I. ALFORD.

ROTARY ENGINE.

APPLICATION FILED NOV. 15, 1911.

1,033,514.

Patented July 23, 1912.

3 SHEETS—SHEET 1.

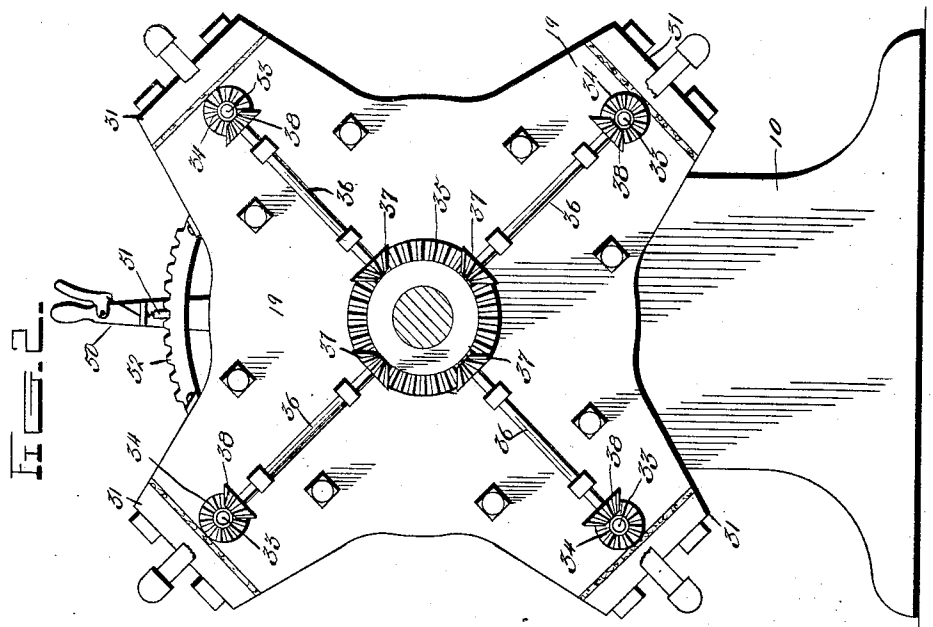

FIG. 2.

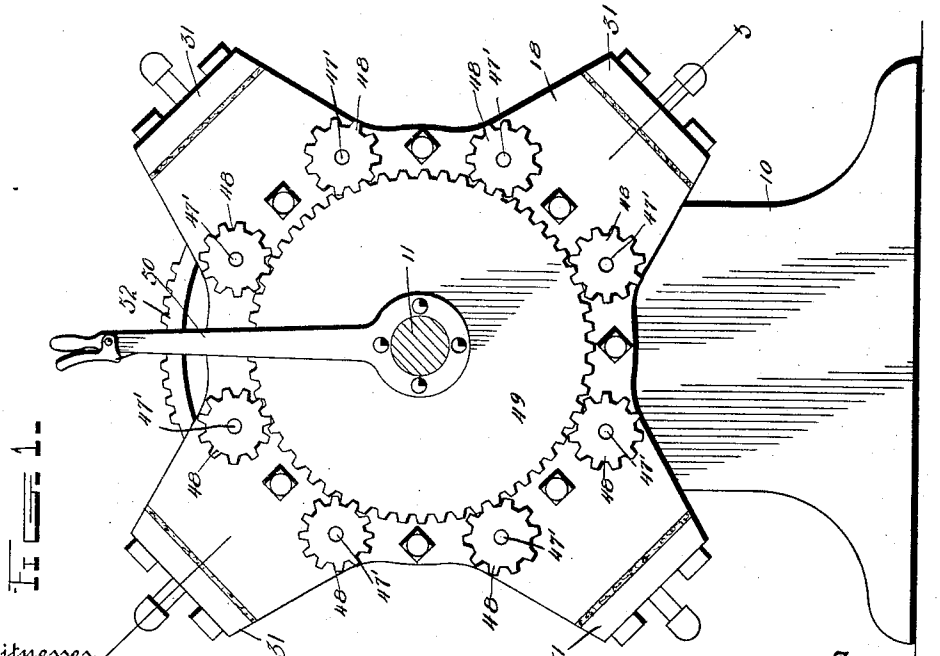

FIG. 1.

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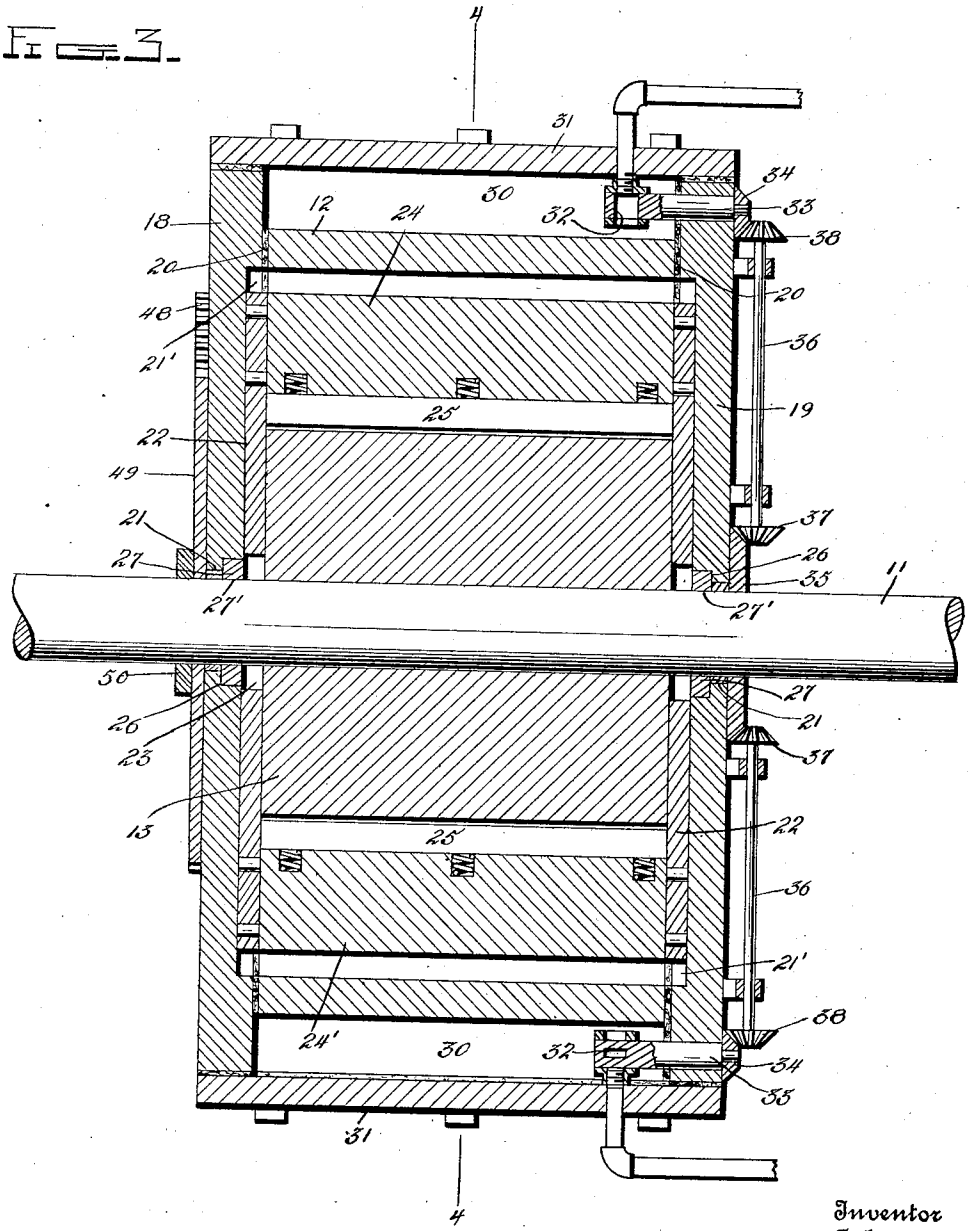
3 SHEETS—SHEET 2.

Fig. 3.



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3 SHEETS—SHEET 3.

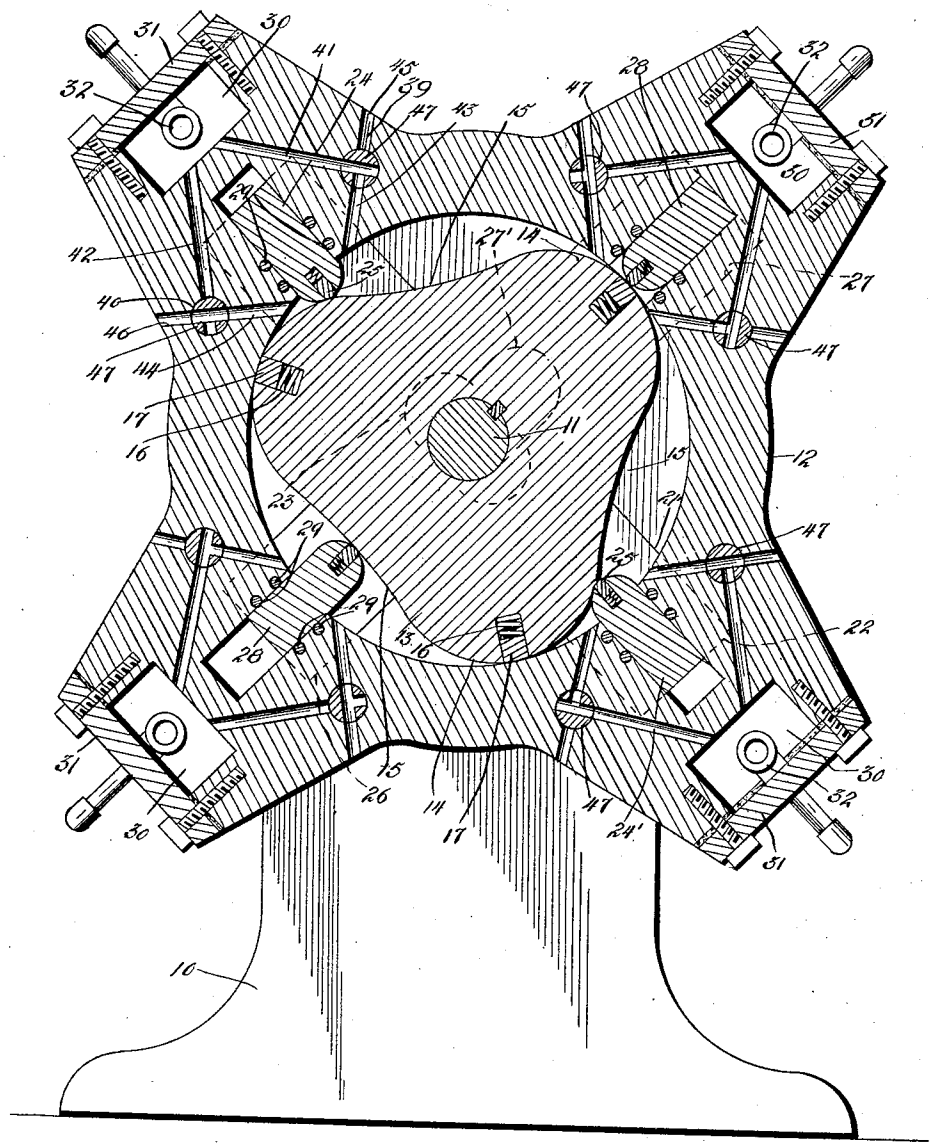

FIG. 4.

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ROTARY ENGINE.

1,033,514. Specification of Letters Patent. Patented July 23, 1912.

Application filed November 15, 1911. Serial No. 660,477.

To all whom it may concern:

Be it known that I, ISAAC ALFORD, a citizen of the United States, residing at Peru, in the county of Chautauqua, State of Kansas, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to new and useful improvements in fluid pressure engines and more especially to rotary engines in which the piston is keyed upon and rotates the shaft by which the power generated by the engine is supplied and the object of my invention is to improve the construction and increase the efficiency of engines of the above described type.

A further object of my invention is the provision of a rotary engine in which the piston is acted upon by the power generating fluid at opposite points and in such a manner that the engine may be readily reversed. To accomplish this I provide a cylinder having a plurality of ports arranged in spaced pairs, one port of each pair being adapted to act as an exhaust port for one direction of the engine and as an inlet port when the engine is reversed, while the other port acts as an inlet port for the forward rotation of the engine and as an exhaust port when the engine is reversed. I also provide a piston having a plurality of heads and a corresponding plurality of intermediate recesses or fluid receiving pockets. The cylinder is provided between the ports of each pair of ports with a radially movable abutment adapted at all times to bear against the working face of the piston and a further object of my invention is therefore to provide means whereby said abutments will be moved radially by the direct action of the piston upon them without the intercession of tension springs or gearing hitherto employed.

With these and other objects in view, my invention will be more fully described, illustrated in the accompanying drawings which show a preferred embodiment of my device and then specifically pointed out in the claims which are attached to and form a part of my invention.

In the drawings, Figure 1 is a front elevation of my engine. Fig. 2 is a rear elevation. Fig. 3 is a longitudinal section on the line 3—3 of Fig. 1. Fig. 4 is a transverse section on the line 4—4 of Fig. 3.

Referring more specifically to the drawings, in which similar reference numerals designate corresponding parts throughout, 10 designates the base or support of my engine which is preferably formed of metal and upon which is mounted the cylinder 12 through which extends the rotatable shaft 11 which extends longitudinally through the cylinder 12 and upon which is keyed the piston 13. As best shown in Fig. 4 this piston is of a type commonly met with in engines of this character having three heads 14 and three intermediate recesses or fluid receiving pockets 15, the outer periphery of said piston being so formed that the diameter of the piston taken anywhere through its center of rotation is constant while the length of the radii is different at different points. The piston is so proportioned that its heads engage closely against the inner face of the cylinder and in order to insure a fluid proof joint between said heads and the cylinder I have provided each of the heads with a longitudinally extending channel 16 in which is seated a spring pressed packing bar 17 which is pressed outwardly by its springs to constantly engage with the inner face of the cylinder.

The cylinder comprises the cylinder body proper 12 and the cylinder heads 18 and 19 which are firmly bolted to the body, suitable packing rings 20 being interposed to form a fluid proof joint. Each of the cylinder heads 18 and 19 is provided with a fluid proof bearing 21 in which the shaft 11 is journaled and each head is provided with a diametrically extending slot 21′ in which is slidably mounted a slide 22, said slides being provided centrally with longitudinally extending slots 23 through which the shaft passes, whereby the slides are free to reciprocate in the slots. These slides extend in parallel spaced relation to each other and are connected at their ends by metallic abutments 24 and 24′ the inner faces of which extend in parallel spaced relation and at a distance apart equal to the diameter of the piston whereby they closely engage against the peripheral face of the same at all times, each of the abutments being provided with a spring pressed packing bar 25 to insure a close bearing between the two. As shown the cylinder is thickened opposite each of these abutments and is recessed to receive

either of the abutments as it is forced outwardly by the action of the piston. The slides 23 have their inner faces flush with the inner faces of the cylinder heads and therefore coact with the latter to form an uninterrupted bearing surface for the ends of the piston. Each cylinder head is further provided with a second slot 26 which extends at right angles to the slot 21 and between said slot and the outer face of the cylinder head, said latter slots at their outer ends opening inwardly through the cylinder heads, and slidably mounted in these slots are slides 27 similar to the slides 22 and slotted as at 27′ for the passage of the shaft 11. The ends of the slides 27 are joined by abutments 28 and 28′ similar to the abutments 24 and 24′ and the cylinder adjacent said abutments is also thickened and recessed to receive either abutment as it is forced outwardly. As will be readily seen each of the above described abutments will constantly engage against the peripheral face of the piston, the outward forcing of any one of the abutments under pressure of one of the pistons causing the reciprocation of its slides and the consequent inward movement of the opposite abutment. The recessed portions of the cylinder through which the abutments move are provided with roller bearings 29 which bear upon either side of each of the abutments and which not only serve to prevent the abutments from binding in their passage through the recesses but also form a fluid proof bearing between the two. Each of the thickened portions of the cylinder is provided with a fluid receiving chest 30 which is closed by a cap 31 and the operating fluid is admitted to each chest through a valve 32 of the turn plug type, the operating stem 33 of which extends outwardly beyond one end of the cylinder and is provided with a bevel gear 34. The shaft 11 is provided with a bevel gear 35 and a shaft 36 provided at each end with bevel gears 37 and 38 are journaled in suitable bearings carried by the cylinder head 19, their gears 37 meshing with the gear 35 and their gears 38 meshing with the gears 34 of the valve, said gears being so proportioned that the valves are turned three times for one rotation of the shaft 11.

Positioned one upon each side of each of the fluid chests 30 are valve chambers 39 and 40, said valve chambers being connected with the chests by passages 41 and 42 respectively, with the bore of the cylinder by passages 43 and 44 respectively and with the outer air by passages 45 and 46 respectively. Positioned in each of these valve chambers is a three-way valve 47 by means of which communication may be made either between the cylinder and the chest or between the cylinder and the outer air. By this means either valve may act as an inlet valve or as an exhaust valve as demanded by circumstances. The valve stems 47′ of the valves 47 are extended beyond the forward end of the cylinder and are provided with gears 48 which mesh with a gear 49 which is rotatably mounted upon the shaft 11 and which is provided with a hand lever 50 having a spring pressed pawl 51 adapted to engage with the teeth of a sector rack 52. As will be readily seen the gear 49 may be swung by means of the lever to open and close the valves 47 and each pair of valves 47 is so arranged that when one is open the other will be closed. Because of this one of each pair of said valves may be used as an inlet valve while the other is employed as an outlet or exhaust valve. The passages 43 communicate with the cylinder upon one side of the abutments while the passages 44 communicate with the cylinder upon the opposite side of the abutment and it therefore follows that when one set of the valves 47 are employed as inlet valves the piston will rotate in one direction and that when the other set of the valves 47 is employed as inlet valves the piston will be driven in the opposite direction. The engine therefore can be readily reversed by a swinging of the hand lever 50. Each of the valves 32 is so arranged with respect to the piston that it may be opened immediately after the passing of one of the piston heads beyond its corresponding abutment and will be closed immediately after said piston head passes the next adjacent abutment.

In operation suppose the piston in the position shown in Fig. 4 of the drawings and to be rotated in the direction of the arrow, then the passages 44 are acting as inlet ports while the passages 43 are acting as exhaust ports. The valve 32 adjacent the abutment 28 is about to open, the valve adjacent the abutment 28′ is fully opened, the valve adjacent the abutment 24 is about to close and the valve adjacent the abutment 24′ is open. It will thus be seen that pressure is constantly applied to two adjacent pockets of the piston simultaneously, thus doing away with all dead centers and permitting the ready starting of the engine irrespective of the position of the piston. When it is desired to reverse the engine the valves 32 are reversed by means of the hand lever, when the valves 47, which were previously the exhaust valves become the inlet valves, and those which were previously the inlet valves become the exhaust valves, the piston therefore being revolved in the opposite direction.

It will thus be apparent that I have provided an extremely simple and efficient form of fluid pressure engine of the rotary type and one in which all dead centers are avoided. It will further be apparent that I have provided means for readily reversing

the engine, said means utilizing the inlet valves as exhaust valves when the engine is reversed and the exhaust valves as inlet valves. I have also provided means for actuating the abutments to constantly maintain them in active position, said means not requiring the use of springs or of gearing such as is commonly employed for this purpose.

It will of course be understood that minor changes in details of construction may be made if desired without departing from the spirit of my invention in the slightest degree.

What I claim is:—

1. A rotary engine, a cylinder having a plurality of spaced fluid chests and a pair of valve chambers adjacent each of said chests, each of said valve chambers communicating respectively with its fluid chest, the cylinder bore, and the atmosphere, three-way valves in said valve chambers, a multiple headed piston in the cylinder bore, a plurality of abutments bearing against said piston and mounted for radial movement, each of said three-way valves having a valve stem, gears carried by said valve stems, a gear mounted for rotation and meshing with said valve stem gears, means for manually rotating said latter gear, supply valves for said fluid chests, and means operable by the piston for opening and closing said supply valve.

2. In a rotary engine, a cylinder having a plurality of spaced fluid chests and a pair of valve chambers adjacent each of said chests, each of said valve chambers communicating respectively with its fluid chest, the cylinder bore, and the atmosphere, three-way valves in said valve chambers, means for actuating all of said three-way valves simultaneously, a multiple headed piston in the cylinder bore, a plurality of abutments bearing against said piston and mounted for radial movement, supply valves for said fluid chests, valve stems for said supply valves, bevel gears carried by said valve stems, a bevel gear rotatable by the piston, and means coacting between said latter bevel gear and the bevel gears of the valve stems to open and close said supply valves.

3. In a rotary engine, a multiple headed piston, a cylinder for said piston having a plurality of diametrically opposed spaced apart pairs of fluid chests, a plurality of abutments bearing against said piston and mounted for radial movement toward and away from said chests, cylinder heads for said cylinder, a plurality of slides reciprocally mounted in said cylinder heads and extending diametrically thereof, each of said slides having its ends secured to diametrically disposed abutments whereby outward movement of one abutment will cause inward movement of the opposed abutment, a plurality of valve chambers formed in said cylinder one adjacent each side of each abutment, each of said valve chambers communicating with a fluid chest, the cylinder bore, and the atmosphere, three-way valves in said valve chambers, means for actuating all of said three-way valves simultaneously, supply valves for said fluid chests, and means operable by the piston for opening and closing said supply valves.

In testimony whereof, I affix my signature, in presence of two witnesses.

ISAAC ALFORD.

Witnesses:
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R. C. Adams.