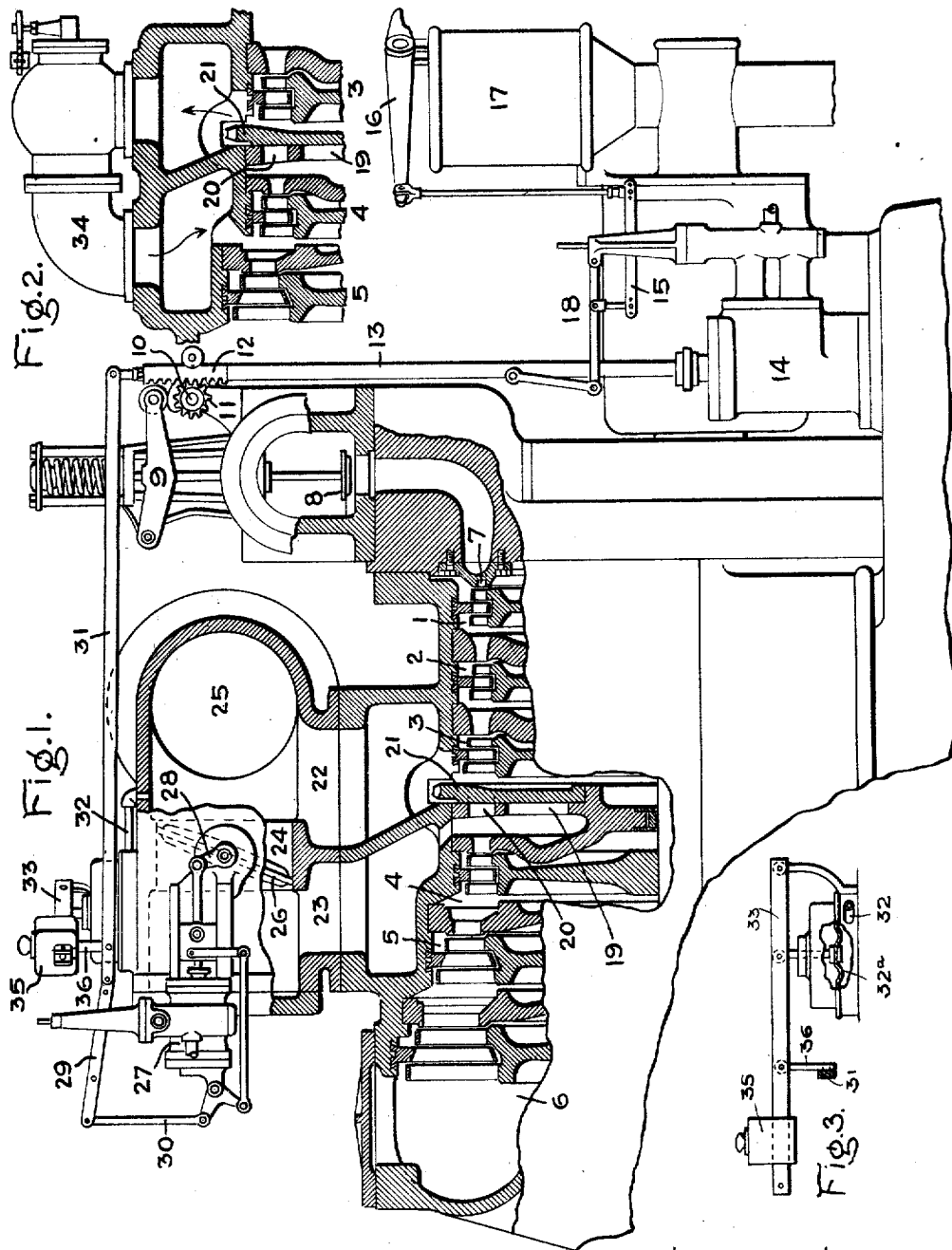


E. D. DICKINSON.  
REGULATING MECHANISM FOR STEAM TURBINES.  
APPLICATION FILED OCT. 7, 1912.

Patented Oct. 20, 1914.

**1,114,713.**



Witnesses:  
 Marcus L. Byng.  
 J. E. Glen

Inventor:  
Edgar D. Dickinson,  
by *Albert H. Davis*  
His Attorney.

# UNITED STATES PATENT OFFICE.

EDGAR D. DICKINSON, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## REGULATING MECHANISM FOR STEAM-TURBINES.

1,114,713.

Specification of Letters Patent.

Patented Oct. 20, 1914.

Application filed October 7, 1912. Serial No. 724,267.

*To all whom it may concern:*

Be it known that I, EDGAR D. DICKINSON, 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 Regulating Mechanism for Steam-Turbines, of which the following is a specification.

This invention relates to that class of steam turbines wherein a portion of the motive fluid exhausting from a suitable pressure stage or region is utilized for some industrial purpose, such as heating, cooking or the like. In a pending application of Oscar Junggren, filed September 14, 1912, Serial No. 720,346, since issued as Patent No. 1,085,132, there is shown a turbine of this sort in which the steam pressure in the heating system is kept constant by providing a by-pass for the excess steam to the next lower stage of the turbine, and controlling such by-pass by a pressure-responsive device exposed to the pressure in the heating system and acting on a throttle valve in said by-pass. Under certain operating conditions, the opening of the by-pass valve and the consequent admission of more steam to the lower stages of the machine will cause it to run more rapidly. The speed governor, which controls the high pressure admission valves will, therefore, tend to close said valves, assuming no change in load. This at once reduces the pressure in the heating system, and this reduction tends to close the by-pass valve again; so that there is a possibility of a hunting action being set up between this valve and the governor-controlled high pressure valves. My present invention aims to overcome this difficulty by mechanically connecting the by-pass (or overflow) valve with the speed governor, so that it will be opened and closed with the opening and closing of the high pressure valves, and in consequence the action of the pressure responsive device in opening the overflow valve to reduce the heating pressure will be counteracted by the closing movement of the high pressure valve mechanism which operates to close the overflow valve and raise the pressure again.

In the accompanying drawing, Figure 1 is a partial section of a horizontal turbine equipped with my invention, Fig. 2 is a de-

tail showing the back-pressure valve, and Fig. 3 is a detail view of the pressure responsive device and adjacent parts.

The turbine illustrated is of the Curtis type, having three high pressure stages 1, 2, 3 and three low pressure stages 4, 5 and 6 but the invention is not limited to this type of turbine. High pressure steam is admitted to stage 1 through nozzles 7 controlled by valve 8 which are lifted by levers 9 actuated by cams on a cam shaft 10. A pinion 11 on this shaft meshes with a rack 12 on the piston rod 13 of a hydraulic motor 14, whose pilot valve is connected to a floating lever 15 connected at one end to the arm 16 of the speed governor 17. The other end of the floating lever is connected to the piston rods 13 by a system of follow-up links and lever 18.

Between the stages 3 and 4 is an extra diaphragm 19 containing ports 20 which are controlled by an annular valve 21 capable of being adjusted by hand, so that said ports can be opened or closed at will. Around this diaphragm is a by-pass comprising a chamber 22 opening from stage 3, a chamber 23 opening from the hollow diaphragm 19 between stages 3 and 4, and a passage 24 connecting said chambers. A conduit 25 leads from the chamber 22 to a heating or other industrial system, and an overflow valve 26, preferably of the butterfly type, controls the passage 24, so that any excess of steam not needed for heating can be shunted to the lower stages of the turbine.

The overflow valve is operated by a hydraulic motor 27 whose piston rod is suitably connected to an arm 28 on the spindle of the valve. The pilot valve of the motor 27 is connected to a floating lever 29, one end of which is connected by a system of follow-up linkage 30 to the piston rod and end is pivoted to one end of a lever 31, joined at its other end to the piston rod 13. A pipe 32 conveys the fluid pressure existing in chamber 22 to a flexible diaphragm 32<sup>a</sup> or other movable abutment adapted to actuate a lever 33 which is linked to the lever 31 near its point of connection with the floating lever 29.

In order to prevent the difference in pressure on opposite sides of the diaphragm 19 from exceeding a predetermined maximum,

a by-pass 34 is provided between stages 3 and 5, in which is a weighted valve which will open automatically to relieve the excess pressure and permit the steam to escape around the hand valve 21 to the lower stage.

The operation is as follows: The steam exhausting from stage 3 flows through the conduit 25 to the heating system, its pressure being regulated and kept approximately constant by the overflow valve 26 operated by the pressure responsive abutment connected to the lever 33. The effective pressure can be varied by shifting a counterweight 35 along said lever 33. Now, if the heating pressure becomes too great, the floating lever 29 will be lifted and shift the pilot valve to cause the motor 27 to open the overflow valve 26 a little and relieve said overpressure. The excess steam acts upon the bucket wheels in the low pressure stages, and may possibly increase the speed of the turbine. The speed governor 17 thereupon shuts one or more nozzle valves 8 to lessen the initial supply of steam, and in so doing it pushes up the right hand end of the lever 31. Fulcruming on the link 36, this lever forces down the floating lever 29, which causes the motor 27 to partially close the valve 26, and thus prevent any undue drop in the heating system pressure owing to the shutting off of part of the high pressure steam. In this way all serious fluctuations in heating pressure, and all hunting of the valves 8 and 26 are prevented.

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 combination, a turbine, regulating valves therefor, a motor for moving one of the valves, a regulator for the motor, a speed governor which acts on the valves to simultaneously open or close the same, a pressure responsive device, and connections from the governor and device to the regulator which are capable of independently moving it.

2. The combination with a turbine from which steam is drawn for industrial purposes, of a by-pass for conveying a portion of said steam to a lower stage of the turbine, a valve in said by-pass, high pressure valves, a speed governor for opening and closing the same, means controlled by the speed governor for opening and closing said by-pass valve simultaneously with the high pressure valves and a device responsive to the pressure in the extraction stage for controlling

the by-pass valve independently of the governor controlled means.

3. In combination, a turbine, a conduit connected to a region of intermediate pressure of said turbine, a valve controlling the admission of high pressure fluid to the turbine, a valve controlling the flow of fluid at the point of intermediate pressure, a speed governor which acts on both said valves to simultaneously open or close the same, and a device responsive to the pressure of the fluid flowing in said conduit which acts to regulate the second named valve only.

4. In combination, a turbine, a valve controlling the admission of fluid thereto, a second valve controlling the passage of fluid through an intermediate part of the turbine, a motor for actuating it, a regulator therefor, a speed governor which acts on the admission valve and regulator to simultaneously open or close the valves, and a pressure responsive device which acts on the regulator to cause the motor to move its valve independently of the speed governor.

5. In combination, a turbine, a valve controlling the admission of high pressure fluid thereto, a valve controlling the passage of fluid therethrough, a speed governor which acts on both said valves to simultaneously open or close the same, and a pressure responsive device which acts to open and close the second named valve independently of the speed governor.

6. The combination with a steam turbine, of high pressure valves, a motor for actuating them, a speed governor controlling said motor, a heating conduit leading from a high pressure stage, a valve for regulating the overflow of excess steam, a device responsive to pressure in the heating conduit for controlling said valve, and a lever pivoted to the high pressure valve gear and operating said overflow valve in opposition to the pressure responsive device.

7. The combination with a turbine having a high pressure valve gear controlled by a speed governor, of a heating conduit leading from said turbine, a valve tending to maintain a constant pressure in said conduit, a pressure responsive device for actuating said valve, and connections with the high pressure valve gear for counteracting the effect of said device.

8. The combination with a turbine having stages or regions of different pressures, of valve mechanism for regulating the admission of steam to the turbine, a conduit through which steam at relatively low pressure is delivered from a given stage or region for industrial uses, valve mechanism for regulating the flow of steam from said stage to a lower pressure stage, speed responsive means for controlling both valve mechanisms, and a device responsive to the

pressure of the low pressure steam for controlling the second valve mechanism only.

9. The combination with a turbine from a given region of which steam at relatively low pressure is drawn for industrial uses, of valve mechanism for automatically regulating the quantity of such steam in order to maintain it at a substantially constant pressure, admission valve mechanism for the turbine, motor mechanism for operating the two valve mechanisms, a speed governor for controlling the motor mechanism, and a device responsive to the pressure of the low pressure steam which also controls the motor mechanism of the first valve mechanism.

10. The combination with a turbine having stages or regions of different pressures, of valve mechanism for regulating the admission of steam to the turbine, a conduit through which steam at relatively low pressure is delivered from a given stage or region for industrial uses, valve mechanism for regulating the flow of steam from said stage to a lower pressure stage, a device responsive to the pressure of the low pressure

steam for controlling the second valve mechanism, speed responsive means that controls both valve mechanisms, a by-pass leading from the extraction stage to a lower pressure stage, and an automatic relief valve that controls the by-pass.

11. In combination, a turbine, a conduit connected to a region of intermediate pressure of said turbine, regulating valves therefor, a motor for moving one of the valves, a regulator for the motor, a speed governor that normally controls the valves, a device responsive to the pressure of the fluid flowing in said conduit, and a pair of pivotally-supported members that are connected to each other and to the regulator for moving it in response to speed or pressure variations.

In witness whereof, I have hereunto set my hand this 5th day of October, 1912.

EDGAR D. DICKINSON.

Witnesses:

BENJAMIN B. HULL,  
HELEN ORFORD.

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

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Corrections in Letters Patent No. 1,114,713.

It is hereby certified that in Letters Patent No. 1,114,713, granted October 20, 1914, upon the application of Edgar D. Dickinson, of Schenectady, New York, for an improvement in "Regulating Mechanism for Steam-Turbines," errors appear in the printed specification requiring correction as follows: Page 1, line 63, for the word "valve" read *valves*; same page, after line 95, insert the words *the cross-head of the motor, while its other*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of December, A. D., 1914.

..[SEAL.]

J. T. NEWTON,  
*Acting Commissioner of Patents.*

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J. T. NEWTON,

*Acting Commissioner of Patents.*