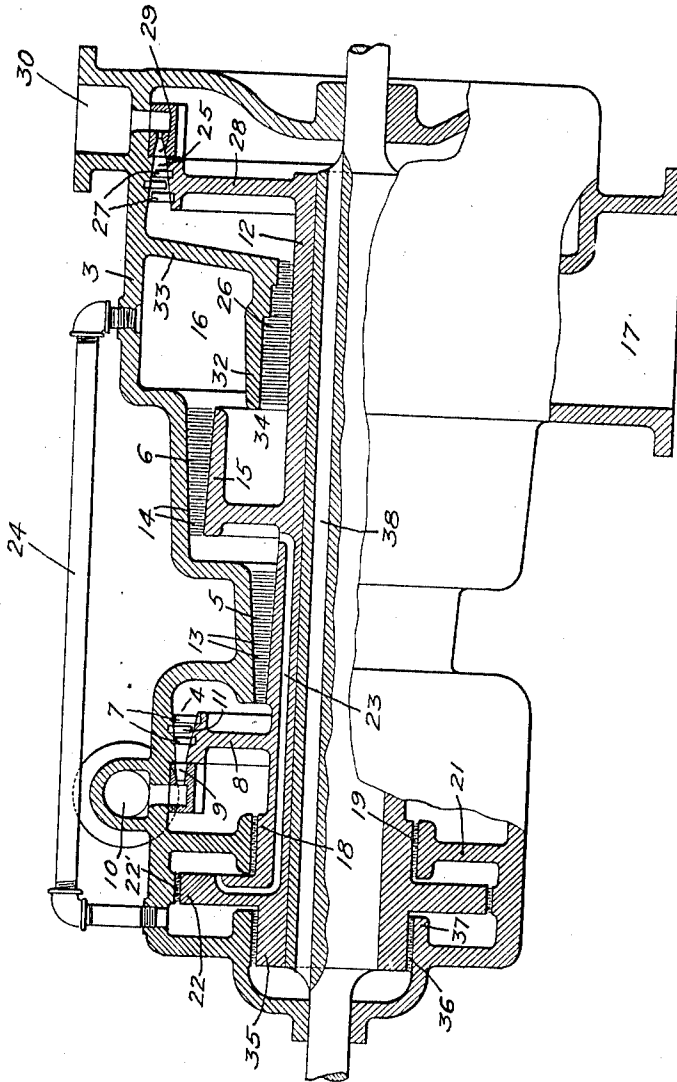


F. HODGKINSON.
MARINE TURBINE.
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1,061,673.

Patented May 13, 1913.



WITNESSES:

B. M. Jero

Emm. Callister

INVENTOR.

Francis Hodgkinson

BY

Geo. S. Stein

HIS ATTORNEY IN FACT.

UNITED STATES PATENT OFFICE.

FRANCIS HODGKINSON, OF EDGEWOOD PARK, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE COLONIAL TRUST COMPANY, TRUSTEE, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

MARINE TURBINE.

1,061,673.

Specification of Letters Patent.

Patented May 13, 1913.

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To all whom it may concern:

Be it known that I, FRANCIS HODGKINSON, a subject of the King of Great Britain and Ireland, and a resident of Edgewood Park, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Marine Turbines, of which the following is a specification.

This invention relates to marine or reversing turbines and has for an object to produce an improved form of reversing turbines, in which the balance dummies employed for the ahead and reversing sections are located adjacent to each other and at one end of the turbine casing.

A further object is to produce a turbine provided with a reversing portion, which does not materially increase the length of the turbine.

These and other objects I attain in a turbine embodying the features herein described and illustrated in the drawings accompanying this application and forming a part thereof.

In the drawings, I have illustrated a turbine embodying my invention, partially in longitudinal section and partially in elevation.

Referring to the drawings: the turbine illustrated as an embodiment of my invention includes an ahead and a reversing portion, both of which are located in a single casing 3, and receive motive fluid at opposite ends of the casing. The ahead portion consists of an initial stage 4, a secondary or intermediate stage 5 and a final or low pressure stage 6. The initial stage illustrated consists of two rows of impulse blades 7 mounted on a wheel 8 and receiving motive fluid from a discharge nozzle 9, which communicates with a source of fluid supply through a port 10 provided in the casing 3. Intermediate directing blades 11 are located between the annular rows of blades 7 and are mounted on the casing 3 in any suitable manner. The wheel 8 is shown as integrally formed with the rotor element 12 of the turbine; this construction, however, is merely illustrative and the wheel may be separately formed and mounted on the shaft or rotor element of the turbine in any suitable manner.

The motive fluid discharge from the final row of blades 7 of the initial stage is received by the intermediate or secondary stage 5, which consists of alternate annular rows of moving and stationary blades 13 mounted on the rotor and casing respectively. The motive fluid discharged from the intermediate stage is delivered to the final or low pressure stage 6, which consists of alternate annular rows of moving and stationary blades 14 respectively mounted on a drum 15 carried by the rotor element and on the casing 3 of the turbine. The motive fluid discharged from the final row of blades of the stage 6 is received by an exhaust passage 16 located within the turbine casing and in direct communication with an exhaust port 17, which may communicate with a condenser or the atmosphere, as desired.

The motive fluid, in traversing the intermediate stage 5, imposes a longitudinal thrust on the rotor element in the general direction of the flow of fluid. I counter-balance this thrust by means of a dummy piston 18, which is located adjacent to the admission end of the stage 5, and is in direct communication with it. An inter-leaving seal or any other suitable form of packing 19 is provided between the peripheral face of the dummy 18 and a diaphragm 21, which is shown as formed integrally with the casing 3. The longitudinal thrust imposed by the stage 6 is counter-balanced by means of a dummy piston 22, which is mounted on the rotor element and which communicates, on one side, with the inlet end of the stage 5, and on the other, with the exhaust passage 16. A passage 23, formed in the rotor element of the turbine, provides the means of communication between the inlet end of the stage 6 and one side of the dummy; and piping 24, located exterior to the casing, forms the means of communication between the chamber 16 and the other side of the balance dummy 22. Either passage may be located in the rotor, or they may both be located exterior to the casing. An inter-leaving seal 22' is shown between the peripheral face of the dummy 22 and the casing 3. With this arrangement, the balance dummy 18 is exposed on

one side to the inlet pressure and on the other side to the exhaust pressure of the stage 5; and the dummy 22 is exposed on opposite sides to the inlet and the exhaust pressure of the stage 6 and the ahead portion of the turbine is balanced for all loads.

The reversing portion of the turbine illustrated consists of an initial stage 25 and a final or low pressure stage 26. The stage 25 includes two rows of rotating blades 27 mounted on a wheel 28 and receiving motive fluid from an expansion nozzle 29 mounted on the casing 3. The wheel 28 is located at the end of the turbine and is shown integrally formed with the rotor element. This construction is merely illustrative, as the wheel may be separately formed and mounted on the rotor element in any suitable manner. The nozzle 29 communicates with a port 30 provided in the casing 3 and receives motive fluid therefrom. The motive fluid discharged from the initial stage 25 is received by the stage 26, which consists of alternate annular rows of moving and stationary blades. The rotating blades of the stage 26 are mounted on the rotor element of the turbine in any suitable manner and the stationary blades of that stage are mounted on the inner peripheral face of the flange 32, which is shown as formed integrally with the turbine casing and which is surrounded by the passage 16. The supporting partition 33 of the flange separates the stage 25 from the exhaust passage 16 of the turbine and extends entirely around the turbine casing.

The motive fluid, after traversing the stationary and rotating blades of the stage 26, is discharged into the exhaust passage 16 through an annular passage 34 located between the edge of the drum 15 and the adjacent edge of the flange 32. With this arrangement, the reversing portion of the turbine is practically located in the exhaust passage of the turbine casing and for that reason does not materially increase the length of the turbine.

The initial stage 25, like the initial stage 4 of the ahead turbine, does not induce a longitudinal thrust on the rotor element, and consequently it is not necessary to provide balance pistons for it. The stage 26, however, produces a longitudinal thrust on the turbine rotor in the general direction of the travel of the fluid through it, which I counter-balance by means of a dummy piston 35 located at the ahead end of the turbine, and shown as integrally formed with the rotor element of the turbine. An inter-leaving seal 36 is shown between the peripheral face of the dummy 35 and a re-entrant flange 37 formed on the turbine casing. The seal 36 is exposed at one end to the inlet pressure of the stage 26 through a passage 38, which extends longi-

tudinally through the rotor element of the turbine, and is exposed at the other end to exhaust pressure through the piping 24. With this arrangement, the reversing portion of the turbine is balanced for all loads, and all the balance pistons are located at the inlet end of the ahead portion of the turbine. This arrangement is advantageous since it is necessary to adjust the relative positions of the separate elements comprising the packings 19, 22' and 37 for the purpose of maintaining fluid tight seals. This adjustment is usually accomplished by providing a thrust block for the purpose of adjusting the rotor element of the turbine longitudinally and locking it in the adjusted position. It is almost absolutely impossible to maintain a packing in the proper adjustment if it is located at any distance from the thrust block. With the arrangement illustrated, the thrust block can be located exterior to the casing and immediately adjacent to the dummy pistons 18, 22 and 35, and consequently the operation of adjusting the packings will be greatly simplified, and the inter-leaving seals will remain in the adjusted position.

While the ahead portion of the turbine is operating, the fluid supply to the reversing portion is shut off and consequently the moving blades of the reversing turbine rotate in a vacuum, if operating condensing, since the stage 26 is in direct communication with the exhaust passage 16 and the stage 25 is in open communication with the stage 26. When the reversing portion of the turbine is operating, the supply of motive fluid is shut off to the ahead portion and its moving blades rotate in a vacuum.

Having thus described my invention, what I claim is:

1. A reversing turbine comprising an ahead portion and a reversing portion located at opposite ends of the turbine, and means located at one end of the turbine for balancing the longitudinal thrust of both portions.

2. A reversing turbine comprising an ahead portion and a reversing portion located at opposite ends of the turbine, an exhaust passage located near one end of the turbine casing and common to both portions and means located at the other end of the turbine for balancing both portions.

3. A reversing turbine comprising an ahead portion and a reversing portion, an exhaust passage common to both portions and located near one end of the turbine and means for balancing both portions located adjacent to the inlet end of the ahead portion.

4. A reversing turbine comprising an ahead and a reversing portion through which the working fluid flows inwardly in opposite direction, and means located ad-

jacent to the inlet end of the ahead portion of the turbine for balancing the longitudinal thrust of both portions.

5 A reversing turbine comprising an ahead and a reversing portion located at opposite ends of the turbine and through which the working fluid flows inwardly in opposite directions, and balancing dummies for both portions located adjacent to each other and at the inlet end of the ahead portion.

15 6. A reversing turbine comprising an ahead portion and a reversing portion located at opposite ends of the turbine and through which the working fluid flows inwardly in opposite directions, and balancing dummies for both portions located adjacent to each other and near the inlet end of the ahead portion.

20 7. A reversing turbine comprising an ahead and a reversing portion through which the working fluid flows inwardly in opposite directions, and balancing dummies for both portions located adjacent to each other and adjacent to the inlet end of the ahead portion.

30 8. A reversing turbine comprising an ahead portion and a reversing portion located at opposite ends of the turbine, an exhaust passage located near one end of the turbine and communicating with both portions and balancing dummies for both portions located adjacent to each other and at the other end of the turbine.

35 9. A reversing turbine comprising an

ahead and a reversing portion, an exhaust passage common to both portions and located near one end of the turbine casing and balancing dummies for both portions located adjacent to each other and at the inlet end of the ahead portion of the turbine.

10. In a reversing turbine, an ahead portion provided with an inlet port and an exhaust passage, a reversing portion surrounded by said exhaust passage and communicating therewith and means located at one end of the turbine casing for balancing both portions.

11. In a reversing turbine, an ahead portion provided with an inlet port and an exhaust passage, a reversing portion surrounded by said passage and communicating therewith and balancing dummies located adjacent to each other and near one end of the turbine for balancing both portions.

12. In a reversing turbine, an ahead portion provided with an inlet port and an exhaust passage, a reversing portion surrounded by said passage and communicating therewith and dummy pistons for balancing both of said portions located adjacent to the inlet end of said ahead portion.

In testimony whereof, I have hereunto subscribed my name this 22nd day of September 1910.

FRANCIS HODGKINSON.

Witnesses:

C. W. MCGHEE,

E. W. MCCALLISTER.