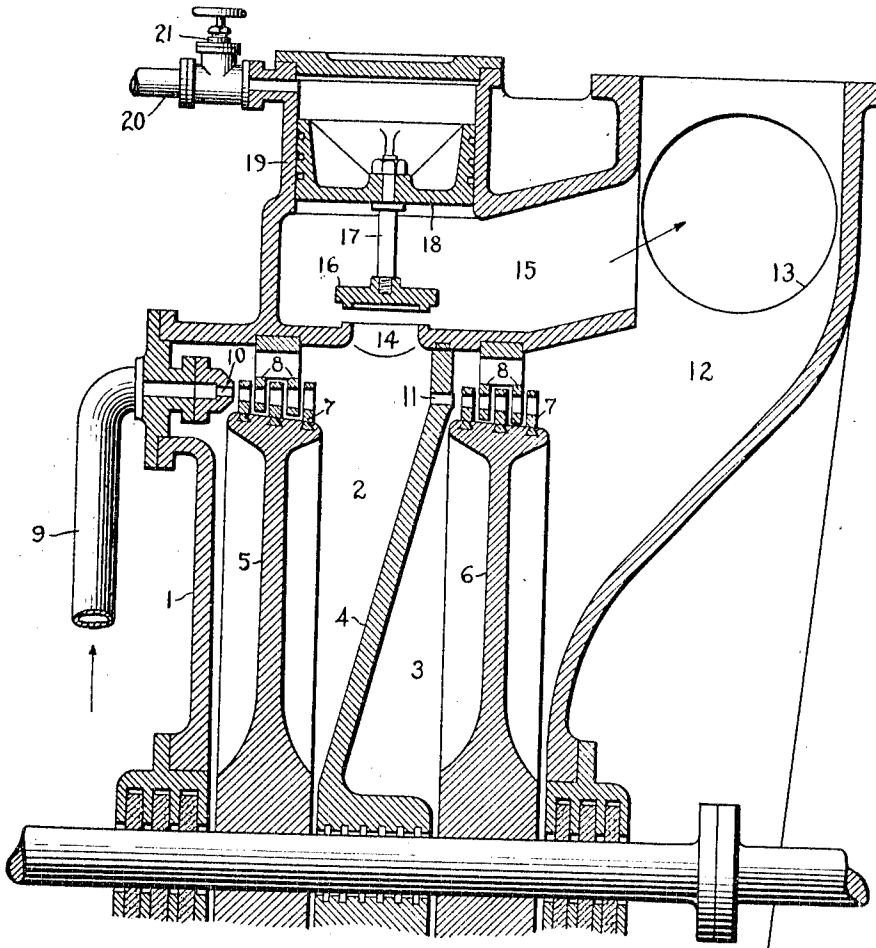


T. THOMSEN.
MULTISTAGE TURBINE.
APPLICATION FILED NOV. 17, 1910.

1,090,110.

Patented Mar. 10, 1914.



WITNESSES.

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INVENTOR:

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UNITED STATES PATENT OFFICE.

THEODOR THOMSEN, OF CHARLOTTENBURG, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MULTISTAGE TURBINE.

1,090,110.

Specification of Letters Patent. Patented Mar. 10, 1914.

Application filed November 17, 1910. Serial No. 592,778.

To all whom it may concern:

Be it known that I, THEODOR THOMSEN, a subject of the King of Denmark, residing at Charlottenburg, Germany, have invented certain new and useful Improvements in Multistage Turbines, of which the following is a specification.

This invention relates to devices for regulating the operation of multi-stage elastic fluid turbines, and its object is to provide an automatic valve responsive to the exhaust pressure which will cut out one or more lower stages when the machine changes over from running condensing to non-condensing. It is generally customary to cut out these stages by hand, in order to maintain a normal speed of rotation. My invention relieves the engineer from this duty, and not only performs the operation of cutting out the stages under the conditions stated, but also automatically restores them to service when the machine changes back to condensing again.

The accompanying drawing is a longitudinal section of a multi-stage turbine equipped with my invention.

A two-stage turbine is illustrated, but the invention is applicable to machines having any number of stages. The casing 1 is divided into two chambers 2 and 3 by the diaphragm 4. In one chamber is a bucket wheel 5 and in the other a wheel 6, each provided with buckets 7 cooperating with stationary intermediates 8. A pipe 9 conveys high pressure steam to one or more nozzles 10 directing the steam upon the buckets of the wheel 5. After acting upon said buckets the steam flows through a nozzle or nozzles 11 in the diaphragm 4 cooperating with the buckets on the wheel 6. Passing from this wheel the steam flows away to the exhaust conduit 12 which can be connected at will either to the condenser (not shown) or to a discharge port 13 leading directly to the atmosphere.

A port 14 opens from the chamber 2 into a bypass 15 leading directly to the exhaust conduit 12 and cutting out the chamber 3. This port is controlled by a valve, preferably a piston or puppet valve 16, opening outwardly and suitably connected, preferably by the stem 17, to a piston 18 working in a cylinder 19 having a closed outer end, and communicating at its inner end with the bypass 15. A pipe 20 provided with a stop

valve 21, conveys steam from a boiler or other source at some suitable constant pressure to the cylinder 19 above the piston 18. The area of the piston is greater than that of the valve.

The operation is as follows: When the turbine is operating condensing, the vacuum prevailing in the condenser also exists in the conduit 12 and bypass 15, so that the pressure acting upon the upper and larger surface of the piston 18 keeps the valve 16 closed. If now, the machine changes over to running non-condensing, the pressure in the bypass 15 rises to atmospheric or thereabout, so that the pressure on the upper side of the piston 18 is more nearly counter-balanced, at least to an extent sufficient to enable the pressure in the chamber 2 to lift the valve 16. This permits the steam to pass directly from the chamber 2 to the exhaust, cutting out the wheel 6 and causing the turbine to maintain its normal rate of speed. Whenever the use of the condenser is resumed, the drop in pressure in the passages 12 and 15 will enable the relatively increased pressure on the top of the piston 18 to close the valve 16 and cause the wheel 6 to come into service again.

This invention has the advantage of dispensing with all springs and other accessories which are liable to alter with variations in temperature and also exert a variable load on the valve, so that the operation of my device is reliable and constant.

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 a multi-stage turbine having a steam inlet and an exhaust, means for automatically cutting out a lower stage when the turbine changes from condensing to non-condensing operation, comprising a valve, and a motor for operating the valve which is actuated in one direction by a substantially constant fluid pressure and in the opposite direction by the exhaust pressure of said stage.

2. In a multi-stage turbine, a bypass around a lower stage to the exhaust, a valve controlling said bypass, and means for automatically opening said valve when the machine changes from condensing to non-condensing operation, and for closing it when the machine resumes condensing operation, said means including a movable member exposed on one side to the exhaust pressure and on the other side to a constant pressure, and devices connecting the member and the valve.

3. In a multi-stage turbine, the combination with a puppet valve controlling a port leading from a higher stage to the exhaust, of a piston of larger area than said valve exposed on one side to the exhaust pressure and on the other to a constant higher pressure, and connections between said piston and said valve.

4. The combination with a multi-stage turbine having in a higher stage a port opening into a bypass leading to the exhaust, of a valve in said bypass closing said port from the outside and exposed to the pressure in said by-pass, a piston of larger area than said valve, exposed on one side to the pressure in said bypass, means for conveying

steam at a substantially constant pressure to the other side of said piston, and connections between said piston and said valve.

5. The combination in a multi-stage turbine having a bypass leading from a higher stage to the exhaust and a port between said stage and the bypass, of a valve controlling the flow through the port that is exposed on one side to stage pressure and on the other side to the pressure in the bypass, a stem for the valve, and means connected to the stem that is subjected on one side to the pressure in the bypass and on the other side to a constant pressure.

6. A multi-stage turbine having a bypass leading from a higher stage to the exhaust, a valve controlling the bypass, and means connected to said valve and responsive to changes in the pressure in the region of the bypass between the valve and the exhaust for opening and closing the valve.

In witness whereof, I have hereunto set my hand this 26 day of October 1910.

THEODOR THOMSEN.

Witnesses:

OSKAR DAHLKE,

ARTHUR CLERSTMANN,