No. 799,062. PATENTED SEPT. 12, 1905.

C. V. KERR.

COMPOUND STEAM TURBINE.

APPLICATION FILED SEPT. 26, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

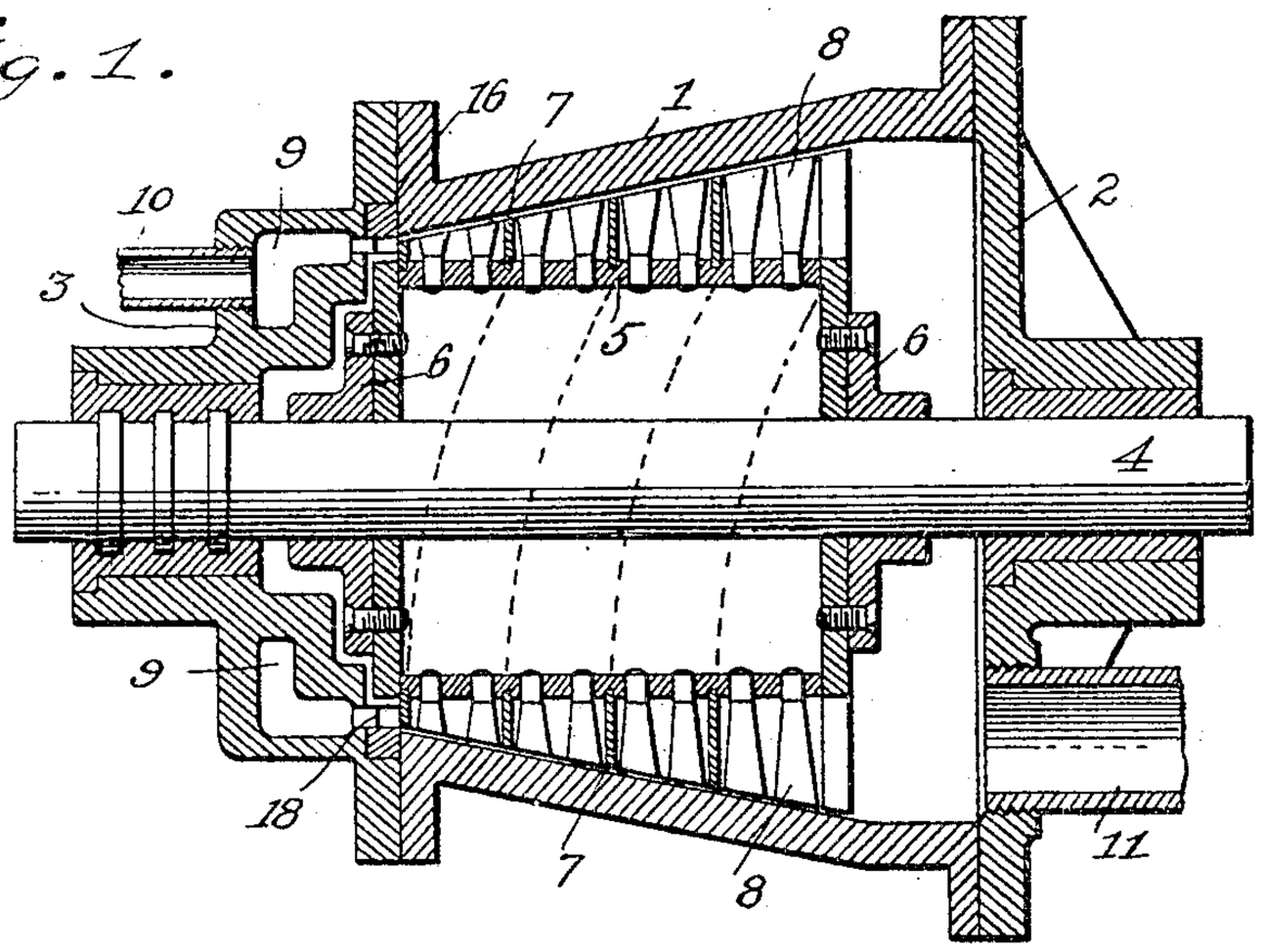


Fig. 3.

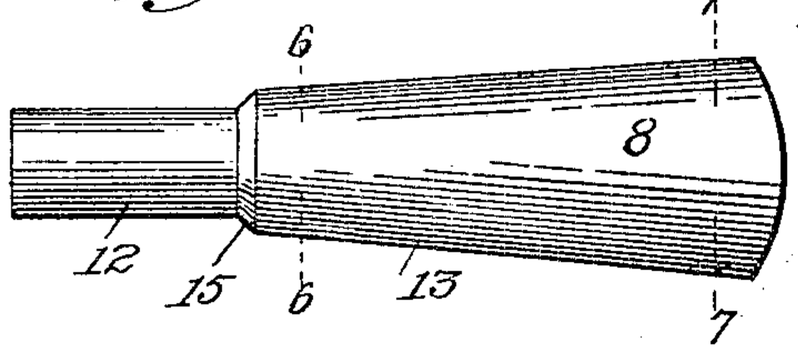


Fig. 4.

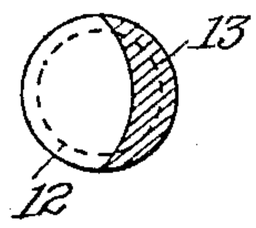


Fig. 5.

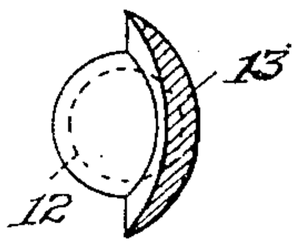


Fig. 6.

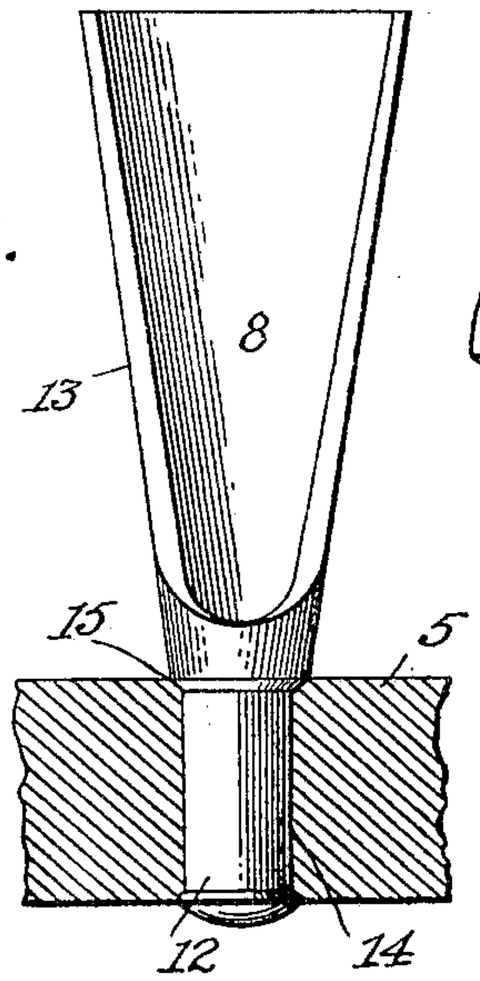


Fig. 7.

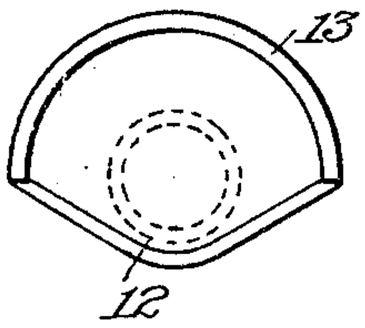
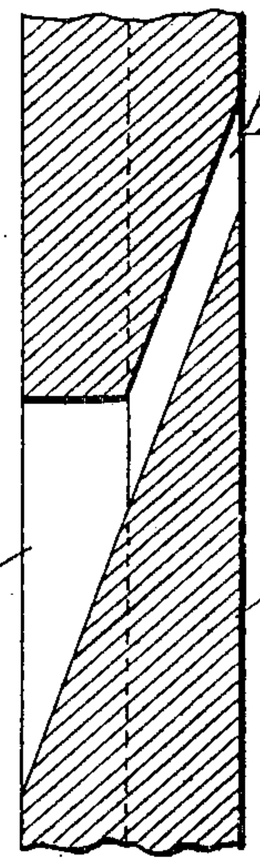


Fig. 8.



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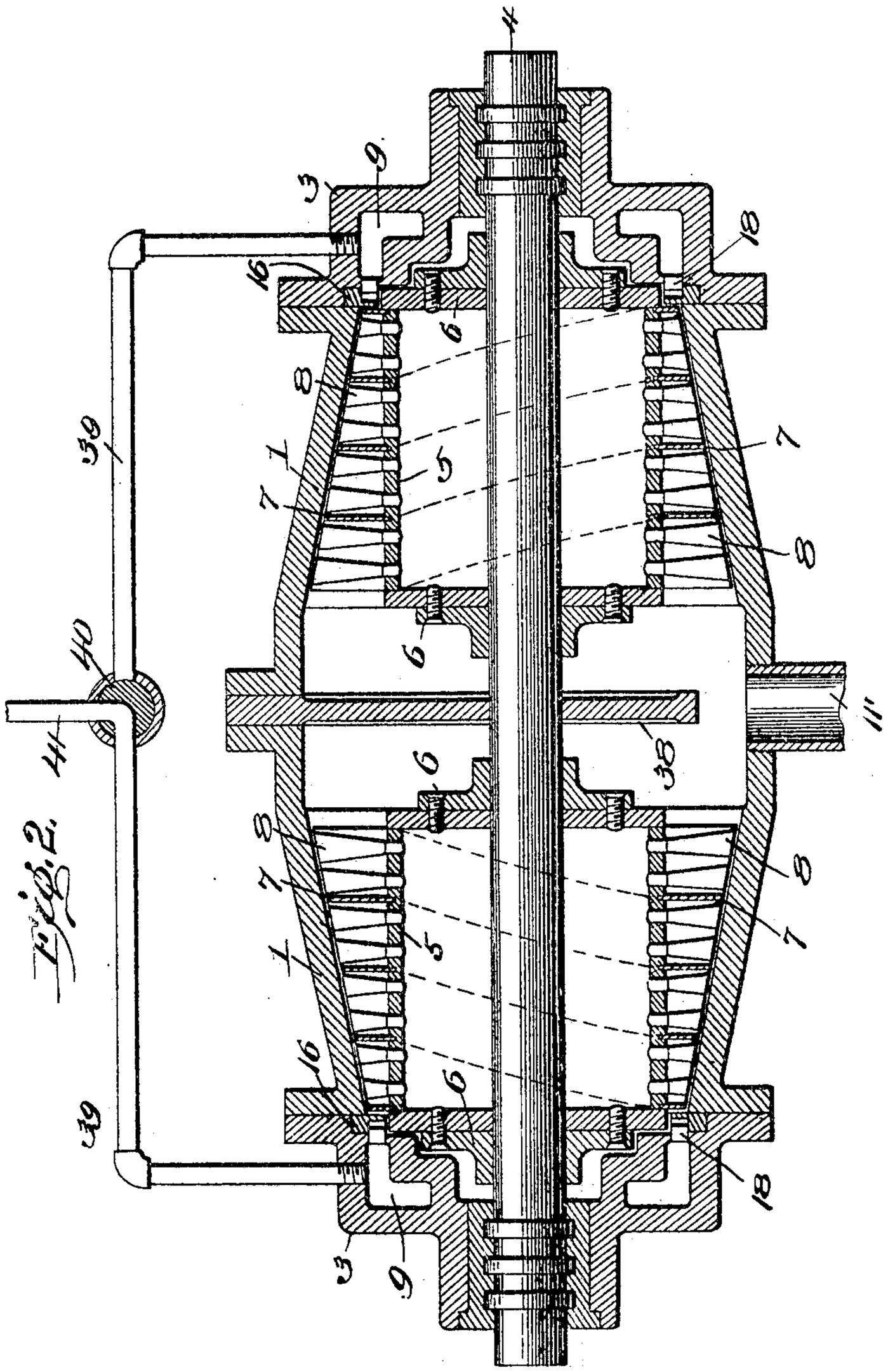

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UNITED STATES PATENT OFFICE.

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COMPOUND STEAM-TURBINE.

No. 799,062. Specification of Letters Patent. Patented Sept. 12, 1905.

Application filed September 26, 1904. Serial No. 225,946.

To all whom it may concern:

Be it known that I, CHARLES V. KERR, a citizen of the United States, residing at Wellsville, in the county of Allegany and State of New York, have invented certain new and useful Improvements in Compound Steam-Turbines, of which the following is a specification.

My invention relates to compound steam-turbines, known more especially as the "helical" or "screw" type.

The objects of my invention are, first, to construct a steam-turbine of compact form and small horse-power which will be particularly well adapted for generating electric current for locomotive-headlights or the like; second, to provide means with my form of turbine construction whereby the engine may be quickly and efficiently reversed; third, to so construct the casing, the steam-chest, nozzle-ring, and the rotating member of the turbine whereby the same may be quickly and easily assembled or repaired; fourth, other evident advantages and features of the specific construction and arrangement of the parts, which will hereinafter appear from the detailed description of the engine and manner of using the same.

My invention consists of structural features and relative arrangements of elements, which will be hereinafter more fully and clearly described, and pointed out in the appended claims.

Referring to the two sheets of drawings, in which similar reference characters indicate the same parts in the several figures, Figure 1 is a longitudinal section of my invention as applied to a single-cylinder construction. Fig. 2 is a longitudinal section of my invention as applied to an engine of the reversible type. Fig. 3 is an enlarged view of one of the baffle pins or posts in the spiral passage around the rotary drum. Fig. 4 is a transverse section of the baffle-pin on line 6 6 of Fig. 3. Fig. 5 is a section on line 7 7 of Fig. 4. Fig. 6 is an enlarged view of a modified form of baffle-post. Fig. 7 is a top view of Fig. 6. Fig. 8 is a fragmentary and sectional view of the ring provided with the nozzle-openings for leading the steam from the chest against the baffle-posts in the spiral passage of the rotating drum.

Referring now more particularly to the drawings, 1 represents the cylinder of the engine, having an internal bore corresponding to the frustum of a cone. 2 and 3 are the heads, respectively, of the larger and smaller ends of the cylinder. The head 3 is provided with a steam-chest 9, to which is connected a pipe 10, leading to a boiler or other source of suitable motive agent. The other head 2 is provided with an outlet 11 for the exhaust of the motive agent.

In the heads 2 and 3 is journaled by any suitable bearings a shaft 4, having secured thereto a rotary piston or cylindrical drum 5. 6 6 are the ends of the drum. Extending from and connected to the outer side of the cylindrical drum 5 is a helical rib 7 of gradually-increasing width from the steam-chest end 3 to the exhaust end 2, so as to form with the interior wall of the cylinder 1 and the outer wall of the drum 5 a helical passage of gradually-increasing depth and corresponding to the expanding or variable internal bore of the cylinder.

8 8 (see Figs. 3–7) are a plurality of baffle pins or posts secured to the outer wall of the rotary drum or piston and in the spiral passages and of gradually-increasing height corresponding to the increased height of the spiral passage from the steam-chest to the exhaust end. Said baffle pins or posts (see Figs. 3–7) are preferably formed with a shank 12, having an extension or plate 13, which has a circular flange at its bottom and gradually increases in size toward its outer end and lunate in cross-section, as indicated in Figs. 4 and 5. While I have particularly described and specifically shown them as lunate in cross-section, they may be solid or circular. The pins or baffle-posts are fastened to the rotary piston or drum 5 (see Fig. 6) by being fitted or seated by means of the flange 15 in properly spaced and arranged openings 14 in the drum and helical passage. The outer ends of the shanks 12 are upset against the inner wall of the piston or rotary drum 5, thereby affording a cheap and secure means of fastening.

16 is a nozzle-ring, and consists of an annu-

lar ring (see Figs. 1, 2) firmly held between the smaller end of the cylinder 1 and the inner end of the smaller head 3 and provided (see Fig. 8) with openings 17 and inclined reduced passages 18, which are connected with the interior of the steam-chest 9, the function and operation of which will be hereinafter described.

In Fig. 1 I have shown my invention of a compound steam-turbine provided with baffle-posts in a helical passage of increasing diameter as applied to a single cylinder.

In Fig. 2 I have provided means for reversing the engine and which comprises two engines similar in construction, as shown and described in connection with the single cylinder, (see Fig. 1,) in which their exhaust ends are connected to a common exhaust-chamber which is provided with a partition 38 and a common exhaust-pipe 11′. 39 39 are branch pipes leading from the steam-chests at the outer ends of the engine to a three-way valve 40, which controls the live steam in pipe 41 to either steam-chest at the ends of the engine.

The operation of the device is as follows: Referring more particularly to Fig. 1, the live steam or other expansible fluid enters the steam-chest 9 through the pipe 10 into and through a nozzle-ring 16, or, if so desired, directly into the gradually-expanding helical passage of the rotary piston and against the baffle-posts therein. The steam in passing through the helical passage with a great velocity impinges against the baffle-posts and thereby rotates the piston or drum and the shaft attached thereto, from which by means of gearing or otherwise power may be transmitted. The expansion of the steam is provided for by the gradually-increasing diameter of the helical passage. The steam after passing through the helical passage enters the chamber at the larger end of the cylinder-casing and by means of the connected exhaust-pipe to the outside air or condenser.

Fig. 2 is an arrangement of the same specific construction of rotary motor as adapted to a reversible type. In this form the motive fluid is passed either to the right or left cylinder by means of the three-way valve, and the other cylinder runs idle in a chamber of reduced pressure or resistance if connected to a vacuum.

Various changes may be made in the details of my invention and the form of the cylinder and its coöperating rotary piston in order to provide a gradually-increasing chamber between the inner wall of the cylinder and the outer wall of the piston, and while I have shown a conical-shaped bore for the cylinder and a cylindrical-shaped piston to effect this construction I do not care to limit myself to this specific construction, as this arrangement could be reversed—that is, a cylindrical bore with a conical-shaped piston could be utilized and accomplish the same results.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A rotary motor comprising a cylinder having a gradually-increasing bore, an expansible motive-fluid inlet at the smaller end and an exhaust-outlet at the larger end of the cylinder, a rotary shaft extending centrally in the cylinder, a rotary piston fixed to the shaft, helical ribs on the rotary piston extending to the inner surface of the cylinder and forming therewith helical passages of gradually-increasing cross-sectional area and baffle-posts on the rotary piston between the adjacent helical ribs and in the passages.

2. A rotary motor comprising a cylinder having a gradually-increasing bore, an expansible motive-fluid inlet at the smaller end and an exhaust-outlet at the larger end of the cylinder, a rotary shaft extending centrally in the cylinder, a rotary piston fixed to the shaft, helical ribs on the rotary piston extending to the inner surface of the cylinder and forming therewith helical passages of gradually-increasing cross-sectional area and staggered baffle-posts on the rotary piston between the adjacent helical ribs and in the passages.

3. A rotary motor comprising a cylinder having a gradually-increasing bore, an expansible motive-fluid inlet at the smaller end and an exhaust-outlet at the larger end of the cylinder, a rotary shaft extending centrally in the cylinder, a rotary piston fixed to the shaft, helical ribs on the rotary piston extending to the inner surface of the cylinder and forming therewith helical passages of gradually-increasing cross-sectional area and baffle-posts on the rotary piston between the adjacent helical ribs and in the passages, said baffle-posts having concave faces for receiving the impingement of the motive fluid.

4. A rotary motor comprising a cylinder having a gradually-increasing bore, an expansible motive-fluid inlet at the smaller end and an exhaust-outlet at the larger end of the cylinder, a rotary shaft extending centrally in the cylinder, a rotary cylindrical piston fixed to the shaft, helical ribs on the rotary piston extending to the inner surface of the cylinder and forming therewith helical passages of gradually-increasing cross-sectional area and baffle-posts on the rotary piston between the adjacent helical ribs and in the passages.

5. A rotary motor comprising a cylinder, a rotary shaft extending centrally in the cylinder, a piston fixed to the shaft, the outer surface of which forms with the inner surface of the cylinder an annular chamber of gradually-increasing cross-sectional area, a mo-

tive-fluid inlet at the smaller end and an exhaust-outlet at the larger end of the chamber, helical ribs on the piston extending to the inner surface of the cylinder and forming therewith helical passages of gradually-increasing cross-sectional area, and baffle-posts on the piston between the adjacent helical ribs and in the passages.

6. A rotary motor comprising a cylinder, a rotary shaft extending centrally in the cylinder, a piston fixed to the shaft the outer surface of which forms with the inner surface of the cylinder an annular chamber of gradually-increasing cross-sectional area, a motive-fluid chest at the smaller end of the annular chamber, a nozzle-ring interposed between the motive-fluid chest and the annular chamber, injector-openings in the nozzle-ring, a motive-fluid inlet connected to the chest, an exhaust-outlet leading from the larger end of the annular chamber, helical ribs on the piston extending to the inner surface of the cylinder and forming therewith helical passages of gradually-increasing cross-sectional area, and baffle-posts on the piston between the adjacent helical ribs and in the passages.

7. A rotary motor comprising a cylinder, a rotary shaft extending centrally in the cylinder, a piston fixed to the shaft the outer surface of which forms with the inner surface of the cylinder an annular chamber of gradually-increasing cross-sectional area, a motive-fluid chest at the smaller end of the annular chamber, a removable nozzle-ring interposed between the motive-fluid chest and the annular chamber, injector-openings in the nozzle-ring, a motive-fluid inlet connected to the chest, an exhaust-outlet leading from the larger end of the annular chamber, helical ribs on the piston extending to the inner surface of the cylinder and forming therewith helical passages of gradually-increasing cross-sectional area, and baffle-posts on the piston between the adjacent helical ribs and in the passages.

8. A rotary motor comprising a cylinder, a rotary shaft extending centrally in the cylinder, a piston fixed to the shaft the outer surface of which forms with the inner surface of the cylinder an annular chamber of gradually-increasing cross-sectional area, a motive-fluid chest at the smaller end of the annular chamber, a removable nozzle-ring interposed between the motive-fluid chest and the annular chamber, injector-openings in the nozzle-ring, a motive-fluid inlet connected to the chest, an exhaust-outlet leading from the larger end of the annular chamber, helical ribs on the piston extending to the inner surface of the cylinder and forming therewith helical passages of gradually-increasing cross-sectional area, and baffle-posts on the piston between the adjacent helical ribs and in the passages, said baffle-posts having concave faces for receiving the impingement of the motive fluid.

9. A rotary motor comprising a cylinder having a gradually-increasing bore, a nozzle-ring at the smaller end of the cylinder, injector-openings in the ring leading into the cylinder, a motive-fluid chest adjacent to and connected with the injector-openings of the nozzle-ring, a motive-fluid inlet connected to the chest, an exhaust-outlet leading from the larger end of the cylinder, a rotary shaft extending centrally in the cylinder, a rotary piston fixed to the shaft, helical ribs on the rotary piston extending to the inner surface of the cylinder and forming therewith helical passages of gradually-increasing cross-sectional area and baffle-posts on the rotary piston between the adjacent helical ribs and in the passages.

10. A reversible rotary motor comprising two cylinders of gradually-increasing bore and whose larger or exhaust ends abut each other, a partition interposed between the larger or exhaust ends of the cylinders, and partially closing communication between the ends of the cylinders, a common exhaust connected with the larger or exhaust ends of the cylinders, a motive-fluid chest at the smaller or outer end of each of the cylinders, a supply-main connected with the motive fluid, a branch pipe leading from each of the motive-fluid chests to the supply-main, a three-way valve in said supply-main and controlling the fluid-supply to either of said branch pipes and motive-fluid chests, a rotary shaft extending centrally in each of the cylinders, a piston in each of the cylinders and fixed to the rotary shaft, the outer surfaces of the pistons forming with the inner surfaces of the cylinders two oppositely-arranged annular chambers of gradually-increasing cross-sectional area, helical ribs on each of the pistons extending to the inner surfaces of the cylinders and forming therewith helical passages of gradually-increasing cross-sectional area and baffle-posts on the pistons between the helical ribs and in the passages.

11. A reversible rotary motor comprising two cylinders of gradually-increasing bore and whose larger or exhaust ends abut each other, a partition interposed between the larger or exhaust ends of the cylinders, and partially closing communication between the ends of the cylinders, a common exhaust connected with the larger or exhaust ends of the cylinders, a motive-fluid chest at the smaller or outer end of each of the cylinders, a removable nozzle-ring interposed between each of the motive-fluid chests and the smaller end of the cylinders, injector-openings in the nozzle-rings, a supply-main connected with the

motive fluid, a branch pipe leading from each of the motive-fluid chests to the supply-main, a three-way valve in said supply-main and controlling the fluid-supply to either of said branch pipes and motive-fluid chests, a rotary shaft extending centrally in each of the cylinders, a cylindrical piston in each of the cylinders and fixed to the rotary shaft, the outer surfaces of the pistons forming with the inner surfaces of the cylinders two oppositely-arranged annular chambers of gradually-increasing cross-sectional area, helical ribs on each of the pistons extending to the inner surfaces of the cylinders and forming therewith helical passages of gradually-increasing cross-sectional area and baffle-posts on the pistons between the helical ribs and in the passages.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES V. KERR.

Witnesses:
WM. D. APPLEBEE,
V. R. BRUCE.