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STEAM TURBINE.

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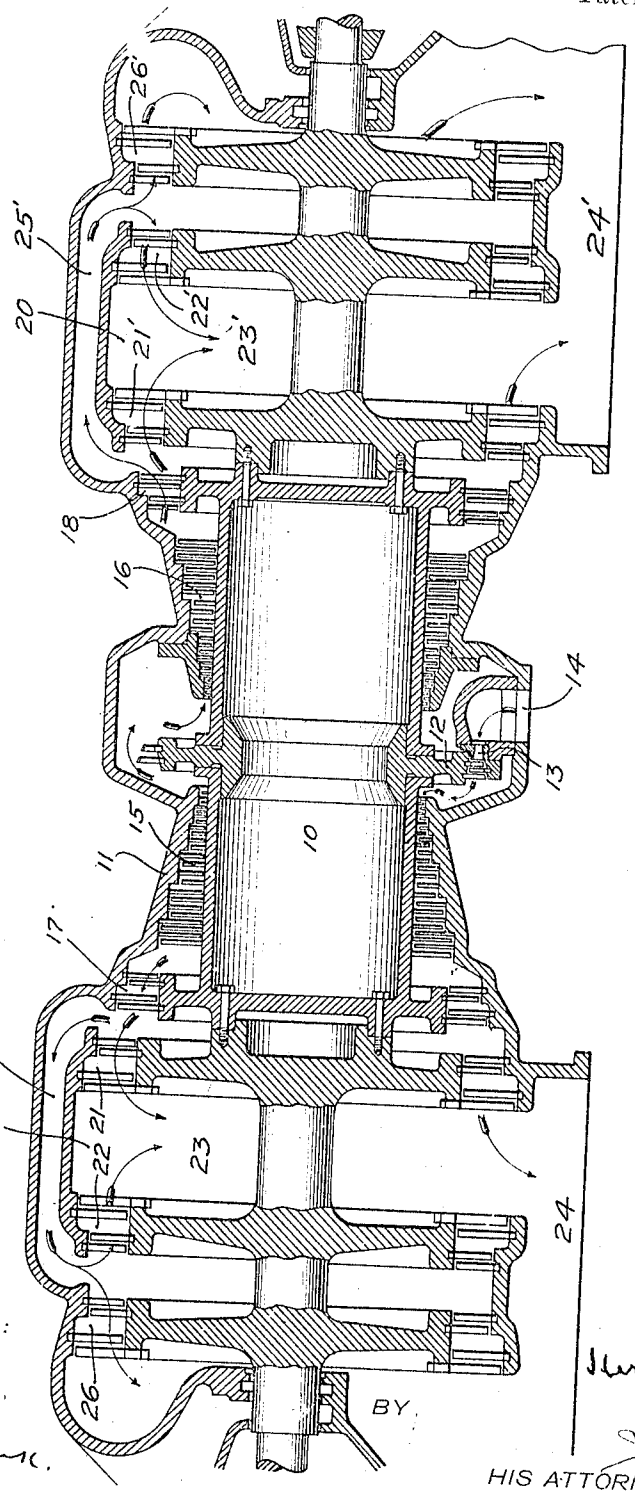
Patented Mar. 25, 1919.



WITNESSES:

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STEAM-TURBINE.

1,298,206. Specification of Letters Patent. Patented Mar. 25, 1919.

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To all whom it may concern:

Be it known that I, HERBERT T. HERR, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Steam-Turbines, of which the following is a specification.

This invention relates to turbines and one of the objects is to provide a turbine through which large volumes of steam may be passed without increasing the lengths of the blades of the low pressure sections to such a size that they will be difficult to construct and to mount on the rotor element.

Another object of the invention is to provide a turbine of this class which will be balanced and which will not require dummy pistons and packing glands.

The figure in the drawing is a vertical longitudinal sectional view through a turbine constructed in accordance with my invention.

Referring now to the drawing by numerals of reference:

10 designates the turbine rotor and 11 the turbine stator. On the rotor 10 is an impulse wheel 12 receiving steam through the nozzle 13 from the inlet 14. 15 and 16 are intermediate sections of the Parsons or reaction or any other type through which the steam exhausted from the impulse wheel passes, it being understood that the turbine here shown is of the double-flow type. 17 and 18 designate sections of lower pressure from which the steam is exhausted into the low pressure sections 19 and 20. As the low pressure sections 19 and 20 are duplicates in so far as their treatment of steam is concerned, I will describe only one of them.

By reference to the low pressure section 19 it will be seen that the steam exhausted from section 17 is divided and part passes through the sub-section 21 and part passes through a similar section 22. The sub-sections 21 and 22 exhaust into the space 23 between the sections 21 and 22 from which the steam passes into the exhaust 24. In the present instance, the passage 25 for directing the steam into the division 22 is formed in the walls of the stator 11, although it may be a pipe led outside of the turbine stator if so desired. At the end of the section 19 is a sub-section 26 which operates in parallel with sub-sections 21 and 22 and may be considered a part of the section 19. Any number of sub-sections similar to 21 and 22 may be employed if desired.

Instead of describing in detail the section 20, I have applied reference numerals to the various parts corresponding to those used in describing section 19, with the exception that to those numerals applied to section 20 I have applied the exponent 1.

Inasmuch as the drawing is practically self-explanatory it is not deemed necessary to enter into a detailed description of the passage of the steam, as this is clearly indicated by the arrows; but attention is called to the fact that in the sections 19 and 20 the steam passes through the sub-sections thereof in opposite directions so as to tend to balance the turbine. By providing two sub-sections for each section the individual blade areas are materially reduced, as for example, by dividing the section 19 into two sub-sections, the blade areas may be one-half the size that would be required to take care of a similar amount of steam if only one section were used.

A construction of turbine similar to the one just described is particularly applicable to units generating high power, or in other words, turbines passing large volumes of steam for power purposes.

Having thus described my invention, what I claim is:

1. A turbine comprising a working section through which the fluid flows in one axial direction only, a divided flow secondary section receiving fluid from said working section, and a triple flow section at each end of said divided flow section, and each receiving motive fluid from the adjacent sub-section of the divided flow section.

2. In a turbine, an initial section, a divided flow secondary section through the separate sub-sections of which motive fluid flows in separate streams, and a triple flow low pressure section receiving fluid from each sub-section of the secondary section.

3. In a turbine, a double flow working section through the separate sub-sections of which motive fluid flows in opposite directions, and a triple flow section receiving motive fluid from each sub-section of the double flow section.

4. A turbine comprising a divided flow section through which motive fluid flows in opposite axial directions, and a section located at each end of the divided flow section,

divided into at least three sub-sections and each receiving motive fluid from the adjacent sub-sections of the divided flow section.

5. A turbine comprising a casing divided into a middle and two end compartments communicating with the middle compartment, a rotor element extending through all of said compartments, two sets of rotor blades located in said middle compartment and forming, with fluid delivery elements mounted on the casing, a divided flow section, a plurality of blade-carrying wheels located in each end compartment and mounted on the rotor element, blades mounted on each wheel, and means for directing the fluid discharged from each set of blades, located in the middle compartment, in separate streams, to the blades mounted on the blade-carrying wheels in the adjacent end compartment, and means for admitting motive fluid to said middle compartment.

6. A turbine comprising a stator, having an exhaust port at each end, a rotor element located within said stator, two sets of blades mounted on the rotor element and forming with fluid delivery elements mounted on the stator a divided flow turbine section, a plurality of blade-carrying wheels located within the stator near each end thereof, blades mounted on each wheel, cooperating fluid delivery elements mounted on the stator, and means for delivering the motive fluid discharged from each sub-section of the divided flow section to the several sets of blades mounted on the adjacent blade-carrying wheels.

7. A turbine comprising a stator, having an exhaust port at each end thereof, and a fluid admission port intermediate the ends, a rotor element located within said casing, a blade-carrying wheel mounted on said element midway between the ends thereof, impulse blades mounted on the wheel and receiving fluid from said admission port, a separate set of blades mounted on the rotor element on each side of the blade-carrying wheel and each receiving motive fluid discharged from the wheel, a plurality of blade-carrying wheels on the rotor element and located at each end of the casing, blades mounted on each wheel and means for dividing the fluid discharged from each of said sets of blades and for delivering it to the said blades mounted on the blade-carrying wheels located in the adjacent end of the casing.

8. A turbine comprising a section through which fluid flows in one axial direction, a divided flow low pressure section divided into at least three sub-sections which operate in parallel on fluid discharged from the first mentioned section, and means for passing fluid discharged from the first mentioned section around two sub-sections of the divided flow section and for delivering it to one of the sub-sections around which it is passed and to an additional sub-section of the divided section.

9. A turbine comprising a section through which the fluid flows in one axial direction only, and a divided flow section having at least three sub-sections, receiving fluid from said first-mentioned section and through two of the sub-sections of which the fluid flows in opposite directions.

10. In an organized turbine apparatus, a turbine section through which fluid flows in one axial direction, a divided flow low-pressure turbine element, operating in tandem with the single flow section, and comprising at least three separate sets of blades through adjacent sets of which fluid flows in opposite axial directions, and means communicating with the exhaust of the first-mentioned section for delivering fluid to the separate sets of blades of the low-pressure turbine element.

11. In an organized turbine apparatus, a turbine section, a divided-flow turbine element, operating in tandem with the section, and comprising at least three separate sets of blades receiving fluid from the section, and through each pair of adjacent sets of which the fluid flows in opposite directions, and means communicating with the exhaust of the section for conveying fluid discharged from the section past two of the sets of blades of the divided-flow turbine element, and for delivering fluid to one of the sets past which it is conveyed, and to an additional set of blades of the divided flow element through which the fluid flows in an opposite axial direction.

12. In an organized turbine apparatus, a turbine section, a low-pressure turbine element, divided into at least three sub-sections, through two of the sub-sections of which fluid flows in opposite directions, and means communicating with the exhaust of the first mentioned section for dividing the fluid issuing therefrom into at least two separate streams, and for delivering the separate streams of fluid to the divided-flow turbine element.

13. In an organized turbine apparatus, a turbine section through which the fluid flows in one axial direction only, a divided flow low-pressure turbine element operating in tandem with said section, and comprising at least three separate sub-sections, through two of which the fluid flows in opposite axial directions, and means communicating with the first-mentioned turbine section for delivering fluid from said section to each of the sub-sections of the low-pressure element.

14. In combination with a turbine section, a low-pressure turbine element receiving fluid therefrom, and through which fluid

flows in at least three separate streams in passing to the exhaust of the organized apparatus, said element comprising at least three sub-sections to which fluid, discharged from said first-mentioned section, is delivered, and through adjacent sub-sections of which the fluid flows in opposite directions.

15. In combination with a turbine section, a low-pressure turbine element, comprising more than two sub-sections having a common rotor and common stator element, and through some of the sub-sections of which fluid flows in opposite directions, and means communicating with the exhaust of the first mentioned section for delivering fluid, discharged therefrom, in at least two separate streams, to the separate sub-sections of the low-pressure turbine elements.

16. In combination in an organized turbine apparatus, a turbine section, adapted to partially expand the motive fluid delivered to it, a second turbine section adapted to receive fluid discharged from the first-mentioned section, and comprising three separate blade-carrying elements located in a common casing, a plurality of rows of blades mounted on each element, and means within the casing for directing the fluid discharged from one row of blades to the next adjacent row, and means communicating with the discharge of said first-mentioned section for conveying fluid issuing therefrom, past the blades mounted on at least one of said elements, and for delivering the fluid so conveyed, to blades on the element, past which it is conveyed, and to blades on any other of said elements, through which the fluid flows in an opposite axial direction.

17. In an organized turbine apparatus, a turbine section through which the fluid flows in one axial direction only, a low pressure section, divided into three sub-sections, which operate in parallel on fluid discharged from the first mentioned section and through some of which the fluid flows in opposite axial directions, and means for delivering the fluid discharged from the first mentioned section in at least two separate streams to the low pressure section.

18. In an organized turbine apparatus, a turbine section for partially expanding the motive fluid delivered thereto, a low pressure section for expanding the motive fluid delivered thereto to exhaust pressure, and comprising three separate sub-sections operating in parallel on fluid discharged from the first mentioned section and through two of which the fluid flows in opposite axial directions.

19. In a turbine, a rotor comprising a drum having pressure blades arranged thereupon and a disk, carrying not more than two rows of peripherally attached low pressure blades, fixed to the low pressure end of the drum so as to constitute a head therefor, said disk being, further, of greater diameter than the drum and the shaft being divided so that the drum lies between its inner ends.

20. In a turbine, a rotor comprising a drum having pressure blades arranged thereupon and a disk, carrying not more than two rows of peripherally attached low pressure blades, fixed to the low pressure end of the drum so as to constitute a head therefor, said disk being of greater diameter than the drum and having its central part extended on the side away from the drum to constitute one end of the shaft.

In testimony whereof, I have hereunto subscribed my name this 12th day of April, 1913.

HERBERT T. HERR.

Witnesses:
C. W. McGHEE,
ADA ROMIG.