

T. J. WESTERMAN.

TURBINE.

APPLICATION FILED SEPT. 22, 1910.

Patented Dec. 27, 1910.

4 SHEETS-SHEET 1.

979,619.

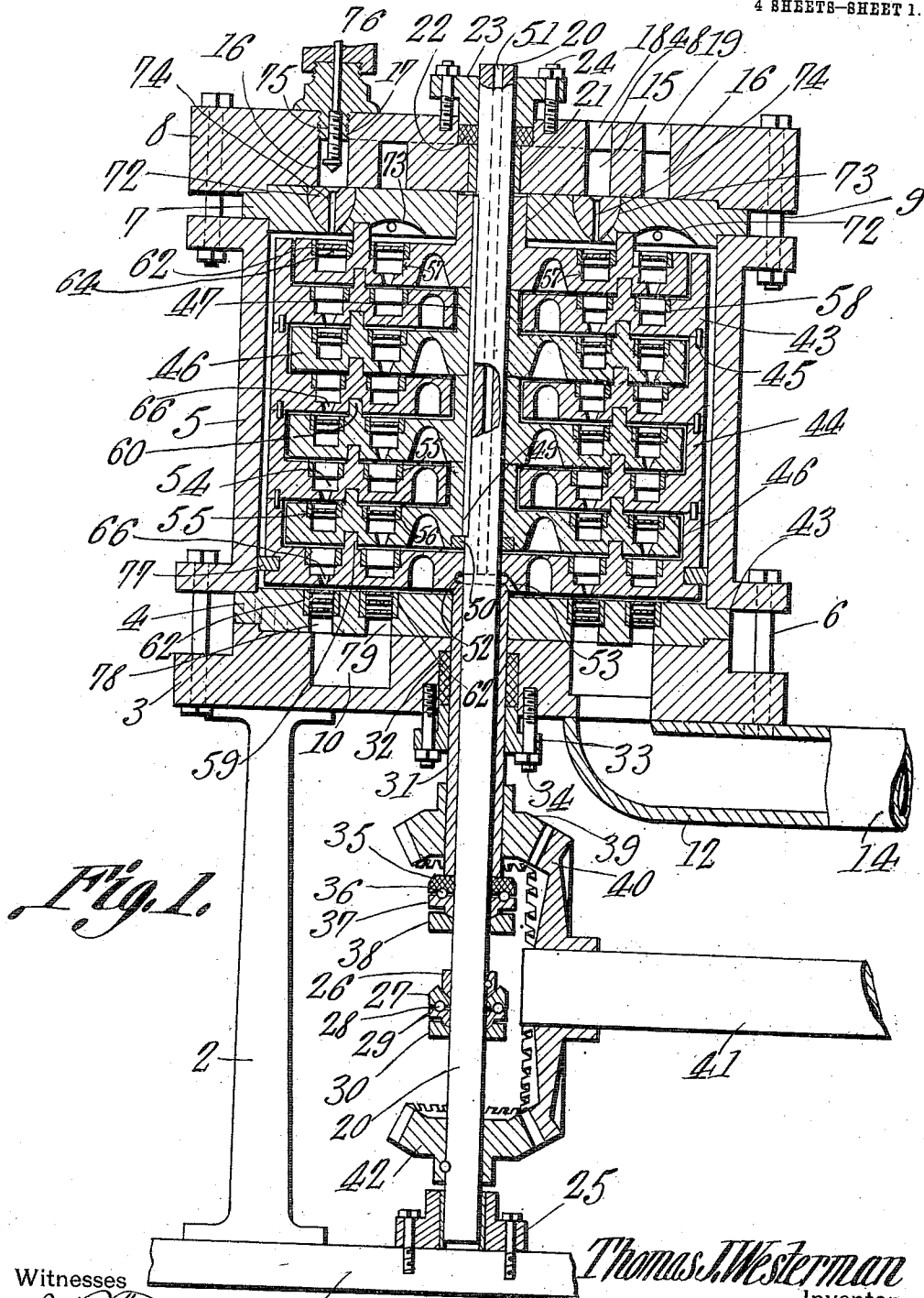


Fig. 1.

Witnesses

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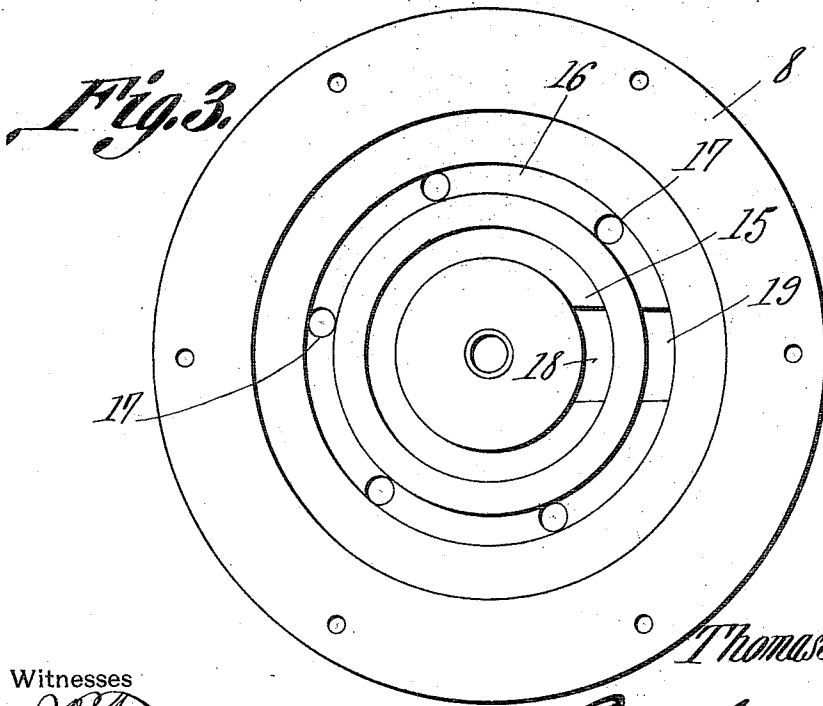
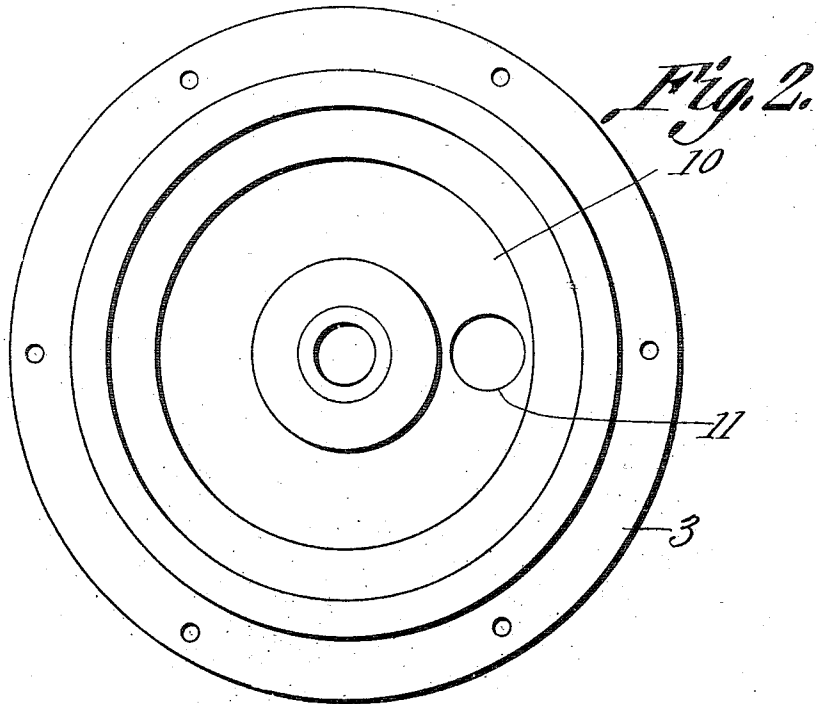
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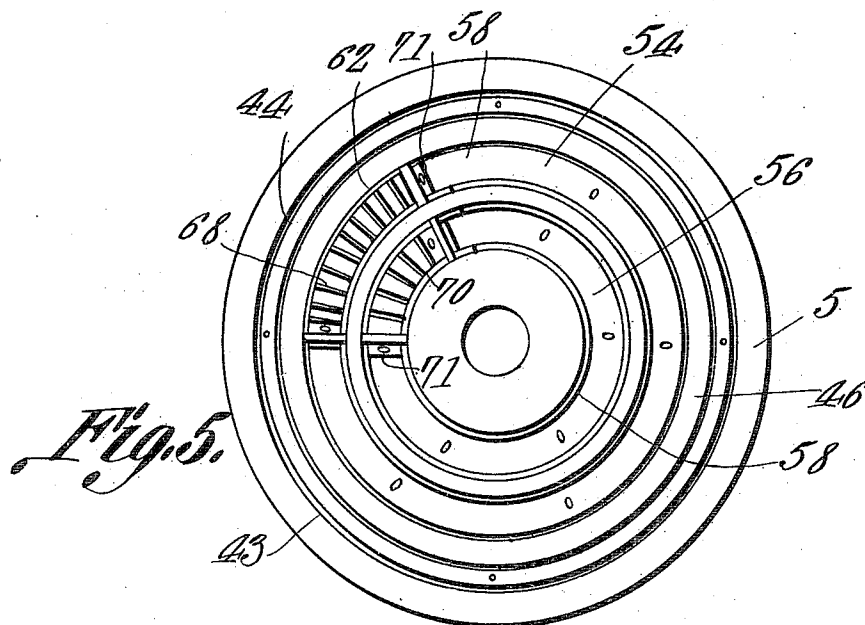
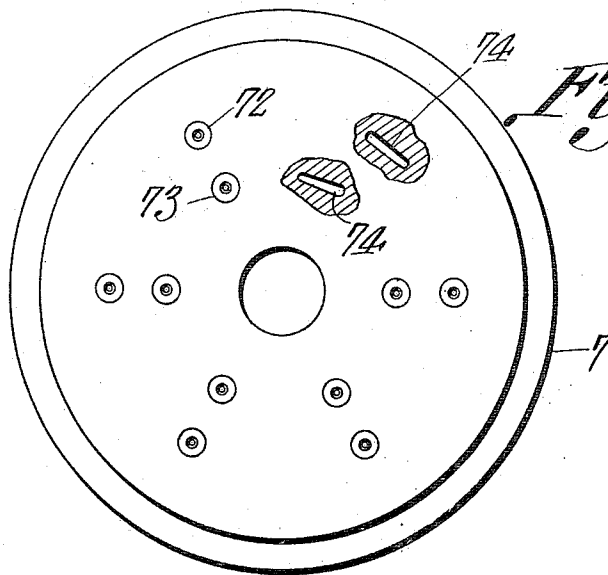
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TURBINE.

Patented Dec. 27, 1910.

4 SHEETS—SHEET 4.

Fig. 6.

65

71

66

Fig. 7.

63 Fig. 8.

Fig. 10.

Witnesses

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UNITED STATES PATENT OFFICE.

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TURBINE.

979,619.

Specification of Letters Patent.

Patented Dec. 27, 1910.

Application filed September 22, 1910. Serial No. 583,242.

To all whom it may concern:

Be it known that I, THOMAS J. WESTERMAN, a citizen of the United States, residing at Olalla, in the county of Kitsap and State of Washington, have invented a new and useful Turbine-Engine, of which the following is a specification.

This invention relates to improvements in turbine engines, and has for its object, to provide a turbine engine of the reaction type, carrying steam under high initial pressure, which is caused to impinge upon a series of rotors in succession, the rotors being adapted to rotate in opposite directions, those rotors which turn in one direction, being united for simultaneous rotation, and those rotors which turn in an opposite direction being likewise united for simultaneous rotation.

It is the object of this invention, to provide, in a device of the class above specified, a means whereby the movement of the rotors may be reversed, thus causing a reversal of the direction of rotation of the driven mechanism.

Another object of the invention is to provide a series of removable racks, adapted to be seated in the rotors, and constituting elements against which the steam is adapted to impinge.

Another object of the invention is to provide novel means for directing steam, as it passes through the engine; to unite the movable elements of the structure in such a manner that there shall be no fluid pressure leakage, and to provide novel means for lubricating the movable elements of the device.

Another object of the invention is so to unite the movable parts of the structure, that a maximum efficiency, combined with durability, will be obtained.

In the drawings,—Figure 1 shows the turbine engine in vertical longitudinal section, parts being in elevation; Fig. 2 is a top plan of the lower head for the casing; Fig. 3 is a bottom plan of the upper head for the casing; Fig. 4 is a top plan of the intake plate; Fig. 5 is a top plan of one of the outer rotors; Fig. 6 is a detail perspective of one of the blocks which carry the nozzles; Fig. 7 is a side elevation of one of these blocks, showing a portion of one of the racks resting thereon; Fig. 8 is a detail perspective, showing the abutting ends of two of the

racks, parts being broken away; Fig. 9 is a fragmental vertical section, the figure being in the nature of a diagrammatic view, showing the relative positions of the inner and outer rotors; and Fig. 10 is a transverse section upon the line A—B of Fig. 9.

The invention includes a base 1, from which rise columns 2. The columns 2 support the lower head 3, upon which rests the exhaust port plate 4. A cylindrical casing 5 is supported upon the exhaust port plate 4, the casing 5 being secured to the head 3 by means of bolts 6, or other suitable connecting devices. Resting upon the upper end of the cylindrical casing 5, is the intake plate 7. The upper head 8 rests upon the intake plate 7, the head 8 being secured to the casing 5 by means of bolts 9, or the like.

In the upper face of the head 3 there is an annular exhaust channel 10. Located in this channel 10 is an opening 11 (see Fig. 2), adapted to receive an elbow 12, forming a part of, or suitably connected with, the exhaust pipe 14. In the lower face of the upper head 8, there is an annular steam inlet channel 15. Disposed in the lower face of the head 8, concentric with the inlet channel 15, but positioned between the channel 15 and the periphery of the structure, is another annular steam inlet channel 16. The channel 16 is provided with a plurality of openings 17 (see Fig. 3), communicating with the exterior of the upper head 8. In this channel 16 is a steam inlet port 19, and in the channel 15 there is a steam inlet port 18.

The invention further includes a driving shaft 20. At its upper end, this driving shaft 20 rotates in a bearing 21 located in the upper head 8. Seated in the upper face of the head 8 and surrounding the shaft 20, is a gasket 22, held in place by a gland 23, secured by bolts 24 in the common manner, to the head 8. The lower end of the shaft 20 is received for rotation in a bearing secured to the base 1. Intermediate the base 1 and the lower head 3, a collar 26 is secured to the shaft 20. This collar 26 fits into the concaved ring 27, so as to form a socketed joint. Balls 28 are interposed between the ring 27 and another ring 29, this ring 29 fitting into the concaved face of a bracket 30, shown conventionally in Fig. 1. This bracket 30 may be supported upon the base 1, upon certain of the columns 2, or in

any other desired manner. The structure above described, serves as a support for the driving shaft 20.

A sleeve 31 is freely rotatable upon the shaft 20. This sleeve 31 is received within a gasket 32, seated in the lower face of the lower head 3. The gasket 32 is controlled by a gland 33, bolted at 34, or secured in any other desired manner to the lower head 3.

Secured to, or formed integrally with, the lower end of the sleeve 31, is an annular head 35, balls 36 being interposed between this head 35 and a ring 37, the ring 37 fitting into the concaved upper face of a bracket 38, so as to have a swiveled, or pivotal bearing thereon. This bracket 38, like the bracket 30, may be upheld by the pillars 2, by the base 1, or in any other desired manner. The structure last above described serves to support the sleeve 31 for rotation upon the shaft 20.

Secured to the lower end of the sleeve 31 is a beveled pinion 39, in mesh with the upper portion of the periphery of a beveled pinion 40, secured to the driven shaft 41. Secured to the lower end of the shaft 20, is a beveled pinion 42, in mesh with the lower portion of the periphery of the pinion 40. It will be seen, from the foregoing, that when the sleeve 31 rotates in one direction, and the shaft 20 rotates in an opposite direction, the pinions 39 and 42, cooperating with the pinion 40, will serve to drive the shaft 41.

The invention further includes a plurality of rotors, disposed within the cylindrical casing 5. One series of these rotors, denoted by the numeral 43, are provided with peripheral flanges 44, upstanding above the bodies of the rotors. Dowel pins 45 serve to unite the flange 44 with the rotor 43 which is superposed. Thus, all of the rotors 43 are held together, so that they will all turn at once. The sleeve 31 is secured to, or formed integrally with, the lowermost of these rotors 43, so that when all of the rotors 43 turn, the sleeve 31 will likewise be rotated. The lowermost of the rotors 43 is grooved in its periphery to receive a packing ring 77 which, engaging the inner face of the cylindrical casing 5, serves to prevent fluid pressure leakage at the base of the casing. Disposed within the upstanding flanges 44 of the rotors 43, are other rotors 46. Since the rotors 43 inclose the rotors 46, the rotors 43 will be referred to hereinafter as the outer rotors, the rotors 46 being denominated the inner rotors. These inner rotors 46 are provided with hubs 47, extended upwardly through openings in the outer rotors 43. The hub 48 of the uppermost rotor 46, however, registers in an opening in the intake plate 7. By means of a spline 49, or the like, all of the inner rotors 46 are united

with the driving shaft 20, so that when the rotors 46 turn, the driving shaft 20 will rotate therewith. Secured to the shaft 20, or formed integrally therewith, is a collar 50 which serves as a support for the lowermost of the inner rotors 46, this lowermost rotor being recessed to receive the collar 50, as clearly indicated in Fig. 1. This collar 50 serves to uphold the inner rotors 46.

Disposed in the driving shaft 20, is a longitudinally extended oil duct 51, having an outlet at the top of the driving shaft. At its lower end, this oil duct 51 communicates with an annular channel 52 in the lowermost outer rotor 43. This annular channel in the lowermost rotor 43, is provided with a laterally extended branch 53, carried beyond the periphery of the sleeve 31. It will be seen that when a lubricant is introduced into the upper end of the oil duct 51, the lubricant, passing downwardly along this oil duct, will enter the chamber 52, thus lubricating the shaft 20, where it turns within the sleeve 31. The lateral extension 53 of the channel 52, serves to deliver the lubricant upon the outer face of the sleeve 31, so that the sleeve 31 will be lubricated where it rotates in the head 3 and in the gasket 32.

In the upper face of each of the outer rotors 43, there is an annular channel 54, aligned vertically with annular channels 55 in the upper faces of the inner rotors 46. In the upper face of each of the outer rotors 43, there is another annular channel 56, aligned vertically with annular channels 57 in the inner rotors 46. The channels 56 and 57 lie respectively between the channels 54 and 55 and the axis of rotation of the members 43 and 46. When the device is in operation, there is live steam in the several channels. In order to prevent the live steam from passing transversely of the rotors 43 and 46, from the channel 54 to the channel 56 in the case of the rotor 43, and from the channel 55 to the channel 57 in the case of the rotor 46, or in a reverse direction from channel to channel, the rotor 43 is provided with an upstanding annular rib 59, the rotor 46 being provided with an upstanding annular rib 60. These ribs register in annular grooves 61 in the lower faces of the rotors 43 and 46 (see Fig. 10).

The channels 54, 55, 56 and 57 are reduced in width intermediate their tops and bottoms, to form shoulders 58 in the side walls of the channels. Upon these shoulders rests racks 62. These racks 62 consist of side walls 63, terminal transverse abutments 64 connecting the side walls, and a plurality of curved or inclined blades 80, likewise connecting the side walls. A space exists between the lower edges of the blades 80 and the bottoms of the channels 54, 55, 56 and 57. The abutments 64 rest upon blocks 65, disposed in the channels, and dividing the

channels into a plurality of segments. These blocks 65 are provided with inclined, tapered nozzles 66, extended through the bottoms of the rotors 43 and 46. The alined nozzles in the rotors 46 are inclined in one direction, and the nozzles in the rotors 43 are in an opposite direction (see Fig. 9). The blades 67 in the racks in the channels 55 of the inner rotors 46 slope in one direction, the blades 68 in the racks in the channels 54 of the outer rotors 43, slope in an opposite direction. The blades 69 in the racks in the channels 58 of the inner rotors 46, slope oppositely to the blades 67, and in the same direction as the blades 68. The blades 70 in the racks in the channels 56 of the outer rotors 43, slope oppositely to the blades 68, and in the same direction as the blades 67. At this point it may be stated that there may be any number of these racks 62 in each of the channels. Moreover, the number of racks 62, for any given set of channels, may be increased as the lower end of the device is approached. This increase in the number of racks, obviously causes an increase in the number of nozzles 66, and by increasing the number of nozzles 66, an increased portage will be provided, as the lower end of the structure is approached. This increased portage is desirable for the reason that the steam expands as it passes downwardly through the turbine engine.

Disposed in the intake plate 7, and alined with the channels 54 and 55, are a plurality of nozzles 72. Likewise disposed in the intake plate 7 and alined with the channels 56 and 57 are other nozzles 73. The passages 74 through these nozzles 73 and 72, are inclined in opposite directions. Bushings 75 are threaded into the openings 17. These bushings 75 carry valves 76, adapted to seat in the upper ends of the passages 74 in the nozzles 72.

Referring to the exhaust port plate 4, it will be seen that there is an annular, shouldered channel 78 therein, alined with the channels 54 and 55; this exhaust port plate being provided with another annular channel 79, alined with the channels 56 and 57. These channels 78 and 79, extend entirely through the exhaust port plate 4. Racks 62 are mounted in the channels 78 and 79, the blades of these racks being inclined in opposite directions, the blocks 65, together with their nozzles 66 being omitted.

The operation of the device is as follows. Steam, or other fluid under pressure, is admitted into either the inlet port 18 or the inlet port 19. Presupposing that the steam is admitted into the inlet port 19, the steam will traverse the annular inlet channel 16, some or all of the valves 76, as may be desired, being unseated from the openings 74 in the nozzles 72. The steam, traversing the channels 74 in the nozzles 72, will, referring

to Fig. 9, impinge against the inclined blades 67 in the inner rotor 46, causing the rotor 46 to turn in one direction. The steam, passing beneath the blades 67 will traverse the nozzles 66 of the inner rotor, and be deflected against the blades 68 of the outer rotor 43, causing this outer rotor 43 to turn in a direction opposite to the direction of rotation of the inner rotor 46. By this operation, all of the inner rotors 46 will turn in one direction, together with the shaft 20, while all of the outer rotors 43 will turn in an opposite direction, together with the sleeve 31. As the steam leaves the channel 54 in the lowermost of the outer rotors 43, the steam will impinge against the blades in the rack which is located in the exhaust port plate 4, and pass thence into the channel 78 in the exhaust port plate, thence into the channel 10 in the lower head 3, and out through the exhaust pipe 14.

When it is desired to reverse the direction in which the driven shaft 41 moves, the steam supply is cut off from the inlet port 19, and directed into the inlet port 18, the steam thus traversing the channel 15 in the upper head 8, traversing the nozzles 73 impinging the blades 69 and 70, in the channels 57 and 56, respectively. By reason of the fact that the blades 69 slant in an opposite direction from the blades 67, the blades 70 slanting in an opposite direction from the blades 68, it will be seen that the rotors 46 and 43 will turn in opposite directions from those in which they rotate when the steam, as hereinbefore described, impinges the blades 67 and 68. Thus, by directing the steam supply into the inlet port 18, the engine will be reversed. The steam, having impinged against the blades 69 and 70, and traversed the engine from top to bottom, will finally pass into the channel 79 in the exhaust port plate 4, and, entering the annular channel 10 in the head 3, pass out of the exhaust pipe 14.

By reason of the fact that the impact of the steam is received by the racks 62, these impact receiving elements are likely to become roughened, or broken. The racks 62 may be removed individually, and thus a single impact element may be renewed, when broken, without renewing the rotor in which the rack is located.

Having thus described the invention, what is claimed is:—

1. In a device of the class described, superposed rotors provided in their upper faces with ported channels diminished intermediate their tops and bottoms to define shoulders; racks removably resting upon the shoulders and provided with inclined blades.

2. In a device of the class described, superposed rotors provided in their upper faces with ported channels diminished in-

intermediate their tops and bottoms to define shoulders; removable racks comprising parallel side walls and inclined blades connecting the side walls, the side walls fitting
5 closely in the channels and resting on the shoulders.

3. In a device of the class described, superposed rotors provided in their upper faces with ported channels diminished in-
10 termediate their tops and bottoms to define shoulders; removable racks including parallel side walls and inclined blades connecting the side walls, the side walls fitting
15 closely in the channels and resting upon the shoulders; blocks disposed in the channels beneath the ends of the racks, to divide the channels into a plurality of segments, the blocks being provided with inclined nozzles
20 extending through the bottoms of the rotors.

4. In a device of the class described, a plurality of superposed rotors provided in their upper faces with concentric, inner and
25 outer channels, the inner and outer channels of each rotor being alined with the inner and outer channels of the adjacent rotors and having communication therewith; racks removably mounted in the channels and provided with blades inclined in one direction
30 in the outer channels and in an opposite direction in the inner channels, to provide for a reversal of the rotors; each rotor being provided with an upstanding annular rib, positioned between the concentric channels of said rotor, and adapted to register
35 in an annular groove in the superposed rotor, to prevent the passage of fluid under pressure from the inner to the outer channels, transversely of the rotors.

5. In a device of the class described, superposed rotors provided in their upper
40 faces with concentric inner and outer channels, the inner and outer channels of each rotor being alined with the inner and outer

channels of the adjacent rotors and having communication therewith; racks removably
45 mounted in the channels and provided with blades inclined in one direction in the outer channels and in an opposite direction in the inner channels.

6. In a device of the class described, superposed rotors provided in their upper
50 faces with concentric inner and outer channels, the inner and outer channels of each rotor being alined with the inner and outer channels of adjacent rotors and having communication
55 therewith; racks removably mounted in the channels and provided with blades inclined in one direction in the outer channels and in an opposite direction in the inner channels; blocks disposed in the channels
60 beneath the ends of the racks and constituting means for dividing the channels into a plurality of segments, the blocks being provided with inclined nozzles extended
65 through the bottoms of the rotors.

7. In a device of the class described, a supporting structure; a sleeve journaled for
rotation therein; a shaft mounted for rotation in the sleeve; a series of rotors connected
70 with the shaft; a series of rotors connected with the sleeve, the lowermost rotor of the sleeve carried series being provided with an annular channel extended around
75 the shaft, and having a lateral branch discharging beyond the periphery of the sleeve; there being an oil duct in the shaft, accessible from the end of the shaft and having communication with the channel in said
lowermost rotor.

In testimony that I claim the foregoing as
my own, I have hereto affixed my signature
in the presence of two witnesses.

THOMAS JAMES WESTERMAN.

Witnesses:

HARRY ATCHINSON,
BEN CARLTON.