

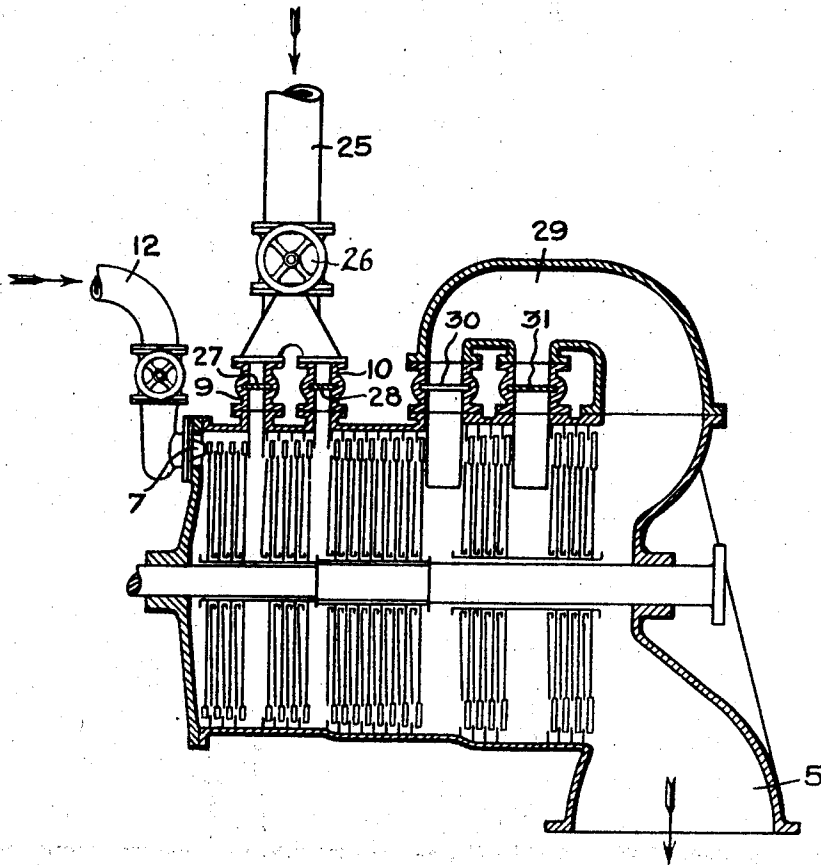
L. CUBELIC & G. FORNER.

STEAM TURBINE.

APPLICATION FILED DEC. 27, 1911.

1,063,510.

Patented June 3, 1913.



Witnesses:

Marcus L. Byng.
Anthony E. Marx

Inventors:
Ludwig Cubelic,
Georg Forner,
by *Albert S. Davis*
Their Att'y

UNITED STATES PATENT OFFICE.

LUDWIG CUBELIC, OF CHARLOTTENBURG, AND GEORG FORNER, OF BERLIN, GERMANY,
ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

STEAM-TURBINE.

1,063,510.

Specification of Letters Patent.

Patented June 3, 1913.

Application filed December 27, 1911. Serial No. 668,044.

To all whom it may concern:

Be it known that we, LUDWIG CUBELIC, a subject of the King of Prussia, residing at Charlottenburg, Germany, and GEORG FORNER, a subject of the King of Prussia, residing at Berlin, Germany, have invented certain new and useful Improvements in Steam-Turbines, of which the following is a specification.

The present invention relates to steam turbines and is illustrated as applied to mixed pressure turbines, i. e., turbines that are operated by low pressure steam, or by a mixture of low and high pressure steam, or by high pressure steam only; but the invention is applicable to other types of turbines than the one illustrated.

The invention has for its object to improve the construction and operation of such turbines and their controlling mechanism whereby said turbines will utilize the steam to better advantage than heretofore.

The accompanying drawing is a sectional view of a turbine showing an illustrative embodiment of our invention.

In the first or high pressure section of the turbine we employ several wheels or several rows of buckets with their cooperating intermediate buckets and abstract the velocity of the steam fractionally by successive operations. A single larger wheel can be used if preferred. Low pressure steam is admitted to the low pressure stages through the pipe 25 containing a throttle valve 26. The turbine is intended to be operated by this low pressure steam to as large an extent as possible. Live or high pressure steam is used to supplement the low pressure supply when the latter is insufficient to meet the demand of the turbine. The pipe beyond the valve 26 is divided in order to supply the low pressure conduit 9 and the second low pressure conduit 10. The conduit 9 is used when the supply of low pressure steam is relatively small because it leads to a region where the steam passages are of relatively small cross section and therefore adapted to efficiently handle the smaller volume of steam. When the supply of low pressure steam is normal it enters the turbine by the conduit 10. In the former conduit is located a slide or other valve 27 for regulating the passage of steam and in the latter a valve 28. The stages of lowest pressure are divided into groups or regions and shunting

them is a passage 29 to which steam can enter under the control of slide or other suitable valves 30 and 31. The valves may be operated by substantially the same mechanism as the valves of our co-pending application Serial No. 699,389, if desired. The novel features of the turbine shown but not claimed herein are claimed in said application. For low pressure operation with steam entering the conduit 10 all of the subsequent stages will be in service and the valves 30 and 31 will be closed. For mixed pressure operation high pressure steam from the pipe 12 will enter the admission nozzle 7 and low pressure steam will enter by the conduit 9 in which case valve 28 will be closed and valve 27 open. As to the last two groups of stages one or both may be cut out. Opening valve 31 and closing valve 30 results in shunting the last group of stages which is the arrangement we prefer under said circumstances. When operating with high pressure steam alone, the valve 30 is opened to shunt both stages. The reason for cutting out stages is that the high pressure steam contains much more energy than the low pressure steam and hence a smaller total volume is passed through the machine. Since the working passages in the extreme low pressure stages are relatively large for the amount of steam that would pass through them under conditions of mixed pressure or high pressure operation, and since failure to properly fill the passages results in uneconomical operation, we prefer to so design the turbine as a whole that these stages may be cut out and thereby increase the efficiency by using only such stages as are capable of effective, economical action. The different conditions of operation will determine whether one or more of said low pressure groups of stages will be cut out.

In accordance with the provisions of the patent statutes, we have described the principle of operation of our invention, together with the apparatus which we now consider to represent the best embodiment thereof; but we desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What we claim as new and desire to secure by Letters Patent of the United States, is,—

1. In combination, a steam turbine di-

vided into a plurality of stages, a conduit for admitting high pressure fluid to the turbine, a conduit for admitting low pressure fluid to the turbine, and means for changing the number of active low pressure fluid stages when the turbine is operating on steam supplied wholly or in part by the high pressure conduit.

2. In combination, a steam turbine divided into a plurality of stages, conduits admitting high and low pressure motive fluid to the turbine, controlling valves therefor, and valve means for changing the number of active low pressure stages.

3. In combination, a steam turbine divided into a plurality of stages, a conduit admitting high pressure motive fluid to the turbine, conduits admitting low pressure motive fluid to stages of the turbine of different pressures, and valve mechanism for controlling the number of active low-pressure stages.

4. In combination, a steam turbine divided into a plurality of stages, a conduit admitting high pressure motive fluid to the turbine, conduits admitting low pressure

motive fluid to stages of the turbine of different pressures, valve mechanism for controlling the passage of fluid through said conduits, and means for cutting out one or more stages when the turbine is operating on the mixed or high pressure plan.

5. In combination, a multi-stage turbine comprising a stage that utilizes high pressure fluid only, one or more stages that normally utilize low pressure but which utilize high pressure fluid only when the turbine is operating on the mixed pressure plan, and stages that normally utilize low pressure fluid but which utilize both low and high pressure fluid when the turbine is operating on the mixed pressure plan, and means for cutting out certain of the low pressure stages when the turbine is operating on the mixed or high pressure plan.

In witness whereof, we have hereunto set our hands.

LUDWIG CUBELIC.
GEORG FORNER.

Witnesses:

FRANZ SCHOERNER,
FRIEDRICH GANZERT.

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