R. N. EHRHART.

MULTIPLE DECK REENTRANT TURBINE.

APPLICATION FILED AUG. 22, 1912.

1,137,591.

Patented Apr. 27, 1915.

2 SHEETS—SHEET 1.

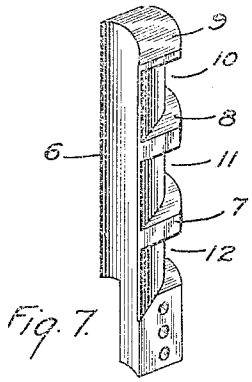


Fig. 7.

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

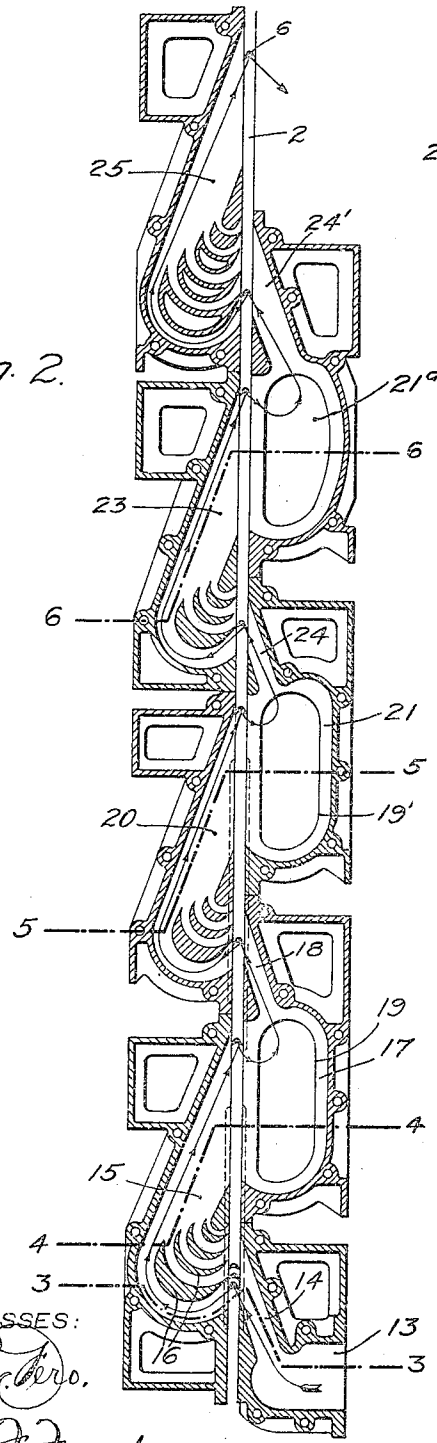


Fig. 6

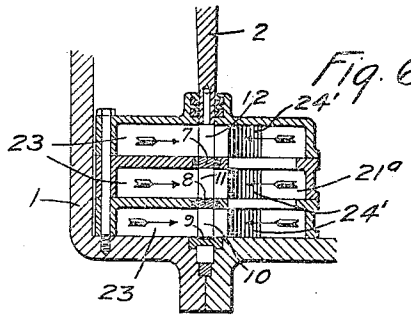


Fig. 5.

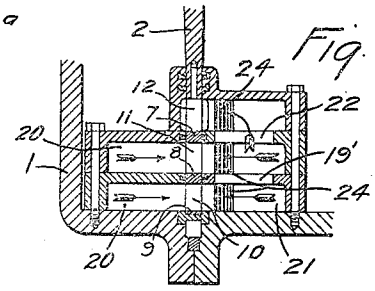


Fig. 4.

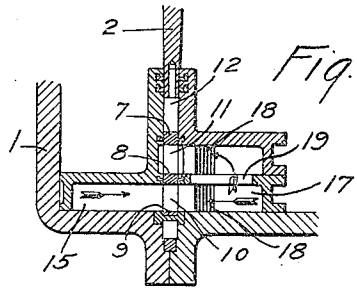
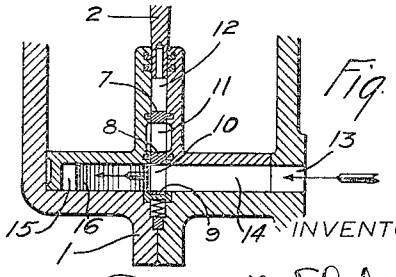


Fig. 3.



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UNITED STATES PATENT OFFICE.

RAYMOND N. EHRHART, OF EDGEWOOD, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE MACHINE COMPANY, A CORPORATION OF PENNSYLVANIA.

MULTIPLE-DECK REËNTRANT TURBINE.

1,137,591. Specification of Letters Patent. Patented Apr. 27, 1915.

Application filed August 22, 1912. Serial No. 716,450.

To all whom it may concern:

Be it known that I, RAYMOND N. EHRHART, a citizen of the United States, and a resident of Edgewood, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Multiple-Deck Reëntrant Turbines, of which the following is a specification.

This invention relates to fluid-pressure engines, but particularly to turbines of the impulse type.

My invention relates specifically to that class of turbines in which the impelling fluid passes through the same wheel from one side to the other more than once. This class of turbine has become known to the art as of the reëntrant type.

One of the objects of my invention is to provide a multi-stage impulse turbine with a number of rows of blade-sections for each wheel.

Another object of my invention is to provide a turbine of the multi-stage impulse type whereby the steam or other motive fluid will act upon an increasing number of rows of blade-sections on the successive admission of the power medium.

Other objects and advantages of my invention will be specifically referred to hereinafter, it being understood that changes in form, proportion and minor details of construction may be resorted to without departing from the spirit of the invention or sacrificing any of its advantages.

In the drawings: Figure 1 designates a transverse sectional view through a turbine constructed in accordance with my invention; Fig. 2 is a diagrammatic projection of the successive stages and nozzles for admitting steam to the turbine blades; Fig. 3 is a sectional view on the line 3—3 of Fig. 2; Fig. 4 is a sectional view on the line 4—4 of Fig. 2; Fig. 5 is a sectional view on the line 5—5 of Fig. 2; Fig. 6 is a sectional view on the line 6—6 of Fig. 2; and Fig. 7 is a detail view of one blade.

The turbine herein illustrated is shown as comprising a casing 1 with a rotatable element 2 attached to the shaft 3 in any well known manner. The shaft 3 is shown as projecting through the casing 1 and in suitable bearings 4 and 5. On the disk 2 are removable blades 6 provided on their convex sides with transverse ribs 7, 8 and 9, bearing against the adjacent blades. In this way the set of blades is divided into three concentric rows of blade-sections with passages 10, 11 and 12.

For the purpose of the present invention it is immaterial as to how many sets of blades are formed in this manner and what their construction may be. In place of the individual blades which are provided with ribs, the blades and ribs could be made integral with one another.

The passage of the impelling working fluid through one set of blades is illustrated in Fig. 2. The working fluid enters at 13 and passes through the nozzle 14 through the passage 10 into the chamber 15 in which are the guide-vanes 16, thence back through the blades into the reëntrant chamber 17 through the nozzle 18, which is a double-deck nozzle (the steam passing through the opening 19 in the chamber 17 for this purpose), then through the passages 10 and 11 into the chamber 20, constructed similar to the chamber 15 except that the chamber 20 is two decks high so that the steam entering the reëntrant chamber 21 may do so without being restricted. The steam then passes through the opening 19′ forming the chamber 21 and through the opening 22 in the chamber 21 through nozzle 24 and the passages 10, 11 and 12 into the chamber 23, which is three decks high, then back through the blades into the chamber 21^a, which corresponds to the chamber 21, the steam entering the chamber 21^a being at a lower pressure than that which entered chamber 21. From the chamber 21^a the steam passes through the nozzle 24′ into the chamber 25 and out to the exhaust.

As here shown, the conduits which are successively traversed by the steam or motive fluid in thus passing through the turbine more than once are alternately arranged on opposite sides of the blade-sections. Therefore, according to the present invention, the circulation and return flow of the working fluid takes place in such a manner that upon each successive admission of driving fluid an increasing number of rows of blade-sections is acted upon. The arrangement is such that the radial height of the nozzle 14 is equal to the blade-section 10 so that during the first impulse the driving medium passes between the periphery of the rotor 2 and the rib 8 to the passage 15. The nozzle 18 being of the radial height

equal to that of the blade-sections from the periphery of the rotor to the ribs 7, the steam will pass through the passages 10 and 11, and as the nozzles 24 and 24′ are each equal to the distance from the periphery of the wheel to the rib 9, steam will flow through the passages 10, 11 and 12. In this way, a constantly increasing number of rows of blade-sections are operated upon.

My invention may be used with turbines provided with any number of blades and said blades may be of any desired size.

Having thus described my invention what I claim is:

In a turbine having blades divided by ribs into a plurality of radially disposed blade sections, a series of conduits for delivering and re-delivering motive fluid to the blades, so that the fluid passes first in one and then in the opposite direction through the blades, the passages on one side of the blades being formed in superimposed or radially located sections with partitions between the sections, and a plurality of redirecting vanes located in each of said superimposed sections.

In testimony whereof I have hereunto subscribed my name this 20th day of August, 1912.

RAYMOND N. EHRHART.

Witnesses:
C. W. McGHEE,
ANNA CLOHERTY.

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