S. J. PIGOTT.

ELASTIC FLUID TURBINE.

APPLICATION FILED AUG. 18, 1911.

1,021,260.

Patented Mar. 26, 1912.

2 SHEETS—SHEET 1.

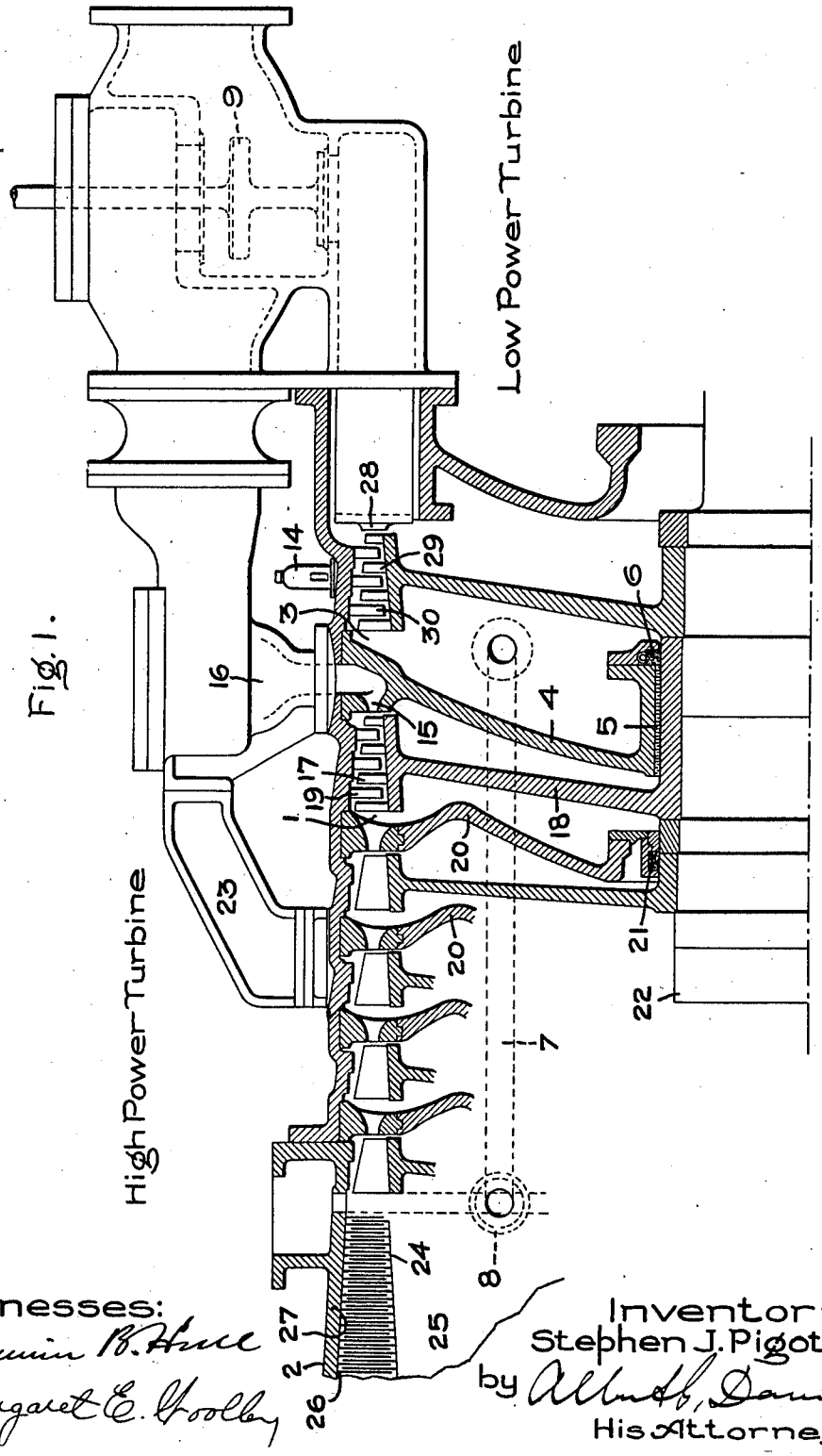

Fig. 1.

Witnesses:

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Margaret E. Woolley

Inventor:

Stephen J. Pigott,

by Albert G. Davis

His Attorney.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

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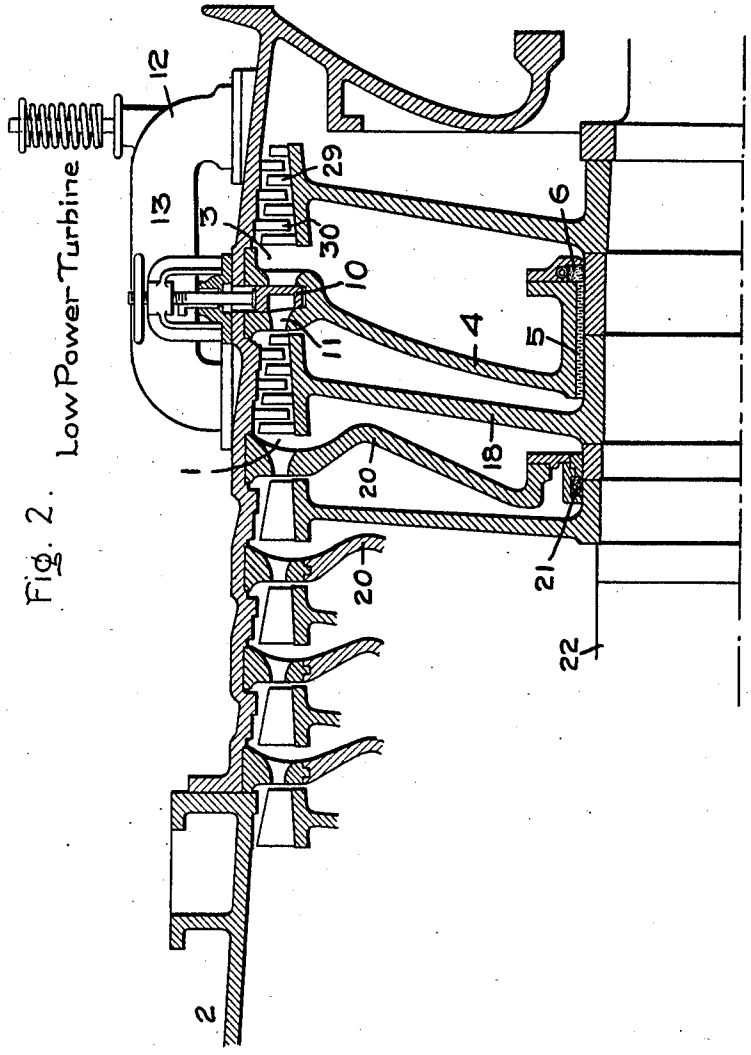

Fig. 2.

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UNITED STATES PATENT OFFICE.

STEPHEN J. PIGOTT, OF ST. ANN'S, HELENSBURGH, SCOTLAND, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELASTIC-FLUID TURBINE.

1,021,260. Specification of Letters Patent. Patented Mar. 26, 1912.

Application filed August 18, 1911. Serial No. 644,801.

To all whom it may concern:

Be it known that I, STEPHEN J. PIGOTT, a citizen of the United States of America, residing at St. Ann's, Helensburgh, Scotland, have invented certain new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification.

My invention relates to elastic-fluid turbines, and more particularly of the type used for marine propulsion and has for its object to improve the efficiency of such turbines at different powers and speeds.

My invention comprises a main or high-power turbine and a cruising or low-power turbine mounted on the same shaft, the cruising turbine when running idle being connected to a low pressure stage of the main turbine. The cruising turbine when in operation exhausts through suitable valve-controlled nozzles into the main turbine and, in order to prevent abnormal increase of pressure in the cruising turbine in the event of failure to open said valves, a by-pass connection controlled by an automatic valve is provided between the two turbines.

The accompanying drawings illustrate one arrangement for carrying my invention into effect, Figure 1 being a part longitudinal section through the turbine illustrating the means by which motive fluid is admitted when full power is required; and Fig. 2 is a similar view illustrating the means by which motive fluid is admitted at low power or cruising speeds.

In carrying my invention into effect as illustrated in the drawings, the main turbine consists of a number of impulse stages 1 and one or more reaction stages 2. A cruising or low-power turbine 3 of the impulse type is mounted on the same shaft as the main turbine, and is housed in the casing in such manner that it is isolated from the main turbine when full power is being developed, by means of a diaphragm in which the inlet valves for controlling the passage of steam from the cruising to the main turbine are located. The cruising turbine is shown as consisting of a single stage impulse wheel, but it may consist of any number.

In order to prevent leakage of steam from the high pressure stage of the main turbine into the cruising turbine when the main turbine is working, I provide the diaphragm 4 between the two with a labyrinth shaft packing 5. It may also be provided with carbon ring packing 6 held in place by a garter spring. Any other suitable packing device than that illustrated may be used. Should any fluid pass through this packing into the cruising turbine casing, it would tend to lower the efficiency of the main turbine, and to overcome this objection I connect the cruising turbine portion of the casing by a pipe 7 with a low pressure stage of the main turbine, so that a low pressure may be maintained in the cruising turbine while the main turbine is in operation, and also so that the motive fluid which has leaked through may be returned to the main turbine, where it can do useful work. This pipe is controlled by the valve 8.

The motive fluid can be admitted to these turbines by any suitable type of valve. In the drawing I have illustrated a double beat valve 9 situated in the main steam pipe. This valve is adapted to admit motive fluid alternatively to the first stage 1 of the main turbine or to the cruising turbine 3. When the cruising turbine is in operation, the exhaust fluid from it passes through the main turbine by means of valves 10, Fig. 2, controlling nozzles 11 in the diaphragm separating the main turbine from the cruising turbine, and these valves should be opened before the double beat valve is opened to supply the low power turbine with steam. In the event of these valves being inadvertently left closed, the pressure in the cruising turbine might rise to the pressure of the boiler or other source, and to prevent this I provide a pressure controlled escape valve 12, set so as to open at any desired pressure above the normal working pressure, and by-pass the fluid through the conduit 13 into the first stage of the main turbine. In order to call attention to the fact that the valves 10 have not been opened, I may provide a small blow-off valve or steam whistle 14, set to blow off and so give a warning when the pressure rises a certain predetermined amount above the normal working pressure.

In order that the structure of the turbine used to illustrate my invention may be understood, the following description is given: The diaphragm 4 is provided with the nozzles 11, previously referred to, and also with nozzles 15 through which live steam enters from the supply conduit 16,

under the control of a suitable valve means. Steam from both nozzle diaphragms act on the wheel buckets 17 to drive the wheel or rotor 18. Between the rows of wheel buckets are stationary intermediate buckets 19 whose function it is to receive steam from one row of wheel buckets and properly direct it against the next. The structure is the same in the subsequent impulse stages, the only difference being that the nozzles and buckets are larger to accommodate the increased volume of steam due to the decreased pressure. Between the impulse stages of the high power turbine are diaphragms 20 having packings 21 of suitable construction through which the shaft 22 extends.

I have omitted some of the buckets for the lower pressure stages of this turbine for the purpose of simplifying the illustration.

In order to change the power developed by the high-power turbine, steam may be admitted through the nozzles 15 to its initial stage or through conduit means 23 to a stage of lower pressure under the control of suitable valve means. In the low pressure end of the turbine the rotor buckets 24 are mounted on a drum 25, and the intermediate buckets 26 are carried by the main casing 27 which carries all of the intermediates for both the high and low power turbines. The low-power turbine is provided with fluid admitting nozzles 28, and wheel and intermediate buckets 29 and 30.

Instead of exhausting the fluid from the cruising stage directly into the first stage of the main turbine, it will be obvious that one or more of the stages of the main turbine may be by-passed and the fluid admitted to a stage at lower pressure. It will also be obvious that various modifications may be made in the construction and design of the various parts without departing from my invention.

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

1. An elastic-fluid turbine comprising a high- and a low-power turbine mounted on the same shaft and within the same casing, with a valve controlled connection between the low-power turbine casing and one of the low pressure stages of the high-power turbine to insure that the low-power turbine will rotate in a low pressure atmosphere when the high-power turbine is in operation.

2. An elastic-fluid turbine comprising a high- and a low-power turbine mounted upon the same shaft within the same casing, but separated from each other, the low-power turbine being connected to a low pressure stage of the high-power turbine when the latter is in operation and the high-power turbine receiving the exhaust of the low-power turbine when the low-power turbine is in operation.

3. An elastic-fluid turbine comprising a high- and a low-power turbine mounted within the same casing, a shaft common thereto, valves arranged to control the passage of exhaust fluid from the low-power turbine to the first stage of the high-power turbine, and an automatic valve arranged to by-pass the exhaust steam to the high-power turbine from the low-power turbine in the event of the failure of the first named valves to open.

4. An elastic-fluid turbine comprising a high- and a low-power turbine mounted within the same casing, a shaft common thereto, valves arranged to control the passage of exhaust fluid from the low-power turbine to the first stage of the high-power turbine, and an automatic valve arranged to by-pass the exhaust steam to the high-power turbine from the low-power turbine in the event of the failure of the first named valves to open, and a signal device which operates when the pressure in the low-power turbine rises above a predetermined value.

5. An elastic-fluid turbine comprising a high-power multi-stage turbine and a low-power turbine, a casing common to both turbines, a shaft also common to both, a conduit connecting the low-power turbine with one of the low pressure stages of the high-power turbine, a valve in said conduit, and an admission valve that alternatively admits motive fluid to the said turbines.

6. In combination, a high-power turbine comprising a plurality of stages, a low-power turbine, a casing common to both turbines, a diaphragm in the casing that separates the two turbines, nozzles that supply live steam to the high-power turbine, other nozzles that supply exhaust steam from the low-power turbine to the high-power turbine for cruising speed conditions, valve means for admitting steam to the turbines, and valve means that control the passage of steam through nozzles conveying steam from the low- to the high-power turbine.

7. In combination, a high-power turbine comprising one or more impulse stages, and a reaction portion, an impulse low-power turbine, a shaft common to said turbines, a conduit connecting the casing of the low-power turbine with a low-pressure stage of the high-power turbine when the latter only is in service, conduits for conveying steam at high pressure to said high- and low-power turbines, valve means controlling the admission of steam to the turbines, and other valve means controlling the passage of steam from the low- to the high-power turbine for operating at cruising speed.

8. In combination, a high-power turbine comprising one or more impulse stages and a reaction portion, an impulse low-power turbine, a shaft common to said turbines, a conduit connecting the casing of the low-

power turbine with a low pressure stage of the high-power turbine when the latter only is in service, conduits for conveying steam at high pressure to said high- and low-power turbines, valve means controlling the admission of steam to the turbines, and other valve means controlling the passage of steam from the low- to the high-power turbine for operating at cruising speed, a conduit that shunts the last named valve means, and a valve in said conduit that opens in response to a predetermined increase of pressure in the low-power turbine.

9. In combination, high- and low-power turbines, a connection between the two that is open only when the former is in service, a connection for supplying steam from the low- to the high-power turbine which is open only when both turbines are in operation, and a shunt from the low- to the high-power turbine which is responsive to pressure conditions in the low-power turbine.

In witness whereof, I have hereunto set my hand this 13th day of July, 1911.

STEPHEN J. PIGOTT.

Witnesses:

HAROLD MCCUNN,

FRED MIDDLETON.