J. BROWN.

TURBINE.

APPLICATION FILED NOV. 17, 1909.

967,494.

Patented Aug. 16, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

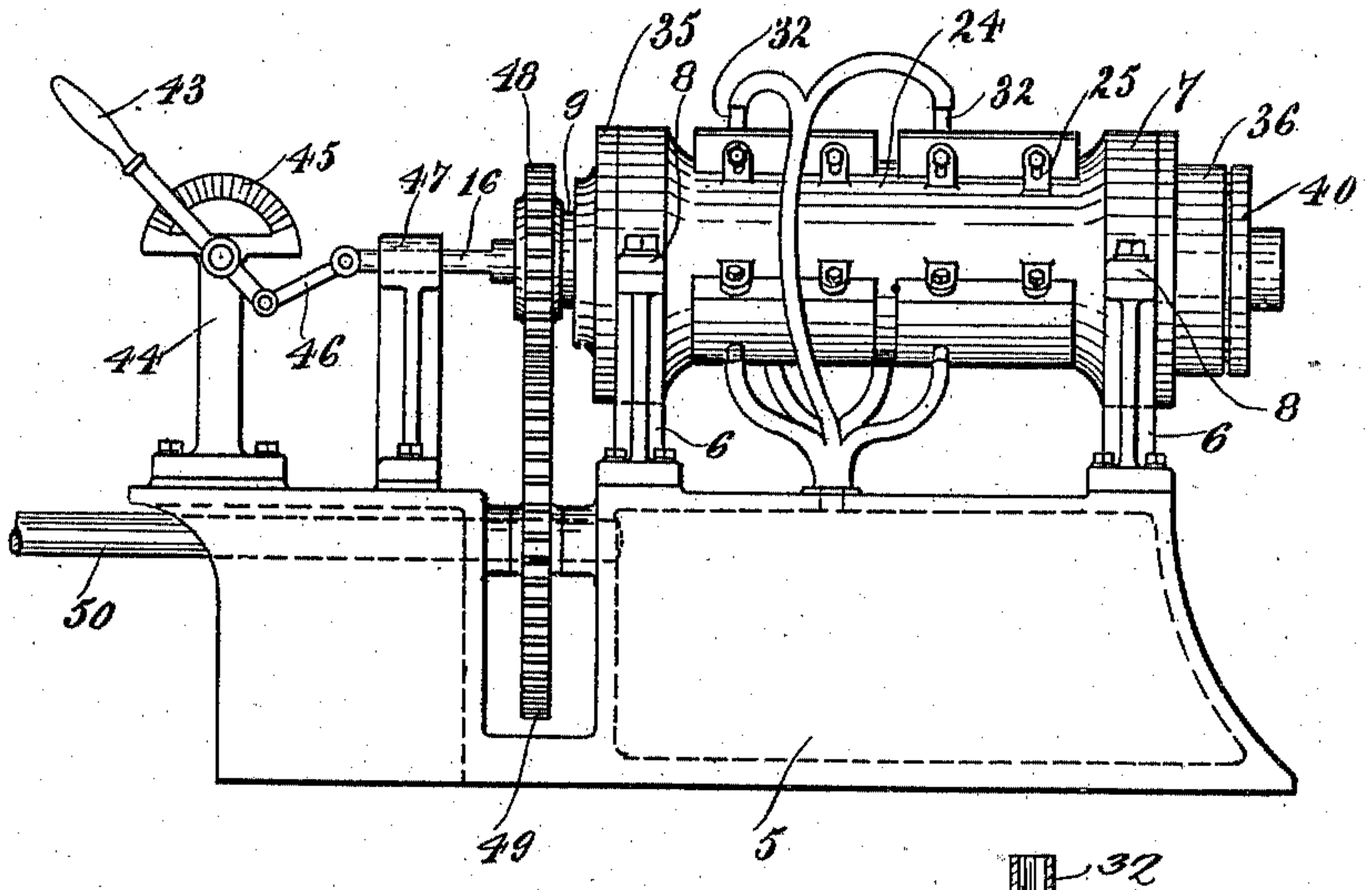
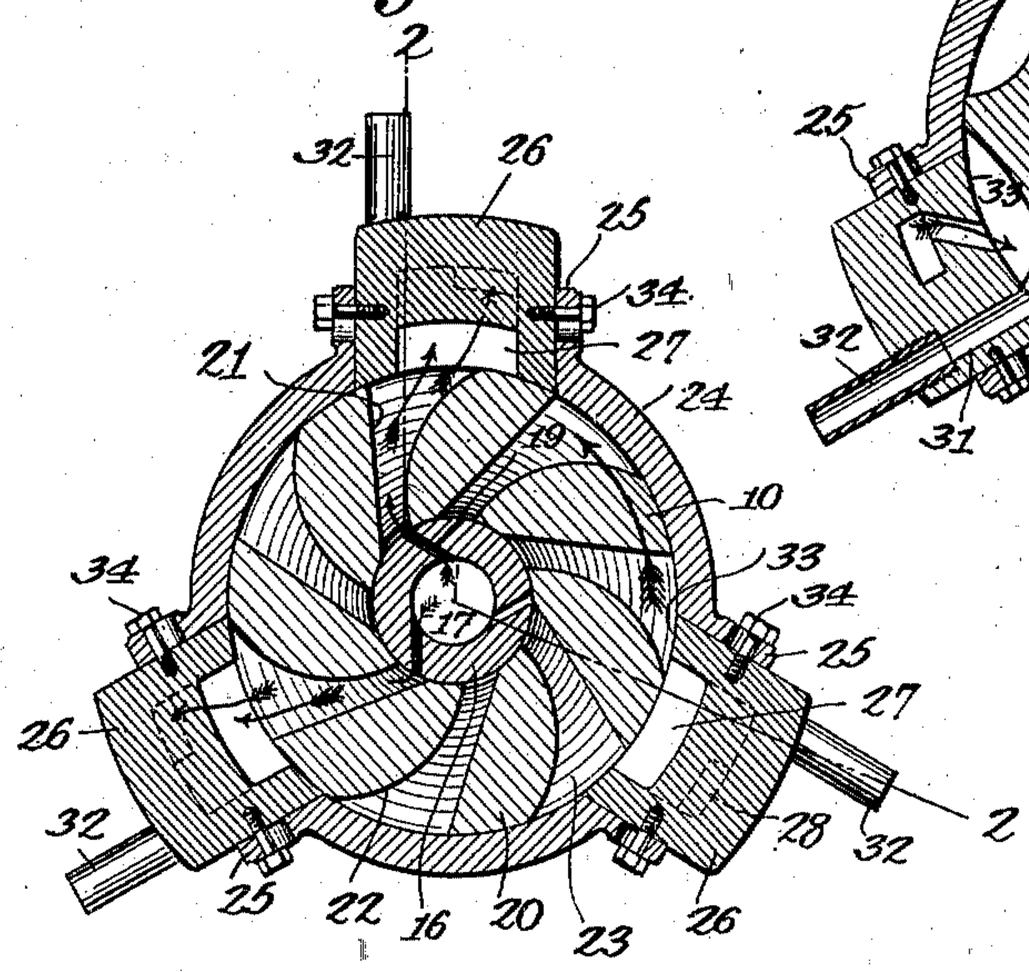


Fig. 3.



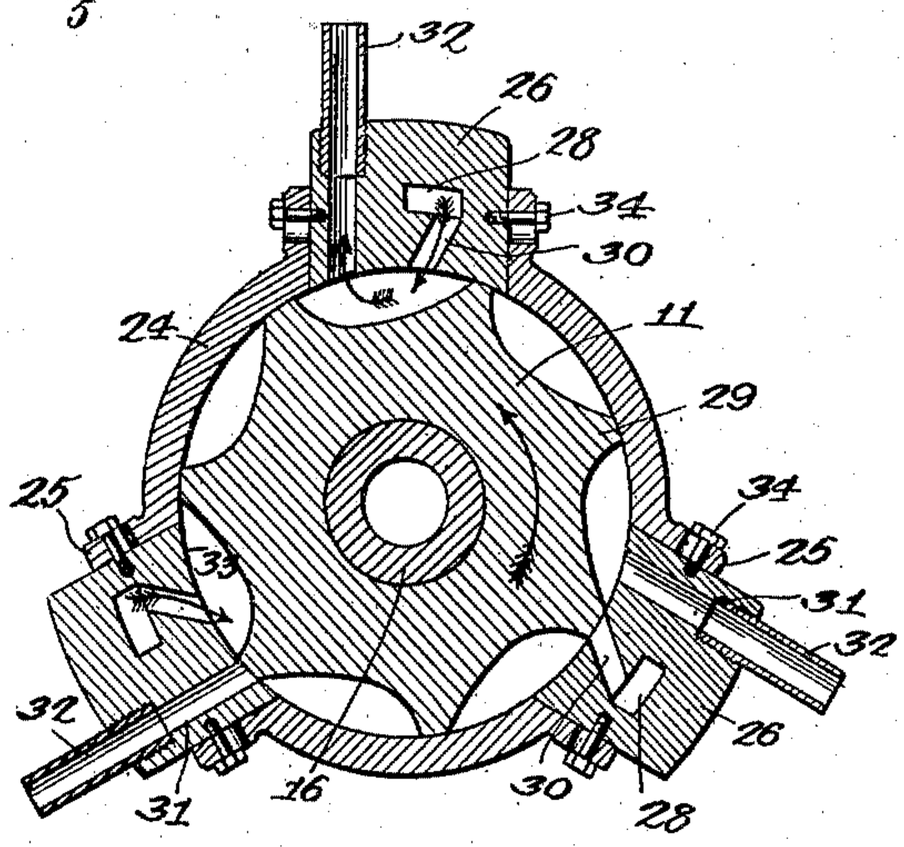


Fig. 4.

Witnesses:

L. C. Badeau.

H. D. Penney.

Inventor:

Julius Brown,

By his Attorney, F. A. Richards.

J. BROWN.

TURBINE.

APPLICATION FILED NOV. 17, 1909.

967,494.

Patented Aug. 16, 1910.

2 SHEETS—SHEET 2.

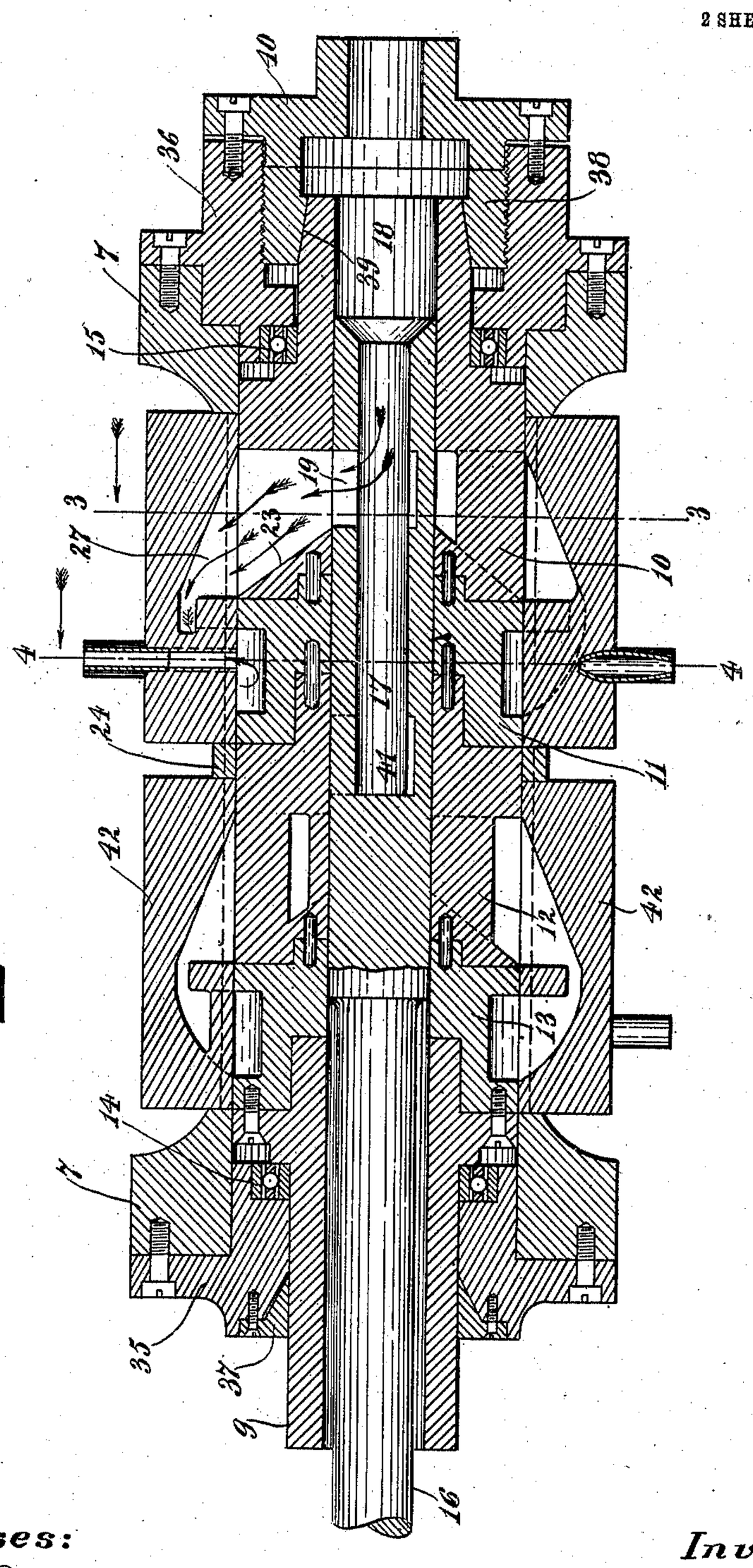


FIG. 2.

Witnesses:

L. C. Badeau.

H. D. Penney

Inventor:

Julius Brown,

By his Attorney, F. H. Richards.

UNITED STATES PATENT OFFICE.

JULIUS BROWN, OF PEEKSKILL, NEW YORK.

TURBINE.

967,494. Specification of Letters Patent. **Patented Aug. 16, 1910.**

Application filed November 17, 1909. Serial No. 528,468.

To all whom it may concern:

Be it known that I, JULIUS BROWN, a subject of the Emperor of Germany, residing in Peekskill, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Turbine-Engines, of which the following is a specification.

This invention relates to turbine engines and has for its object to provide an improved double expansion reversible steam turbine. In this improved engine there are provided expansion chambers for the first and second stage of steam expansion, and chambered blocks are provided for conveying the steam from the first to the second stage. There are provided in the form of the invention herein illustrated three induction ports and three of these chambered blocks for conveying the steam from the first to the second stage and from the second stage to the exhaust. These chambered blocks are located in such positions as to provide a three point bearing as it were for the rotary or turbine head, affording not only a bearing but also a packing for preventing the steam from escaping to the atmosphere and from the first to the second stage by a path other than that provided for it.

There are various features of novelty and utility embodied in the engine which will be described in their proper place in the description and amply set forth in the claims.

In the drawings accompanying and forming a part of this specification, Figure 1 is a side elevation of a practicable embodiment of a form of my invention. Fig. 2 is a horizontal longitudinal section of the engine illustrated in Fig. 1; but shown on an enlarged scale. This view is taken on planes indicated by the line 2—2 in Fig. 3. Fig. 3 is a vertical cross section taken on a plane at about the line 3—3 in Fig. 2; and Fig. 4 is a similar view taken on a plane at about the line 4—4. The arrows adjacent to the section lines 3—3 and 4—4 indicate in which direction the section is viewed.

The mechanical parts are shown mounted upon a suitable housing or framework 5 having standards 6 which support the main casing 7 of the device by means of suitable extensions 8 which are bolted down upon the standard 6. The rotary portion of the device is made up of a number of parts fastened together and fastened to the power delivery portion 9. The portions 10 and 11 of the rotary member carry the vanes for the first and second stage of the forwardly driving turbine, and the parts 12 and 13 carry the vanes for the first and second stage of the reverse turbine. The part 13 is fastened to the power delivery member 9 and the parts 13, 12, 11 and 10 are all fastened together. The power delivering part 9 is supported in the main casing by suitable ball bearings 14 and the part 10 is similarly supported by ball bearings 15.

Within the turbine or rotary member there is mounted a valve member or steam supply conduit carrying member 16 which is held from rotation relative to the turbine member and is mounted for longitudinal movement therein. The right hand end in Fig. 2 of this member is chambered out, as at 17, and is open at the end and communicates with a chamber 18, which chamber will be in communication with the source of steam supply. Three induction port openings 19 are provided for communication between the steam chamber 17 and the vanes 20 carried by the member 10 for the first stage of the forwardly driving turbine. By reference to Figs. 2 and 3 it will be seen that one of the ports 19 is fully opened and the steam is passing against the side 21 of the vane which is substantially tangential to the periphery of the member 16. The steam passes out of the induction port into the space between two of the vanes, which space it will be seen is narrow at the center and rapidly increases in area toward the periphery of the turbine. This rapid increase in area is effected in part by the contour of the face 22 of the vane. The face 22 of each vane curves outwardly in respect to its face 21, and then curves inwardly in respect to such face 21. The increase is also enhanced by having the face 23 which constitutes the end wall of the intervaned space also on an angle so that the increase in the area is accelerated. This gives the steam opportunity to expand quickly and to move rapidly from the port outwardly. In the present illustration there are shown three induction ports and seven vanes, and consequently seven intervane spaces. By this arrangement two of the ports will always be open, one of the ports will be closed.

The central portion of the casing 7 is of cylindrical form, as at 24. This portion has openings adjacent to the exhaust port openings. Adjacent to these openings upon

each side there is provided a flange 25, between which flanges there is mounted a block 26 which is chambered out at 27 to permit the steam to pass from the intervane spaces to the port 28 which leads to the vanes 29 of the second stage. The vanes 29 are carried by the member 11. It will be noted that the delivery portion 30 of the steam passage 28 is disposed at such an angle that an impact of the steam will be received against the vane and drive this forward. Each of the blocks 26 also is provided with an eduction port 31. The eduction ports by means of suitable tubing 32 will lead to a common exhaust. The relative distance between the ports 30 and 31 is such that after steam has been admitted in the space between two of the vanes 20 and expanded therein through the chamber 27 and passage 28 and passes through the port 30 and into the space between two of the vanes 29 and effected a certain amount of rotary motion of the turbine the port 31 will then be opened and the steam will commence to escape through the exhaust 32 at or prior to the time the movement of the part 10 has caused one of the vanes 20 to shut off the induction port 19, which was supplying the steam.

The perimeters of the vanes 20 and 29 and the perimeters of the end members of the portions 10 and 11 of the turbine engage the inner surfaces 33 of the blocks 26. The blocks 26 are held in position by means of set screws 34 traversing suitable slots in the flanges 25 and screwed into the blocks 26. By this means as the contact surfaces between the turbine and the blocks are respectively worn away the blocks may be set down closer to the path of rotation of the turbine and thus effect a steam tight joint at the various points of contact. The blocks 26 also afford three point bearings as it were for the turbine so that all the support is not furnished by the antifriction bearings 14 and 15.

There is interposed between the framework and the ball bearing members 14 and 15 suitable removable portions 35—36 in the nature of cover or end plates. The end plate 35 has fastened to it a packing member 37 for packing the shaft portion 9. The member 36 is interiorly screw threaded and adjustably carries a soft metal packing 38, which packing is shown as provided with a flaring conical inner end for engaging the conical end 39 of a sleeve portion which extends from the turbine member 10. After the packing 38 has been properly screwed down into place it will be securely held in position by means of the bolting on of the cap or cover member 40. The steam chamber 17 is also provided with a series of eduction ports 41 which lead to the spaces between vanes of the reverse turbine 12, which vanes are similar to those previously described for the direct rotation with the exception of being turned in the opposite direction. The same is also true of the blocks 42 for leading the steam from the first stage in the member 12 to the second stage in the member 13. Since these parts are identical with the exception of reversing the face direction a detailed description will not be made.

When the valve member 16 is moved from the position in which it is shown in Fig. 2 to the left in such figure the ports 19 will be drawn within the turbine member to such a position that they will cease to register with the spaces between the vanes 20, and the ports 42 will be drawn to such a position that they will register with the spaces between the vanes of the member 12. By this means a reversal of the engine is effected. In Fig. 1 there is shown a hand lever 43 pivoted to a standard 44 provided with a ratchet 45 for holding the lever in its proper position and indicating its position. The lever 43 is fastened by means of a link 46 to the end of the member 16, which member is supported in the bearing of the standard 47. By this means the valves may be opened and closed. By moving the member 16 into such a position that steam is supplied to both turbine heads the momentum of the parts will be elastically retarded and brought to a stop before the steam is applied for effecting the reverse.

The power is taken from the power member 9, in the present instance by means of a pinion 48 meshing with a gear wheel 49 which is fast upon a shaft 50.

Having thus described my invention, I claim:

1. In a turbine engine, the combination with a rotary member provided with two series of vanes, of a steam supply conduit centrally located within such rotary member and having a series of ports located in position to register with the spaces between the vanes of one series, a casing surrounding the rotary member and provided with ports equal in number to the ports in the conduit, and a steam chamber at each of the casing ports located in position for receiving the steam from the spaces between the vanes in communication with the conduit ports and for directing the same against the vanes of the other series.

2. In a turbine engine, the combination with a rotary member provided with two series of vanes, of a steam supply conduit centrally located within such rotary member and having a series of ports located in position to register in sequence with the spaces between the vanes of one series, a casing surrounding the rotary member and provided with ports equal in number to the ports in the conduit and each located to reg-

ister with the space between the vanes which is in register with a supply port and a steam chamber at each of the casing ports located in position for receiving the discharge steam from the space between the vanes in communication with the supply port and for directing the same against the vanes of the other series.

3. In a turbine engine, the combination with a casing, of a rotary member located within the casing and provided with two series of vanes, of a member located within the rotary member and held from rotation relative thereto and provided with a steam supply conduit and a series of ports located in position to register with the spaces between the vanes of one series, the casing being provided with ports equal in number to the ports from the conduit, and a steam chamber at each of such casing ports and located in position for receiving the steam from the spaces between the vanes in communication with the conduit ports and for directing the same against the vanes of the other series.

4. In a turbine engine, the combination with a casing, of a rotary member located within the casing and provided with two series of vanes, the spaces between the vanes being of gradually increasing area toward their discharge ends of a member located within the rotary member and held from rotation relative thereto and provided with a steam supply conduit and a series of ports located in position to sequentially register with the spaces between the vanes of one series, the casing being provided with ports equal in number to the ports from the conduit and each located to register with the space between the vanes which is in register with a supply port, and a steam chamber at each of such casing ports and each located in position for receiving the steam from the space in communication with the open conduit port and having a port of reduced area for directing the steam against the vanes of the other series.

5. In a steam turbine, the combination with a rotary member having a central longitudinal opening, of a steam conduit member of cylindrical formation within said opening, a series of vanes on said rotary member, each having a side disposed in a plane substantially tangential to the inlet member and a side curving outwardly from such plane for part of its length and inwardly toward the same for the remainder of its length, the spaces between each two adjacent vanes increasing from the inlet side to the outlet side.

6. In a steam turbine, the combination with a rotary member having a central longitudinal opening, of a steam conduit member of cylindrical formation within said opening, a series of vanes on said rotary member, each having a side disposed in a plane substantially tangential to the inlet member and a side curving outwardly from such plane for part of its length and inwardly toward the same for the remainder of its length, the spaces between each two adjacent vanes increasing from the inlet side to the outlet side, each of the vanes increasing in width from the inlet to the outlet side.

JULIUS BROWN.

Witnesses:
FRED. J. DOLE,
CHAS. LYON RUSSELL.