

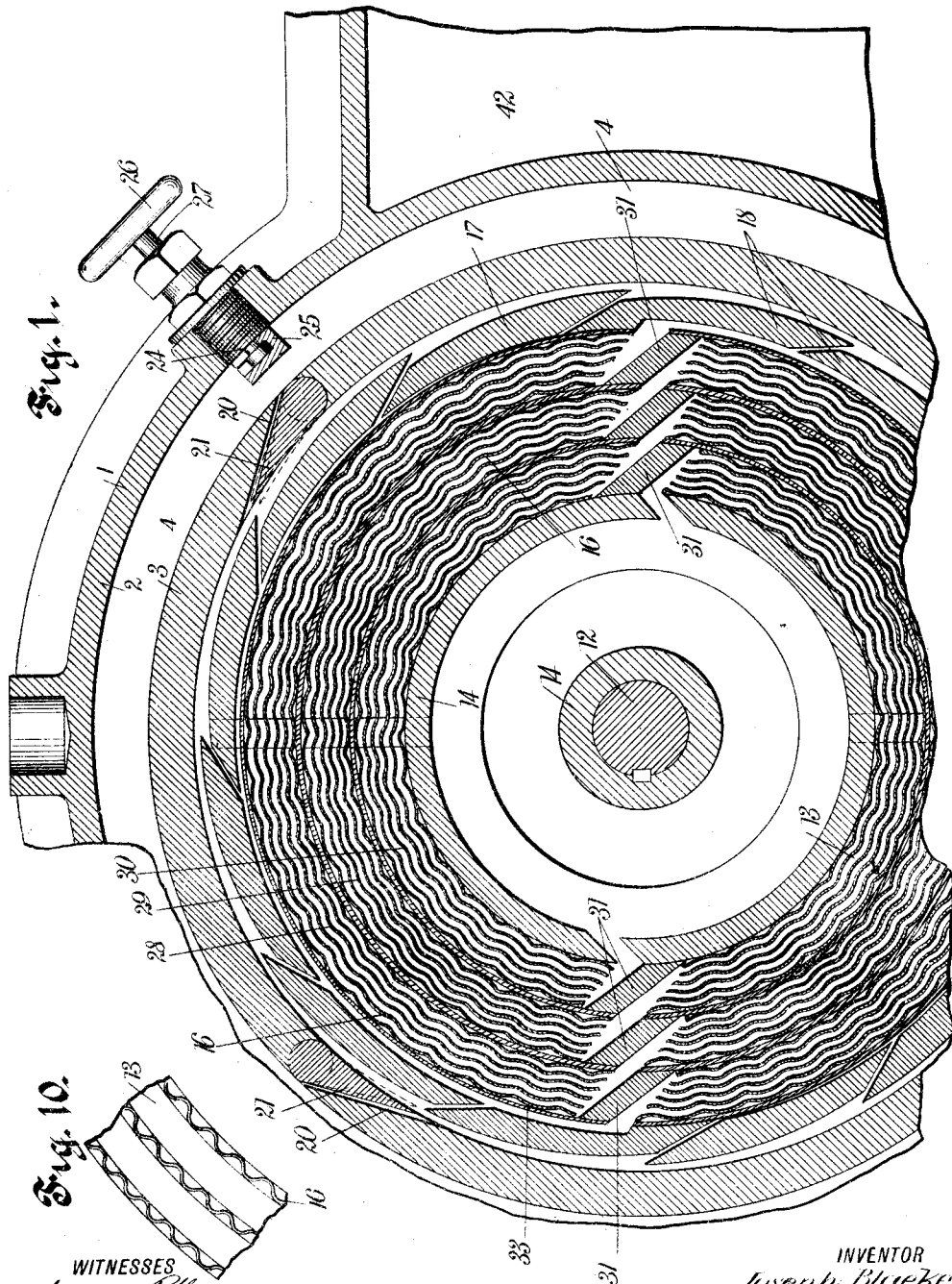
J. BLAEKER.
TURBINE.

APPLICATION FILED JUNE 14, 1911.

Patented May 7, 1912.

3 SHEETS-SHEET 1.

1,025,241.



WITNESSES

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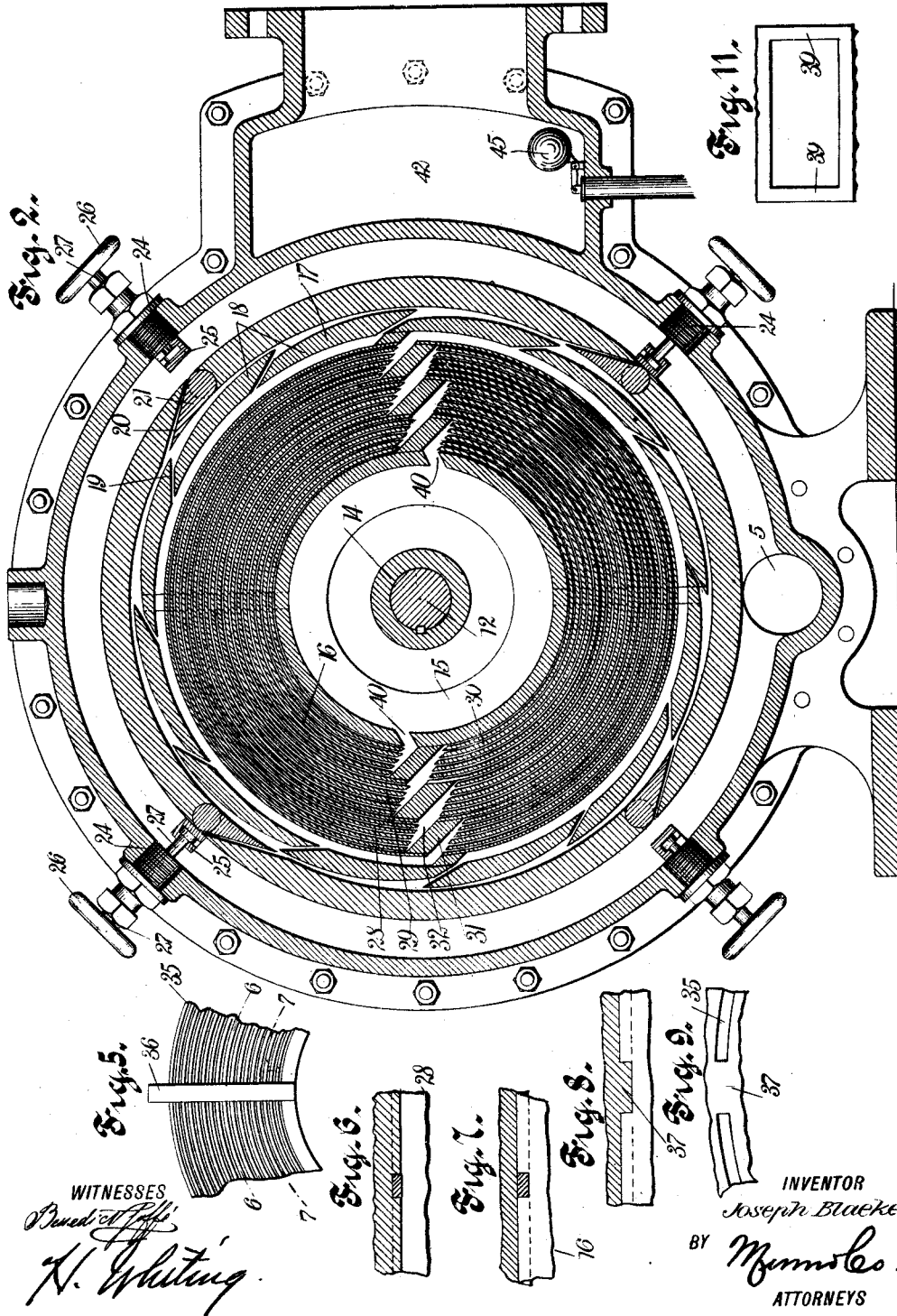
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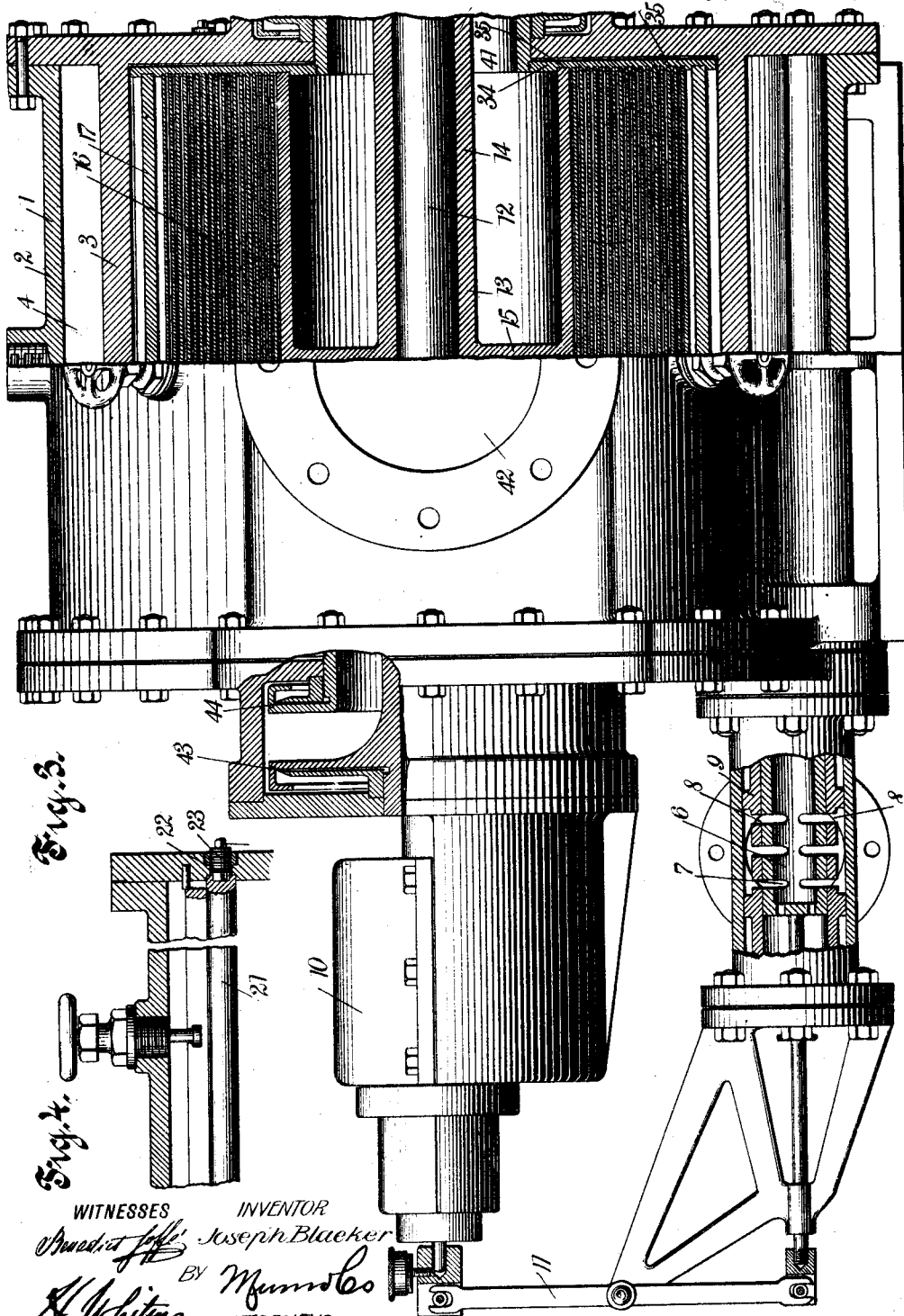


Fig. 3.

Fig. 4.

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JOSEPH BLAEKER, OF NEW YORK, N. Y.

TURBINE.

1,025,241.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JOSEPH BLAEKER, a subject of the Czar of Russia, and a resident of the city of New York, borough of Brooklyn, in the county of Kings and State of New York, have invented a new and Improved Turbine, of which the following is a full, clear, and exact description.

This invention relates to a new and improved turbine in which there is provided a rotor adapted to absorb the energy in a motive fluid passing therethrough at a considerable velocity, as for example, expanded steam, by constantly changing the direction of motion of the motive fluid, so as to receive therefrom a continuous series of minute impulses, which in the aggregate amount to a considerable force, and yet which are so evenly distributed and taken up over so long a period of time, corresponding to the period of passage of the motive fluid through the rotor, that the motion of the rotor is comparatively slow with respect to the velocity of the motive fluid, and yet absorbs substantially the full force thereof without splashing or shock.

An object of this invention is to provide a turbine with adjustable expansion nozzles through which the motive fluid, such as steam, expands adiabatically to the existing back pressure in the turbine casing, and thus converting the static or potential energy, in the form of pressure, into kinetic energy, in the form of velocity.

A further object of this invention is to provide a turbine with means for destroying the kinetic energy of the motive fluid by continuously changing its direction of motion.

A further object of this invention is to provide a turbine rotor with a path therein through which the motive fluid can travel and give up its energy due to its velocity, to the reacting passage walls, which constantly change the direction of motion of the stream of motive fluid, while said stream remains substantially unbroken and the minute particles thereof not separated or torn apart during the absorption of the energy of the stream, due to its velocity, by the rotor.

A further object of this invention is to provide a rotor in which each individual particle of the motive fluid will exert its energy on a very long working surface, whereby there is produced at individual points

minute reactions to the flow of the motive fluid, the latter being always in contact with the rotor, in order to avoid shock, splashing or other eddy currents, thus producing effects so as to obtain a high efficiency at a slow speed of the rotor.

A further object of this invention is to provide a perfectly balanced rotor, which will be inexpensive to manufacture, compact in form, utilizing all the available space for working surface, thus developing a very great torque and enabling the turbine to actuate a great load at a slow speed.

A still further object of this invention is to provide a rotor comprising a plurality of concentrically arranged cylinder sections spaced apart from each other sufficient distances to form motive-fluid passages with side plates having grooves therein to maintain the cylinders in their relative positions, and with keys for preventing a circular motion of the cylinders.

These and further objects, together with the construction and combination of parts, will be more fully described hereinafter and particularly set forth in the claims.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views, and in which—

Figure 1 is a vertical transverse section through a form in which the cylinders are corrugated or waved so as to offer a greater exposed surface and more abrupt changes in the path of the motive fluid; Fig. 2 is a view similar to Fig. 1, showing the rotor with the cylinders smooth and uncorrugated; Fig. 3 is a side view in elevation, partly in longitudinal section to show the underlying structure; Fig. 4 is a detail longitudinal sectional view, showing means for controlling one of the nozzles or expanding passages; Fig. 5 is a fragmentary inside view of one of the side plates, showing the key for securing the cylinders in position; Fig. 6 is a section taken on the arcuate line 6—6 of Fig. 5; Fig. 7 is a section taken on the arcuate line 7—7 of Fig. 5; Fig. 8 is a view similar to Fig. 7, in which the key is done away with and its place taken by a special formation of the side plate; Fig. 9 is a detail face view of one of the side plates of the form shown in Fig. 8; Fig. 10 is a fragmentary view of a portion of a rotor, in which the cylinders are corrugated, with the

corrugations exactly parallel; and Fig. 11 is a fragmentary view of a portion of a cylinder, in which the opening for the passage of motive fluid for the successive cylinders is
5 opened by cutting an opening in the continuous cylinder for a distance just short of the side plates of the rotor.

Referring more particularly to the separate parts of this invention as embodied in the forms shown in the drawings 1 indicates a motor casing, which may be of any suitable structure and material, and is preferably provided with a cylindrical outer wall 2 and an inner wall 3, spaced apart from
15 each other a sufficient distance to form an annular motive-fluid chamber 4. The motive fluid, which may be of any suitable character, such as steam, is admitted into the chamber 4 through an inlet 5 (see Fig. 2),
20 and is controlled in its admission by a valve 6, which may be of any suitable character, and in this instance is shown as a sliding cylindrical valve, having ports 7 adapted to be brought into alinement with ports 8 in
25 a valve casing 9. The valve 6 may be controlled in any suitable manner, as for example from a centrifugal governor, not shown but located adjacent the casing 10, through the intermediary of a pivoted lever
30 11. This governor will form the subject-matter of a subsequent application, and therefore is not shown in detail in the present case.

Rotatably supported in the casing 1 in any
35 suitable manner, there is provided a shaft 12, which has secured thereto a rotor 13. The rotor 13 may be of any suitable structure, but preferably consists of a central hub 14, which may be a casting, and may be
40 divided into two compartments by a radial partition 15; a plurality of concentrically arranged cylindrical sections 16, which form a body portion with passages therein for the steam or other motive fluid to pass through;
45 and an outer bucket ring or cylinder 17. It will be noted by reference to Figs. 1 and 2 that the bucket ring or cylinder 17 comprises a plurality of buckets 18, spaced apart from each other to form passages 19, through
50 which the motive fluid can pass, and that these buckets taper on their outside surfaces from one end to the other, so as to leave a portion of the head of each bucket freely exposed to the action of the motive fluid in
55 passing through the passages 19. The motive fluid obtains access from the chamber 14 to the rotor 13 by means of a plurality of nozzles or passages 20 formed in the cylindrical wall 3 of the casing 1. These pas-
60 sages or nozzles are preferably inclined in the direction of rotation of the rotor, so as to direct the motive fluid properly to the rotor. One side of the nozzles or passages in each instance is shown to be formed of
65 the side wall of a cut in the cylindrical wall

3; the other side is shown to be formed of the face of a movable flap or valve 21, which is pivotally mounted in the casing 1, as will be more clearly seen by reference to Fig. 4, so as to permit it to be adjusted to vary the
70 size of the passage or nozzle so as to vary the extent to which the steam is expanded before entering the rotor.

It will be seen, still by reference to Fig. 4, that the flap or valve 21 is provided with
75 an angular socket at one end, in which face the angular lugs 22 of an actuator 23, which extends outside of the casing; where it is provided with an angular projection 24, which may be engaged by a lever, hand-
80 crank or the like, so as to vary the position of the flap 21 with respect to the cylindrical wall 3, as indicated in the full and dotted lines in Fig. 1. The inlet to the expanding
85 passages or nozzles 20 is controlled by valves 24, which are shown in the form of longitudinally-extending strips 25, adapted to be forced toward and withdrawn from the in-
90 lets to the expanding passages or nozzles 20, by means of hand wheels 26, which control screw-threaded spindles 27 connected to the strips 25.

As has been mentioned above, the rotor embodies a plurality of concentrically-ar-
95 ranged cylinders, which are located intermediate the bucket ring or cylinder 17 and the hub 14. These cylinders may be in sections, as indicated in Figs. 1 and 2, any number of them going to make up a single cylinder, and in this instance, the sections are shown
100 to be substantially semi-cylindrical, that is to say, each forming a half of a cylinder, with the edges thereof spaced apart a sufficient distance to form passages from the
105 outer cylinders to the inner cylinders. It will be further seen that the cylinders are arranged in groups 28, 29 and 30, which represent successive stages in the passage of the motive fluid between the periphery and the
110 center of the rotor.

In order to cause the motive fluid to pass from one stage to the other, there are inter-
posed between the adjacent ends of corresponding sections of the cylinders, stops 31, which form between themselves passages 32,
115 connecting an outer group or stage with an inner group or stage. It will be seen that the sections or cylinders in each group or stage are spaced apart from each other equal amounts, so as to form motive-fluid passages,
120 and so that each group has a multiplicity of passages of equal magnitude, through which the motive fluid can pass. These passages, in view of the circular nature of the cylinders, are constantly changing in their direc-
125 tion, so that the motive fluid, in passing therethrough, will constantly change its direction of travel, and thereby impinge continuously on the outer curved surface of each passage, imparting to the rotor a frac- 130

tion of its energy. In view of the fact that these passages are long drawn out and extending circularly around the rotor, the effect of the giving up of energy of the motive fluid to the rotor will be a gradual one, without shock, splashing, or eddying.

It is evident from the fact that the cylinders are symmetrically divided, the stops 31 on one side of the rotor will be counter-balanced by corresponding stops on the other side of the rotor, these stops being located symmetrically with respect to each other and at equal distances from the axial center of the rotor. In event the cylinders of the rotor were divided into a greater number of sections, the stops would likewise be symmetrically located, so as to balance each other and form an evenly balanced rotor, whereby there will be no eccentric force during its rotation.

The cylinders may be smooth, as indicated in Fig. 2, or they may be corrugated, as indicated in Figs. 1 and 10. In the latter case, the direction of travel of the motive fluid is more frequently changed by the tortuous passages formed between the corrugated cylinders, and thereby has its energy taken up more quickly and on a shorter path. It is, of course, desirable that the corrugations on one cylinder should be exactly parallel to the corrugations on the adjacent cylinders, as indicated in Fig. 10. In event it is found impracticable for the entire diameter of the rotor, the corrugations in the cylinders of each group can be made parallel, so that the passages will have substantially the same magnitude throughout their length, and these groups separated from each other by partitions, indicated at 33.

The corrugations may be formed by cutting away grooves alternately on opposite sides from a perfect cylindrical section, or preferably may be rolled out of sheet-metal, in which instance, they can be more cheaply and quickly constructed. In event the material is cut out, as by milling machines, for the purpose of forming the corrugations, the side edges may be left cylindrical, so as to properly fit in grooves provided in the face plates, as will be described hereinafter. The cylinders, even if not corrugated, may be constructed of sheet-metal, and thus be light and inexpensive.

For the purpose of holding the hub, cylinders, and bucket-ring or cylinder in their relative position with the passages formed therebetween, the rotor is provided with side plates 34, which have on their inward-facing surfaces, grooves 35, one for the cylinder of the hub, another for the bucket cylinder, and a plurality for the passage-forming cylinders 16. These grooves 35 are concentrically arranged, as will be seen by reference to Fig. 5, so that they prevent the cylinders spreading relative to each other

in a radial direction. In order to prevent the parts from moving circumferentially under the stress of the torque placed thereon, they may be held in place by one or more keys 36, extending radially and being inset in the side plates 34 about the depth of the grooves 35, as will be seen by reference to Figs. 5, 6 and 7. It will be noted that the keys 36, in cutting the ridges between the grooves 35, also cut the grooves so that the various cylinders which extend into these grooves must be rabbeted, as indicated in Fig. 7, so as to permit the keys 36 to lock the cylinders to the side plates. In place of removable keys, the grooves 35 may be interrupted at intervals, as indicated in Figs. 8 and 9, at 37, with the same rabbets formed in the cylinders, so that they will set into the interrupted grooves 35, and be locked, not only from radial movement, but also from circular movement.

The cylinders forming the body of the rotor need not be made in sections, as indicated in Figs. 1 and 2, but may be in the form of integral cylinders. In such an event, the opening between the separate passages formed by the cylinders may be obtained, as will be seen by reference to Fig. 11, by providing therein openings 38, which, however, do not extend the full length of each cylinder, that is to say, these openings extend just short of the edges of the cylinder, so as to form the necessary connecting strips 39 at the sides of the cylinder, which also extend into the grooves 35 and prevent the movement of the cylinder as a whole in a radial direction.

The steam or other motive fluid passing through the various passages of the rotor enters the compartments provided in the hub 14 through passages 40. It will be seen in this connection that there are two separate streams of motive fluid passing from opposite sides of the rotor around each other and out through the passages 40 into the compartments separated by the partition 15 of the hub 14. From these compartments, the motive fluid passes out at each side into exhaust passages 41, to an exhaust 42, the leakage of the motive fluid from the casing of the rotor being controlled by the centrifugal locks 43 and 44, which are the subject-matter of my co-pending application Serial No. 586,465, filed October 11, 1910. The water to these locks may be controlled by a float controller, indicated at 45.

The operation of the device will be readily understood when taken in connection with the above description.

The steam or other motive fluid is admitted to the casing 1 through the inlet 5, being controlled in its passage thereto by the cylindrical valve 6, which in turn is controlled by the centrifugal governor, not shown. The motive fluid, on entering the chamber 4,

circulates around the full circumference thereof, and passes through the expanding nozzles or passages 20. One or more of these expanding passages or nozzles may be closed, if desired, any amount by the valves 24, as indicated in Fig. 2. In passing through the expanding passages 20, the motive fluid is expanded a certain amount, depending on the position of the flap or valve 21, which position can be regulated to suit conditions, preferably, however, an amount just short of full expansion, so that it can complete its expansion on entering the rotor. The motive fluid thus expanded travels at a high velocity and impinges on the buckets 18 of the bucket-ring or cylinder 17, which, however, in view of their small surface, do not take up very much of the energy of the steam or other motive fluid, but leaves it to be absorbed in passing through the continuous passages formed between the cylinders of the body portion of the rotor. It will be noted that the motive fluid passes in two streams entering at opposite sides of the body portion of the rotor, and passing in the same clockwise direction, each stream being divided up into groups by the series of passages in each stage or group of the rotor. Inasmuch as these passages are preferably of small depth, the streams of motive fluid will have almost every particle thereof in intimate contact with the sides thereof, and in view of the fact that the passages are constantly changing in their direction, the particles of motive fluid will impinge continuously on the curved walls of the passages, giving up their energy due to their velocity gradually in small amounts. Inasmuch as this giving up of energy is prolonged throughout the extensive length of the passages, the action will be devoid of shock, splashing and eddying, so that the rotor can travel at a slow speed and yet utilize substantially all of the energy in the motive fluid. In view of the fact that the cylinders are secured to the side plates, and thus to the hub and shaft, so that there will be no relative movement, the entire force of the motive fluid as absorbed by the cylinders which form the walls of the passages will be changed into rotation of the shaft 12, from whence the power generated can be taken off to any suitable point.

It will thus be seen that there is provided a simple and inexpensive turbine, which will absorb the velocity energy of a rapidly-moving motive-fluid in such small increments, over such a long period of time through elongated passages, that the turbine itself may rotate at a comparatively slow speed while generating power at a high efficiency.

While I have shown several embodiments of my invention, I do not wish to be limited to the specific details thereof, but desire to

be protected in various changes, alterations and modifications which may come within the scope of the appended claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:—

1. The combination with a casing, of a rotor rotatably mounted in said casing, said rotor embodying side plates and a plurality of concentrically-arranged solid cylinders secured to said side plates, said cylinders being equally spaced one from the other to form fluid passages of constant volume.

2. The combination with a casing, of a rotor rotatably mounted in said casing, said rotor embodying side plates and a plurality of concentrically-arranged cylinders secured to said side plates, said cylinders being equally spaced one from the other, said cylinders being arranged in groups or stages and having passages connecting one group or stage with the next adjacent group or stage.

3. The combination with a casing, of a rotor rotatably mounted in said casing, said rotor embodying side plates and a plurality of concentrically-arranged cylinders secured to said side plates, said cylinders being equally spaced one from the other, said cylinders being arranged in groups or stages and having passages connecting one group or stage with the next adjacent group or stage, and symmetrically-located stops forming the walls of said passages.

4. The combination with a casing, of a rotor rotatably mounted in said casing, said rotor embodying a plurality of plates and a plurality of concentrically-arranged perforated cylinders secured to said plates and forming fluid passages between them.

5. The combination with a casing, of a rotor rotatably mounted in said casing, said rotor embodying a plurality of plates, said plates having concentrically-arranged grooves therein, a plurality of solid cylinders engaging said grooves and spaced apart so as to form continuous fluid passages of uniform length therebetween, and means for preventing circular movement of said cylinders relative to said plates.

6. The combination with a casing, of a rotor rotatably mounted in said casing, said rotor embodying a plurality of plates, said plates having concentrically-arranged grooves therein, a plurality of cylinders engaging said grooves and spaced apart so as to form fluid passages therebetween, said plates having keyways formed therein, extending transversely with respect to said grooves, said cylinders having rabbets in the edges thereof corresponding to said keyways, and one or more keys engaging said rabbets and said keyways, for securing said cylinders against movement relative to said plates.

7. The combination with a casing, of a rotor rotatably mounted in said casing, said rotor embodying a plurality of plates, said plates having concentrically-arranged grooves therein, a plurality of cylinders engaging said grooves and spaced apart so as to form fluid passages therebetween, and a key and keyway connection between said cylinders and said plates, preventing circular motion of said cylinders relative to said plates.

8. A rotor, having a plurality of concentric passages of equal magnitude, said passages being arranged in groups, the passages in one group being connected to the passages of another group by an intermediate passage.

9. The combination with a casing, of a rotor rotatably mounted in said casing, said casing having a plurality of expanding nozzles or passages therein, and said rotor having a plurality of concentric passages connecting the periphery of the rotor with the center.

10. The combination with a casing, of a rotor rotatably mounted in said casing, said casing having a plurality of expanding nozzles or passages therein, and said rotor having a plurality of concentric passages connecting the periphery of the rotor with the center, and a movable flap for varying the expanding effect of each of said expanding nozzles or passages.

11. The combination with a casing, of a rotor rotatably mounted in said casing, said casing having a plurality of expanding nozzles or passages therein, and said rotor having a plurality of concentric passages connecting the periphery of the rotor with the center, a movable flap for varying the expanding effect of each of said expanding nozzles or passages, and a valve for controlling the inlet to each of said expanding nozzles or passages.

12. The combination with a casing, said casing having an annular chamber therein, of means for controlling the admission of motive fluid to said annular chamber, said casing having a central cavity therein, a rotor rotatably mounted in said chamber, said casing having one or more expanding nozzles or passages connecting said chamber with said cavity, so that the motive fluid in said chamber may be supplied to said rotor, and flap valves forming one side of said expanding passages, movably mounted so as to vary the expanding effect of said passages, and valves for controlling the passage of steam into said passages.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOSEPH BLAEKER.

Witnesses:

HORATIO WHITING,
PHILIP D. ROLLHAUS.