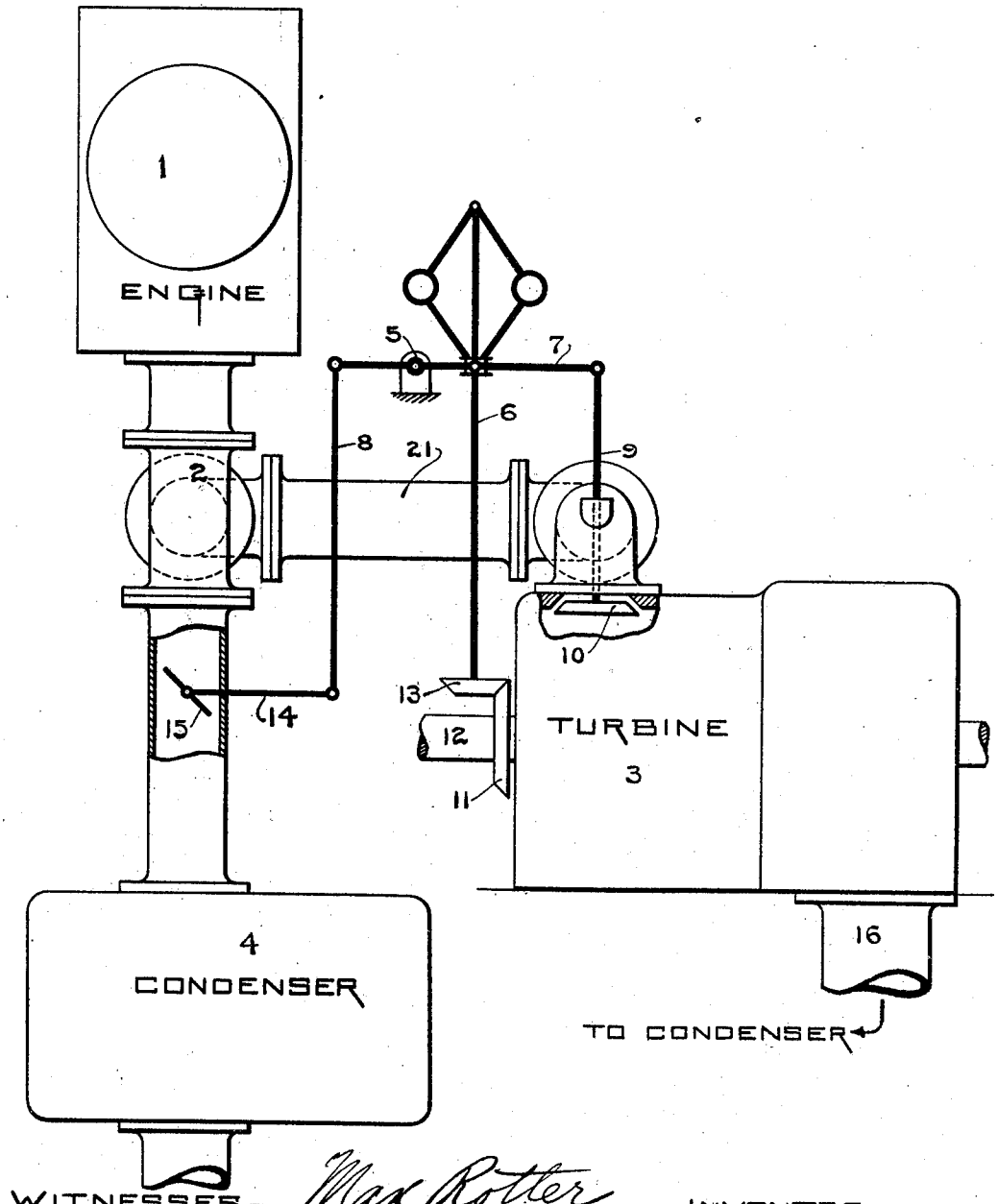
M. ROTTER.

STEAM TURBINE.

APPLICATION FILED JULY 2, 1910.

1,002,813. Patented Sept. 5, 1911.

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# UNITED STATES PATENT OFFICE.

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## STEAM-TURBINE.

1,002,813. Specification of Letters Patent. Patented Sept. 5, 1911.

Application filed July 2, 1910. Serial No. 570,065.

*To all whom it may concern:*

Be it known that I, MAX ROTTER, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Steam-Turbines, (Case B,) of which the following is a specification.

This invention relates to elastic fluid turbines, especially of the low pressure type and where the supply of elastic fluid, such as steam, comes from some other source than a generator or boiler, usually having been first made use of in some way at a higher pressure than that at which it is used in the turbine.

The object of the invention is to secure better economy in the operation of the system in which the low pressure elastic fluid turbine is used.

In the operation of a low pressure steam turbine, by means of the exhaust steam from a reciprocating steam engine, it is the usual practice to operate the engine with an exhaust pressure slightly above the atmospheric pressure; the portion of such exhaust steam, necessary to carry the existing load of the turbine at any moment, being admitted to the turbine under control of a governor; and any excess above this amount, being exhausted into the atmosphere, past an automatic valve if found necessary. In such a system, should the turbine load be proportionately low, the steam entering same would be throttled to a pressure below the atmospheric pressure, in its passage by the governor-operated inlet valve on the turbine.

In the present invention, the back pressure on the reciprocating engine, in other words the engine exhaust pressure, may be reduced in proportion to the reduction in the inlet pressure to the turbine. For this purpose the pipe which conveys the exhaust steam from the engine to the turbine is extended to a condenser, which may or may not be the same one as the condenser into which the turbine exhausts, and a valve is introduced in the extension. This valve is under control of the same governor, operated by the turbine, which controls the turbine inlet valve; the arrangement of levers and links which are operated by the governor, being such that as the inlet valve to the turbine moves toward full open position to admit more steam, the valve in the condenser connection moves toward closed position to pass less steam, thus raising the pressure in the engine exhaust. On the other hand when the inlet valve to the turbine moves toward closed position to admit less steam, the valve in the condenser connection moves toward full open position and passes more steam, thus lowering the pressure in the engine exhaust. The engine exhaust pressures are those maintained at the most economical values possible with any combination of engine load and turbine load.

For a complete understanding of this invention reference is made to the accompanying drawing in which the figure represents a view in elevation, partly in section, of the system to which the invention is applied.

Referring to the drawing, the engine 1 passes its exhaust steam through pipe 2 to condenser 4. A pipe 21 leads off from engine exhaust pipe 2 to the inlet of turbine 3. The turbine exhaust pipe 16 passes to a condenser which may be the same condenser 4 to which the exhaust passes directly from engine 1. The inlet to turbine 3 is controlled by valve 10. The engine exhaust pipe 2 has a butterfly valve 15 therein at a point beyond the connection thereto of pipe 21, in other words, between the point at which pipe 21 leads off and condenser 4 to which the engine exhaust pipe 2 directly delivers. The turbine inlet valve 10 and the butterfly valve 15 are connected by levers 14, 7, link 8 and stem 9 and are under the control of the turbine governor 6 having its collar connected to lever 7 pivoted to some stationary point 5, the governor being operated by the turbine 3 through shaft 12 and gears 11, 13. The connection between the turbine inlet valve 10 and the butterfly valve 15 is such that when the inlet valve 10 is moved toward full closed position the butterfly valve 15 moves toward full open position.

The operation of the invention is as follows: The engine 1 may be supposed to be running with a back pressure of sixteen pounds, the butterfly valve 15 throttling to the necessary extent the passage of steam from engine 1 directly to condenser 4. The turbine inlet valve 10 may then be supposed to be open to nearly its fullest extent so that the turbine may be operating at an inlet pressure of say fifteen pounds. The condition of loading of the turbine 3 may now be such

as to require a drop in the inlet pressure to eight pounds. This is automatically accomplished by the speeding up of the governor 6 to operate lever 7 and stem 9 of inlet valve 10 to move the said valve toward closing position to an extent that will result in a drop in inlet pressure of the turbine to eight pounds. At the same time the governor 6 will, through lever 7, link 8, lever 14, so operate the butterfly valve 15 as to move same toward full open position, the movement being proportional to the movement of inlet valve 10. This will cause a drop in the pressure of the exhaust from engine 1, say from sixteen pounds to ten pounds, thus relieving engine 1 of the high back pressure and permitting more economical operation. Upon an increase in the turbine load, the slowing down of the governor 6 will move inlet valve 10 and butterfly valve 15 in the reverse directions to those just described, thus augmenting the inlet pressure of the turbine 3 by dropping the exhaust from engine 1.

It should be understood that it is not desired to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim and desire to secure by Letters Patent,—

1. In a power system, the combination of an engine, an exhaust pipe extending therefrom divided into two paths, a condenser in direct communication with said exhaust pipe by one of said paths, a turbine in communication with said exhaust pipe by the other of said paths, valves for limiting the flow through said paths, and a governor controlling said valves.

2. In a power system, the combination of an engine, an exhaust therefor, a turbine in communication with said exhaust, a valve in the turbine inlet, a valve in said exhaust beyond the point of said communication, a governor controlling both said valves, and a condenser connected to the exhausts of said engine and turbine.

In testimony whereof, I affix my signature in the presence of two witnesses.

MAX ROTTER.

Witnesses:
A. C. CASE,
W. H. LIEBER.