

July 22, 1924.

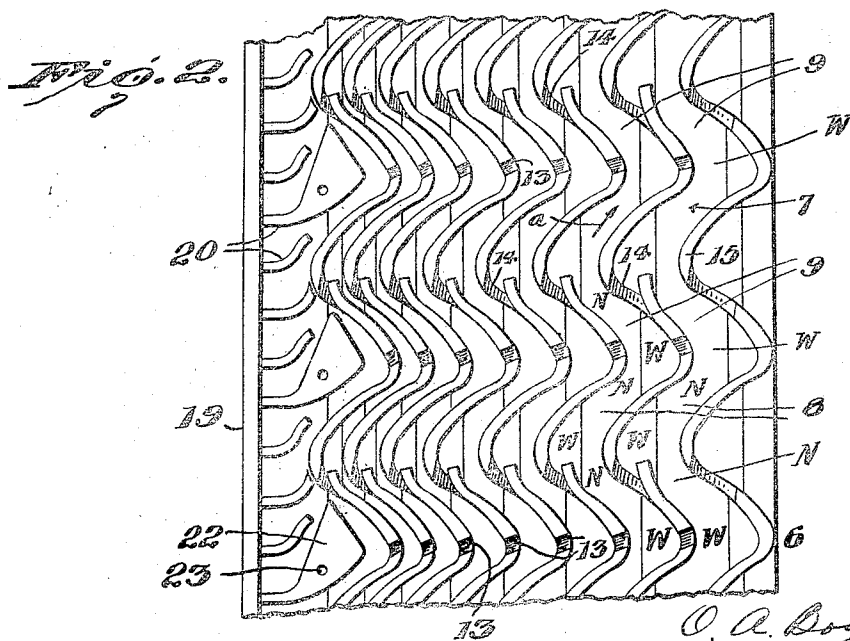
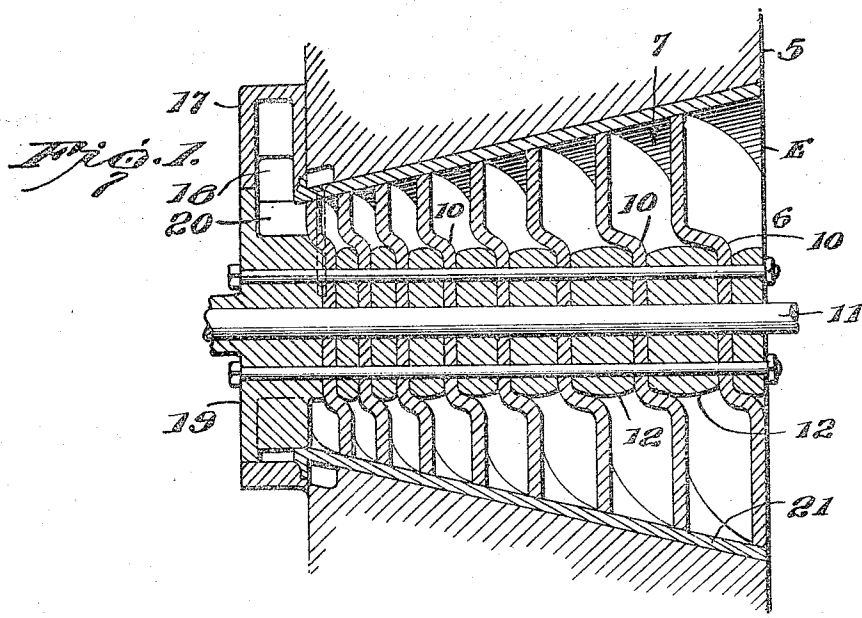
1,502,289

O. A. BOYER

FLUID JET MOTOR

Filed Feb. 28, 1923

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

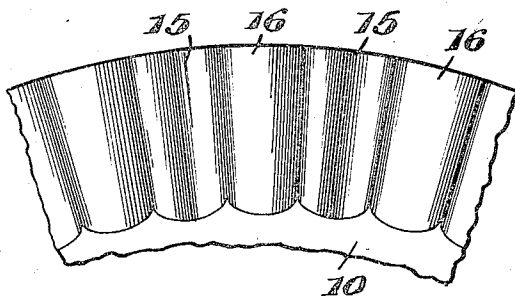


Fig. 3.

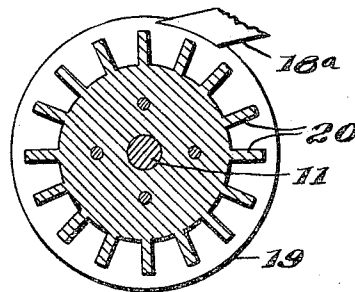
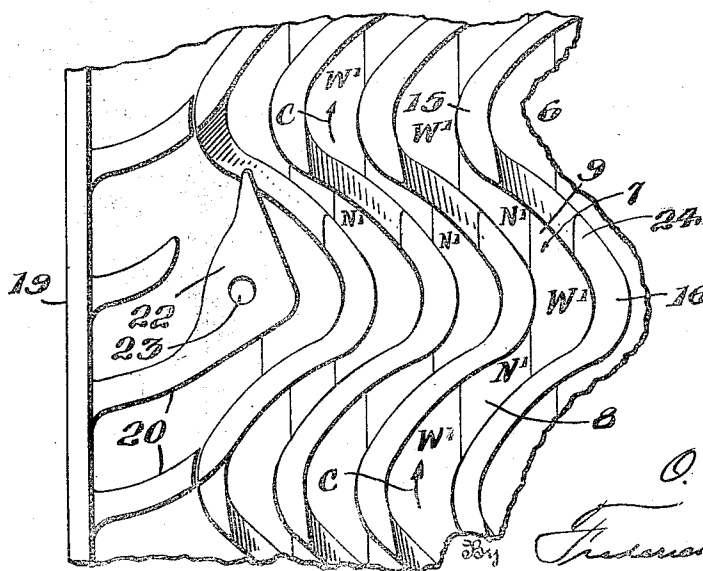


Fig. 4.

Fig. 5.



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UNITED STATES PATENT OFFICE.

ORAM A. BOYER, OF CHESTER, PENNSYLVANIA.

FLUID-JET MOTOR.

Application filed February 28, 1923. Serial No. 621,850.

To all whom it may concern:

Be it known that I, ORAM A. BOYER, a citizen of the United States, residing at Chester, in the county of Delaware and State of Pennsylvania, have invented certain new and useful Improvements in Fluid-Jet Motors, of which the following is a specification.

This invention relates to certain new and useful improvements in fluid jet motors and has particular reference to a device of that kind adapted to be primarily employed as a rotary steam turbine.

The primary object of the present invention is to generally simplify and improve devices of this character in such manner that the driving energy of the steam is utilized to its fullest extent for producing great power.

Another object of the invention is to provide a rotary turbine which embodies a rotor actuated entirely by the direct action of the steam, or in other words, one which does not involve reaction in its actuation, and whereby the direct action of the steam is utilized to its fullest extent for obtaining maximum power.

Still another object of the invention is to provide a rotary turbine including a rotor actuated by the direct action of the steam and involving extreme simplicity of construction so that the invention may meet with this specific requirement for a successful commercial use.

A still further object is to provide a direct action steam turbine embodying a rotor having a plurality of peripheral continuous steam chambers and constructed in a novel manner to provide substantially direct communication between all of the chambers and the steam inlet whereby the driving action of the steam is utilized simultaneously in all of the chambers for obtaining maximum power.

Another object of the invention is to form the chambers of sinuous form so that each chamber embodies an annular series of oppositely extending obliquely positioned chamber portions which converge in the direction of rotation of the rotor whereby the steam will be continuously allowed to expand and then caused to be obstructed in its flow in passing through each chamber. In other words, each chamber has the effect of a series of converging nozzles allowing the continuous re-expansion and damming

of the steam for obtaining a maximum amount of power.

With the above general objects in view and many others that will become apparent as the nature of the invention is better understood, the same consists in the novel form, combination and arrangement of parts hereinafter more fully described, shown in the accompanying drawings and claimed.

In the drawings, wherein like reference characters indicate corresponding parts throughout the several views:—

Figure 1 is a fragmentary longitudinal sectional view taken substantially centrally through a fluid jet motor constructed in accordance with the present invention;

Figure 2 is an enlarged fragmentary diagrammatic plan view showing the impulse wheel and rotor;

Figure 3 is an enlarged fragmentary side elevational view of one of the impulse discs of the rotor;

Figure 4 is a fragmentary view partly in section taken radially through the impulse wheel; and

Figure 5 is a view similar to Figure 2 showing a modified form of the invention.

Referring more in detail to the several views, the present invention embodies a cylinder 5 having a rotor 6 rotatably fitted therein and provided in its periphery with a plurality of circumferentially extending annular steam chambers 7 of sinuous form so that each chamber is composed of a series of obliquely positioned and oppositely extending chamber portions 8 and 9 respectively which taper or converge in the direction of rotation of the rotor and in the direction of the steam flow as indicated by the arrow *a*. This provides a relatively wide portion *W* at the inlet end of each of the chamber portions 8 and 9 and a relatively narrow portion *N* at the outlet end of each chamber portion so that, in effect, each chamber portion acts as a tapered nozzle whereby the steam is alternately restricted in flow and then allowed to expand a number of times in passing around each chamber.

As shown, the chambers 7 preferably increase in depth and width gradually from the inlet end of the cylinder to the exhaust end thereof so that a maximum amount of power is derived from the steam as its energy is gradually spent in passing through the chambers to the exhaust. The chambers

7 are preferably formed by suitably shaping the margins of a plurality of discs 10 which are fixed upon a driven shaft 11 in side by side spaced relation, the margins of these
 5 discs thus affording nested partitions of similar general form. The desired spaced relation of the discs 10 may be maintained by the placing of suitable spacing discs 12 therebetween, and the discs 10 and 12 may
 10 be rigidly fastened together in their proper relation by bolting or otherwise.

Communication is established between the several chambers 7 by means of oblique slots or openings 13 provided in the margins of
 15 the discs 10 in such position as to lead a portion of the steam from the narrow part of one chamber portion 8 to the wide part W of the chamber portion 9 in the next adjacent chamber. This oblique position of
 20 the openings 13 insures flow of a portion of the steam from one chamber through an opening 13 into the next succeeding chamber at a point forwardly of the similar opening 13 of the next disc 10 so that this portion
 25 of the steam will be caused to impinge against the oblique wall of said next disc. In other words, direct flow of the steam from one opening 13 to and through the next adjacent opening 13 is prevented because
 30 said next adjacent opening 13 is positioned slightly behind the point to which the steam is delivered from one chamber to the other.

The margins of the discs 10 are also provided with further openings 14 which afford
 35 direct communication between the narrow portion of each chamber section 9 and the wide portion of the adjacent chamber section 8 of the adjacent chamber 7. The openings 14 are disposed in obliquely positioned
 40 portions of the discs 10 so that the steam, in passing through the openings 14, moves in a general circumferential direction corresponding with the direction of rotation of the rotor instead of an axial direction. For
 45 this reason the steam will not pass from one opening 14 to and through the adjacent opening 14 of the next disc, but will pass through the adjacent oblique chamber portion 8 where a portion of the
 50 steam will then be diverted through an opening 13 in the disc at the exhaust side thereof. The openings 13 and 14 are preferably gradually increased in area as shown, and it will be understood from the above
 55 that soon after the turbine is placed into operation, steam will fill all of the annular chambers and exert its driving influence in all of the same, so as to obtain a maximum amount of power. It will also be under-
 60 stood that the steam will pass from one chamber to another, through one of the openings 13, where it will expand, and then pass through the adjacent tapered portion of this chamber. This steam will then be
 65 partially diverted through the adjacent

opening 14 into the next succeeding chamber so as to expand and similarly pass through an oppositely extending converging portion of said succeeding chamber.

Obviously the several discs may be
 70 stamped in like form by depressing portions of its margin laterally in opposite directions as at 15 and 16 respectively in Figure 3, and when the discs are placed side
 75 by side with their margins nested, a slight relative rotation of the discs will cause the converging chamber portions to be formed, after which the discs may be rigidly fixed in this relation so as to provide a rigid
 80 rotor having the features above described.

The nozzle 17 may embody a hollow arcuate or circular member fixed to the smaller or inlet end of the turbine and carried by the cylinder 5, with tangentially disposed
 85 outlets as at 18.

Securely fastened to the inlet end of the rotor or to the shaft carrying the latter is an impulse plate or disc 19 lying within the nozzle 17 and provided with peripheral
 90 vanes 20 which extend laterally and then obliquely in the general direction of rotation of the rotor, as shown clearly in Figure 2. These vanes 20 extend inwardly of the adjacent end of the cylinder 5 so as to effectively direct the steam into the adjacent oblique
 95 portions of the adjacent chambers.

The rotor preferably also embodies an outer wall or casing 21 which encircles the marginal edges of the discs 10 so that the
 100 chambers 7 are closed at the periphery of the rotor. Also, it is to be noted that the vanes 20 project inwardly of the rotor and lie inwardly of the rotor casing 21.

At suitable intervals certain of the vanes 20 may be enlarged as at 22 and provided
 105 with threaded sockets 23 for the reception of screws whereby the casing 21 may be rigidly fastened in place with the impulse plate 19 attached to the rotor proper.

Referring to Figure 5, wherein a modification of the invention is illustrated, the construction is substantially the same at that
 110 previously described except that the communication between the several chambers 7 is solely established by means of openings 24 in the oblique marginal portions of the
 115 discs 10 which extend toward the inlet end of the turbine and in the general direction in which the rotor rotates, thus providing for the action of the steam in straight lines
 120 as indicated by the arrows *c* parallel with the direction of rotation of the rotor. In other words, in this form of the invention, the steam passes from one chamber to the next adjacent chamber through an opening
 125 24 as it emerges from a narrow portion N' of one chamber section to enter the wide portion W' of the next adjacent chamber.

In both forms of the invention it will be seen that the steam or motive agent will
 130

pass from one chamber to the next succeeding chamber through an opening and then the motive agent will pass in an oblique portion of said next succeeding chamber until a portion of the same encounters the next opening and is diverted therethrough, said motive agent being subjected to a damming action and then allowed to expand in passing from one oblique portion of a chamber to another, or from one chamber to the other, whereby the driving energy of the motive agent is utilized to a maximum extent.

The exhaust end of the turbine is generally denoted by the reference character E and it is obvious that the exhaust passage at this end of the turbine may be formed in any well known or preferred manner whereby the passage for the exhaust is equal in area to the amount of motive agent passing from the rotor.

It is to be understood that the term "steam" is herein employed in a broad or generic sense so as to include gas or any equivalent of steam and that the invention is not limited in any manner by this term to the use of vaporized water as a motive agent.

In operation, the steam is conducted to the nozzle 17 from any suitable source of supply and passes from this nozzle so as to impinge upon the vanes 20 in a tangential direction as illustrated in Figure 4, at 18°. The steam will then soon fill all of the chambers 7 and simultaneously exert its energy in all of the same for driving of the rotor. The motive agent will be partially diverted from one chamber to another through either of the series of apertures 13 or 14 and the remaining portion of the motive agent will follow the tortuous path formed by each chamber. In passing through the several chambers the steam will be continuously subjected to a damming action and then allowed to re-expand due to the tapering form of the chamber sections. At the same time, a positive driving action will be had by the direct impinging of the steam against the oblique walls which divide the periphery of the rotor into the several chambers and to this positive driving action will be added the driving force caused by the friction of the motive agent against the surfaces of these oblique walls. It will thus be seen that the energy of the motive agent is utilized to a maximum degree, particularly as the steam is caused to travel partially through one chamber before passing from said chamber to the next adjacent chamber.

From the foregoing description it is believed that the construction and operation, as well as the advantages of the present invention, will be readily understood and appreciated by those skilled in the art.

Also, it is to be understood that the exact positions of the openings, as well as their form and size, may be considerably changed and varied without departing from the spirit and scope of the invention as claimed.

What is claimed is:—

1. A direct action fluid jet motor including a cylinder, a rotor revoluble therein and provided with a plurality of circumferentially extending endless steam channels of sinuous form with each channel providing a communicating series of obliquely extending chamber portions, alternate chamber portions extending in opposite directions, said chamber portions tapering smaller in the direction of rotation of the rotor certain of said chamber portions of each of said channels being in communication with the chamber portions of the next succeeding channel.

2. In a direct action fluid jet motor, a cylinder, a rotor rotatably mounted therein and provided with a plurality of circumferentially extending peripheral endless steam channels of sinuous form, each channel embodying oblique channel portions extending in opposite directions, and said channel portions tapering narrower in the direction of rotation of the rotor, said rotor having openings providing communication between the several channels and arranged in the oblique portions of the rotor walls which extend toward the inlet end of the motor, whereby the steam moves in the general direction in which the rotor rotates when passing from one chamber to another.

3. In a direct action fluid jet motor, a cylinder, a rotor rotatably mounted therein and provided with a plurality of circumferentially extending peripheral endless steam channels of sinuous form, each channel embodying oblique channel portions extending in opposite directions, and said channel portions tapering narrower in the direction of rotation of the rotor, said rotor having openings providing communication between the several channels and arranged in the oblique portions of the rotor walls which extend toward the inlet end of the motor, whereby the steam moves in the general direction in which the rotor rotates when passing from one channel to another, said openings being arranged to provide communication between the narrow ends or certain of said oblique chamber portions of one chamber and the large end of the chamber portions of the oppositely extending oblique chamber portions of the next adjacent chamber the walls of the chamber portions converging toward the outlet ends thereof.

4. In a fluid jet motor, a cylinder, a rotor revolubly mounted therein adapted to receive a motive agent at one end and to exhaust the same at the other end thereof, said rotor having a plurality of circumferentially

extending endless steam channels of sinuous form separated by walls of sinuous form whereby each channel embodies a plurality of oblique channel portions alternately extending in opposite directions, said walls having substantially axially aligned openings therethrough in the portions thereof which extend toward the inlet end of the motor in the general direction of rotation of the rotor for providing communication between each channel and the adjacent channels, whereby the motive agent may flow in a circumferential direction corresponding with the direction of rotation of the rotor from one channel to the next succeeding channel each of said channels tapering toward the outlet end thereof.

5. In a fluid jet motor, a cylinder, a rotor revolvably mounted therein adapted to receive a motive agent at one end and to exhaust the same at the other end thereof, said rotor having a plurality of circumferentially extending endless steam channels of sinuous form separated by walls of sinuous form whereby each channel embodies a plurality of oblique chamber portions alternately extending in opposite directions, said walls having substantially axially aligned openings therethrough in the portions thereof which extend toward the inlet end of the motor in the general direction of rotation of the rotor for providing communication between each channel and the adjacent channels, whereby the motive agent may flow in a circumferential direction corresponding with the direction of rotation of the rotor from one channel to the next succeeding channel, said walls having further openings at the juncture of each oblique wall portion with the adjacent oppositely extending oblique wall portion lying to the exhaust side of the motor, said last named openings being obliquely disposed to direct the steam from one channel to another at a point ahead of the next adjacent similar opening.

6. In a fluid jet motor, a cylinder, a rotor rotatably mounted therein and adapted to receive a motive agent at one end and to exhaust the same at the other end thereof, said rotor being provided with a plurality of circumferentially extending endless peripheral channels of sinuous form separated by walls of sinuous form, each of said channels embodying a series of oppositely extending oblique chamber portions which converge in the general direction of rotation of the rotor, said walls having openings therethrough establishing communication between the narrow outlet end of each chamber portion which extends toward the exhaust end of the motor and the wide end of the oppositely ex-

tending chamber portion of the next succeeding channel.

7. In a fluid jet motor, a cylinder, a rotor rotatably mounted therein and adapted to receive a motive agent at one end and to exhaust the same at the other end thereof, said rotor being provided with a plurality of circumferentially extending endless peripheral channels of sinuous form separated by walls of sinuous form, each of said channels embodying a series of oppositely extending oblique chamber portions which converge in the general direction of rotation of the rotor, said walls having openings therethrough establishing communication between the narrow outlet end of each chamber portion which extends toward the exhaust end of the motor and the wide end of the oppositely extending chamber portion of the next succeeding chamber, said walls having further openings establishing communication between the narrow end of each chamber portion which extends toward the inlet end of the motor and the wide end of the oppositely extending chamber portion of the next succeeding chamber.

8. In a fluid jet motor, a cylinder, a rotor rotatably mounted therein and adapted to receive a motive agent at one end and to exhaust the same at the other end thereof, said rotor being provided with a plurality of circumferentially extending endless peripheral channels of sinuous form separated by walls of sinuous form, each of said channels embodying a series of oppositely extending oblique chamber portions which converge in the general direction of rotation of the rotor, said walls having openings therethrough establishing communication between the narrow outlet end of each chamber portion which extends toward the exhaust end of the motor and the wide end of the oppositely extending channel portion of the next succeeding channel, said walls having further openings establishing communication between the narrow end of each chamber portion which extends toward the inlet end of the motor and the wide end of the oppositely extending chamber portion of the next succeeding channel, said openings being arranged in a plurality of axially aligned series disposed so that the motive agent is delivered from one channel to the other at a point in advance of the similar opening at the opposite side of the opening through which the steam has passed in flowing from one channel to the other.

In testimony whereof I affix my signature.

ORAM A. BOYER.