No. 630,693. Patented Aug. 8, 1899.

# J. T. HAYS & G. L. DEPUY.

## ROTARY ENGINE.

(Application filed July 22, 1898.)

(No Model.)

FIG. 1.

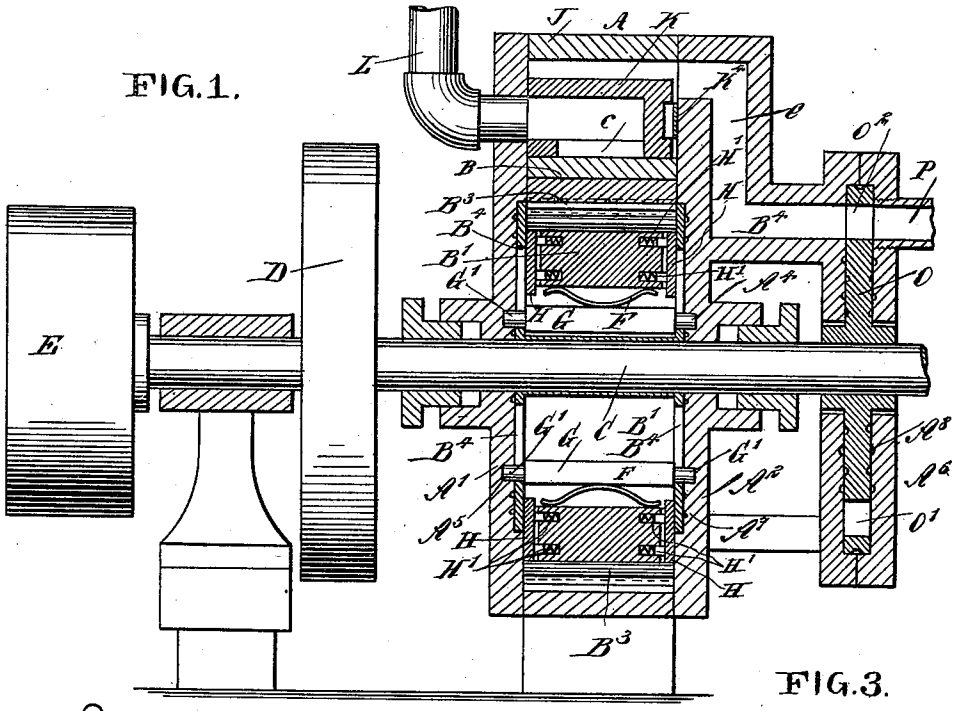


FIG. 3.

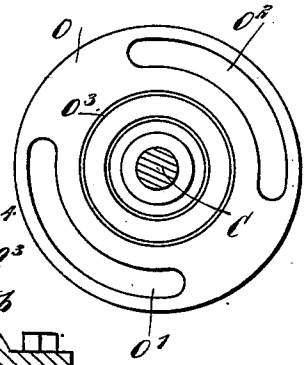
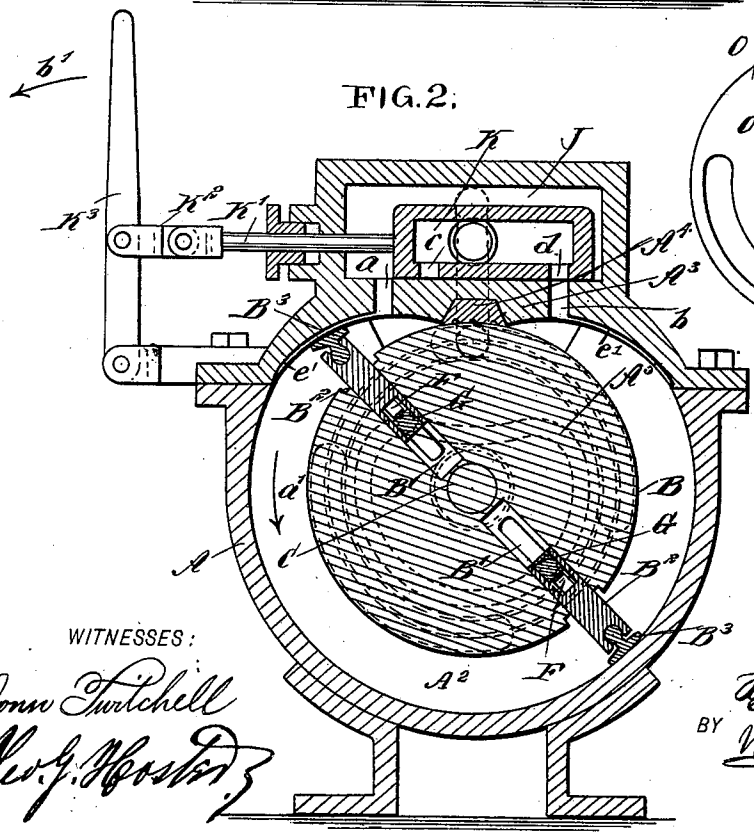


FIG. 2.



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# UNITED STATES PATENT OFFICE.

JAMES THOMAS HAYS AND GILBERT LEFEVRE DEPUY, OF GARLAND, TEXAS, ASSIGNORS OF ONE-FIFTH TO THOMAS SLATER WALKER, OF DALLAS COUNTY, TEXAS.

## ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 630,693, dated August 8, 1899.

Application filed July 22, 1898. Serial No. 686,597. (No model.)

*To all whom it may concern:*

Be it known that we, JAMES THOMAS HAYS and GILBERT LEFEVRE DEPUY, of Garland, in the county of Dallas and State of Texas, have invented a new and Improved Rotary Engine, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved rotary engine which is simple and durable in construction, very effective in operation, and arranged to utilize the motive agent to the fullest advantage.

The invention consists of novel features and parts and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a longitudinal sectional elevation of the improvement. Fig. 2 is a transverse section of the same, and Fig. 3 is a face view of the cut-off valve.

The improved engine is provided with a cylinder A, in which is mounted to turn a piston B, secured on a shaft C, mounted to rotate in suitable bearings held in the cylinder-heads A' $A^2$, as is plainly illustrated in Fig. 1. On the shaft C is secured a fly-wheel D and a pulley E, to be connected by belt with other machinery for transmitting the rotary motion imparted to the piston B, as hereinafter more fully described.

The piston B is concentric to the cylinder A, the peripheral surface of the piston coming in contact with a packing $A^4$, held in an abutment $A^3$, preferably formed at the top of the cylinder, as is plainly indicated in Fig. 2. In the piston B are formed diametrically opposite slots B', in which are fitted to slide the piston-heads $B^2$, each carrying at its outer end a block $B^3$, engaging the inner surface of the cylinder A and that of the packing $A^4$ when passing the abutment. The block $B^3$ is mounted to rock in the end of the piston-head $B^2$, so as to readily accommodate itself to the shape of the abutment $A^3$ when passing from the concentric surface of the cylinder to and over the curved surface of the abutment, as will be readily understood by reference to Fig. 2. The piston-head $B^2$ is pressed outward to hold the block $B^3$ in frictional contact with the inner surface of the cylinder, as described, by means of a spring F, resting on a bar G, formed at its ends with trunnions G', extending through radial slots $B^4$, formed in the piston B, into cam-grooves $A^5$, formed on the inner faces of the cylinder-heads A' and $A^2$, so that when the piston B is turned the piston-heads are moved inward and outward to hold their blocks $B^3$ in frictional contact with the inner surface of the cylinder and the abutment thereof. By having a yielding connection between the bars G and the piston-heads it is evident that the latter can readily yield to insure an easy passage of the blocks over the inner surface of the abutment and at the same time produce a sufficiently tight joint between the contacting surfaces to prevent leakage of steam from one side of the piston-head to the other.

Each piston-head $B^2$ is provided on its sides with packing-strips H, pressed in contact with the sides of the piston B by springs H', set in the corresponding head $B^2$, (see Fig. 1,) it being understood that the packing-plates are held in position on the piston-heads by pins engaging the recesses containing the springs H', as will be readily understood by reference to Fig. 1.

Into the cylinder A and on opposite sides of the abutment $A^3$ open the ports *a* and *b*, leading from a steam-chest J, secured to or formed on the cylinder above the abutment. A slide-valve K is fitted to slide in the steam-chest J and has its valve-stem K' connected by a link $K^2$ with a hand-lever $K^3$ under the control of the operator for shifting the slide-valve K to reverse the engine, as hereinafter more fully described. The slide-valve K is formed in its bottom with ports *c* and *d*, adapted to register with the ports *a* and *b*, respectively, for forming the exhaust, it being understood that only one port is in register at a time with the corresponding cylinder-port. Thus, as shown in Fig. 2, the port *c* is cut off from the port *a*, which latter is now the steam-inlet

port, while the other ports *b* and *d* are in register with each other and form the exhaust-ports. One inner side of the slide-valve K opens at all times into an exhaust-pipe L, so that the exhaust-steam passing from the cylinder into the slide-valve can readily escape through said exhaust-pipe L. A spring $K^4$ presses on the slide-valve K to hold its open side in firm contact with the head A', carrying the exhaust-pipe L. Steam is thus prevented from leaking from the steam-chest into the valve, or vice versa.

Into the steam-chest J opens a channel *e*, registering at intervals with segmental slots or ports $O' O^2$, formed in a rotary cut-off valve O, secured to the main shaft C and revolving in a casing $A^6$, formed or secured on the head $A^2$ of the cylinder. A steam-supply pipe P opens into the casing $A^6$ directly opposite the channel *e*, so that when the cut-off valve O registers with one of its ports O' or $O^2$ with the channel *e* and the pipe P then live steam can pass into the steam-chest J and from the latter through the open ports *a* or *b* into the corresponding side of the cylinder.

Now when the several parts are in the position illustrated in the drawings live steam passes from the steam-supply pipe through the port $O^2$ into the channel *e* and to the steam-chest J, from which steam passes to the port *a* into the cylinder at the left-hand side of the abutment $A^3$. The steam thus passing in the cylinder acts on the piston-head $B^2$ in front of the port *a* to turn the piston B in the direction of the arrow *a'*, the live steam being cut off at the time this piston-head reaches a lowermost position, as then the port $O^2$ is out of register with the pipe P and the channel *e*. The other piston-head $B^2$ now passes the abutment $A^3$ and the port *a*, and when this has taken place the port O' commences to register with the pipe P and channel *e* to again supply the steam-chest J with live steam. A second impulse is now given to the piston B in the direction of the arrow *a'* by the steam acting on the second piston-head $B^2$.

One or more grooves *e'* may be formed in the curved inner surface of the abutment-piece $A^3$ at each side of the packing-block $A^4$ to transmit a limited quantity of live steam to the side of the piston $B^2$ that is nearest the arrow *a'* in Fig. 2, and thus increase pressure of the expanding steam that will act on the nearest face of the other piston-head $B^2$.

When it is desired to reverse the engine, the operator moves the hand-lever $K^3$ in the direction of the arrow *b'*, (see Fig. 2,) so as to connect the port *a* with the port *c* to form the exhaust, while the port *d* is cut off from the port *b* and the latter opens into the steam-chest J. Live steam can now pass from the chest J into the cylinder at the right-hand side of the abutment $A^3$, and the steam pressing on the corresponding piston-head turns the piston in the inverse direction of the arrow *a'*.

In order to prevent leakage of steam between the cylinder-heads and the piston, the inner faces of the cylinder-heads are provided with annular grooves $A^7$, adapted to receive the water of condensation to prevent leakage of steam. A similar arrangement is in the casing $A^6$ for providing opposite faces thereof with annular grooves $A^8$, and like grooves $O^3$ are formed in the faces of the cut-off valve O. As the grooves fill with water of condensation they form a packing for preventing the escape of steam.

It is evident that the steam-spaces below the abutment $A^3$ may be changed in area by increasing or decreasing the curvature of the inner face of said abutment. Furthermore, the grooves $A^7$ may be proportioned to suit the requirements of service, and thus insure efficiency in operation of the engine as relates to water packing the piston at each side thereof.

Having thus fully described our invention, we claim as new and desire to secure by Letters Patent—

1. A rotary engine comprising a cylinder having a fixed abutment, a piston mounted to turn concentrically therein and having peripheral contact with the abutment, piston-heads fitted to slide in the said piston, trunnion-bars having yielding connection with the piston-heads and engaging cam-grooves on the heads of the said cylinder, a steam-chest connected by ports with the cylinder on opposite sides of the abutment, a reversing-valve in the steam-chest and a rotary cut-off valve secured on the piston-shaft and controlling the supply of live steam to the steam-chest, substantially as shown and described.

2. A rotary engine comprising a cylinder having a fixed abutment, a piston mounted to turn concentrically therein and having peripheral contact with the abutment, piston-heads fitted to slide in the said piston, trunnion-bars having yielding connection with the piston-heads and engaging cam-grooves on the heads of the said cylinder, a steam-chest on the cylinder above the abutment connected by ports with said cylinder on opposite sides of said abutment, a reversing-valve in said steam-chest and under the control of the operator, and a valve for regulating the supply of steam to the steam-chest, substantially as shown and described.

3. A rotary engine, comprising a cylinder having a fixed abutment, a piston mounted to turn concentrically in the cylinder and contacting with the abutment, piston-heads sliding in the piston and having on their outer ends blocks mounted to rock, trunnion-bars having yielding connection with the piston-heads and working in grooves in the cylinder-heads, a steam-chest connected by ports with the cylinder on opposite sides of the abutment, a sliding reversing-valve in the steam-chest and provided with ports in its bottom, said valve being always in communication with the exhaust-pipe, a valve-casing through which the piston-shaft projects, a connection between the said valve-casing and the steam-

chest, and a rotary valve mounted in the said valve-casing on the piston-shaft and provided with segmental slots or ports, substantially as described.

4. A rotary engine comprising a cylinder having a fixed abutment, a piston mounted to turn concentrically in the cylinder and contacting with the abutment, sliding piston-heads mounted in the piston, a steam-chest connected with the cylinder by ports on opposite sides of the abutment, a sliding reversing-valve in the steam-chest and provided with two ports in its bottom, said valve being at all times in communication with the exhaust-pipe, a valve-casing secured to one head of the cylinder and connected with the steam-chest, and a rotary valve mounted on the piston-shaft in the said casing and provided with segmental slots or ports, substantially as described.

5. In a rotary engine, the combination with a cylinder having a fixed abutment, and ports, one on each side of the abutment, a piston mounted to turn concentrically in the cylinder, and sliding piston-heads mounted in the piston, of a steam-chest above the ports of the cylinder, an exhaust-pipe connected with the steam-chest, a hollow slide-valve in the steam-chest and provided with two ports in its bottom, and with an opening in the side next to the side of the chest into which the exhaust-pipe opens, and a spring for holding the valve in contact with the side of the steam-chest carrying the exhaust-pipe, substantially as described.

6. In a rotary engine, the combination of a cylinder provided with a fixed abutment, ports leading from the cylinder on opposite sides of the abutment, and grooves on the inner surface and leading from the said ports, a rotary piston in the cylinder, and provided with sliding piston-heads, a steam-chest on the cylinder, a hollow reversing-valve in said chest having one side communicating with the exhaust and provided with ports in its bottom adapted to alternately register with the ports of the cylinder, and cut-off valve for regulating the supply of steam to the steam-chest, substantially as described.

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