H. LINDENBERG.

ROTARY ENGINE.

APPLICATION FILED JULY 20, 1911.

1,038,398. **Patented Sept. 10, 1912.**

Fig. 2

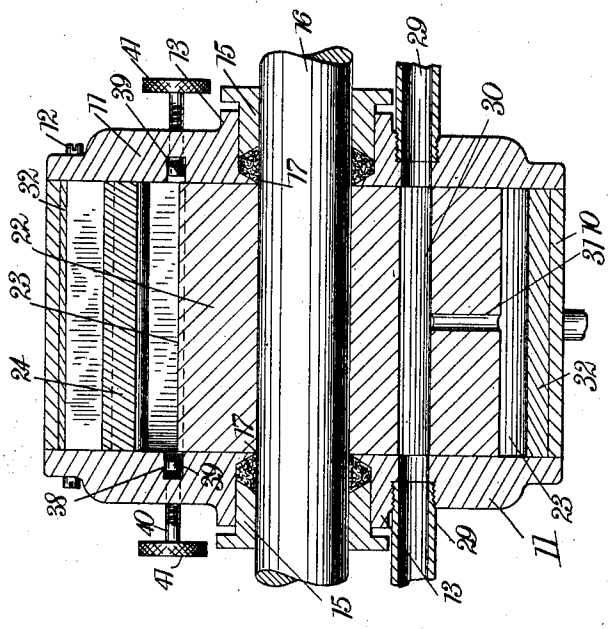
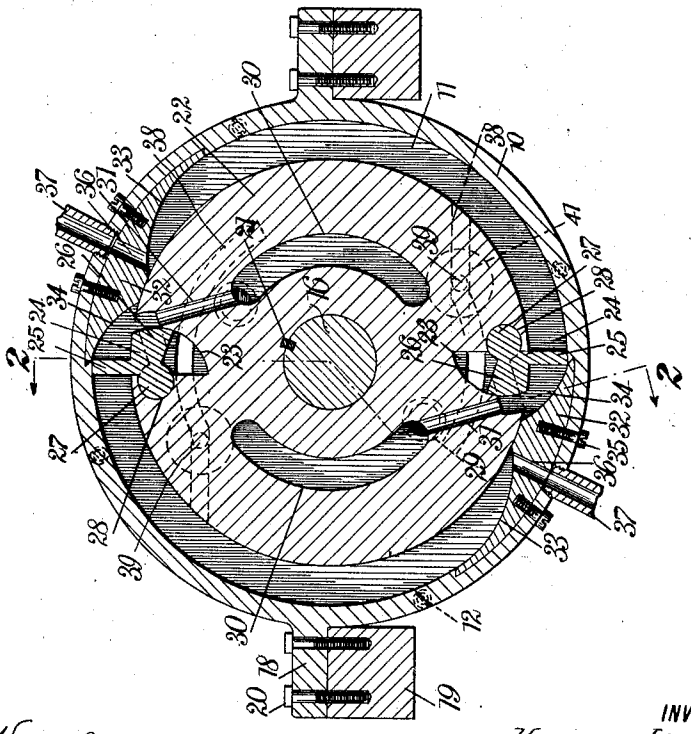


Fig. 1



WITNESSES

Frank H. Vick Jr.

John K. Bachman

INVENTOR

Herman Lindenberg

BY Munn & Co.

ATTORNEYS

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HERMAN LINDENBERG, OF WEST HOBOKEN, NEW JERSEY.

ROTARY ENGINE.

1,038,398. Specification of Letters Patent. **Patented Sept. 10, 1912.**

Application filed July 20, 1911. Serial No. 639,495.

To all whom it may concern:

Be it known that I, HERMAN LINDENBERG, a citizen of the United States, and a resident of West Hoboken, county of Hudson, and State of New Jersey, have invented a new and Improved Rotary Engine, of which the following is a full, clear, and exact description.

This invention relates to rotary engines adapted to be driven by steam or other suitable fluid under pressure, and has reference more particularly to an engine of this class which comprises a stator, a rotor provided with a piston movable into an operative and an inoperative position, and means whereby said piston when in an operative position is partly balanced by live steam or other fluid under pressure.

An object of the invention is to provide a simple and efficient rotary engine which comprises comparatively few parts, which can be easily assembled and taken apart, which can be driven by steam, compressed air or any other suitable motive fluid under pressure, in which the expansive power of the fluid can be utilized in driving the engine, in which the wear of the movable parts is reduced to a minimum, in which a movable piston is employed which is pressed into operative engagement with the stator, by the live steam, and in which the piston when operative, is partly balanced by the live steam itself.

A further object of the invention is to provide a rotary engine in which is employed a movable piston, that is, a piston carried by the rotor, and movable from an operative to an inoperative position, and vice versa, as the rotor revolves, and in which the action of the piston is cushioned by means of the motive fluid.

The invention consists in the construction and combination of parts to be more fully described hereinafter and particularly set forth in the claims.

Reference is to be had to the accompanying drawings forming part of this specification, in which similar characters of reference indicate corresponding parts in both views, and in which—

Figure 1 is a vertical section of an embodiment of my invention; and Fig. 2 is a cross section on the line 2—2 of Fig. 1.

Before proceeding to a more detailed explanation of my invention, it should be clearly understood that while I have shown for example an embodiment of the invention which comprises a single unit, two or more of these units can be combined in a single engine, in order to utilize fully the expansive power of the motive fluid. It will be seen however that each unit in itself makes use of the expansive force of the motive fluid, and the degree of "cut-off," *i. e.*, the point at which the motive fluid inlet is closed to permit the expansion to begin, can be varied.

Certain of the details of construction shown for example herewith, form no part of the invention, and can be varied in accordance with individual preference and special conditions, without deviating from the essence of the invention as defined in the appended claims.

Referring more particularly to the drawings, I employ a stator casing which is of substantially cylindrical form, and of suitable dimensions. It comprises an annular member 10 having on the opposite sides heads or side plates 11, secured in position by means of bolts 12 or in any other convenient manner. The heads have central hubs 13, having associated therewith stuffing boxes 15 which in effect are bearings for a main shaft 16, suitable openings 17 in the heads 11 being provided for the shaft. The casing has lateral extensions 18 adapted to be supported upon the usual framework 19, and secured in position thereon by means of screws or bolts 20.

Rigidly secured upon the shaft, within the stator casing, by means of a key 21 or in any other suitable manner, is a rotor 22 of circular cross section and of less diameter than the internal diameter of the stator, so that a space for steam or other motive fluid is provided. At diametrically opposite points the rotor has cut away parts 23, extending elementally along it and of substantially semi-circular cross section. Movable pistons 24, each consisting of two angularly disposed wings or vanes 25 and 26, and a central rib or shaft 27, are movably mounted in the recesses, each of which has at one side a lateral groove 28 of rounded cross section to receive the correspondingly formed rib 27 of a piston. The edge of the vane 26 is curved to conform to the curvature of the recess 23 so that each piston is mounted to swing freely within a recess 23 as will be clearly seen from an inspection of Fig. 1. The arrangement is such that

in one position of the piston it lies completely within the periphery of the rotor, as is indicated in dotted outline in Fig. 1. In the same figure the pistons are shown in their operative or projected positions, in both instances the piston vanes 25 extending radially beyond the periphery of the rotor and substantially into engagement with the inner wall of the stator. In this position the outer face of the vane 26 is substantially flush with the surface of the rotor. The piston vanes 25 are of materially greater area than the other piston vanes 26. Live steam or other motive fluid is introduced into the engine at both sides by means of inlet conduits or pipes 29 which have threaded extremities received in correspondingly threaded openings of the heads 11. The rotor has two arcuate passages 30 which are so positioned that each, during a part of the rotation of the rotor comes into operative relation with the inlet pipe so that motive fluid can enter the passages. At one end, each of these communicates with a further passage 31 which has an outlet end in one of the cut away parts 23, so that live steam can be introduced behind the outer face of the corresponding piston vane 25. The pressure will also be exerted against the adjacent face of the vane 26 so that each piston is partially balanced. As the vanes 25 are of greater area, however, than the vanes 26, the steam will tend to force the pistons into their projected operative positions. It will be understood that when the pistons are inoperative, the vanes 25 extend over the outlet ends of the passages 31.

Secured within the stator at diametrically opposite parts thereof are two abutments 32 of substantially triangular cross section, with oppositely inclined, concave faces 33 and 34, of elliptical curvature. They are preferably not integral with the casing, and are removably secured in position by means of bolts 35 or in any other suitable manner. Each abutment has through it a passage 36 communicating with an exhaust pipe 37 and serving as an escape for the exhaust motive fluid from the casing. The abutments extend inwardly to their rotor, and are positioned closely against the same. They serve to force the pistons inwardly into inoperative positions, as the rotor revolves, as will appear hereinafter. Each of the casing heads 11 adjacent to the abutments 32 has partly arcuate passages 38 in which are arranged movable valve members 39 controlled by threaded valve stems 40, extending through suitable, threaded openings of the heads 11. Each valve has a manipulating head 41 by means of which it can be easily operated. The valve members permit the passages to be effectively controlled. These passages are so arranged that at predetermined positions of the rotor, the cut away parts 23 communicate through the passages with the space between the rotor and the casing. The purpose of this is to permit the pistons to swing freely. It will be understood that when the pistons swing outwardly, the movement will be resisted unless the cut away parts 23 are open, because the movement of the inner piston vane would tend to create a vacuum within the part 23. Consequently, the parts are so arranged that when each piston has passed an abutment 32 and live motive fluid begins to enter and exert its pressure at the back of the piston, the latter can swing into an operative position freely, as at that time the cut away part 23 communicates through a passage 38, with the space between the rotor and the stator. This cut away part is partly closed when a piston comes into engagement with an abutment, so that the movement of a piston into an inoperative position is cushioned by the exhaust fluid which is thus confined in this space or chamber 23, and partially compressed. The outward movement of the piston will also be cushioned by the partial vacuum created, and the degree of this vacuum can be regulated by means of the valve member 39 which can be moved in or out to vary the passage opening.

The operation of the engine is simple and will be readily understood. Live fluid entering between each projected piston and the corresponding abutment will cause the rotor to revolve. At the same time the exhaust steam at the front of each piston will be escaping through a corresponding exhaust outlet. As each piston comes into engagement with an abutment it will be gradually displaced into inoperative position, until it can pass the abutment, whereupon the entering live motive fluid will force it into its projected, operative position. Live motive fluid will enter during a part of the revolution of the rotor, corresponding to the length of the passage 30. This passage thus performs the function of a "cut off," which can be varied by suitably altering the length of the passage. It will be noted that the passages 38 are operative substantially during the entire part of each revolution during which the abutment 32 acts upon the piston. The passage thus serves the purpose of controlling the movement of the piston, cushioning it and preventing excessive wear of the parts. It will be seen that as soon as the elliptical portion 33 of the abutment begins to force the piston into the recess 23, the latter comes into communication with the space between the rotor and stator through the passage 38. The communication is maintained more over during the period of rotation when the elliptical portion 34 of the abutment permits the piston to be forced out, owing to the action of the live steam back of it, so that the piston

can maintain its normal, radially projected position.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent:—

1. A rotary engine comprising a stator, a rotor therein having a recess, and a movable piston mounted in said rotor and adapted to be projected therefrom into operative position, said stator and said rotor having means for introducing motive fluid into the engine, and a controllable by-pass for intermittently connecting said recess and the space between said rotor and said stator, whereby the operation of said piston can be cushioned in various degrees.

2. A rotary engine comprising a stator having a fixed abutment, a rotor mounted in said stator and having a recess, a piston movably mounted in said recess and adapted to be projected therefrom into an operative position, said stator and said rotor having passages for introducing motive fluid into the engine, said stator having a passage constituting a by-pass for intermittently connecting said rotor and the space between said recess of rotor and said stator, and a valve for controlling the flow of fluid through said by-pass whereby the operation of said piston can be cushioned in various degrees.

3. A rotary engine comprising a stator, a rotor therein and having a recess, a piston movably mounted in said recess and adapted to be projected therefrom into an operative position, and means for introducing motive fluid into said recess to project said piston, said stator having a controllable passage for effecting intermittent communication between said recess of said rotor and the space between said rotor and said stator.

4. A rotary engine comprising a stator having a fixed abutment therein, a rotor within said casing and spaced inwardly from the wall thereof, said rotor having an elemental recess, said recess being open at the periphery of said rotor, a double-vane piston mounted to swing within said recess whereby one of its vanes can be radially projected, said vanes of said piston being of different areas, said rotor having a passage communicating with said recess, means for introducing motive fluid into said passage, said stator having a passage for intermittently connecting said recess and the space between said rotor and said stator, said stator having an exhaust outlet, and an adjustable member for controlling said last-mentioned passage of said stator.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HERMAN LINDENBERG.

Witnesses:

JOHN K. BRASHORGEL,

JOHN P. DAVIS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."