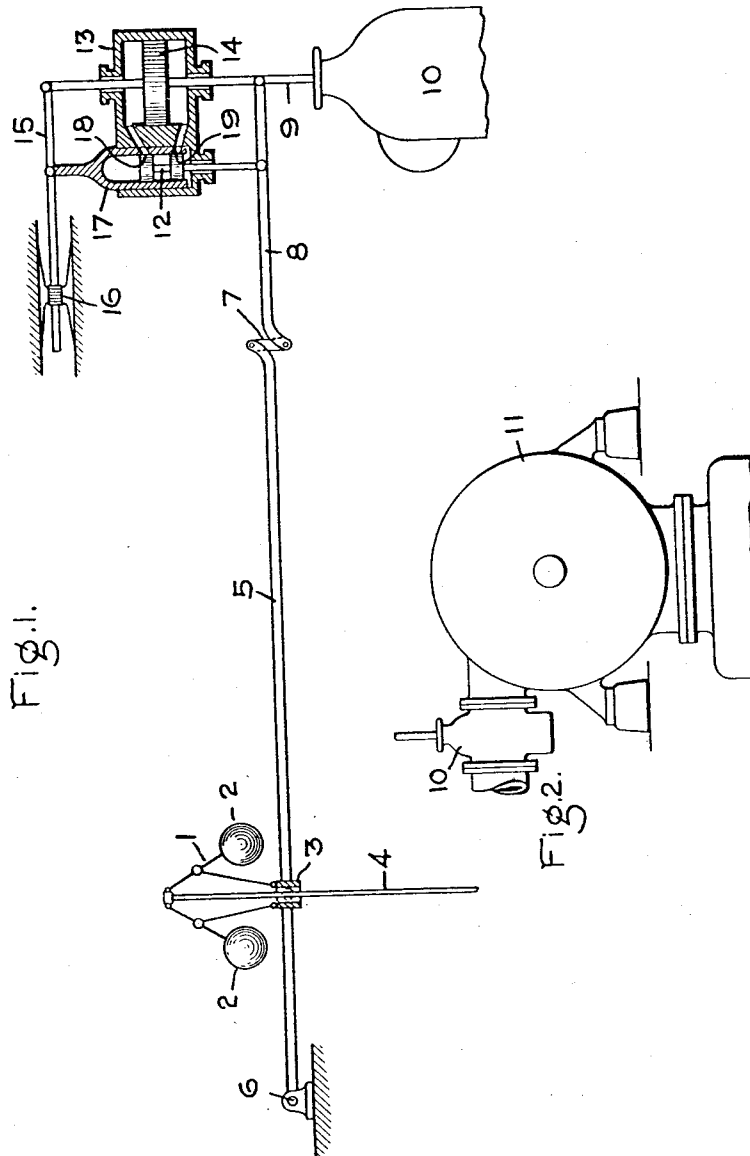


W. PAPE.
GOVERNING MECHANISM FOR TURBINES.
APPLICATION FILED DEC. 27, 1911.

1,029,312.

Patented June 11, 1912.



Witnesses:

Marcus L. Byng.
Anthony E. Marx

Inventor,
Wilhelm Pape,
by *Alfred Davis*
Att'y.

UNITED STATES PATENT OFFICE.

WILHELM PAPE, OF CHARLOTTENBURG, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

GOVERNING MECHANISM FOR TURBINES.

1,029,312.

Specification of Letters Patent.

Patented June 11, 1912.

Application filed December 27, 1911. Serial No. 668,132.

To all whom it may concern:

Be it known that I, WILHELM PAPE, 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 turbines, and has for its object to improve their construction and operation by decreasing the change in shaft speed heretofore found necessary in passing from no-load to full-load operating conditions.

In the accompanying drawing is illustrated one of the embodiments of my invention, wherein—

Figure 1 shows diagrammatically a governing mechanism, and Fig. 2 is an end view of a steam turbine.

1 indicates a speed governor of the centrifugal type having a pair of weights 2 that are connected to the collar 3 that surrounds the shaft 4 and is movable axially thereon. This latter may be the main shaft of the turbine or a secondary shaft driven thereby. The collar is pivotally attached to the lever 5, the latter being pivoted at 6 to a stationary support. To the right-hand end of the lever is pivotally attached a link 7, the lower end of which is pivotally connected to a secondary lever 8. The secondary lever is pivotally attached at its free end to the piston rod 9 that actuates the throttle valve 10 or which actuates mechanism for moving one or more valves controlling the admission of steam to the turbine 11. At some point between its ends the lever 8 is pivotally attached to the pilot valve 12 that controls the admission of fluid under pressure, such as oil, to the cylinder 13 of the main valve actuating motor. Located within the cylinder and attached to the rod 9 is a piston 14. The upper end of the rod 9 is attached to a lever 15, the opposite end of which is adjustably and pivotally carried by the support 16. At some point between its ends the lever 15 is pivotally attached to the sleeve 17 that surrounds the pilot valve 12 and contains ports 18 and 19 that normally register with similar ports in the valve casing leading to opposite sides of the motor piston 14.

Fluid, such as oil, is admitted to the space between the heads of the pilot valve and the spaces at the ends are connected with a suitable exhaust pipe.

As the load on the turbine changes, its speed changes, causing the governor to actuate the levers 5 and 8, thereby moving the pilot valve 12 and causing oil to enter the cylinder 13 and move the piston 14 and the valve or valve mechanism connected therewith. Movement of the piston rod acting through the lever 8 restores the pilot valve to its normal position. In other words, the pilot valve is provided with a follow-up device to prevent over travel.

If the load on the turbine is gradually increased from no-load to full-load, the shaft speed will fall a certain amount, and in proportion to the change in speed the collar 3 will be depressed and the valve 10 will be opened. Therefore to the stroke of the valve 10 corresponds an entirely definite path of the collar 3, and thus also an entirely definite difference in shaft speed. The difference in shaft speed between the upper and lower positions of the collar is dependent upon the degree of non-uniformity of the speed governor. If this lack of uniformity is made very small there is danger of an unsteady regulation, that is to say the shaft speed will vary. With a very great degree of non-uniformity very stable regulation may be obtained, yet the difference in shaft speed between no-load and full-load will be too great, so that the voltage of the electric generator driven by the turbine must have some form of supplementary regulation. I overcome all of these disadvantages by artificially introducing over-regulation into the organization of the governing mechanism by the use of the ported sleeve 17 and cooperating parts. Thus as the load on the turbine is increased from no-load to full-load, the shaft speed falls a certain amount, which is necessary in order to open the valve 10 or the other valve mechanism operated by the motor.

By reason of the artificial over-regulation, due to said sleeve 17 and associated parts, the valve 10 is opened to a greater degree than is determined by the governor so that the shaft speed rises, whereby a small difference in shaft speed between no-load and full-load may be attained. The motor piston 14 in its movements, and acting through its rod 9 and the lever 15, shifts the ported sleeve 17 with respect to the pilot valve 12 whereby an additional movement of the piston 14 and the valve mechanism actuated thereby for a given speed change is obtained. As will be seen the movement of the sleeve has the same ultimate effect as though the pilot valve were moved by a greater amount, thereby prolonging the opening of the ports admitting fluid to the motor. Inasmuch as this additional opening or more strictly period of opening is attained without additional movement on the part of the governor, it follows that close regulation of the turbine will be attained.

It will be seen that the controller for the motor comprises two principal parts, the pilot valve 12 and the ported sleeve 17, said valve being moved by the governor and the sleeve by the motor.

By adjusting the position of the normally fixed pivot 16 of the lever 15, either locally or from a distance, it is possible to regulate at will in starting up the turbine the difference in shaft speed between no-load and full-load.

The principal advantages secured by my improved mechanism are as follows: (a) The regulating process is accelerated because the fluid passages leading to the motor are opened more rapidly. (b) It is possible to employ springs for the governor having a great degree of non-uniformity while maintaining a small speed change between no-load and full-load. (c) In putting the turbine into service the effect of the governor can easily be changed by adjusting the position of the pivot 16, and it is also possible to change the assumption of load by a turbo-generator operating in parallel with other generators so that the load will adjust itself uniformly to both parts of the system.

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 prime mover, a valve means regulating the admission of motive fluid thereto, a governor that controls the

action of the valve means, and a device which artificially causes over-regulation by the valve means.

2. In combination, a prime mover, a valve means regulating the admission of motive fluid thereto, an actuator for said means, a governor controlling the movements of the actuator, and a device moved by the actuator which artificially causes over-regulation by the valve means.

3. In combination, a prime mover, a valve means regulating the admission of motive fluid thereto, a motor for moving the valve means, a controller for the motor, a governor, and a device that acts on the controller to artificially cause over-regulation by the valve means.

4. In combination, a prime mover, a valve means regulating the admission of motive fluid thereto, a fluid actuated motor for moving the valve means, a pilot valve for the motor, a governor, and a device for prolonging the period that the motor ports controlled by the pilot valve are open.

5. In combination, a prime mover, a valve means regulating the admission of motive fluid thereto, a motor for actuating the valve means, a controller for the motor comprising two principal parts, a governor that is connected to and moves one of said parts to cause movement of the motor, and a means connected to and moving the other of said parts to cause a greater motor movement than would be due to governor action only.

6. In combination, a prime mover, a regulating valve means therefor, a motor for actuating the means, a controller for the motor comprising two principal parts, a speed governor connected to and moving one of said parts, and a means pivoted at one end and attached to a moving part of the motor at the other and connected to the second of said parts to move it independently of the first when the motor starts into operation.

7. In combination, a prime mover, a regulating valve means therefor, a motor for actuating the means, a controller for the motor comprising two principal parts, a speed governor connected to and moving one of said parts, a means pivoted at one end and attached to a moving part of the motor at the other and connected to the second of said parts to move it independently of the first when the motor starts into operation, and an adjustable pivot for said means.

8. In combination, a prime mover, a regulating valve means therefor, a fluid motor for actuating the means, a pilot valve for the motor, a ported sleeve that surrounds the pilot valve and coöperates therewith to control the motor, a governor, a lever actuated thereby, a secondary lever attached to the first and also to a moving part of the

motor to form a follow-up device, a rod connecting the secondary lever and the pilot valve, and a device actuated by the motor for moving the ported sleeve.

- 5 9. In combination, a prime mover, a valve means therefor, a motor for actuating said means, a governor therefor, and a device which causes the motor to travel greater dis-

tances than are determined by the movements of the governor.

In witness whereof, I have hereunto set my hand this fifth day of December, 1911.

WILHELM PAPE.

Witnesses:

HENRY HASPER,

WOLDEMAR HAUPT.

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