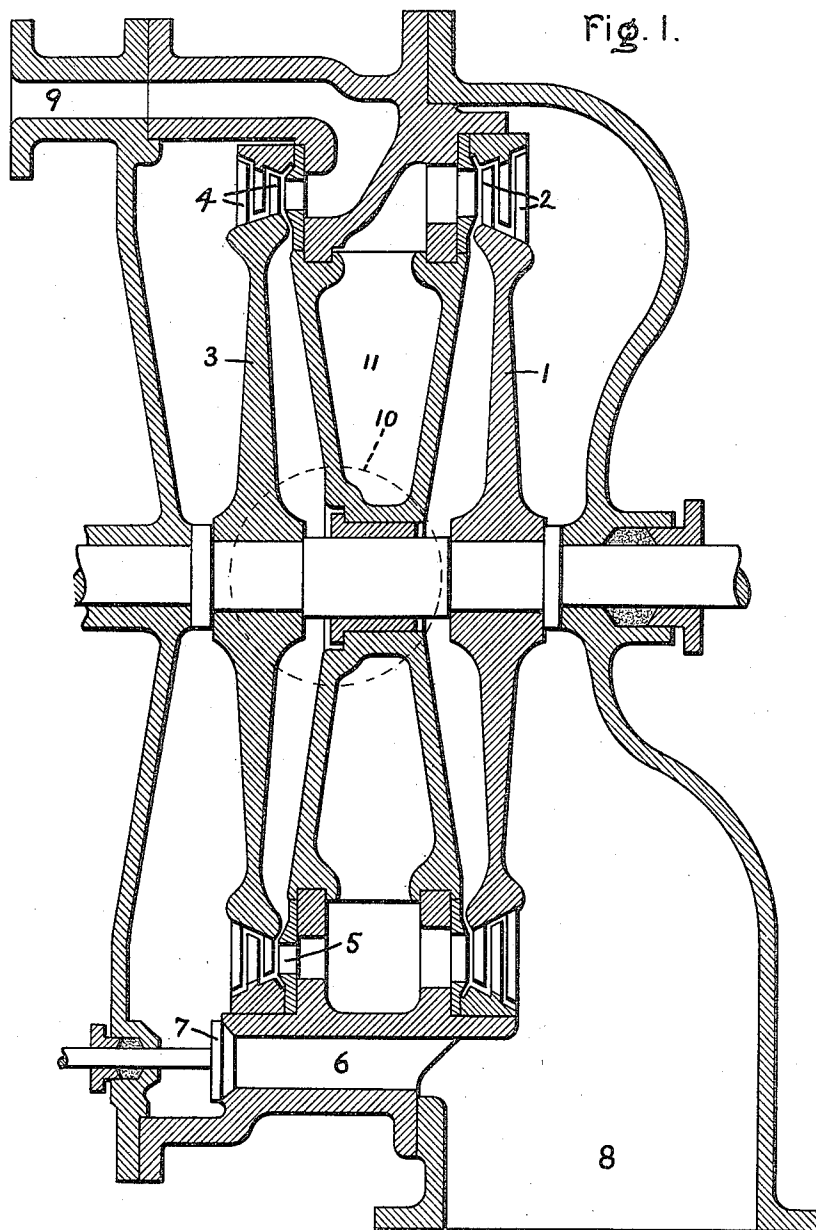


K. ALQUIST.
FLUID PRESSURE TURBINE.
APPLICATION FILED OCT. 22, 1910.

994,049.

Patented May 30, 1911.

2 SHEETS—SHEET 1.



Witnesses:

Earl G. Klock
J. Ellis Elm

Inventor.

Karl Alquist,

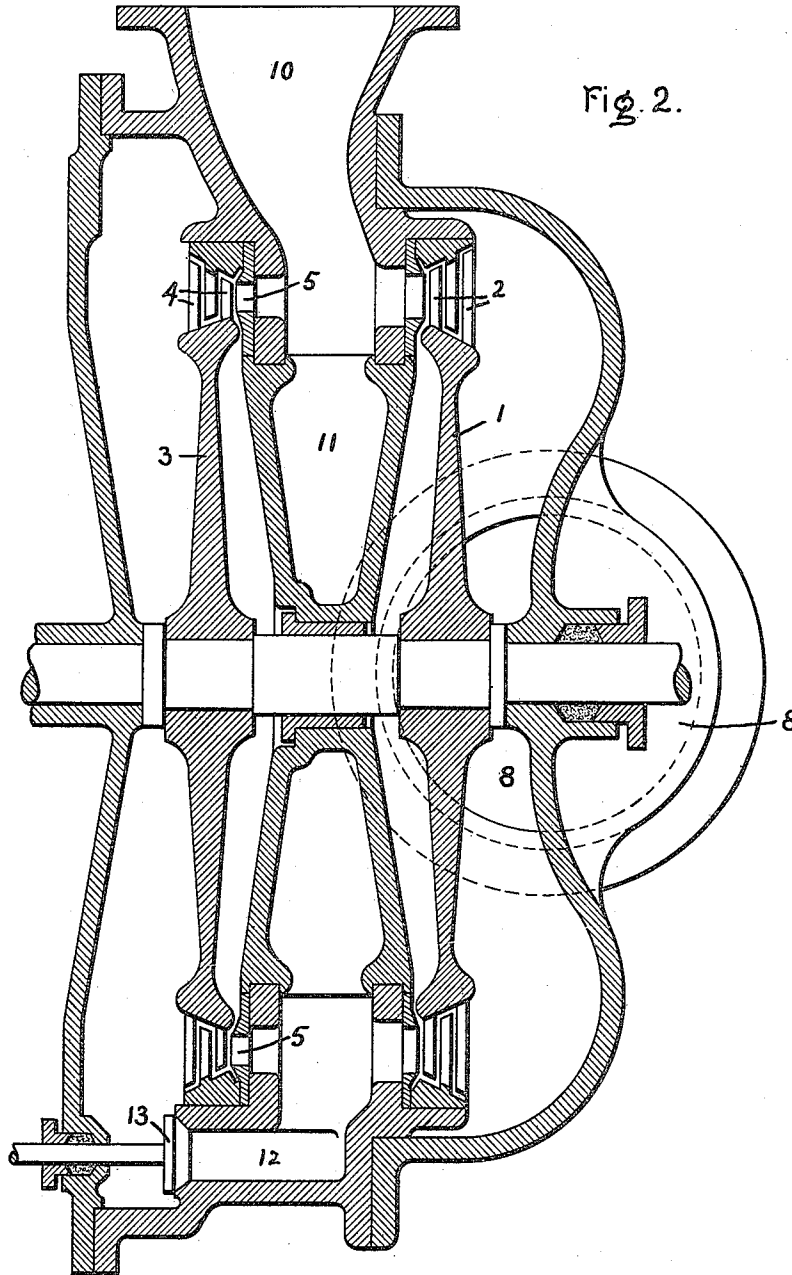
by *Alfred S. Davis*
His Attorney.

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Witnesses:
Earl G. Klock
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UNITED STATES PATENT OFFICE.

KARL ALQUIST, OF RUGBY, ENGLAND, ASSIGNOR TO GENERAL ELECTRIC COMPANY,
A CORPORATION OF NEW YORK.

FLUID-PRESSURE TURBINE.

994,049.

Specification of Letters Patent.

Patented May 30, 1911.

Application filed October 22, 1910. Serial No. 588,406.

To all whom it may concern:

Be it known that I, KARL ALQUIST, a subject of the King of Sweden, residing at Clifton Road, Rugby, England, have invented certain new and useful Improvements in Fluid-Pressure Turbines, of which the following is a specification.

My invention relates to fluid pressure turbines and more particularly to steam turbines of the mixed type. In this class of turbines it is sometimes difficult to provide steam passages of sufficient capacity when only exhaust steam is used, owing to the large volumes required, and the output of the turbine is thus limited by this consideration. According to the present invention I increase this capacity by arranging the high pressure part of the turbine in such a way as to be also suitable to be used in parallel with the low pressure part, as a low pressure turbine driven by a part of the low pressure steam. Under these conditions high pressure steam will generally not be wanted, but such steam may still be used at the same time.

The accompanying drawings, in which Figure 1 is a vertical sectional longitudinal view showing the high pressure steam inlet and the arrangement of the wheels and Fig. 2 is a horizontal section showing the low pressure steam inlet, serve to illustrate an application of the above principle to a mixed pressure turbine of the impulse type having one high pressure and one low pressure stage, but it will be evident that the invention can also be applied to other cases.

In the drawings 1 is the low pressure wheel, which may have two rows of buckets 2, as illustrated, with as large steam passages as may be convenient, having regard to bucket stresses or other considerations. The high pressure wheel 3 is also shown with two rows of buckets 4 and may be so arranged that the steam flows through the wheel in a direction opposite to the direction in which it flows through the low pressure wheel 1. The steam may, for instance, in both cases flow from the middle toward the ends of the turbine. Now it is well known that the steam passages in the high pressure wheel require to be small, as compared with those in the low pressure wheel, due to the difference in specific volume, and also due to the fact that when high pressure steam is used to drive the turbine only about

one-half of the weight of steam is required as compared with the weight of low pressure steam required for the same output. Thus the length of steam belt even with short buckets will only occupy a comparatively small portion of the circumference of the high pressure wheel. I provide the remaining portion with low pressure nozzles 5 and by means of using fairly long buckets in the high pressure wheel I can thus easily obtain an increase in output over the maximum obtainable by the low pressure wheel alone of 50 per cent., or more when using exhaust steam only. The steam issuing from the high pressure wheel may be conducted, by way of a passage 6 controlled by a valve 7 to the condenser through the conduit 8, if it has been supplied either from the low pressure source through the passage 10, Fig. 2, or from the high pressure source through the passage 9, Fig. 1.

The following examples will illustrate different conditions under which the turbine may be working:

1. When the maximum output is required by means of high pressure steam only, the steam first enters through passage 9, passes through the high pressure wheel, and is then conducted to the space 11 in front of the nozzles leading to the low pressure wheel 1 by way of a passage 12 shown in Fig. 2, and after having passed through this wheel it goes to the condenser in the ordinary way. The passage 12 is preferably controlled by a valve 13 and is independent of the passage 6 leading to the condenser.

2. When the maximum output is required by means of low pressure steam only, the steam is admitted through the passage 10 to the space 11 in front of the low pressure nozzles of the two wheels, preferably a common compartment, and the steam passing through each wheel may then be separately conducted to the condenser; that is, directly from the wheel 1, and through the passage 6 from the wheel 3.

3. When the turbine is working on the "mixed" principle the high pressure steam passes from the high pressure nozzles through the high pressure wheel and is conducted to the low pressure wheel as in the first case given through the passage 12. The low pressure steam enters the space 11 in front of the low pressure nozzles of the two wheels as in the second case given, but

flows only through the low pressure wheel, as the pressure now is equalized on the two sides of the low pressure nozzles leading to the high pressure wheels.

5 4. If when working on the "mixed" principle as in case 3 there should be more low pressure steam available than can pass through the low pressure wheel, the excess of low pressure steam (up to the maximum output) may be passed through the high pressure wheel by closing the valve 13 controlling the passage of steam from the exhaust side of the high pressure wheel to the inlet nozzle of the low pressure wheel and opening the valve 7 controlling its passage to the condenser. The high pressure steam will then only pass through the high pressure wheel before reaching the condenser, but as in this case only a small amount of high pressure steam will be required to make up the maximum output the efficiency of the turbine will not be appreciably effected.

It will be seen that for the different operations two valves are necessary, viz: one between the exhaust side of the high pressure wheel and the condenser, and one between the exhaust side of the high pressure wheel and the low pressure wheel nozzles. This is, however, not altogether a complication, as by means of the arrangement described some valves can be omitted which in an ordinary turbine would be required to cover part of the low pressure nozzles when high pressure steam is mainly used.

The arrangement described above may evidently be applied also to turbines with several stages in the high and low pressure portions.

40 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. A mixed pressure turbine having a high pressure stage and a low pressure stage, and additional nozzles for the high pressure stage to admit low pressure fluid thereto in parallel with that flowing to the low pressure stage.

2. A mixed pressure turbine having a high pressure stage and a low pressure stage, means for admitting low pressure fluid between them, and nozzles directing said low pressure fluid in opposite directions through both stages.

3. A mixed pressure turbine having a high pressure stage and a low pressure stage, means for conveying the exhaust from the high pressure stage direct to the condenser, and means for causing it to pass alternatively to the low pressure stage.

4. A mixed pressure turbine having a high pressure stage, a low pressure stage, a valve controlling the flow of the exhaust from the high pressure stage direct to the condenser, and a valve controlling the flow of said exhaust to the low pressure stage.

5. A mixed pressure turbine having a high pressure bucket wheel, a low pressure bucket wheel, a chamber between said wheels, nozzles opening from said chamber in opposite directions toward said wheels, and means for supplying said chamber with low pressure steam.

6. A mixed pressure turbine having a high pressure bucket wheel, a low pressure bucket wheel, a chamber between said wheels, nozzles opening from said chamber in opposite directions toward said wheels, a valved passage leading from the exhaust side of the high pressure wheel to said chamber, and another valved passage leading from said high pressure exhaust direct to the condenser.

In witness whereof, I have hereunto set my hand this 11th day of October, 1910.

KARL ALQUIST.

Witnesses:

F. J. SKOYLES,
RIPLEY WILSON.