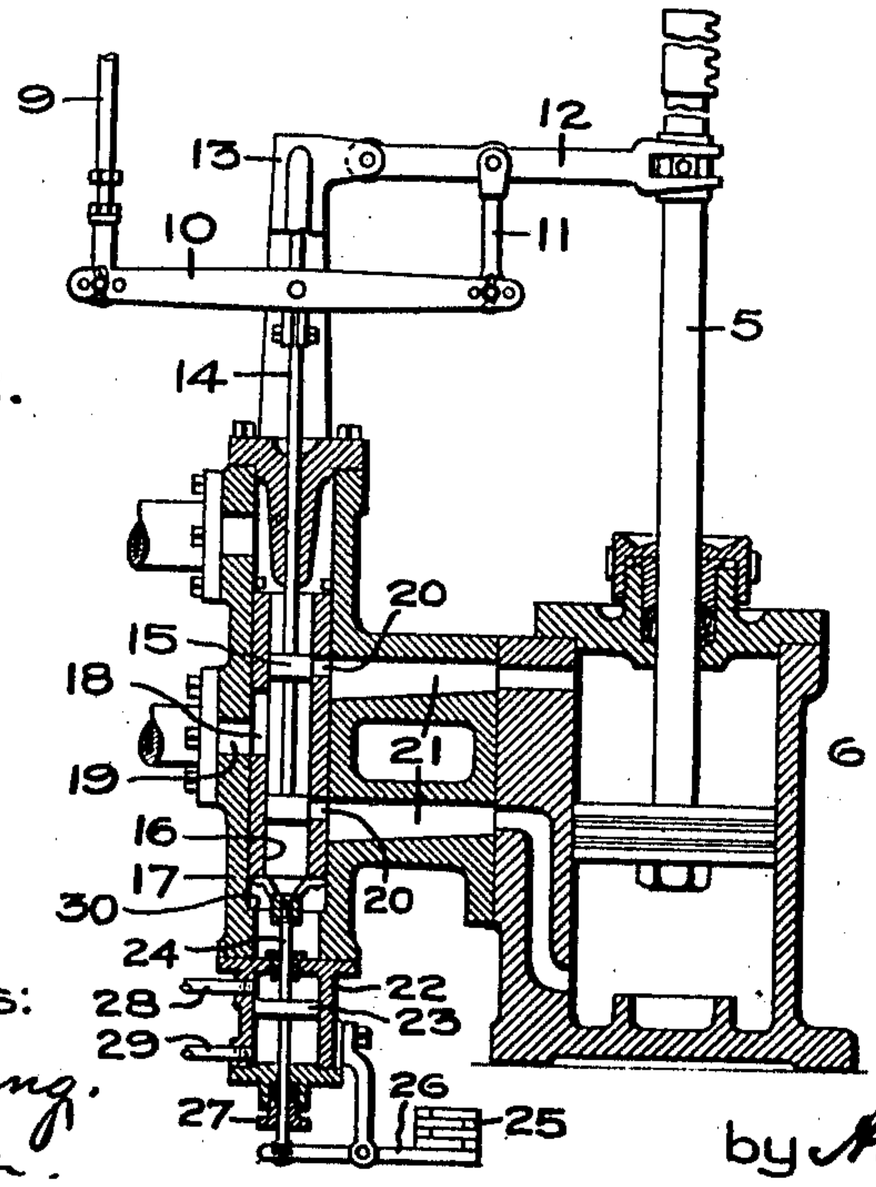


Fig. 2.



Witnesses:
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UNITED STATES PATENT OFFICE.

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VALVE-CONTROL SYSTEM.

991,950. Specification of Letters Patent. **Patented May 9, 1911.**

Application filed September 13, 1910. Serial No. 581,827.

To all whom it may concern:

Be it known that I, MORRIS B. CARROLL, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Valve-Control Systems, of which the following is a specification.

This invention relates to elastic fluid turbines, and especially to what are known as mixed pressure turbines, which are driven normally by low pressure exhaust steam from a high pressure reciprocating engine or turbine. Inasmuch as the supply of low pressure steam may fail at times, or be insufficient to carry the load imposed on the turbines, it has become customary to provide a main supplying high pressure steam, and a set of valves for admitting said high pressure steam to the turbine in case of necessity. These valves are placed under the control of the speed governor of the turbine, and are so arranged and connected that they do not open until the speed governor has fully opened the low pressure valve or valves. But when a turbine equipped with this type of governor is used to drive an electric generator connected in multiple with other units independently driven, the turbine tends to lose its load when changing from low pressure operation to high pressure operation, or if adjusted to carry a certain load under high pressure steam, it will tend to carry double this load or more when changing back to low pressure operation.

To obviate this shifting of load, I provide the valve chest of the hydraulic motor, which actuates the turbine valves, with a movable port-carrying element, preferably a sleeve surrounding the pilot valve and containing the ports through which the motive fluid passes to the cylinder of the motor. This sleeve is arranged to be moved longitudinally in response to variations in the pressure of the low pressure steam, so that it will automatically shift the position of the ports an amount proportional to the travel of the governor rod when changing over from low pressure to high pressure operation and vice versa for the purpose of getting the same speed regulation of the turbine when operating on either low pressure or high pressure steam.

In the accompanying drawing, Figure 1 is an end elevation of a mixed pressure turbine equipped with my invention, and Fig. 2 is a section of the hydraulic valve motor showing my improvement.

The turbine is driven normally by low pressure steam supplied through a conduit 1 in which is a butterfly valve operated by a rack 2 and rod 3, which is actuated by the cam shaft 4 connected to the piston rod 5 of the hydraulic motor 6. The lever 7 of the speed governor 8 is connected by the rod 9 to one end of said floating lever 10. The other end of said floating lever is connected by a link 11 with the arm 12 pivoted at one end to the frame 13 of the hydraulic motor and at the other end to the piston rod 5. At an intermediate point on the lever 10 is pivoted the stem 14 of the pilot valve 15. All these devices are well known and form no part of my invention. The additions which I have made comprise a sleeve 16 or its equivalent interposed between said valve and its casing 17, said sleeve containing an inlet port 18 registering with the inlet 19 for the motive fluid, and two outlet ports 20 registering with the admission ports 21 of the motor cylinder, which are controlled by the pilot valve. The ports 18 and 21 are elongated so that the sleeve can be moved longitudinally for some little distance without interrupting the flow of the motive fluid.

Situated below the valve casing 17, and in line with the pilot valve, is a small cylinder 22, containing a piston 23 whose rod 24 is attached to one end of the sleeve 16. The weight of the piston and sleeve is counterbalanced, preferably by a weight 25 or a lever 26 pivoted to the end of the rod 24 which is extended through a stuffing box 27 on the bottom of the cylinder 22. The weight 25 is adjustable to vary the pressures at which the sleeve 16 will be operated. The space above the piston is open to the atmosphere through the short pipe 28, but the space under the piston is connected by a pipe 29 with the low pressure conduit 1.

The operation is as follows: When the load on the turbine is increased, the speed falls and the governor lifts its lever 7 and the rod 9. The pilot valve 15 is moved up, admitting the motive fluid to the upper part of the cylinder 6, thereby forcing down the piston rod 5 until the low pressure valve in the conduit 1 is opened sufficiently to supply the steam required to carry the increased load. The "follow-up" devices 10, 11, 12

return the pilot valve to its normal mid-position, in which it shuts off the motive fluid. This action may continue until the low pressure valve is wide open. The vacuum on the turbine due to the condenser tends to work back to the conduit 1, and is liable to cause trouble owing to the leakage of air into said conduit. But at this point in the operation, the vacuum is set up also in the lower part of the cylinder 22, so that the atmospheric pressure forces down the piston 26 and pulls down the sleeve 16 against the shoulder 30. This has the same effect as the lifting of the rod 9 by the speed governor, that is to say, the upper port 20 is opened and motive fluid is admitted to the upper part of the cylinder 6. The resulting further downward movement of the piston rod 5 opens all or most of the high pressure valves and admits high pressure steam to the turbine. This tends to increase the speed of the machine, but the speed governor automatically takes care of this, closing sufficient high pressure valves to bring the speed of the machine to the same rate as when operating on low pressure steam at the same load.

When the supply of low pressure steam picks up, the pressure thereof on the under side of the piston 23 will shove the sleeve up again to the position shown in Fig. 2, so that the governor will again control the machine through the low pressure valve.

It will be seen that this device provides for positively bringing into operation the desired set of valves at the time when the load is changing from low to high pressure steam or vice versa by causing the piston of the hydraulic motor to occupy a higher position in its cylinder, for a given position of the speed governor, when the turbine is operating on low pressure steam than said piston occupies when the machine is operating on high pressure.

It will of course be remembered that the low pressure valve is controlled by the motor piston during the movement of said piston in the upper part of the cylinder, and that the high pressure valves are operated when the piston is moving in the lower part of said cylinder.

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. The combination with the hydraulic valve motor of a mixed pressure turbine, of means for shifting longitudinally the position of the admission ports of said motor with reference to the mid-position of the pilot valve of said motor.

2. The combination with the hydraulic valve motor of a mixed pressure turbine, of a longitudinally movable sleeve surrounding the pilot valve of said motor and provided with suitable ports, and means responsive to pressure in the low pressure conduit of said turbine for operating said sleeve.

3. The combination with the hydraulic valve motor of a mixed pressure turbine, of a longitudinally movable sleeve surrounding the pilot valve of said motor and provided with an elongated inlet port and two outlet ports, a valve casing having an inlet port and two elongated admission ports respectively registering with the ports in said sleeve, and means controlled by the pressure in the low pressure conduit of said turbine for shifting said sleeve longitudinally.

4. The combination with the hydraulic valve motor of a mixed pressure turbine, of means for shifting longitudinally the position of the admission ports of said motor with reference to the mid-position of the pilot valve of said motor, said means comprising a piston exposed on one side to atmospheric pressure and on the other side to the conduit pressure.

In witness whereof, I have hereunto set my hand this 12th day of September, 1910.

MORRIS B. CARROLL.

Witnesses:
HELEN ORFORD,
BENJAMIN B. HULL.