L. CUBELIC.

GOVERNING MECHANISM FOR TURBINES.

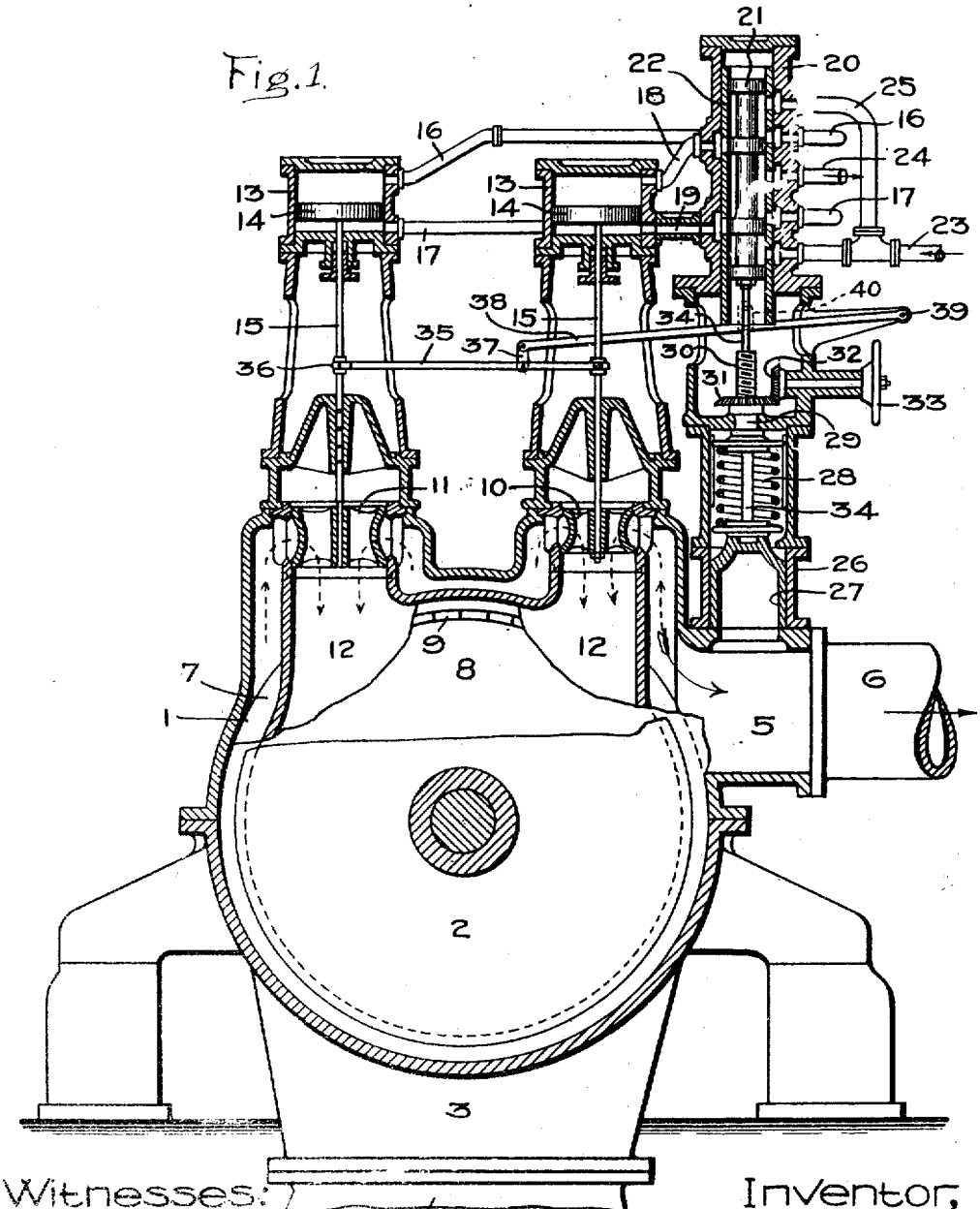
APPLICATION FILED JUNE 13, 1911.

1,020,686.

Patented Mar. 19, 1912.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

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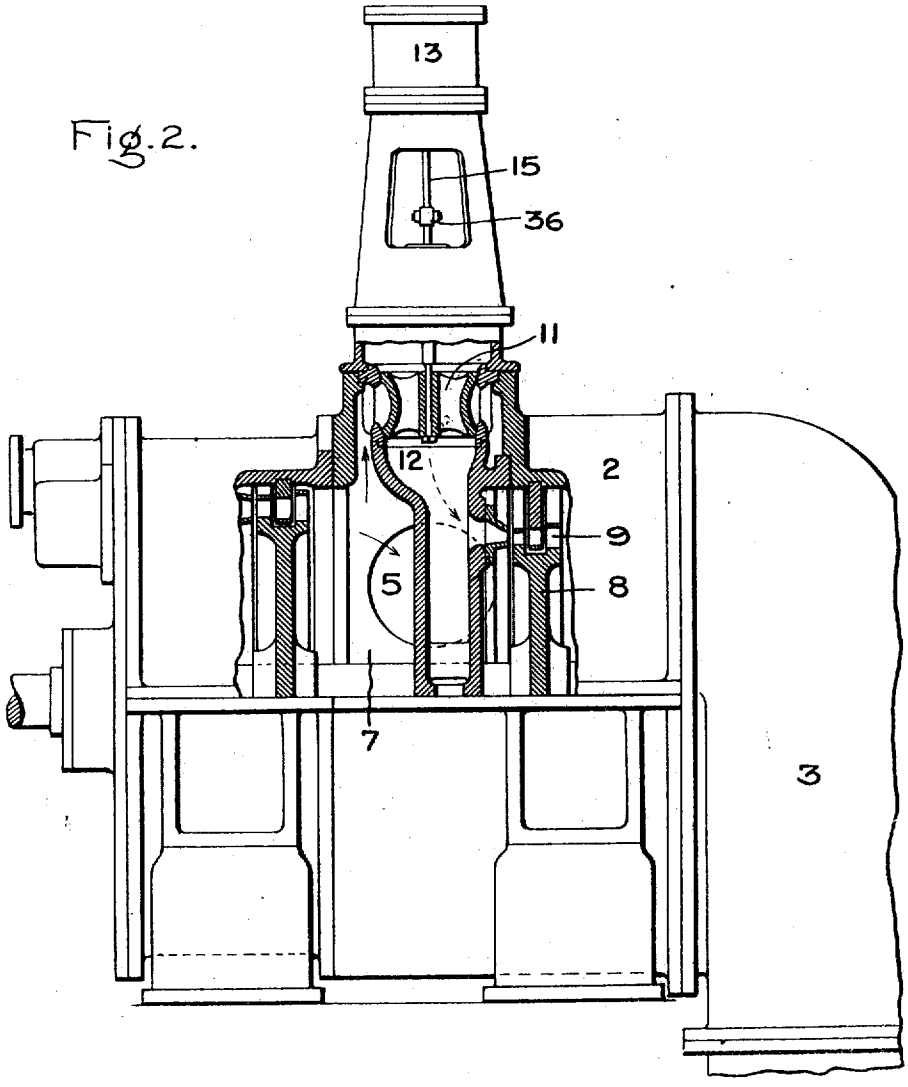
2 SHEETS—SHEET 2.

Fig. 2.



Witnesses:
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His Attorney.

UNITED STATES PATENT OFFICE.

LUDWIG CUBELIC, OF CHARLOTTENBURG, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

GOVERNING MECHANISM FOR TURBINES.

1,020,686. Specification of Letters Patent. Patented Mar. 19, 1912.

Application filed June 13, 1911. Serial No. 632,922.

To all whom it may concern:

Be it known that I, LUDWIG CUBELIC, a subject of the King of Prussia, residing at Charlottenburg, Germany, have invented certain new and useful Improvements in Governing Mechanism for Turbines, of which the following is a specification.

The present invention relates to governing mechanism for elastic-fluid turbines, which turbines, in addition to driving electric generators or other loads, supply steam for heating, cooking or other industrial purposes, said steam having given up a part of its energy in driving the turbine and had its pressure reduced to a relatively low value.

The object of the invention is to provide a governing mechanism of improved construction which will automatically maintain the pressure of the steam in the region of discharge from the turbine for said industrial purposes within very narrow limits, and this in a simple and reliable manner.

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

In the accompanying drawing I have illustrated, in Figure 1, one of the embodiments of my invention as applied to a turbine, the parts of said mechanism being chiefly in vertical section, and in Fig. 2 is shown a partial axial section.

In the drawing is shown a turbine of suitable construction comprising one or more high pressure stages, portions or sections 1 and one or more low pressure stages, portions or sections 2, the latter having a conduit 3 discharging to a condenser 4, or other suitable exhaust.

5 indicates a discharge conduit connected to some region in the turbine where the pressure is intermediate with that between the point of admission and the exhaust. It is to the maintaining of the pressure in said region that my invention is directed. To this conduit is connected a pipe 6 for supplying steam for industrial purposes of various kinds. As illustrated in the present embodiment of my invention the discharge conduit 5 receives its steam from an annular chamber 7 located between what for convenience may be termed the high and the low pressure sections of the turbine. I do not mean to imply by this that there is necessarily a mechanical separation of the parts of the turbine but that the pressure in one portion or section is higher than that in another portion or section and that the steam for industrial purposes is taken from the chamber or region of constant pressure between said portions or sections.

8 indicates a rotor having suitable rows of vanes or buckets 9 mounted on its periphery and running between other rows of vanes or buckets as is customary in steam turbines.

The admission of steam to the low pressure section of the turbine is controlled by one or more valves. For descriptive purposes these may be called overflow valves because they control the discharge of the overflow or excess steam to the low pressure portion of the turbine. In the present illustration two valves 10 and 11 are provided, the former being smaller than the latter to more closely regulate the flow of steam. These valves are exposed on one side to the pressure of the steam in the chamber 7 and on the other side to the pressure of the steam in the annular chamber 12, the latter supplying steam to the buckets of the low pressure rotor section 8. When these valves are closed no steam is permitted to pass to said section. On the other hand, when the valves are open the flow of steam is as indicated by the dotted line arrows. During the period that the valves 10 and 11 are open or closed steam may also flow through the conduit 5 and pipe 6 to the steam consuming devices. Each of the valves is provided with a motor for actuating it comprising a cylinder 13 and a piston 14, the latter being connected by a rod 15 with the valve. Fluid under pressure is admitted to and exhausted from these motors by suitable pipes 16 and 17 extending to the left-hand motor, and by pipes 18 and 19 extending to the right-hand motor. The motors are controlled by a pilot valve that is common to both. This valve comprises a casing 20 and a piston valve 21 having suitable heads thereon which cover and uncover ports located in the sleeve 22, the latter being moved up and down under certain conditions as will appear later. A fluid such as oil is admitted by the pipe 23 to the valve casing and exhausts by the pipe 24. With the parts in the position shown fluid under pressure from the pipe 23 can pass through the pipe 25 and ports and passages in the pilot valve

to the pipe 16, the latter communicating with the upper cylinder space of the left-hand motor. Fluid from the lower cylinder space of this piston exhausts by the pipe 17 and the ports and passages in the valve casing and pilot valve into the exhaust pipe 24.

In order to actuate the pilot valve that controls the motors, the latter moving the valves 10 and 11 in a manner to insure a constant pressure in the chamber or region 7 and conduit 5, a pressure-responsive device is provided comprising a cylinder 26 containing a movable piston or abutment 27. For convenience the piston and cylinder are associated with the discharge conduit 5, but it is to be understood that they may be located elsewhere. The main thing is to so arrange the parts that the piston is subjected to the pressure of the region from which steam is drawn. The underside of this piston is exposed to the pressure in the chamber 7 and conduit 5 and acting in opposition to this pressure is a compression spring 28 that tends to hold the piston in the position shown. The tension of the spring can be regulated by the nut 29 and screw 30, the former being provided with a gear 31 that meshes with a pinion 32. The pinion is mounted on a suitable shaft that can be turned by the hand wheel 33 when it is desired to increase or decrease the tension of the spring 28. Motion from the piston 27 is transmitted to the pilot valve 21 by the rod 34 so that as the piston rises and falls so also will the pilot valve, the latter serving to cover and uncover the various ports located in its surrounding sleeve.

In order to prevent overtravel of the regulating valves 10 and 11 in either the opening or closing direction, a means is provided whereby such movements have a modified effect on the action of the pilot valve. To this end the stems of the regulating valve are connected by a rod 35 having forks 36 at its ends to receive collars on the valve stems which are so arranged that one valve may move independently of the other. The rod 35 is connected by a link 37 with the lever 38, the latter having a fixed pivot 39. The lever is connected to the sleeve 22 surrounding the pilot valve by links 40, one of which is shown in dotted lines.

The action of my improved governing mechanism is as follows: Assuming for example that the pressure in the chamber or region 7 and in the conduit 5 connecting therewith is too high, the piston 27 will move upward and, in so doing carry with it the pilot valve causing the latter to uncover the port communicating with the pipe 19 leading to the under side of the piston of the right-hand motor, the pipe 18 by the same action being placed in communication with exhaust pipe 24. This means that the valve 10, the smaller of the two regulating valves, will be opened and some of the steam will flow from the chamber 7 through the valve into the chamber 12 and through the low pressure section of the turbine. The opening movement of the valve 10 raises the right-hand end of the rod 15, the left-hand end pivoting on the stem 35. As the result of this the link 37 transmits motion to the lever 38, and the latter in turn acting through the links 40 raises the sleeve 22 surrounding the pilot valve, thereby closing the ports which had previously been opened by the upward movement of said pilot valve. Similarly if the pilot valve causes the left-hand motor to operate, the rod 35 will move the sleeve 22 up or down as the case may be to close the ports. Under most conditions of operation there will be a subdivision of the steam between the conduit 5 leading to the steam heating devices and the low pressure portion of the turbine. The amount of steam passing to said ports will be dependent upon the load requirements. When the devices using steam are cut out of service it is evident that all of the steam will then flow through the turbine and it will then function as any other turbine. Assuming that the pressure in the chamber 7 and conduit 5 falls below a certain value the regulating mechanism will first close one or both valves 10 and 11 and if pressure still continues to fall the turbine rotor will begin to slow down due to a failure of the steam supply. This slowing down of the rotor will cause its speed governor and the valve mechanism associated therewith to admit more steam to the high pressure end until the pressure in the chamber 7 is restored to normal, *i. e.*, to the pressure at which it is desired to supply steam to the steam consuming devices. It will thus be seen that the pilot valve which governs the regulating valves is dependent as to its position upon the pressure existing at the point or region where the turbine is tapped to extract steam, while the position of the ported sleeve surrounding said valve is determined by the existing positions of the regulating valves 10 and 11. By thus arranging the parts, over regulation both in increasing and decreasing the passage of fluid from one portion of the turbine to the other is prevented.

My invention while applicable to turbines of various kinds will be found to be of especial value with those of the reaction type.

I have not shown the speed governor and valve mechanism controlled thereby since it seems unnecessary in view of the fact that I can use any of the well known arrangements for the purpose.

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 that is divided into stages, a conduit for conveying steam from the turbine between certain of its stages, a valve controlling the passage of fluid from one stage to another, a means sensitive to the steam pressure in the conduit for controlling the action of the valve, and a device actuated by the valve for modifying the action of said means.

2. In combination, a turbine that is divided into stages, a conduit for conveying steam from the turbine between certain of its stages, a valve controlling the passage of fluid from one stage to another, a motor for actuating the valve, means sensitive to the pressure of the steam in the conduit for controlling the action of the motor, and means for preventing overtravel of the motor and valve.

3. In combination, a turbine that is divided into stages, a conduit for conveying steam from the turbine between certain of its stages, a valve controlling the passage of fluid from one stage to another, a fluid motor for actuating the valve, a pilot valve controlling the motor, a means sensitive to pressure in the conduit for controlling the movements of the pilot valve, a ported member that coöperates with the pilot valve, and means actuated by the movements of the valve for adjusting said member with respect to the pilot valve.

4. In combination, a turbine wherein the pressure of the fluid decreases as it flows therethrough, a valve controlling the passage of fluid through the turbine at some intermediate region, a conduit that receives steam from said region on the side of the valve of higher pressure, a device responsive to the pressure existing in said region which controls the action of the valve, and a means movable with the valve that modifies the action of the device and prevents overtravel of said valve.

5. In combination, a turbine wherein the pressure of the motive fluid decreases as it flows therethrough, a valve regulating the passage of fluid through the turbine at some intermediate point, a motor for actuating the valve, a controller for controlling the action of the motor, a conduit receiving fluid from a region in the turbine adjacent the controlling valve, and a means sensitive to pressure in said region that is connected to and moves the controller.

6. In combination, a turbine wherein the pressure of the motive fluid decreases as it flows therethrough, a valve regulating the passage of fluid through the turbine at some intermediate point, a motor for actuating the valve, a controller for controlling the action of the motor, a conduit receiving fluid from a region in the turbine adjacent the controlling valve, a means sensitive to pressure in said region for actuating the controller, and a device movable with the valve for modifying the action of the controller on the motor.

7. In combination, a turbine wherein the pressure of the motive fluid decreases as it flows therethrough, valves regulating the passage of fluid through the turbine at some intermediate region, a means common to and controlling the valves, a device responsive to changes in pressure in said region for actuating said valve controlling means, a device movable with each of the valves for modifying the action of the controlling means to prevent overtravel of said valves, and a conduit receiving and carrying motive fluid away from the turbine under the control of the valves.

8. In combination, a turbine wherein the pressure of the motive fluid decreases as it flows therethrough, valves regulating the passage of fluid through the turbine at some intermediate region, motors for actuating the valves, a pilot valve common to and controlling the action of the motors, a device sensitive to the pressure existing in the region adjacent the higher pressure side of the valves for actuating the pilot valve, a means acted upon by said valves to modify the action of the pilot valve, and a conduit receiving and carrying motive fluid away from the turbine under the control of the valves.

9. In combination, a turbine wherein the pressure of the motive fluid decreases as it flows therethrough, a valve for regulating the flow of fluid from one portion of the turbine to another, a means for actuating the valve, a controller for the means, a device sensitive to pressure for moving the means, a means for modifying the action of the controller, and a lever movable with the valve for transmitting its motions to the said modifying means.

10. In combination, a turbine wherein the pressure of the motive fluid decreases as it flows therethrough, a valve for regulating the flow of fluid from one portion of the turbine to another, a motor for actuating the valve, a pilot valve controlling the motor, a ported sleeve that surrounds the pilot valve and coöperates therewith to control the motor, and means for mechanically transmitting movements of the regulating valve and motor to said ported sleeve.

11. In combination, a turbine wherein the pressure of the motive fluid decreases as it flows therethrough, valves for regulating the flow of fluid from one portion of the

turbine to another, a conduit conveying fluid from the turbine on the side of the valve of higher pressure, a motor for actuating the valve, a pilot valve for controlling the motor, a device connected to the pilot valve and sensitive to the pressure of the fluid flowing through the conduit from the turbine, means for adjusting the effective action of said device, and a ported sleeve for the pilot valve that is moved by the motor.

12. In combination, a turbine wherein the pressure of the motive fluid decreases as it flows therethrough, valves for regulating the flow of fluid from one part of the turbine to another, conduit means conveying fluid from the turbine from the high pressure side of the valves, means for controlling and actuating the valves, a controller for said means, a pressure-responsive device for modifying the action of said controller, and means moving with the valves for actuating said device to prevent overtravel of the valves.

In witness whereof, I have hereunto set my hand this twenty-seventh day of May, 1911.

LUDWIG CUBELIC.

Witnesses:
FRIEDRIC J. GAUGERT,
OTTO SCHMIDT.