983,653.

B. STEVENS.

TURBINE.

APPLICATION FILED OCT. 5, 1910.

Patented Feb. 7, 1911.

2 SHEETS—SHEET 1.

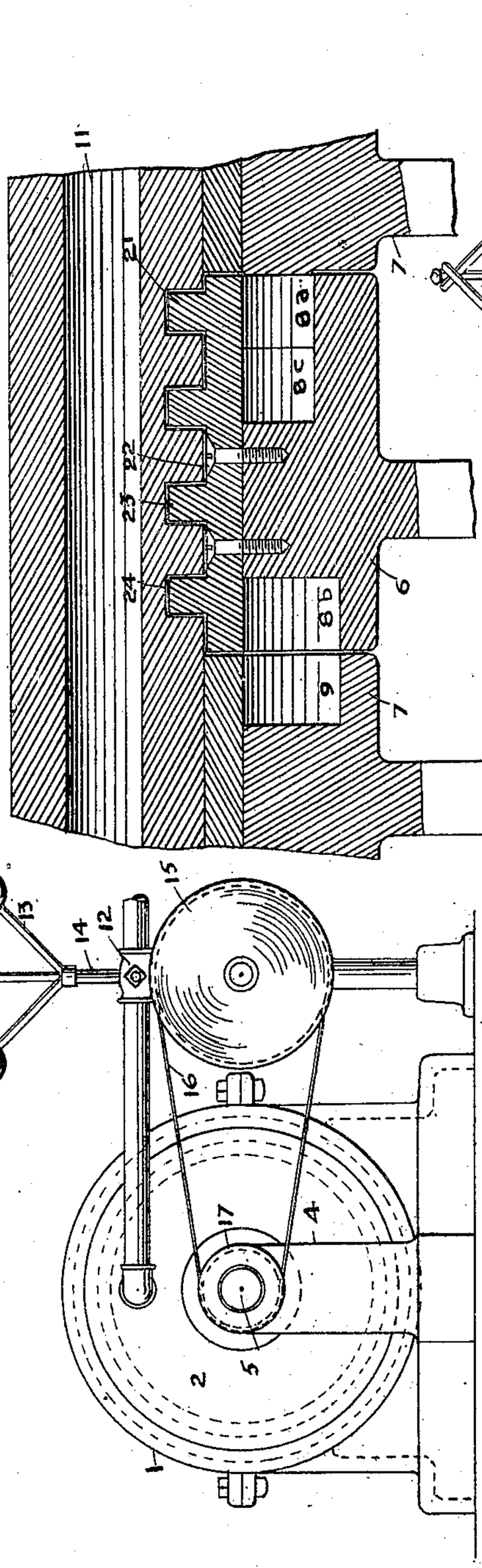

FIG. 2

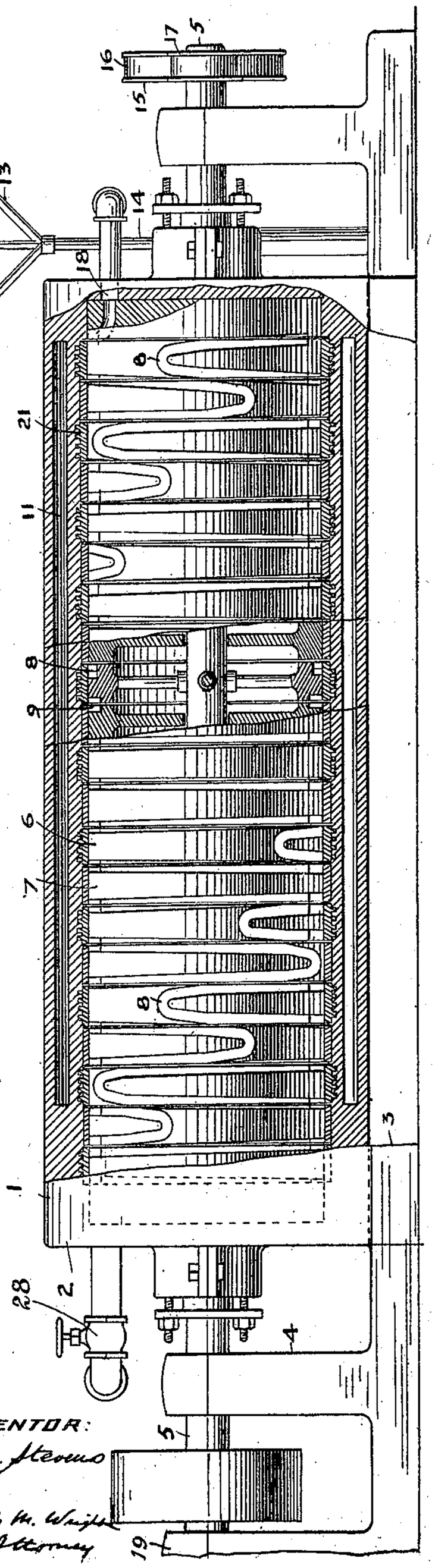

FIG. 1

WITNESSES

T. F. Johnson

Leon Boillot

INVENTOR:

Byron Stevens

By Francis H. Wright

Attorney

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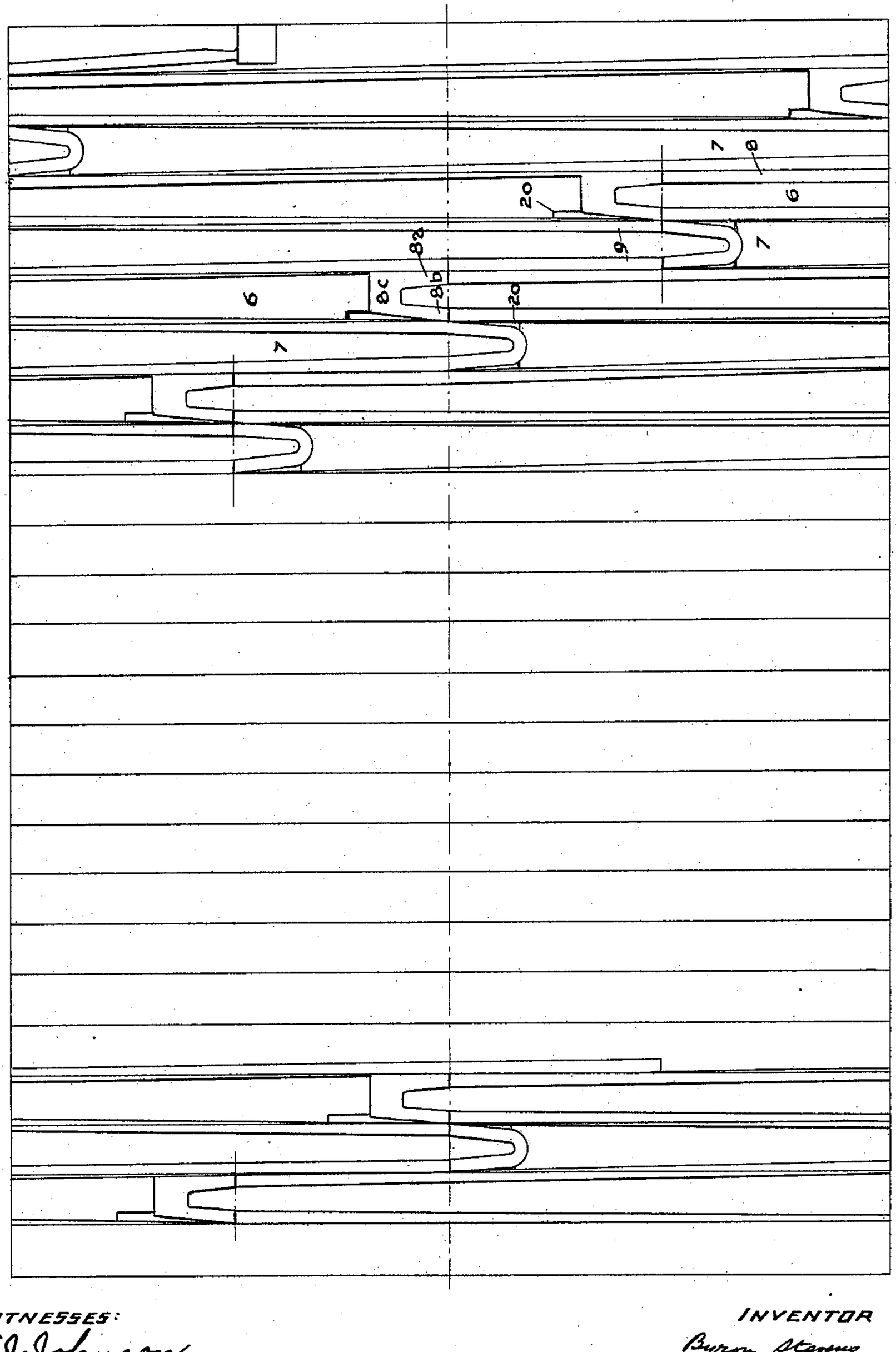

FIG. 4

WITNESSES:

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UNITED STATES PATENT OFFICE.

BYRON STEVENS, OF OAKLAND, CALIFORNIA.

TURBINE.

983,653. Specification of Letters Patent. Patented Feb. 7, 1911.

Application filed October 5, 1910. Serial No. 585,398.

To all whom it may concern:

Be it known that I, BYRON STEVENS, a citizen of the United States, residing at Oakland, in the county of Alameda and State of California, have invented new and useful Improvements in Turbines, of which the following is a specification.

My invention relates to improvements in turbines, the object of my invention being to provide a turbine operating wholly by the reaction or unbalanced pressure of the pressure fluid, and, by avoiding the employment of impulses from said fluid, converting the energy of said fluid into motion of the turbine economically and efficiently, the loss incurred being only that due to friction or leakage.

A further object is to provide means whereby said loss may be rendered as small as possible.

For convenience I shall hereinafter consider steam as being the pressure fluid employed, although it is to be understood that my invention is not limited thereto.

In the accompanying drawings, Figure 1 is a side view of the turbine, broken away in two places to show the construction; Fig. 2 is an end view thereof; Fig. 3 is an enlarged view to show the steam jacket; Fig. 4 is an enlarged diagrammatic view showing the passages of the turbine developed.

Referring to the drawing, 1 indicates a cylinder having suitable heads 2, and supported on a base 3, in which base are supported suitable bearings 4 for a shaft 5. On said shaft within said cylinder are secured wheels 6 alternating with which are disks 7 secured to the cylinder. In each wheel 6 I form a passage 8 leading from the disk 7 on one side to the disk on the other, said passage 8 being bent back on itself so as to return at an angle of nearly 180°, and each side of the passage extending slightly more than the whole circumference of the wheel. The disks 7 are formed with ports 9 similar to the passages 8 in the wheels but directed reversely thereto, the object of the ports 9 in the disks being to change the direction of the steam so as to cause it to properly act upon the next wheel. The return or last portion 8^b of the passage in the wheel is larger than the entrance or first portion 8^a of said passage, so that the steam, on entering said last portion 8^b expands, and its size is such as to cause a velocity relative to the wheel in the return portion of slightly more than double the velocity in the entrance portion 8^a of the passage, the latter velocity being measured with reference to the stationary parts of the machine. The entrance velocity of the steam will be only so much greater than that of the wheel as to supply the place of the steam which escapes by expansion therefrom. However, the parts of the passage are of such size that the steam which is so supplied in the inlet portion 8^a of the passage escapes by expansion from the outlet portion thereof with sufficient rapidity that there is substantially no impulse upon the chamber 8^c between the inlet and outlet side of the passage. But, in said chamber, there is an unbalanced pressure, due to the greater pressure on the front of said chamber 8^c than on the rear on account of the drop or pressure at and around the entrance of the return portion 8^b. For convenience of construction the sides of the intermediate chambers in both ports and passages are formed by means of metal strips or pieces 20 separate from the main castings.

It will be seen that for nearly the entire circumference of the cylinder the inlet portion of the steam port is open on one side to, or forms one conduit, with the outlet portion of the adjacent steam passage. There are two points in the peripheral circuit between wheels and disks where a separation or division of this conduit takes place, one being at the metal strip on the outlet side of the intermediate chamber of the steam passage, and the other being at the metal strip on the inlet side of the intermediate chamber of the steam port. The latter point of division remains fixed, while the former point of division is constantly changing its position, and in fact rotates with the rotation of the turbine. At each revolution of the turbine, these strips are at one time in contiguity, and at that time the steam has to travel the whole circumference of the rotor to pass from the intermediate chamber of the steam passage to the intermediate chamber of the steam port. Immediately afterward said strips separate and thereupon the steam can pass immediately from the steam passage to the steam port and has to travel but a short distance to do so. As the turbine rotates from this position, part of the steam flows over into the inlet portion of the adjacent steam port and as the steam passage diminishes in depth more and more

steam flows over into the inlet portion of the steam port. But the steam flowing along said outlet portion of the steam passage, when it arrives opposite to the intermediate chamber of the steam port, divides into two parts, one part flowing by the steam port in the disk, and the other part flowing by the steam passage, and making a complete circuit of the cylinder before it finally escapes into the steam port. The proportions of these parts change with the rotation of the turbine, and depend upon the position of the outlet portion of the steam passage with reference to the inlet portion of the steam port in the next disk. Neglecting the effect of friction, the steam escapes from the intermediate chamber with a velocity greater than that in the inlet portion of the passage (both of said velocities being relative to the wheel) by twice the velocity of the periphery of the wheel. Thus if v be the velocity of the wheel, and V the velocity relative to the wheel of the entering steam, then v+V must be the absolute velocity of the entering steam. The expansion of the steam must be such that the velocity of the outgoing steam relative to the wheel is V+2v or an increase of 2v. Then this velocity, on entering the disk will be, relative to such disk, V+v which is therefore also the velocity on leaving said disk to enter the wheel. In practice, on account of the loss of velocity by friction and leakage, the outgoing velocity in the moving disk must be somewhat higher than V+2, in order that, notwithstanding the reduction of velocity owing to friction and leakage, it may still have, when it enters the next wheel, an absolute velocity of V+v, or a velocity of V relative to said wheel, which is the same as that at which it entered the preceding wheel. In this way it is provided that the steam enters all of the wheels at the same speed. Within said cylinder is cast a steam jacket 11 surrounding the wheels and disks for the greater part of the length of the shaft.

The supply of steam is controlled by a valve 12, operated by governor 13, driven from a shaft 14, operated by a pulley 15 driven by belt 16 on a pulley 17 on the shaft of the turbine.

18 is a conduit formed in the head of the turbine cylinder, leading to the passage 8 in the first rotating disk 6. In order to balance the turbine said passages 8 are preferably arranged at different circumferential positions on said disks 6. A thrust bearing 19 is secured upon the shaft to take up the end thrust. 28 indicates the exhaust port.

The inlet and outlet portions of both ports 8 and passages 9 are closed on two sides by the wheels and disks in which they are respectively formed, on the third side by the adjacent disk or the port or passage formed therein, and on the fourth side, the ports by the overhanging portions of the casing, and the passages by the overhanging portions of a ring 21 secured to the wheel by screws 22, said ring being formed with a series of outwardly extending circular ribs 23 which rotate in a corresponding series of grooves 24 formed in the casing, said ribs and grooves being provided for the purpose of preventing leakage between the inlet and outlet sides of the wheels.

I claim:—

1. In a steam turbine, the combination of a shaft, wheels secured on said shaft, a casing for the turbine, disks secured to the casing and alternating with the wheels, the peripheries of the disks and wheels being formed with ports and passages respectively, each port and passage leading from one side of its disk or wheel to the other, each port and passage having its inlet and outlet portions extending in nearly opposite directions, the inlet portions of the ports and passages, and also the outlet portions thereof, opening in opposite directions, the outlet portions of the passages being of sufficiently greater sectional area than the inlet portions thereof to cause the pressure fluid flowing through the passages to flow into the outlet portions of the passages with a velocity greater than in the inner portions thereof by slightly more than twice the velocity of the periphery of the wheels, substantially as described.

2. In a steam turbine, the combination of a shaft, wheels secured on said shaft, a casing for the turbine, disks secured to the casing and alternating with the wheels, the peripheries of the disks and wheels being formed with ports and passages respectively, each port and passage leading from one side of its disk or wheel to the other, and having inlet and outlet portions each extending the greater part of the circumference of the wheel or disk, each port and passage having its inlet and outlet portion extending in nearly opposite directions, the inlet portions of the ports and passages and also the outlet portions thereof opening in opposite directions, the outlet portions of the passages being of sufficiently greater sectional area than the inlet portions thereof to cause the pressure fluid flowing through the passages to flow into the outlet portions of the passages with a velocity greater than in the inner portions thereof by slightly more than twice the velocity of the periphery of the wheels, substantially as described.

3. In a steam turbine, the combination of a shaft, wheels secured on said shaft, a casing for the turbine, disks secured to the casing and alternating with the wheels, the peripheries of the disks and wheels being formed with ports and passages respectively, each port and passage leading from one side of the disk or wheel to the other, each port and passage having its inlet and outlet por-

tions extending in nearly opposite directions, each port and passage being open at its side to the adjacent wheel or disk, the inlet portions of the ports and passages, and also the outlet portions thereof, opening in opposite directions, the outlet portions of the passages being of sufficiently greater sectional area than of the inlet portions thereof to cause the pressure fluid flowing through the passages to flow into the outlet portions of the passage with a velocity greater than in the inner portions thereof by slightly more than twice the velocity of the periphery of the wheels, substantially as described.

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

BYRON STEVENS.

Witnesses:

FRANCIS M. WRIGHT,

D. B. RICHARDS.