No. 664,085. Patented Dec. 18, 1900.

J. C. HENDERSON.

COMPOUND REACTION STEAM TURBINE.

(Application filed Sept. 21, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

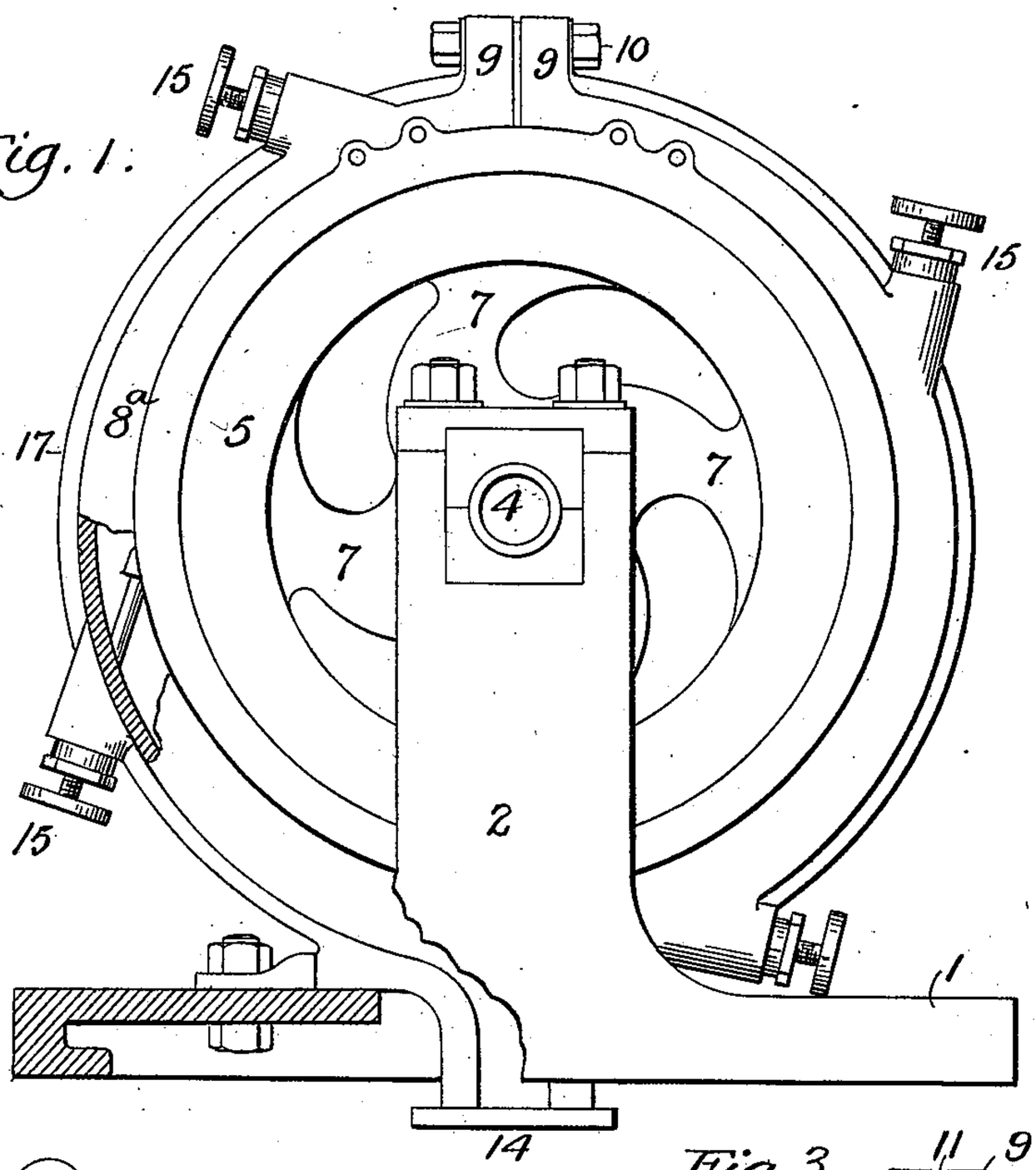


Fig. 2.

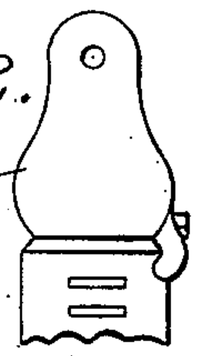


Fig. 7.

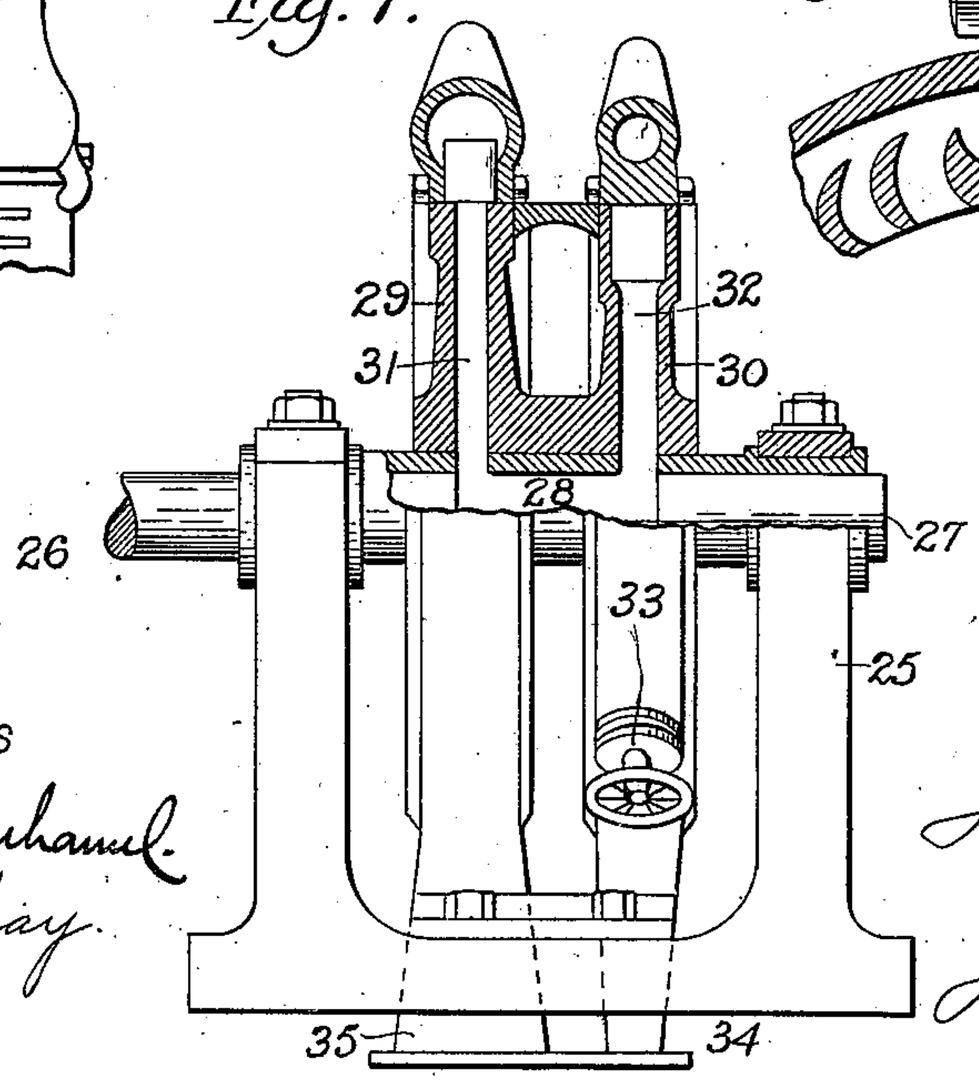
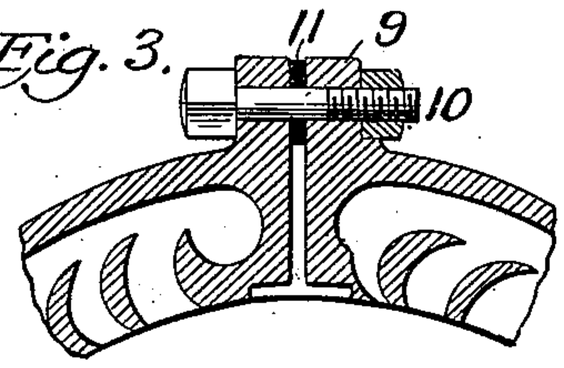


Fig. 3.



WITNESSES

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(No Model.) 2 Sheets—Sheet 2.

Fig. 4.

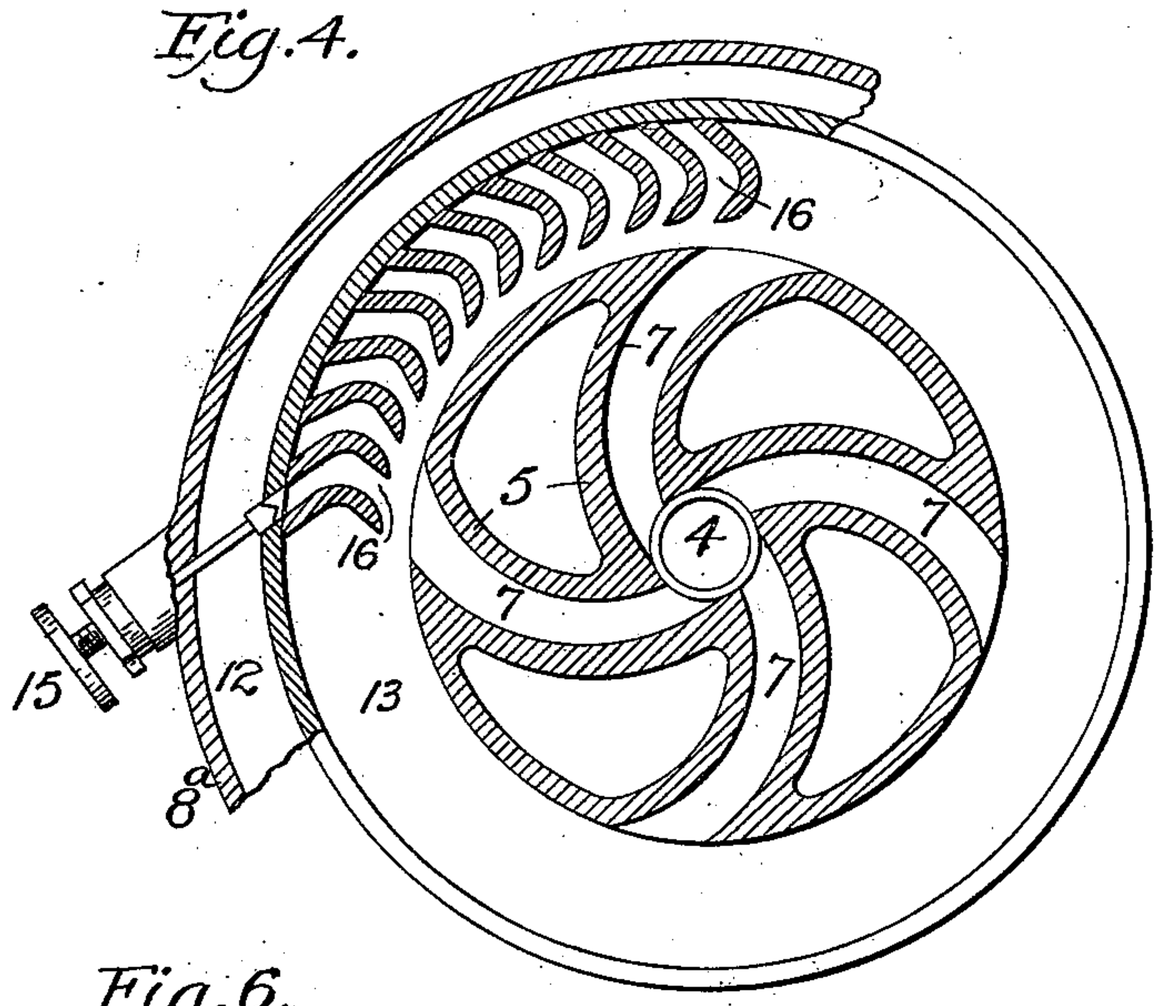


Fig. 6.

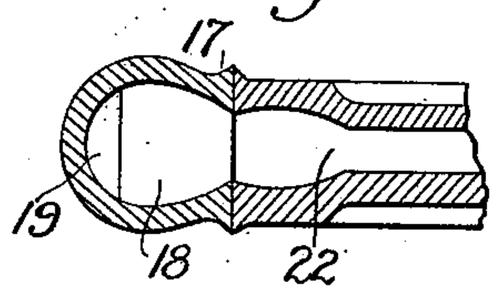
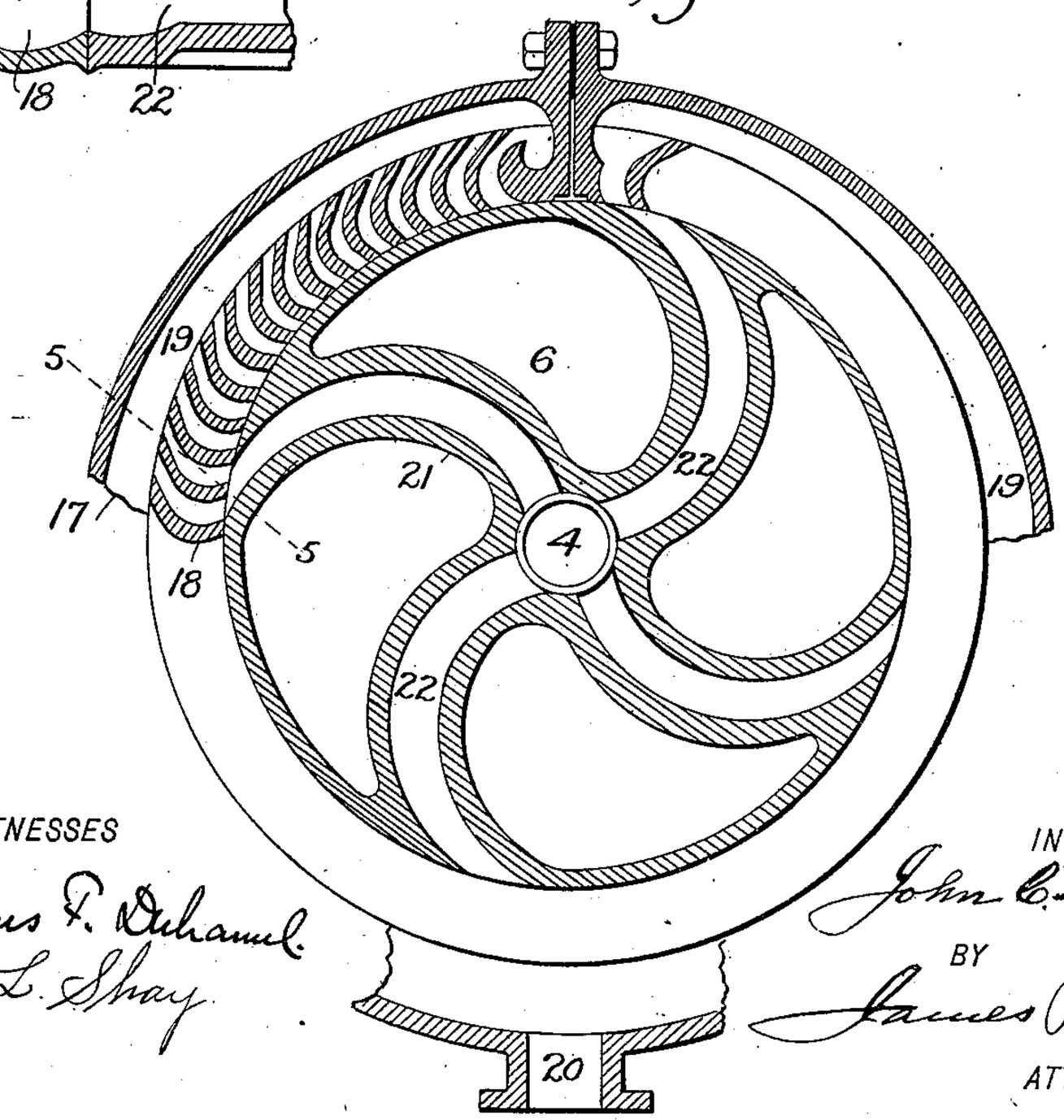


Fig. 5.



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JOHN C. HENDERSON, OF NEW YORK, N. Y.

COMPOUND REACTION STEAM-TURBINE.

SPECIFICATION forming part of Letters Patent No. 664,085, dated December 18, 1900.

Application filed September 21, 1899. Serial No. 731,207. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. HENDERSON, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Compound Reaction Steam-Turbines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to that class of motors called "turbines," and particularly to what are known as "compound reaction turbines;" and some of the objects of the invention are to provide a turbine having two or more stages for the compounding of the induction and eduction, thereby equalizing and distributing the initial impact over the entire apparatus, and in the case of steam, &c., taking advantage of the expansive properties of the actuating medium and lessening the loss in heating the walls of the apparatus.

In addition to the expansive properties of the actuating medium when air, gas, or steam is employed the induction impact with the reacting impact of eduction is utilized.

The foregoing results may be obtained by the employment of hollow arms or conductors, whereof one set may preferably be for the high pressure and one set for the low pressure, or, if found desirable in practice, independent sets may be used for high, intermediate, or low pressure, as the case may require.

The induction flow going through a section of one hundred and eighty degrees in reversal of the line of flow and by the aid of centripetally-curved hollow arms or conductors is drawn to the center of the pulley or piston, where a preferably-hollow shaft or core conducts the actuating medium to the intermediate or low pressure set of hollow arms or conductors, which are desirably curved centrifugally or in a direction opposite to the first or induction set of arms or conductors.

By means of the foregoing construction the actuating medium is driven or thrown again toward the inside face of the stationary low-pressure or intermediate shell or casing, and passing through the opening in the face of the stationary low-pressure or intermediate shell as the parts connecting the centrifugally-shaped arms or conductors through the pulley-rim revolves and striking against the stationary deflecting vanes or guides in the stationary low pressure shell or casing completes the balance of the one hundred and eighty degrees reversal of flow.

With these and other objects in view the invention consists, essentially, of the construction, combination, and arrangement of parts, substantially as hereinafter more fully described in the following specification and illustrated in the accompanying drawings, forming part of this application, in which—

Figure 1 is an end elevation, partly broken away, of a turbine embodying my improvements. Fig. 2 is a detail of one of the connecting-lugs of the stationary rim or casing. Fig. 3 is a sectional view of a portion of the stationary shell. Fig. 4 is a longitudinal sectional view taken through the high-pressure cylinder and piston. Fig. 5 is a similar view taken through the low-pressure cylinder and piston. Fig. 6 is a detail sectional view taken on lines 5 5 of Fig. 5; and Fig. 7 is an end end elevation, partly in section, of a modified form of construction.

Similar characters of reference designate corresponding parts throughout the several views.

Referring to the drawings, and particularly to the construction illustrated in Figs. 1 to 6 thereof, inclusive, the reference character 1 designates the base of a frame or support 2, in which is journaled a drive or other shaft 4, and these parts may be of any preferred form or construction. That here illustrated is employed for the purpose of facilitating the understanding of the invention.

The shaft or core 4 is preferably tubular or hollow in part or throughout the entire length thereof to act as a conduit for the actuating medium employed to and from the respective parts of the apparatus, as will be hereinafter more fully explained, and is preferably provided with ports or openings for this purpose.

Connected with the shaft 4 by a key or otherwise is one or more movable parts or pistons 5 and 6, the former being the high-pressure and the latter the low-pressure piston;

but it will be understood that any number of pistons may be employed, as the conditions under which the invention is employed may require.

The piston 5 is preferably provided with hollow arms or spokes 7, registering with the ports in the apparatus, curved in a direction against the line of motion of the piston in the high-pressure piston for the purpose of producing a centripetal force to counteract the centrifugal force, and the hollow arms or spokes 8 of the low-pressure piston 6 are preferably curved with the line of motion to induce centrifugal force, as will be readily understood.

The high-pressure stationary casing or cylinder 8^a is preferably eccentrically bored or is desirably so filled upon the high-pressure piston that the cylinder tapers or diminishes in area toward the free ends thereof, which are preferably provided with attaching-lugs 9, constructed to receive bolts 10 or other devices to draw said cylinder tightly upon said piston, and the former is preferably constructed of slightly less diameter than that of the latter in order that the cylinder may be sprung upon the piston to keep the faces of the parts tight.

If found desirable in practice, suitable packing may be introduced between the ends of the cylinder to form a tight joint and the abutting or contacting edges of the cylinder and piston may be constructed V-shaped to receive an annular packing-ring 11, Fig. 3, to insure tight connection between the parts.

The cylinder 8 is preferably constructed with two annular chambers 12 and 13, the former being provided with an inlet-tube and connection 14 and having controlling-valves 15, of any preferred construction, to regulate the passage of the actuating medium into the chamber 13, which is preferably provided with a plurality of vanes or projections 16, desirably curved in a direction opposite to the flow of the actuating medium or with the line of motion of the piston, Fig. 4 of the drawings.

The secondary or low-pressure cylinder 17 is preferably constructed integrally with the high-pressure cylinder, both preferably being part of a rim or casing inclosing both pistons; but each cylinder may inclose only one piston, if desired.

The low-pressure cylinder 17, Fig. 5, is preferably provided with curved vanes or guides 18, desirably located at regular intervals therein, and the annular chamber 19 thereof preferably increases in area toward the exhaust pipe or orifice 20, as described in connection with the high-pressure or primary cylinder 8.

The low-pressure piston 21, Fig. 5, is preferably provided with arms or spokes 22, curved with the line of motion of the piston for the purpose before explained, and the arms 22 register with the exhaust-ports in the hollow shaft 4, as stated. Otherwise the construction and operation of the high, low, or intermediate cylinders and pistons are similar, and separate description will not be required.

In Fig. 7 is illustrated a modified form of the construction hereinbefore shown and described, wherein suitable standards or frames 25 support independent shafts 26 and 27, upon which is keyed a hollow core or shaft 28, preferably as shown. The shells or cylinders 29 and 30 are preferably separate at one or more points and are desirably fitted upon the high-pressure piston 31 and the low-pressure piston 32, substantially as before described, the high-pressure cylinder 30 preferably having controlling-valves 33 and being provided with an inlet-port 34, while the low-pressure cylinder is desirably provided with an exhaust-port 35, as shown.

The operation of the invention will be readily understood from the foregoing description when taken in connection with the accompanying drawings and the following description thereof: The actuating medium enters through the inlet of the induction-chamber of the high-pressure cylinder 8 and passes into the chamber 13 through the valve-controlled passages in the chamber 12, is directed by the vanes 16 into the hollow arms 7 of the high-pressure piston 5, whence the medium passes into and through the hollow shaft 4 and out into the hollow arms 22 of the low-pressure piston 21, against the vanes 18 of the low-pressure cylinder 17, and finally exhausts through the outlet 20 thereof.

The operation of the construction shown in Fig. 7 is substantially similar to that before described, and further explanation thereof will be unnecessary.

I do not desire to confine myself to the construction, combination, and arrangement of parts herein shown and described, and I reserve the right to make all such changes in and modifications of the same as come within the scope of my invention.

What I claim is—

1. A rotary motor or turbine having pistons provided with hollow arms, cylinders constructed to receive the actuating medium and introduce the said medium into and through said pistons, and encircling steam-chambers decreasing in area from the inlet and exhaust thereof respectively.

2. A rotary motor or turbine having pistons provided with curved hollow arms and cylinders constructed to receive the actuating medium and introduce the said medium into and through said pistons, and encircling steam-chambers eccentrically arranged upon said pistons.

3. A rotary motor or turbine having pistons provided with hollow radial arms centrifugally curved and cylinders constructed to receive the actuating medium and introduce the said medium into and through said pistons, and having encircling steam-chambers diminishing in area toward the free ends thereof.

4. A rotary motor or turbine having pistons

provided with hollow radial arms centrifugally curved and cylinders constructed to receive the actuating medium and introduce the said medium into and through said pistons, having solid ends carrying attached lugs and means engaging said lugs for adjusting the diameter thereof.

5. A rotary motor having a piston provided with hollow arms carried by a hollow shaft and a cylinder constructed to receive an actuating medium and introduce the same into and through said piston and finally discharge said medium.

6. A rotary motor having a piston provided with hollow arms carried by a hollow shaft, and a cylinder upon said piston constructed to receive an actuating medium and discharge the same by deflecting-vanes into and through said piston, and shaft to receive the worked medium and be finally discharged.

In testimony whereof I have hereunto affixed my signature in presence of two witnesses.

JOHN C. HENDERSON.

Witnesses:
A. C. McNULTY,
D. D. MACDONALD.