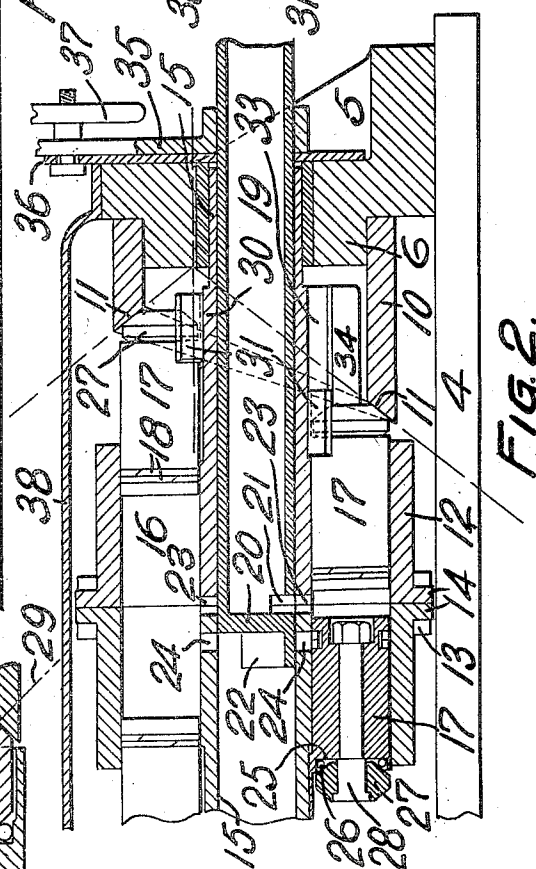
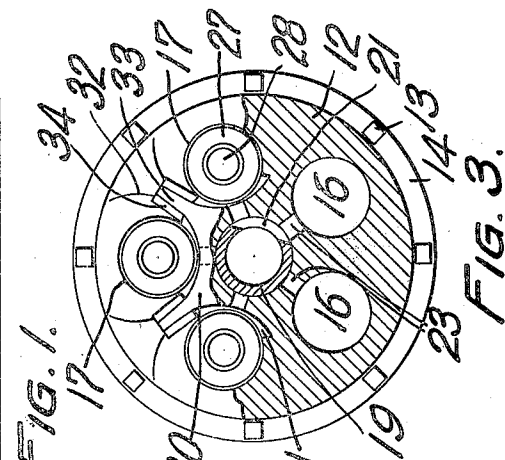
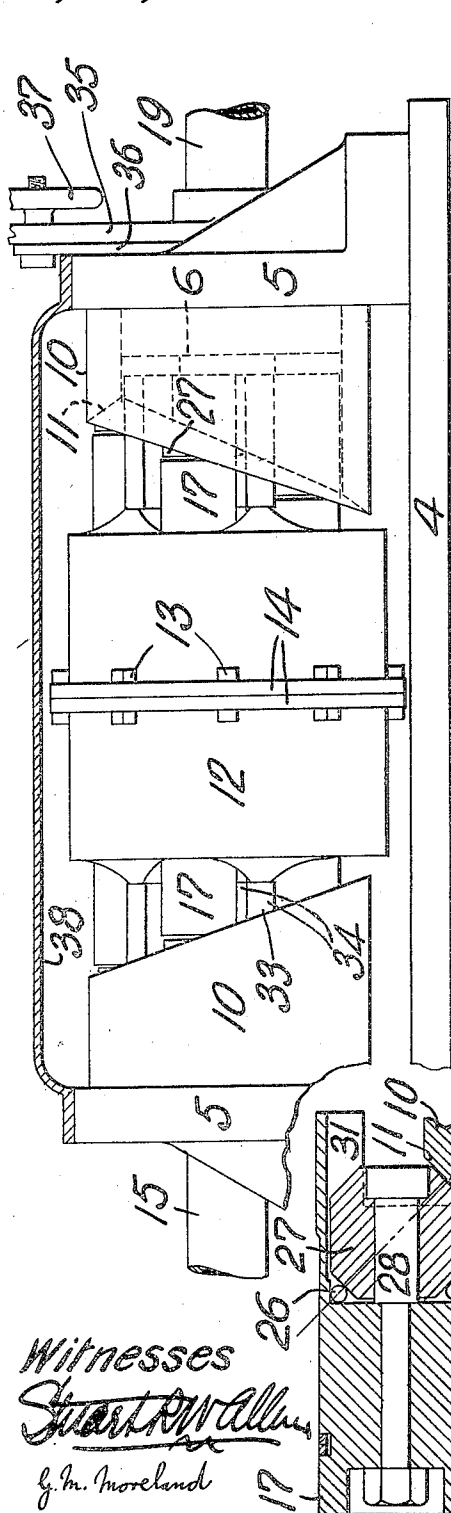


1,104,539.

Patented July 21, 1914.



Witnesses
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UNITED STATES PATENT OFFICE.

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ROTARY ENGINE.

1,104,539.

Specification of Letters Patent.

Patented July 21, 1914.

Application filed February 17, 1912. Serial No. 678,180.

To all whom it may concern:

Be it known that I, CRAVEN ROBERT ORD, of McAdam Junction, in the Province of New Brunswick and Dominion of Canada, have invented new and useful Improvements in Rotary Engines, of which the following is a full, clear, and exact description.

This invention relates broadly to improvements in rotary engines, and more particularly to that class of engines consisting essentially of a rotor carrying a plurality of pistons having their axes arranged parallel with the axis of the rotor.

The primary object of this invention is to provide an improved construction of rotary engine in which all the reciprocating parts move parallel with the axis of rotation, and in which the full expansive force of the motive fluid is transmitted to the moving pistons.

A further object is to provide improved means for counteracting the centrifugal force which tends to cause the pistons to move away from the axis of the rotor, and bear against the outer sides of the cylinders.

In the drawings which illustrate the invention:—Figure 1 is a side elevation of the engine. Fig. 2 is a partial vertical section showing the arrangement of the pistons, thrust blocks and valves. Fig. 3 is an end elevation of the rotor partly in transverse section, to show the ports. Fig. 3^a is an enlarged longitudinal section of one of the pistons and a fragment of thrust ring showing the direction of thrust.

Referring more particularly to the drawings, 4 designates a bed plate having a pillow block 5 attached to each end thereof. The adjacent faces of the pillow blocks are provided with bosses 6 on which are mounted the thrust blocks or rings 10. These rings 10 have their adjacent faces 11 inwardly sloped, the sloping face being part of an obtuse cone, that is, a cone having an angle of more than 90 degrees at the apex having its axis parallel with and eccentric to the rings 10, as is clearly shown by the broken lines in Fig. 2. The eccentric arrangement of the cone surface causes the ring 10 to be deeper at one side than at the other, as is clearly seen in the drawings.

The rotor, generally designated by the numeral 12, is in the form of a cylinder, and may for convenience be made in two or more parts and connected by bolts or the like 13 passing through flanges 14 formed on the

several parts of the rotor. This rotor is mounted on a hollow shaft 15 which is journaled in the pillow blocks 5 so as to pass concentrically through the rings 10. The rotor is provided with a plurality of bores 16 parallel with its axis with a plurality of cylinders, each of which preferably contains two pistons 17 arranged to operate in opposite ends of the cylinder. These pistons are provided with rings 18 or other suitable means for forming a fluid tight joint between themselves and the cylinder walls. The motive fluid is admitted through a pipe 19 which passes through one end of the hollow shaft 15 to the approximate center of the rotor. The inner end of this pipe is closed by a wall 20, and is provided on one side of its diameter with a port 21 through which the motive fluid escapes from the pipe. Beyond the wall 20, the pipe is provided on the opposite side of its diameter with a similar port 22, through which the motive fluid is exhausted from the cylinders and escapes through that end of the hollow shaft not occupied by the pipe 19. The ports 23 and 24 respectively are cut radially from the bore of the shaft into each cylinder 16. The ports 23 are preferably centered in a vertical plane which bisects the rotor transversely, while the ports 24 are located in a parallel plane a short distance away from the ports 23. The ports 21 and 22 of the fluid pipe 19 extend through preferably less than half the circumference of the pipe so as to communicate with only a predetermined number of the cylinders at a time, as will be clearly understood from an examination of Figs. 2 and 3, and a perusal of my former U. S. Patent #968,969, dated August 30th, 1910. A further and very important reason for forming these ports through less than half the circumference of the pipe 19 is that there may be a dead space between the ports, that is to say, a space opposite which the ports 23 and 24 will be connected neither to the inlet port 21 nor to the exhaust port 22. The reason for this will be fully explained hereafter.

The outer ends of the pistons 17 are recessed as shown at 25 so as to form a race way for the balls 26 of a bearing. These outer ends of the pistons are provided with rings or rollers 27 journaled on pins 28 secured to the pistons. These rings 27 are double frusto-conical in form, the angular slope of the conical faces being the same as

the slope of the faces 11 of the thrust rings 10. These rings 27 bear against the balls 26 so that they rotate on the pistons with practically no friction, and at the same time travel on the thrust rings 10 so that friction between the pistons and thrust rings is reduced to a minimum.

To further hold the pistons in proper alinement, the ends of the rotor are provided with guides 30 engaging cross heads 31 formed on the outer ends of the pistons. The cross heads furthermore operate to hold the pistons against revolution in the cylinders, which revolution is known in the engineering world to be detrimental to a perfect fit between piston and cylinder. These cross heads and guides may be of any suitable form. At the present time, the preferred method of forming the same is to make a counter bore, indicated at 32, of suitable larger diameter than the cylinder and eccentric thereto. The ribs 33 of material between the counter bores are provided with guide bars 34 which engage the edges of the cross heads 31 and hold the same in the guides. The cross heads are formed with the same curvature as the guides. It is obvious that numerous changes may be made in the shape of these guides without in any way departing from the spirit of the invention.

The pipe 19 in addition to forming the motive fluid inlet forms a valve, and is therefore a means for reversing the engine. To effect this reversal, the pipe 19 which is normally stationary is provided with a shifting lever 35 operating over a quadrant 36. A suitable locking device 37 is provided to hold the lever in any position to which it is set.

The rotor and thrust rings are entirely inclosed by a casing 38.

The operation of the engine is very simple and will be readily understood. Assuming the pipe or valve 19 to be in the position shown in Fig. 2, when the motive fluid is admitted it flows through the ports 21 and 23 between the pistons 17 in the lower part of the cylinder, these pistons being in their inward positions, as clearly seen in the figure. The expansive force of the fluid tends to separate the pistons, and this outward movement of the pistons is by reason of the sloping faces 11 of the thrust rings of cams 10 transformed into rotary motion, so that the rotor is caused to rotate. This rotation brings the next cylinder in line with the port 21 so that the motive fluid is admitted between the pistons thereof. As the rotor moves, the port 23 of the first cylinder is carried past the port 21 so that the admission of the motive fluid is cut off, and the expansion of the fluid already imprisoned between the pistons continues to force them apart, until at approximately the

time that the cam surfaces 11 commence to drive the pistons toward each other, the port 24 comes opposite the exhaust port 22 of the valve and the fluid is allowed to escape or is driven out by the approaching pistons. Shortly before the pistons reach their limit of inward movement, one of them closes the exhaust port 24. At the time of this closure the dead space between the inlet and exhaust ports of the valve previously referred to is in register with the inlet port 23. In this way a certain amount of steam is imprisoned between the pistons and is slightly compressed by the completion of the inward movement of the pistons, so as to form the cushion which has been found to be essential in practically all types of fluid motors. The compression formed by this cushion is sufficient to hold the ring 27 of the piston in engagement with the thrust ring 10. If this engagement were not maintained and the piston were allowed to disengage from the ring, the sudden admission of steam would drive the pistons outwardly with such force that a very heavy blow would be delivered to the thrust rings. As this blow would invariably occur at the same point, a depression would rapidly become worn in the thrust ring. This fact has been amply demonstrated by experiment. It is believed that heretofore in this type of engine, this condition has not been foreseen, or if its occurrence was noted the use of a cushion of the motive fluid to prevent the pistons leaving the thrust members has not been thought of. The size of the ports 21 and 22 may be made as desired so as to supply any number of cylinders at the same time, or to supply only one cylinder. To reverse the engine, the lever 35 is thrown to upright position so that the tube 19 is rotated until the port 21 admits motive fluid equally on both sides of the vertical center. If the lever is left in this position, the pressure will hold the rotor motionless and in equilibrium. If the movement is continued and the lever thrown over so that the valve tube 19 is rotated sufficiently to bring the ports 21 and 22 on the opposite sides of the rotor, the fluid is admitted on the opposite side, and the engine will start itself in the reverse direction.

Having thus described my invention, what I claim is:—

1. A device of the character described comprising a rotor, containing a plurality of bores forming cylinders and a plurality of counter bores of larger diameter than said cylinders, pistons adapted to reciprocate in said cylinders, cross heads on the ends of said pistons, ribs between said counter bores having guide bars thereon engaging said cross head, and thrust members engaging said pistons.

2. In a device of the character described, a rotor, a thrust block having the thrust sur-

face thereof in the form of a truncated cone, the axis of which is parallel and eccentric to the axis of the rotor, and pistons in said rotor engaging said conical thrust surface.

5 3. A device of the character described comprising a rotor, containing a plurality of cylinders located axially parallel therewith, pistons reciprocating in said cylinders, thrust members adjacent the ends of the
10 rotor, a conical roller mounted on each piston engaging said thrust members, a ball bearing between said roller and piston,

guides extending from the ends of the rotor, and cross heads on the pistons engaging said guides and arranged to receive the resultant 15 force from the piston and conical thrust surface, and to impart turning motion to the rotor.

In witness whereof I have hereunto set my hand in the presence of two witnesses. 20
CRAVEN ROBERT ORD.

Witnesses:

L. G. SPEEDY,
H. A. THOMAS.

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