C. ROTH.

TURBINE.

APPLICATION FILED JUNE 24, 1908.

984,493.

Patented Feb. 14, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

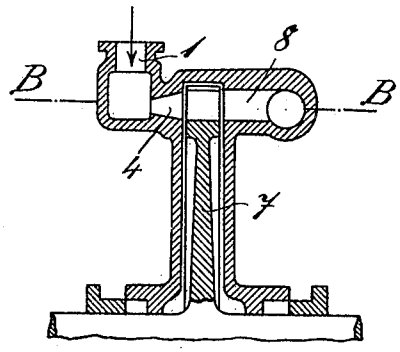


Fig. 2.

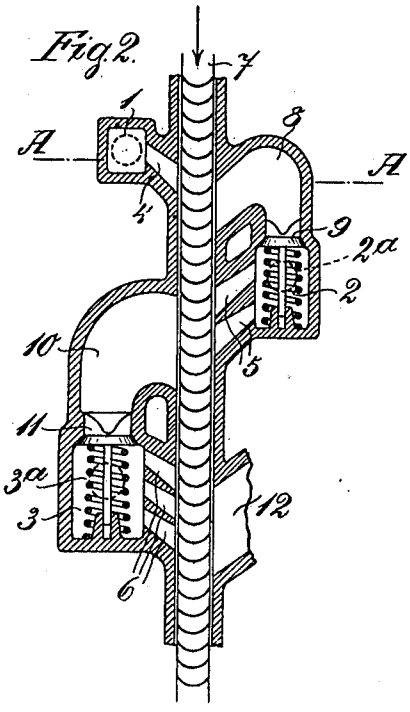
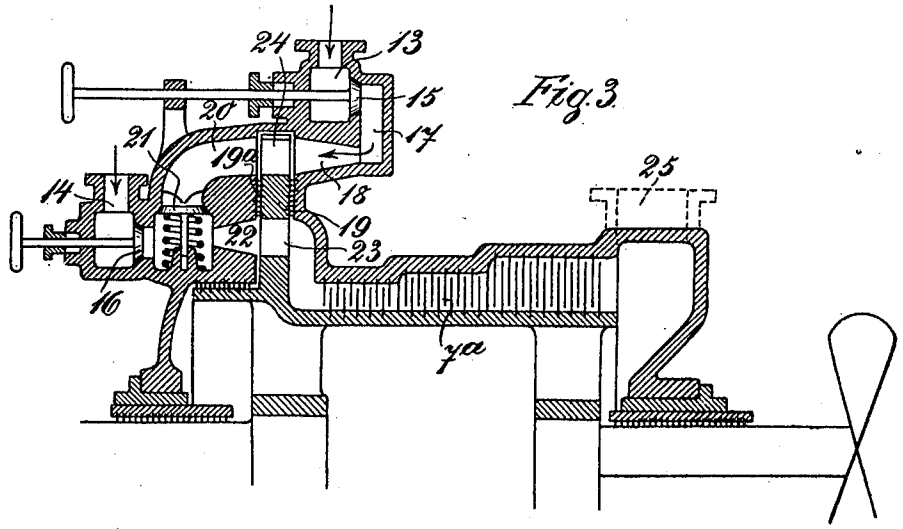


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 6.

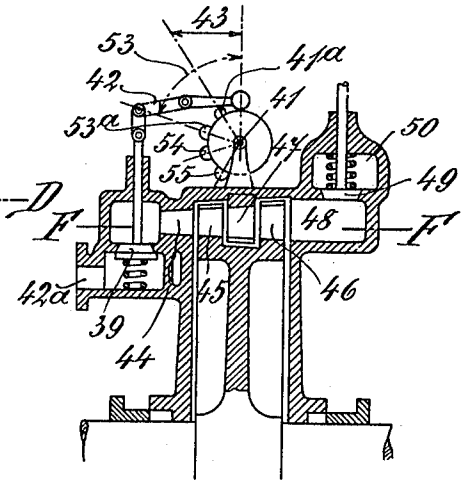


Fig. 4.

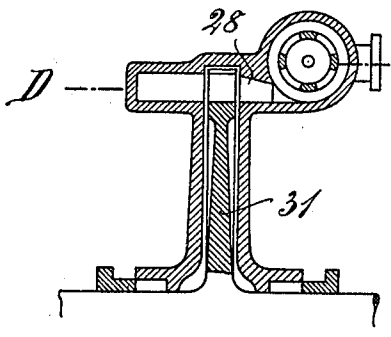


Fig. 5.

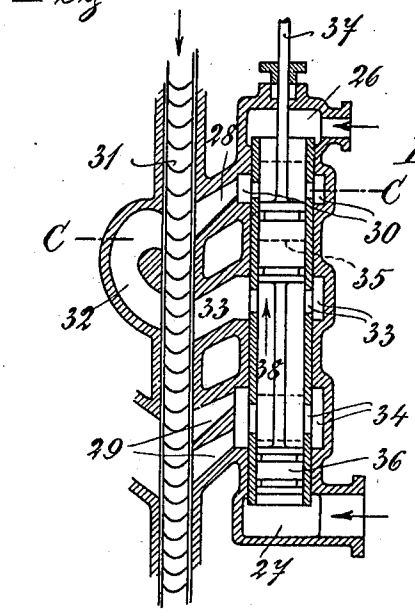
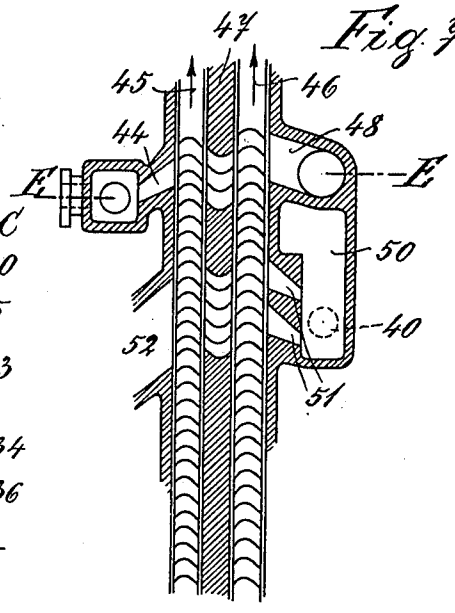


Fig. 7.



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UNITED STATES PATENT OFFICE.

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TURBINE.

984,493. Specification of Letters Patent. Patented Feb. 14, 1911.

Application filed June 24, 1908. Serial No. 440,181.

To all whom it may concern:

Be it known that I, CARL ROTH, a citizen of the Confederation of Switzerland, and resident of 2 Annastrasse, Zehlendorf, near Berlin, Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in and Relating to Turbines, of which the following is a specification.

This invention relates to steam turbines, especially such as are intended for ship propulsion.

The invention has for its object to provide a simple and efficient arrangement by which the power of the turbine may be altered within wide limits to meet the requirements of different speeds of propulsion.

According to the present invention the steam turbine is provided with a series of nozzle chambers, the nozzles in which increase in capacity as the series advances. These nozzle chambers are connected in series and valves are arranged in the connections. Steam pipes are led to each or several of the chambers in the series and the valves in the connections between two adjacent chambers in the series are such that the connection between the more advanced chamber in the series and the chamber immediately in front of it is closed when steam is passed to the said advanced chamber for the purpose of increasing the power of the turbine as hereinafter described. Thus an essential characteristic of the present invention is that when increasing the power of the turbine by passing steam to a more or less advanced chamber in the series all back flow of steam into earlier chambers in the series is prevented by the valve mechanism provided in the connections between the chambers.

The accompanying drawings illustrate this invention in several modifications.

Figure 1 is a vertical section through a turbine arranged according to the present invention, the section being on the line A—A of Fig. 2, Fig. 2 is a development of a section taken on the line B—B of Fig. 1, Fig. 3 is a vertical cross section through a modified form of the present invention, Fig. 4 is a vertical cross section of another modified form, the action being taken on the line C—C of Fig. 5, Fig. 5 is a section on the line D—D of Fig. 4, Fig. 6 is a vertical section through another modification, the section being taken on the line E—E of Fig. 7, while Fig. 7 is a section on the line F—F of Fig. 6.

In carrying the invention into effect according to the form shown in Figs. 1 and 2 steam enters by the inlet 1 and passes through a nozzle 4 where it is expanded and directed to impinge on the blades of the turbine wheel 7, the steam then passes to the exhaust chamber 8 and from this chamber the steam passes through a non-return valve 9 into the chamber 2. From the chamber 2 two nozzles 5 again direct the steam onto the blades of the turbine wheel 7 after which the steam passes into the chamber 10 and through the non-return valve 11 to the chamber 3. From the chamber 3, nozzles 6 again direct the steam onto the blades of the turbine wheel 7 which steam passes to the chamber 12 which is only partially indicated.

The arrangement above described is that which is employed for driving the turbine during cruising, in the case in which this turbine is employed for the propulsion of ships. Should a greater speed be required steam is passed directly into the chamber 2 through the pipe indicated by the dotted lines 2^a. Naturally in this case a larger amount of steam passes from the boiler to the turbine wheel and a greater energy output is obtained from the turbine. Should a still greater output of energy be required steam is passed to the chamber 3 through the pipe 3^a. It will be seen that when the high pressure steam is passed to the chamber 2 the non-return valve 9 closes the passage from the exhaust space 8 to the chamber 2. Further when the steam is passed to the chamber 3 the non-return valve 11 prevents the passage of boiler steam to the chamber 10. In this way the efficient working of the turbine is secured at a very widely varying range of powers. At the same time the arrangement of the separate turbine wheels 7 as have been hitherto suggested is avoided. It will be seen that the nozzle chambers 1, 2 and 3 are arranged to receive steam in series and that the output of energy of the turbine is very simply controlled by passing the live steam to one or other of these chambers while at the same time the capacity of the nozzles leading from the chambers increases as the series advances.

According to the form shown in Fig. 3 the same results as described with reference

to the form illustrated in Figs. 1 and 2 are obtained by arranging the nozzle chambers to direct the steam onto concentrically arranged blades on the same wheel. Thus in the form shown in Fig. 3 during cruising, steam enters by the pipe 13 and is passed through the valve 15 to the nozzle chamber 17 then through the nozzles 18 to impinge on the blades 24. From the blades 24 the steam passes to an exhaust passage 20 through a non-return valve 21 and nozzle 22 to blades 23 arranged concentrically with the blades 24 on the turbine wheel 19. Any suitable form of packing 19[a] is provided to prevent the leakage of steam in a radial direction past the wheel 19. During higher speeds of the ship when greater power is required from the turbine, steam is admitted from the inlet 14 by the valve 16 to that nozzle chamber from which the nozzles 22 open. The nozzles 22 may be greater in number or larger in capacity in any other way than the nozzles 18. In Fig. 3 there is illustrated a form in which the steam passing from the turbine wheel 19 is further expanded in a pressure flow turbine 7[a]. It will be understood that in this case when steam is supplied through the pipe 14 by opening the valve 16 the valve 21 is automatically closed before the steam impinges on the blades 23. There is thus no danger of the high pressure steam passing past the valve 21 to the blades 24 where, as will be readily understood it might do serious damage.

Instead of employing the automatic non-return valves illustrated in Figs. 1–3 I may employ piston controlling valves in the form shown in Figs. 4 and 5. By means of these piston controlling valves not only is the closure between the different nozzle compartments effected in the required manner but the supply of working fluid to the nozzles may be regulated. In Fig. 5 steam enters the space 26 to the valve chamber. In the valve chamber there is arranged a valve composed of two pistons 35 and 36 which may be operated by a rod 37. In the position of the pistons illustrated, the steam passing to the chamber 26 passes to the nozzles 28 and impinges on the blades of the turbine wheel 31. The steam is then led by a return pipe 32 through the blades and through a passage 33 into the space between the pistons 35 and 36. From this space the steam passes through the nozzles 29 and is again caused to impinge on the blades of the turbine 31. This is the course of the steam during the cruising speeds. It will be seen that by moving the pistons in an upward direction the opening to the nozzles 28 may be controlled. If the pistons are moved so far upward till the lower piston 36 in Fig. 5 passes over the ports 34 past the position illustrated in dotted lines steam may pass from the inlet 27 to the nozzles 29. In this way the necessary power for higher speeds of the ship or the like may be obtained. When the pistons 35 and 36 are moved upward in the manner described, it will be remarked that the piston 36 first of all closes off the free connection between the passage 33 and the passages 34 before the lower end of the said piston starts to uncover the ports 34 to allow steam to pass from the inlet 27 to the nozzles 29.

According to the form illustrated in Figs. 6 and 7 a still further modification is made in the arrangement of the valves. In this form during cruising the drum 41 rotatably mounted on the housing of the turbine is moved through the angle indicated by 43 so that a projection 41[a] comes under one end of the centrally pivoted lever 42 which thereby causes the opening of the valve 39. Steam thereby is allowed to pass from the inlet 42[a] to the nozzles 44 and then impinges on the blades of the turbine wheel. In this case the turbine wheel is shown as provided with two rows of blades 45 and 46. It will be understood that the turbine wheel or drum may be arranged to carry a larger number of rings of blades. Between the blades 45 and 46 the fixed blades 47 are arranged. The steam leaving the blades 46 passes into a chamber 48 and past the non-return valve 49 into the chamber 50. From the chamber 50 nozzles 51 guide the steam so as to cause it to again impinge on the blades 46 and 45. For greater speeds the drum 41 is moved through the angle 53 so that the knob 53[a] comes opposite the roller of a centrally pivoted lever which is arranged exactly like the lever 42. This centrally pivoted lever is connected in the same manner as the lever 42 to a valve controlling the supply of steam through the inlet indicated by the dotted lines 40. In this position the knob 43[a] is moved away from engagement with the end of the lever 42 and the valve 39 is closed. In Fig. 6 it will be seen that other two knobs 54 and 55 are illustrated and these knobs may be arranged to operate in the same manner on further valves controlling the supply of steam to further chambers arranged in the series. The description given above, however, of the arrangement as regards the valve 39 renders it unnecessary to complicate the drawings or extend the description to these substantially similar arrangements. The knobs 43[a], 53[a], 54 and 55 may be arranged on separate disks keyed to the same shaft or these knobs may be arranged in different cross planes on a common drum. The arrangement illustrated in Fig. 6 forms a very convenient means for passing the live steam to one or other of the nozzle chambers as required.

I claim:

1. The combination, with a turbine hav-

ing a rotatable bladed member, a casing in which said member rotates, nozzle chambers of different capacity in said casing, said chambers communicating with each other through said bladed member and fresh steam supply pipes to said nozzle chambers, of automatically opening and closing organs in said nozzle chambers whereby, on the admission of steam to one of said nozzle chambers, communication is established between said nozzle chamber and the succeeding nozzle chambers, and whereby on the admission of steam to another of said nozzle chambers, communication between the steam supplied chambers is established until the pressure of steam in said steam supplied chambers is equal, or nearly so, when the communication is automatically cut off.

2. The combination, with a turbine having a rotatable bladed member, a casing in which said member rotates, nozzle chambers of different capacity in said casing, said chambers communicating with each other through said bladed member and fresh steam supply pipes to said nozzle chambers, spring controlled valves in said nozzle chambers whereby, on the admission of steam to one of said nozzle chambers communication is established between said nozzle chamber and the succeeding nozzle chambers, and whereby on the admission of steam to another of said nozzle chambers, communication between the steam supplied chambers is established until the pressure of steam in said steam supplied chambers is equal, or nearly so, when the communication is automatically cut off.

3. A turbine comprising in combination a rotatable bladed member having concentric rings of blades thereon, a casing in which said member rotates, nozzle chambers of different capacity in said casing, said chambers communicating with each other through said bladed member and opening on to different rings of blades in said bladed member, fresh steam supply pipes to said nozzle chambers and automatically opening and closing organs in said nozzle chambers.

4. A turbine comprising in combination, a rotatable bladed member, a casing in which said member rotates, nozzle chambers of different capacity in said casing, said chambers communicating with each other through said bladed member, fresh steam supply pipes to said nozzle chambers, spring controlled valves in said nozzle chambers and means for externally operating said spring controlled valves.

5. A turbine comprising in combination, a rotatable bladed member, a casing in which said member rotates, nozzle chambers of different capacity in said casing, said chambers communicating with each other through said bladed member, fresh steam supply pipes to said nozzle chambers, spring controlled valves in said nozzle chambers, a rotatable member, projections on said member, pivoted levers engaging said projections and rods connecting said pivoted levers and valves.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

CARL ROTH.

Witnesses:
ERNST STRUMSKI,
ELSIE FRIESE.