No. 793,583. PATENTED JUNE 27, 1905.

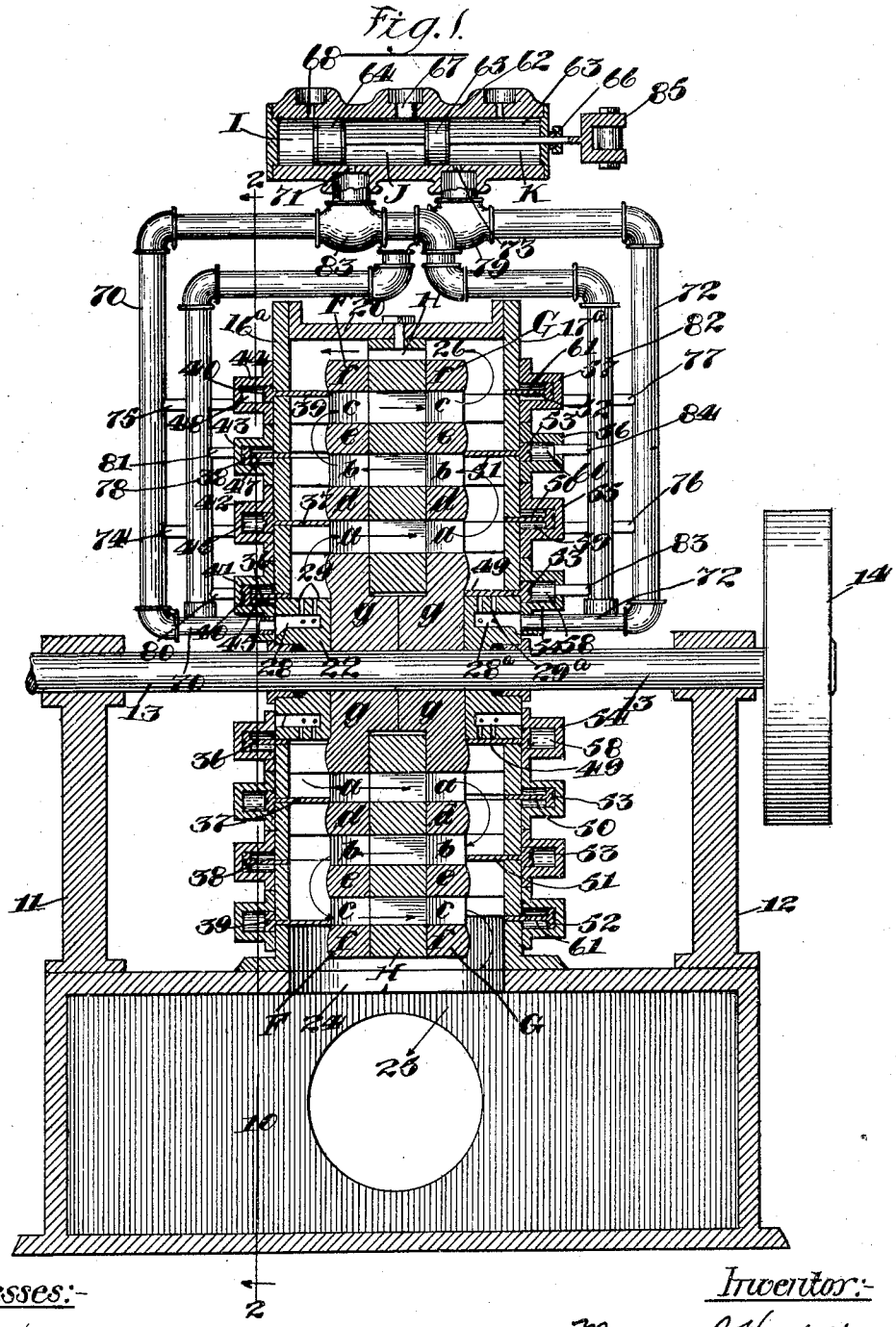
M. J. HEWLETT.

ROTARY ENGINE.

APPLICATION FILED OCT. 3, 1902.

2 SHEETS—SHEET 1.

Fig. 1.



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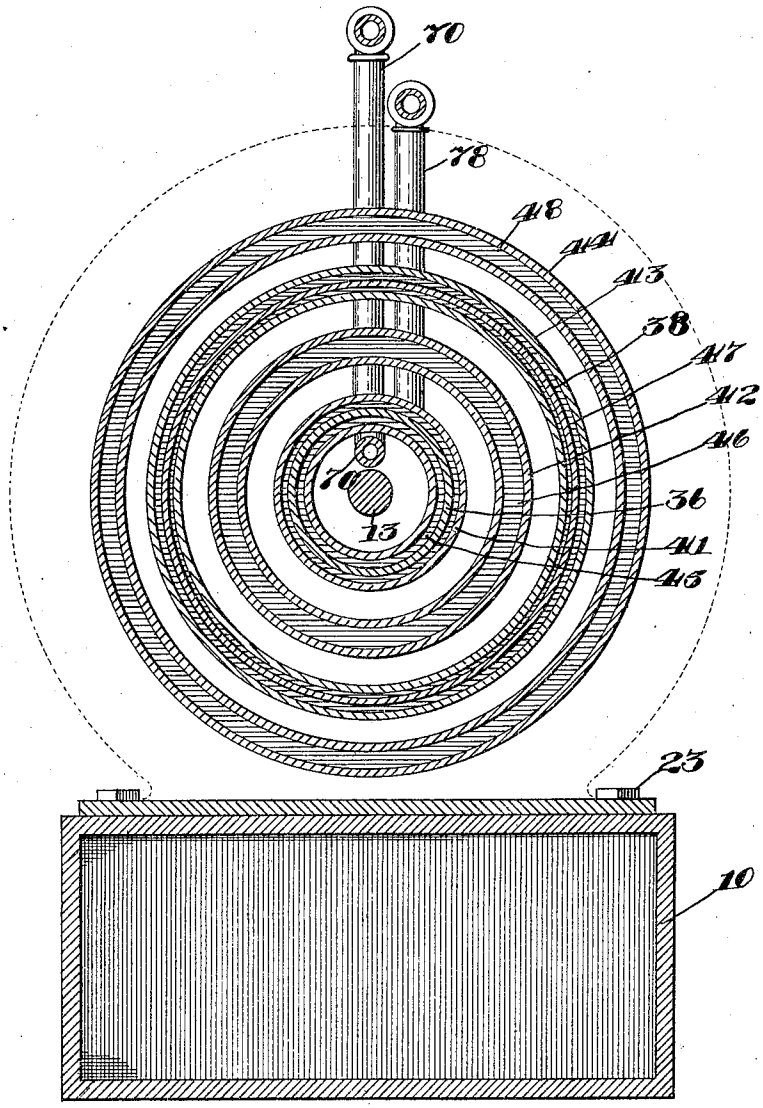
2 SHEETS—SHEET 2.

Fig 2.



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UNITED STATES PATENT OFFICE.

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ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 793,583, dated June 27, 1905.

Original application filed April 2, 1902, Serial No. 101,014. Divided and this application filed October 3, 1902. Serial No. 125,836.

To all whom it may concern:

Be it known that I, MADDRA J. HEWLETT, a citizen of the United States, residing at Kewanee, in the county of Henry and State of Illinois, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to rotary engines involving the turbine principle, and has for its object to provide certain improvements in engines of this class by which the direction of movement of the steam through the engine may be reversed, consequently reversing the direction of rotation of the engine. This, broadly considered, is the principal feature of my invention, which, however, also includes certain further improvements which will be hereinafter pointed out. That which I regard as new is set forth in the claims.

Referring to the drawings, Figure 1 is a transverse vertical section of my improved engine, and Fig. 2 is a vertical section on line 2 2 of Fig. 1.

In the drawings, 10 indicates the base of the engine, and 11 12 indicate standards or supports in which is journaled the shaft 13 of the engine. The form of the base and supporting devices for the shaft may of course be of any approved design. 14 indicates a pulley mounted on a shaft 15 for transmitting power therefrom.

F G indicate rotary disks set a distance apart and mounted upon and keyed to the shaft 13.

H indicates a stationary disk arranged between the disks F and G, as shown in Fig. 1. Said disk is fixedly secured to the cylinder of the engine and is provided with transverse passages adapted to register with the passages in the disks F and G. The passages in the disk H are, however, not inclined.

The rotary disks F and G are provided with several series of inclined transverse passages, the different series of passages being at different distances from the center. The first or innermost series of passages is indicated by the letter *a*, the next by *b*, and the third by *c*. Such passages are formed by inclined blades impact members suitably arranged in the disks, as fully described in my original application, Serial No. 101,014, filed April 2, 1902. The passages *a* and *c* in each of the disks are inclined in the same direction, while the passages *b* are oppositely inclined, so that steam passing in opposite directions through passages *a* and *b* will operate to rotate the disks in the same direction. By providing the passages *a*, *b*, and *c*, as shown and described, a series of concentric rings *d*, *e*, and *f* is provided, as shown in Fig. 1, the ring *f* forming the rim of the wheel. Between the passages *a* and the shaft 13 are the hubs *g* of the disks.

16ª 17ª indicate the heads of a cylinder in which are inclosed the disks F and G, as shown in Fig. 1, and 20 indicates a band which connects the peripheries of said heads, forming the intermediate portion of the cylinder. The band 20 is suitably secured to the base 10. In order to provide an exhaust-outlet, the band 20 does not extend entirely under the heads 16ª 17ª, so that a central exhaust-passage 24 is provided immediately below the disks for the escape of exhaust-steam into the base, which is hollow and is provided with an outlet-passage 25, as shown in Fig. 1. It will be observed that the heads 16ª 17ª are of somewhat greater diameter than the disks F and G, so that an annular exhaust-chamber 26 is provided outside the disks, which exhaust-chamber communicates with the interior of the base through the passage 24, above described. The head 16ª is provided with a central hub 27, which fits upon the shaft 13, as shown in Fig. 1, said hub being provided with an annular passage 28, having ports 29, by which exhaust-steam is admitted from the passage 28 to the engine. As shown in Fig. 1, the head 16ª is also provided with a series of baffle-rings 36 37 38 39, respectively, which are concentrically arranged in annular slots in the head 16ª and are movable transversely of the engine—that is to say, perpendicularly to the head 16ª. The inner portions of said baffle-rings are adapted to project into the cylinder and are of such length that when they are in their in-

nermost position they are adapted to bear against the outer face of the disk F of the engine. The rings 36 37 38 39 are provided at their outer edges with heads 40, which are inclosed in housings 41 42 43 44, annular in form and adapted to overlie the slots in which the rings 36 37 38 39, respectively, are fitted. By this construction steam-chambers 45 46 47 48 are provided, in which the heads 40 of the different baffle-rings move. The heads 40 fit snugly in the different steam-chambers, so that they perform the function of piston-heads, as will be hereinafter explained.

The head 17ª is similar in construction to the head 16ª and is provided with a series of baffle-rings 49 50 51 52, which are similar to the baffle-rings 36 37 38 39, respectively, but are arranged to operate oppositely—that is to say, when the baffle-ring 36 is in its outermost position the baffle-ring 49 is in its innermost position, and so on. Similarly adjacent baffle-rings at either side of the engine are arranged to operate oppositely—that is to say, when the baffle-ring 36, for example, is in its outermost position the baffle-ring 37 is in its innermost position. The means by which this is accomplished will be hereinafter described.

53 indicates the heads of the baffle-rings 49 50 51 52.

54 55 56 57 indicate housings which correspond to the housings 41 42 43 44, respectively, and form steam-chambers 58 59 60 61, respectively.

The inner ends of the baffle-rings 49 50 51 52 are arranged to engage the outer face of the disk G in the same manner that the rings at the opposite side of the engine engage the disk F.

62 indicates a valve by which the position of the different baffle-rings is controlled. Said valve is provided with a valve-chamber 63, in which are fitted pistons 64 65, carried by a piston-rod 66, as shown in Fig. 1. The pistons 64 65 are arranged a distance apart, as shown, so that considerable steam-space is provided between them.

67 indicates a port which opens into the chamber 63 between the pistons 64 and 65. 68 indicates a port which opens into the chamber 63 between the piston 64 and the adjacent end of the valve-casing. 69 indicates a port near the other end of the valve-casing, which opens into said chamber 63 between the piston 65 and the adjacent end of the valve-casing. All the ports 67 68 69 communicate with a suitable source of steam-supply. It will thus be seen that the chamber 63 is, in effect, divided into three separate compartments I, J, and K, respectively, of variable size and that steam is admitted to the compartment I through port 68, to the compartment J through port 67, and to compartment K through port 69.

70 indicates an inlet-pipe which communicates with the steam-inlet passage 28 and also with a port 71, opening into the chamber 63 at a point between the ports 68 and 67, as shown in Fig. 1. 72 indicates a second pipe, similar to the pipe 70, which communicates with a passage 28ª in the head 17ª, which is similar to the passage 28, and also with a port 73, which opens into the valve-chamber 63 at a point between the ports 67 and 69. 74 indicates a branch pipe leading from pipe 70 to chamber 46 in the housing 42. 75 indicates a similar branch pipe which extends from pipe 70 to chamber 48 in the housing 44. 76 77 indicate branch pipes leading from pipe 72 to chambers 69 71, respectively, in housings 55 57, respectively, the object being to supply live steam to the different chambers mentioned, as will be hereinafter described.

78 indicates a pipe which communicates with the pipe 72 by a T-coupling 79 or other suitable connection, which pipe extends down parallel with the head 16ª and is provided with branch pipes 80 81, connecting said pipe 78 with the chambers 45 and 47, respectively, of housings 41 and 43. Similarly 82 indicates a pipe which is connected by a T-coupling 83 or other suitable device with pipe 70 and communicates by branch pipes 83 84 with chambers 58 and 60, respectively, in housings 54 and 56.

From the foregoing description it will be seen that whenever live steam is introduced into the engine through pipe 70 and passage 28 steam will also be supplied to chambers 46 and 48 through branch pipes 74 and 75 and to chambers 58 and 60 at the opposite side of the engine through pipe 82 and branch pipes 83 and 84. Similarly whenever live steam is supplied through pipe 72 and passage 28ª at the opposite side of the engine live steam is also supplied to chambers 59 and 61 through branch pipes 76 77, respectively, and to chambers 45 and 47 through pipe 78 and branch pipes 80 81, respectively.

As shown in Fig. 1, the ports 71 73, through which steam is admitted to pipes 70 72, respectively, are always separated by one or the other of the heads of the pistons 64 or 65, and the arrangement is such that when the piston 64 moves to the left far enough to bring the port 71 into communication with chamber J port 73 is brought into communication with chamber K, which then becomes the exhaust-chamber. Similarly when port 73 is brought into communication with chamber J by the movement of the pistons to the right port 71 is brought into communication with chamber I, which then becomes the exhaust-chamber. The port 67, which communicates with chamber J, is the main steam-inlet port, the ports 68 69 being provided so that steam-power may be supplied in operating the pistons 64 65 to reverse the engine. It will be understood that suitable steam connections

(not shown) are provided by which steam may be directed into either of the chambers I or K, and mechanism is also provided for regulating the supply of steam to either of said chambers or to the chamber J. Any suitable throttle-valve may be employed for these purposes.

The operation is as follows: Assuming the valve mechanism to be in the position shown in Fig. 1, if it be desired to operate the engine with the valve in such position the valves controlling the admission of steam to chambers I and K are closed, so that steam enters chamber J only. From chamber J the steam passes into pipes 70 and 82 and through pipe 70 to passage 28 and thence into the engine through ports 29. Upon entering the engine it passes laterally, first through the inclined passages *a* in the disks F and G, passing also through the straight passage in the stationary disk H. It then moves radially, passing back through passages *b*, which, as already described, are inclined oppositely to the passages *a*. After passing through the passages *b* the steam again moves radially until it reaches passages *c*, when it again moves transversely, and finally is exhausted into exhaust-chamber 26 and passes from thence through passage 24 to the base of the engine. Steam entering the cylinder is directed laterally through the different passages, since when steam is admitted through branch pipes 74 75 to chambers 46 and 48 the pressure thereof upon the heads 40 of baffle-rings 37 39 forces said rings in until they engage the disk F. Consequently the steam entering through passage 28 and ports 29 is directed by the baffle-ring 37 into the passages *a*. At the same time the baffle-rings 49 and 51 will have been forced into the position shown in Fig. 1 by the steam in the pipe 82, which is admitted to chambers 58 and 60 through branch pipes 83 and 84. The baffle-ring 49 lies immediately over and adjacent to the ports 29^a, which lead from the passage 28^a into the cylinder of the engine, and when it is in its innermost position, as shown in Fig. 1, it acts to close such ports to prevent the admission of steam. The baffle-ring 36 serves the same purpose at the opposite side of the engine, acting when in its innermost position to close the ports 29. The baffle-rings 36, 38, 50, and 52 are at this time in their outermost position, being forced out and held in such position by the steam in the cylinder, which acts against their inner edges and forces them out, inasmuch as there is no steam in their respective chambers 45, 47, 59, and 61, the pipes 72 and 78, which conduct steam to such chambers, being at this time connected with compartment K, which is then the exhaust-compartment, as shown in Fig. 1. It will be understood that the heads of the baffle-rings being of greater area than the inner edges thereof whenever steam is admitted to the baffle-ring chambers said rings are forced in and held in, notwithstanding the constant pressure of steam against the inner edges of said rings. It will be seen from the foregoing description that the steam entering through ports 29 follows a circuitous path until finally exhausted at the peripheries of the rotary disks, the baffle-rings 37, 51, and 39 serving to guide the steam through the different passages. If it be desired to reverse the engine, the pistons 64 65 are adjusted to connect the port 73 with the compartment J and the port 71 with compartment I, which then becomes the exhaust-compartment. This admits live steam to pipes 72 and 78, forcing in baffle-rings 36, 38, 50, and 52 and supplying steam to passage 28^a for admission to the cylinder. At the same time, the steam being exhausted from pipes 70 and 82, the baffle-rings 37, 39, 49, and 51 are forced out. The result is that the steam entering through ports 29^a passes transversely of the engine in a direction opposite to that indicated by the arrows in Fig. 1, and the disks are consequently rotated in the opposite direction.

85 indicates a connecting device by which the pistons 64 and 65 may be adjusted by hand. Said connecting device may be in the form of a lever, or any other suitable device for the purpose may be employed.

The heads 16^a 17^a are preferably provided with a series of radial partition-plates to properly direct the steam, as described in my original application above referred to.

The apparatus shown and described illustrates my invention in the best form at present known to me; but I wish it to be understood that my invention, broadly considered, is not limited to the specific construction illustrated and described, as it may be embodied in other constructions and forms of apparatus. Except, therefore, in so far as the specific features of construction are particularly claimed they are not to be regarded as essential to the invention generically set forth in the broader claims. It should be understood, also, that the term "rotary disk," as employed in the broader claims, is used in a generic sense to indicate the rotary member through which the transverse passages extend, whether such disk be single or consists of a plurality of members between which the stationary disks or partitions extend.

While my improved engine is designed to be operated by steam, any equivalent fluid may be employed to operate it.

That which I claim as my invention, and desire to secure by Letters Patent, is—

1. A rotary engine comprising a rotary disk having a plurality of series of inclined transverse passages at different distances from the center, baffle-rings at opposite sides of said disk, said rings being adjustable to control the direction of travel of the steam, means

for admitting steam at one side of said disk for rotating it in one direction, and means for admitting steam at the opposite side of said disk for rotating it in the opposite direction, substantially as described.

2. A rotary engine comprising a rotary disk having a plurality of series of inclined transverse passages at different distances from the center, baffle-rings at opposite sides of said disk, said rings being adjustable to control the direction of travel of the steam, means for admitting steam at one side of said disk for rotating it in one direction, means for admitting steam at the opposite side of said disk for rotating it in the opposite direction, and means for automatically adjusting said baffle-rings to direct the flow of the steam, substantially as described.

3. In a rotary engine, the combination of a rotary disk having a plurality of series of inclined transverse passages, heads at opposite sides of said disk, steam-chambers carried by said heads, baffle-rings having heads fitted in said steam-chambers, said baffle-rings being movable to control the direction of the flow of the steam, a pipe for admitting steam at one side of said disk, branch pipes connecting said pipe with alternate steam-chambers at opposite sides of said disk, a pipe for admitting steam at the opposite side of said disk, branch pipes connecting the latter pipe with alternate steam-chambers at opposite sides of said disk, and a valve controlling the admission of steam to said pipes, substantially as described.

4. In a rotary engine, the combination of a rotary disk having a plurality of series of inclined transverse passages, heads at opposite sides of said disk, steam-chambers carried by said heads, baffle-rings having heads fitted in said steam-chambers, said baffle-rings being movable to control the direction of the flow of the steam, a pipe for admitting steam at one side of said disk, branch pipes connecting said pipe with alternate steam-chambers at opposite sides of said disk, a pipe for admitting steam at the opposite side of said disk, branch pipes connecting the latter pipe with alternate steam-chambers at opposite sides of said disk, and a valve controlling the admission of steam to said pipes, said valve being arranged to exhaust the steam from one of said pipes when live steam is supplied to the other, substantially as described.

5. In a turbine, a rotary member having a plurality of series of blades or impact members at different distances from its axis of rotation, and movable rings for directing the motive fluid from one series of blades to another, and for changing the order in which the different blades of each series are acted on by the motive fluid, substantially as described.

6. In a turbine, a rotary member having a plurality of series of blades or impact members at different distances from its axis of rotation, and movable rings for directing the motive fluid successively from one series of blades to the next, and for changing the order in which the different blades of each series are acted on by the motive fluid, substantially as described.

7. In a turbine, a rotary member having a plurality of series of blades or impact members at different distances from its axis of rotation, and movable rings at opposite sides of said rotary member for directing the motive fluid from one series of blades to another, and for changing at will the connections by which the fluid is directed from one series of blades to another, substantially as described.

8. In a turbine, a rotary member having a plurality of series of blades or impact members at different distances from its axis of rotation, movable rings at opposite sides of said rotary member for directing the motive fluid successively from one series of blades to the next, and means for actuating said rings to alter the fluid-directing connections by which the fluid is directed from one series of blades to the next, substantially as described.

9. A steam-turbine, comprising a rotary shaft, a plurality of concentric rings, one located inside the other, blades located inside the inner of said rings, blades located inside the outer of said rings, said blades being inclined, respectively, in opposite directions, said shaft, rings and blades being fast together, and a valve movable longitudinally of said shaft for controlling the direction of flow of the motive fluid, substantially as described.

10. A steam-turbine, comprising a rotary shaft, a plurality of concentric rings, one located inside the other, blades located inside the inner of said rings, blades located inside the outer of said rings, said blades being inclined, respectively, in opposite directions, said shaft, rings and blades being fast together, and valves at opposite sides of said rings and movable longitudinally of said shaft for controlling the direction of flow of the motive fluid, substantially as described.

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