No. 615,664. Patented Dec. 6, 1898.

# D. M. DEARING.

## ROTARY ENGINE.

(Application filed Apr. 22, 1897.)

(No Model.) 2 Sheets—Sheet 1.

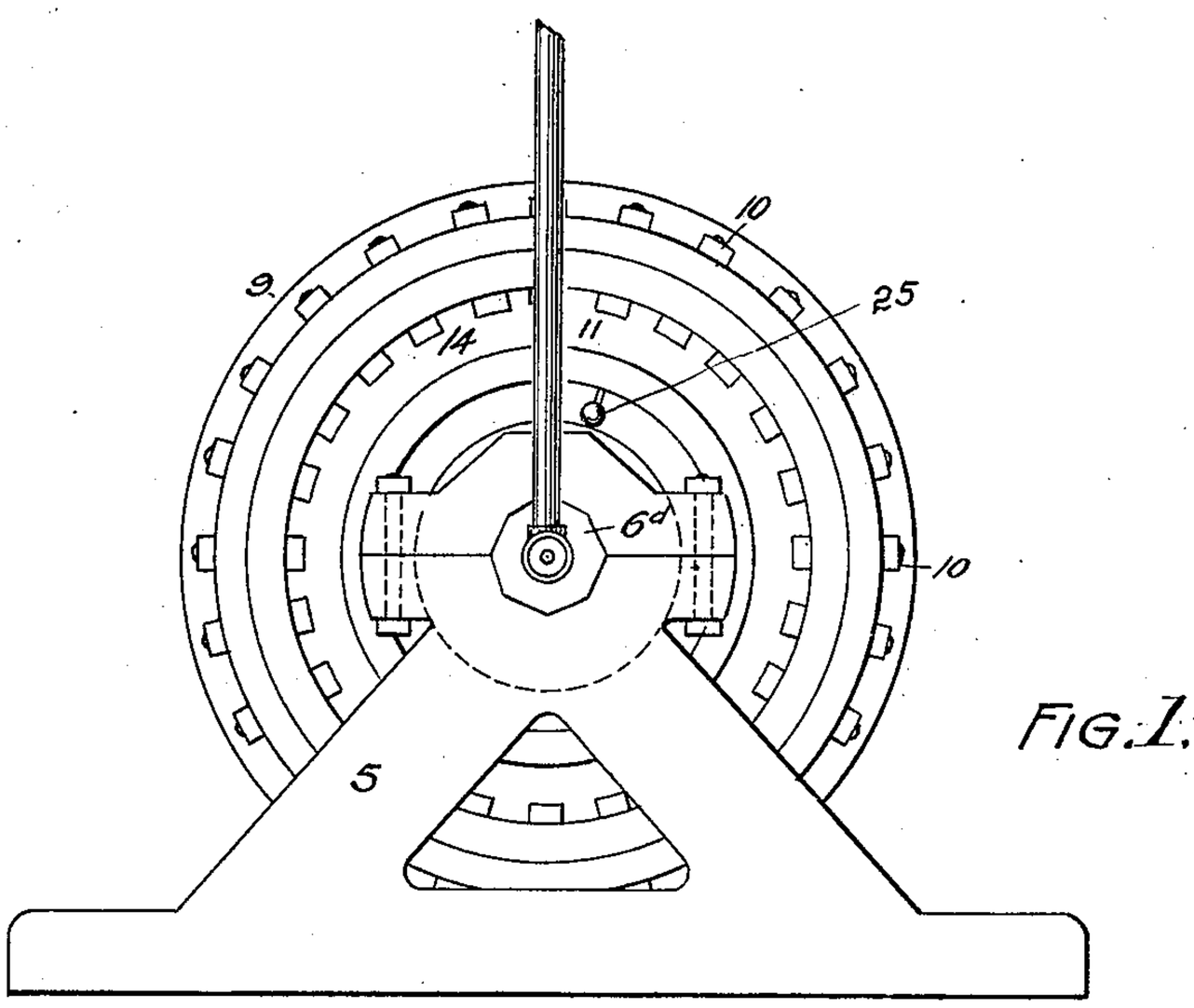


FIG. I.

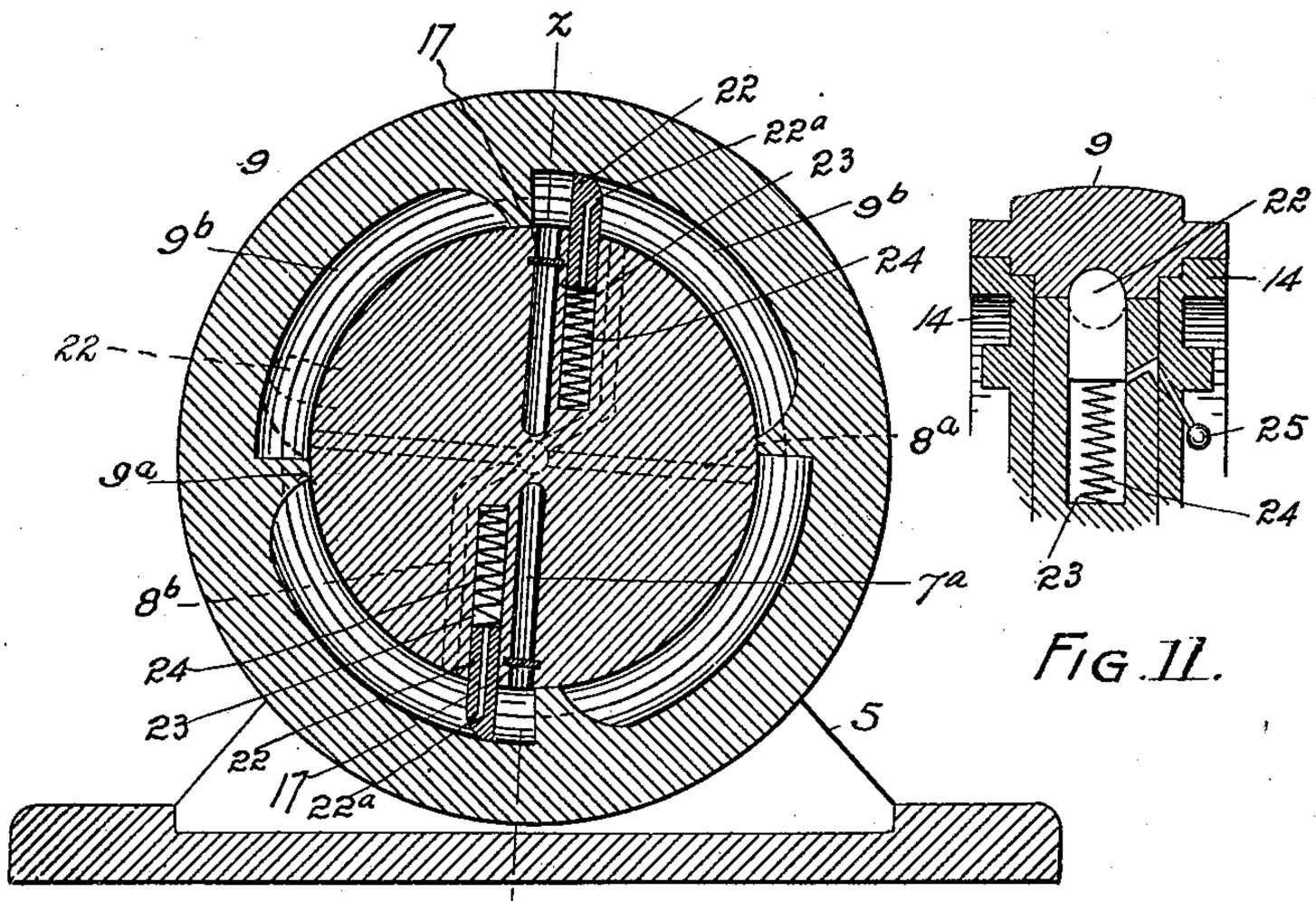


FIG. 2.




FIG. II.

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No. 615,664. Patented Dec. 6, 1898

# D. M. DEARING.

## ROTARY ENGINE.

(Application filed Apr. 22, 1897.)

(No Model.) 4 Sheets—Sheet 2.

FIG. 3.

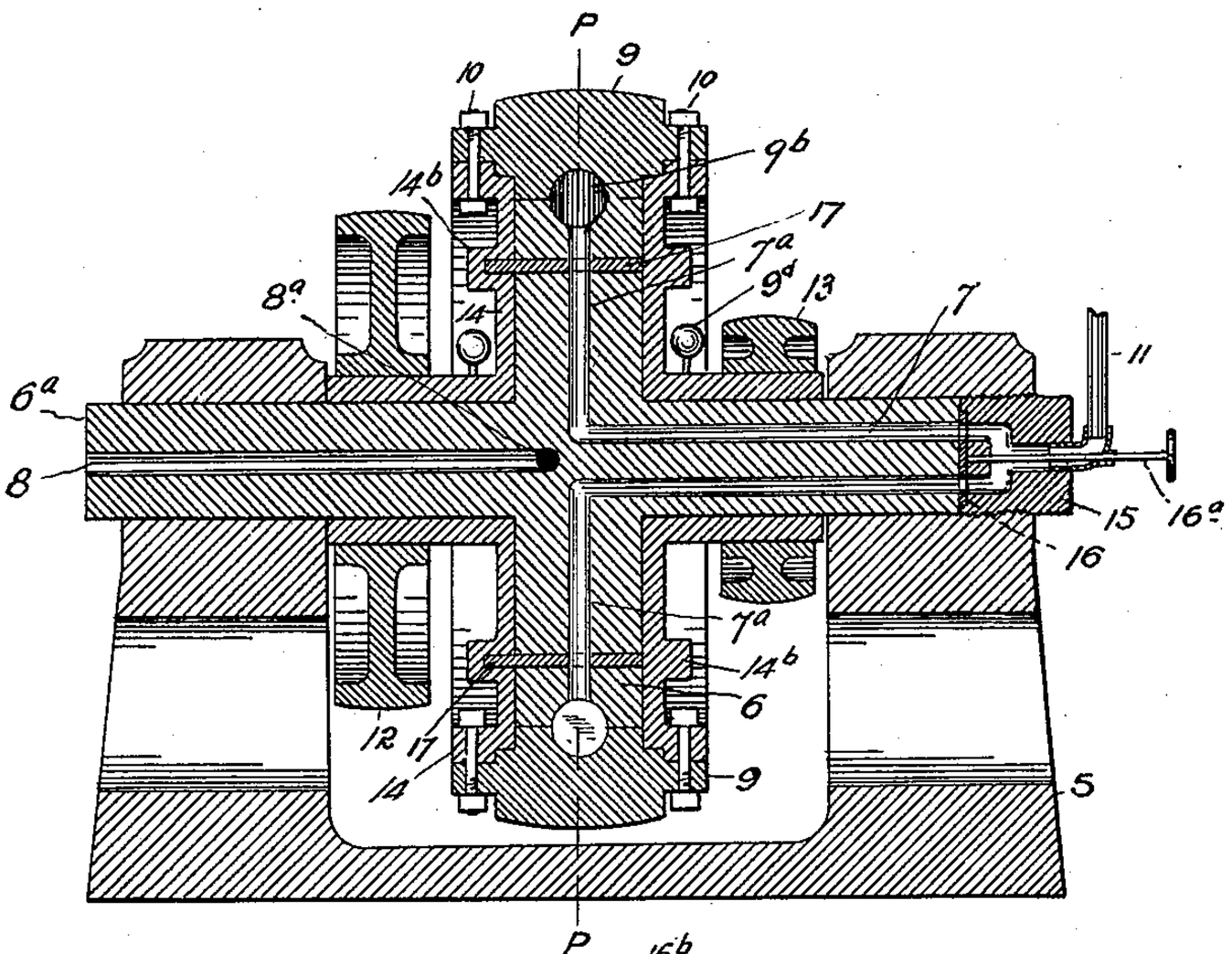



FIG. 5.

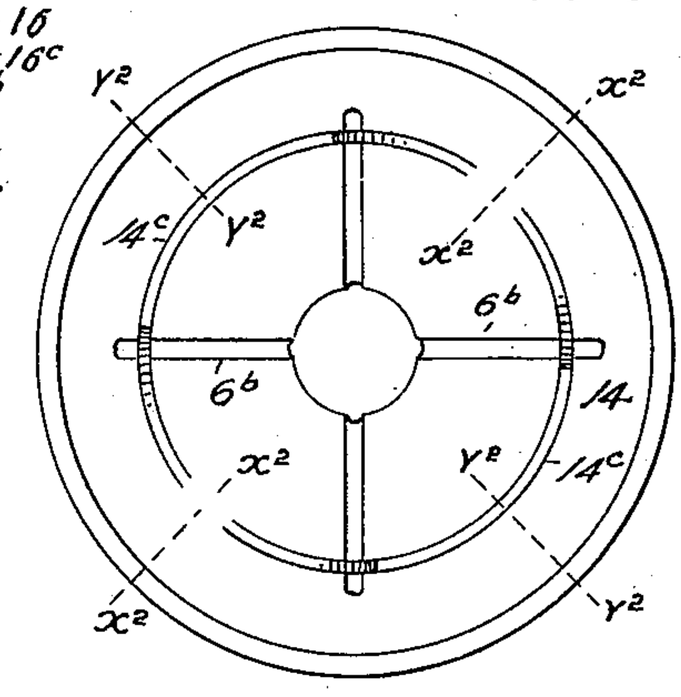



FIG. 6.

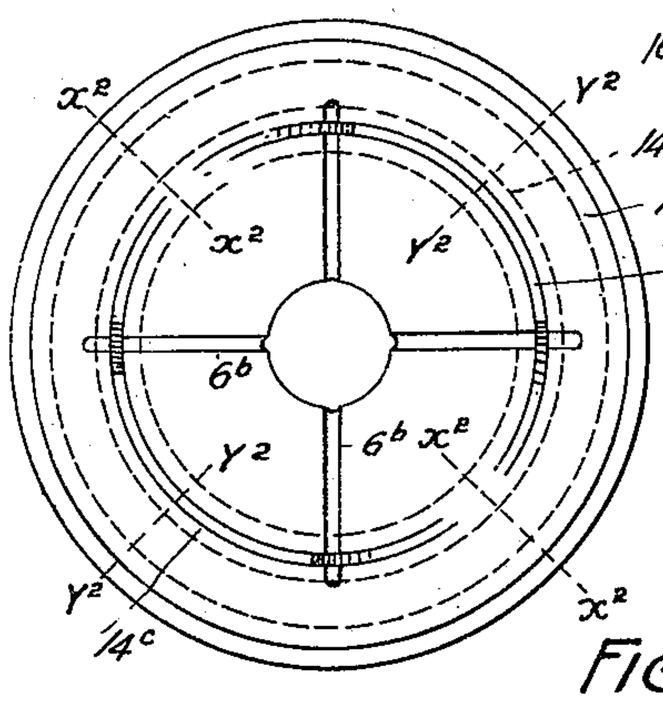
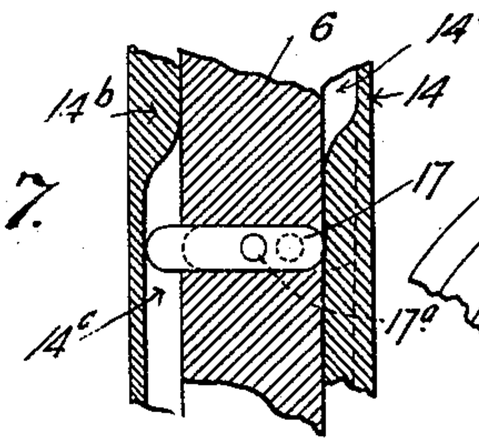



FIG. 4

FIG. 7.



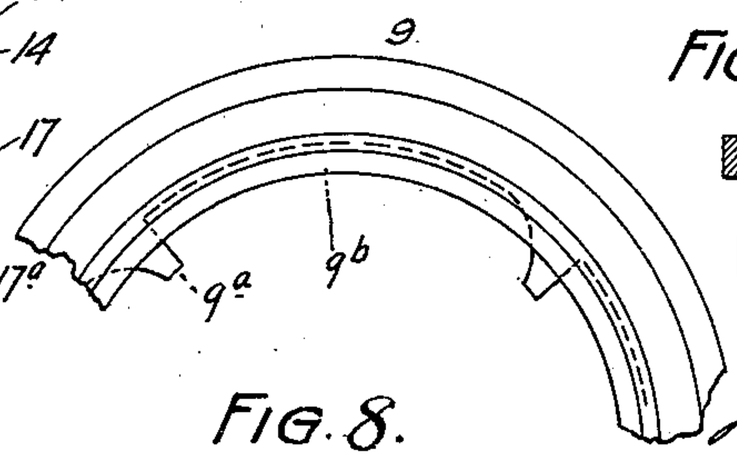




FIG. 8.

FIG. 9. FIG. 10.

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# UNITED STATES PATENT OFFICE.

DAVID M. DEARING, OF JACKSON, MICHIGAN.

## ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 615,664, dated December 6, 1898.

Application filed April 22, 1897. Serial No. 633,324. (No model.)

*To all whom it may concern:*

Be it known that I, DAVID M. DEARING, a citizen of the United States, residing at Jackson, in the county of Jackson and State of Michigan, 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.

This invention relates to engines, and more especially to that class thereof known as "concentric piston;" and the object of the same is to effect certain improvements in machines of this character.

To this end the invention consists in the construction and arrangement of parts set forth below and as illustrated in the accompanying drawings, wherein—

Figure 1 is a side elevation of this machine. Fig. 2 is a vertical section on the line P P of Fig. 3. Fig. 3 is a similar vertical section on line $z\ z$ of Fig. 2 and at right angles to the section of Fig. 2. Figs. 4 and 5 are inside elevations of the left and right casing-plates, respectively. Fig. 6 is an elevation of the switch-plate in the throttle-valve. Fig. 7 is a section showing the operation of the automatic cut-off. Fig. 8 is a side elevation of a portion of the rim. Figs. 9 and 10 are sectional details taken on the lines $x^2\ x^2$ and $y^2\ y^2$, respectively, in Figs. 4 and 5, showing the solid and grooved cam in one casing-plate in which the cut-off works. Fig. 11 is a cross-section through the rim, casing, and one edge of the core, showing the operation of the piston.

Referring to said drawings by reference-numbers, 5 designates the bed or framework, constituting a support for the entire motor, preferably shaped at its ends to receive the octagonal extremities $6^d$ of the shaft $6^a$, as best seen in Fig. 1, so as to prevent the rotation of said shaft and secure a perfect and stationary fastening thereof in place.

11 is the inlet steam-pipe, leading to one end of the shaft and then throughout half its length, and 8 is the outlet leading out the other end thereof.

The numeral 6 designates the core, here shown as forming an integral part of the shaft and located at its center, and the outer edge of this core is preferably struck on an inward curve or semicircular groove. The inlet 11 communicates with one or more pipes 7, leading through the shaft $6^a$ and thence outward, as at $7^a$, within the body of the core 6, as seen in Fig. 3. The outlet 8 communicates at its inner end with several radial pipes $8^a$, also within the body of the core, but out of communication with the openings $7^a$, and the outer ends of these pipes open into the grooved periphery of the core at suitable points, as seen in dotted lines in Fig. 2, and according to the number of steam-chambers in the rim, as will be understood.

The numeral 9 designates the rim, here made ring-shaped and of a size to fit closely around the core, and its inner face is struck on an inward curve, so as to form a semicircular rib $9^a$, adapted to fit the peripheral groove in the outer edge of the core, while at suitable points in this rib pockets $9^b$ are formed, which pockets when in communication with the steam-passages $7^b$ constitute steam-chambers, as usual. These pockets are elongated so as to consume nearly the entire inner face of the ring-shaped rim, and the elongated semicircular pockets $9^b$ therefore form an internal groove, interrupted by inwardly-projecting ribs $9^a$, the forward faces of which are flat, as seen in Fig. 2, while their radial rear faces are rounded longitudinally. The outer extremity of each cylinder-head is transversely rounded (see Fig. 11) so as to fit the lateral curvature of the pockets, and its front face is flat, while its rear face is rounded, so as to ride smoothly over the rearward rounded end of each pocket, as will be clear. The dotted lines in Fig. 2 indicate how both ends of each pocket might be rounded, as well as both faces of the cylinder-head, thus providing for reversing the engine when desired. The rim 9 is somewhat thicker axially than the core, for a purpose to appear below, and, if desired, it may be provided with teeth on its periphery, so as to adapt it to act as a cogged driving-wheel, or a belt might be applied to its smooth outer surface, if preferred.

The numeral 14 designates each casing-plate, of which there are two, one at each side of the core. Each plate has an outwardly-extending hub, on which may be se-

cured cogged or smooth driving-pulleys 12 and 13, the two being of different sizes to adapt them to the machinery to be driven. The edges of these plates are so shaped as to adapt them to the edges of the rim which project beyond the core, and bolts 10 hold the plates to the rim, as will be clear. $9^d$ are oil-cups which may be set through said hubs, or other and additional oil-cups might be provided, if preferred.

I have found that the two casing-plates greatly strengthen all parts and guard against any tendency to explosion or dissolution under centrifugal force when the machine is revolving at a high rate of speed. The fact that these plates have hubs revolving around the shaft also centers them accurately and prevents the rim from binding and wearing upon the core, and the hubs are useful for carrying differently-sized pulleys and receiving the oil-cups, as set forth above.

It will be noticed that the pipe 7, which conducts steam from the inlet 11 to the engine, is here double, a construction which may be employed with the preferred form of my engine, if desired.

15 is a nut having cored therethrough a branch or Y, leading from the single inlet 11 to the double pipe 7, and 16, Fig. 6, is a switch-plate mounted for rotation within the shaft $6^a$ and operated by a handle $16^a$. Through this plate are two openings or holes $16^b$, diametrically disposed, so that they can be simultaneously thrown, set, or turned to open both pipes 7, and in the plate is another opening $16^c$, so placed that it can be set to open one or the other of the pipes 7. By this construction a proper turning of the handle will admit steam to both pipes, to either one, to both or either partially, or to neither, and hence the machine by the use of this form of throttle-valve can be supplied with whatever amount of steam is desired.

The core is provided with a nearly-radial chamber 23, standing parallel with each radial inlet-pipe $7^a$, and within such chamber is an expansive spring 24, on which rests the inner end of a cylinder-head 22, preferably having a fine opening $22^a$ through it into the chamber to prevent the formation of an air-cushion, as will be understood. In the form shown there are two pipes $7^a$, cylinder-heads adjacent them and in rear thereof. The outlet-pipes $8^a$ are set quartering to these inlets, and additional outlet-pipes $8^b$ are here provided through the body of the core on the other side of the cylinder-heads from the inlets and parallel with the chambers 23. However, I do not confine myself to the exact number of parts here shown.

With the construction thus far described, steam being admitted to, say, one of the chambers $7^a$ flows into the pocket $9^b$ forward of the head 22 and utilizes its impact upon the front end of said pocket, then expanding therein between such front end and the head 22 it utilizes its expansive force to give additional power to the engine. As the rounded end of the pocket strikes the rounded rear face of the head 22 these parts work upon each other like cam-faces, and the head is forced radially inward against the tension of its spring 24, the fine port $22^a$ preventing accumulation of air in the chamber 23, and when the rib $9^a$ has passed the tip of the head 22 the latter is again forced outward by its spring and the action is repeated. While the forward end of each pocket is filling its rearward end is exhausting through the pipe $8^b$, so as to prevent the formation of a steam-cushion in the rear, and after the pocket $9^b$ has served its usefulness and passed the head it exhausts through pipe 8 above described. It is obvious that by proper adjustment of the throttle-plate of Fig. 6 more or less steam may be admitted to one or more of the inlet-pipes $7^a$, so as to give the desired speed or power to the engine. In order to reverse the direction of rotation of this engine, the opposite face of the cylinder-head and the other end of the pocket being rounded, as seen in dotted lines, steam must be admitted through pipe 8 and will pass out to the opposite side of the cylinder-head 22, the pipe $7^a$ now becoming the exhaust and the operation being substantially the same, except that the rim rotates in the other direction around the core; but with rotary engines wherein the steam utilizes its expansive power to assist in rotating the rim it will be seen that such expansion cannot take place readily when the inlet-pipe is open, or else the expansion would set back to the boiler and cause undesirable pulsations of the pressure therein. I have therefore devised an automatic cut-off which I will now describe.

Across each inlet-pipe $7^a$ and guided in a suitable opening within the core is a plate 17, having a hole or port $17^a$ through its body and provided with rounded ends, as seen best in Fig. 7. The casing-plates 14 are provided with integral outwardly-projecting rings, as seen in section in Figs. 10 and 11, and these rings are provided with grooves on the inner faces of the plates, as at $14^c$ in Figs. 4 and 5, while the grooves are omitted at points opposite, as at $14^b$, thus forming a cam-shaped way, as seen in Fig. 7, in which the extremities of the plate 17 work. The rise and fall of the several cams therein are so located and timed that when each pocket $9^b$ has been filled to a point about half way of the length of its stroke or movement the cut-off closes the inlet-pipe $7^a$ and permits the steam within the pocket forward of the cylinder-head to expand. Then, again, as soon as the next pocket comes opposite the inlet and the head 22 has been forced outward into position to form a steam-chamber the next succeeding cam $14^b$ on the opposite plate 14 forces the cut-off in the opposite direction and permits the steam to pass into such steam-chamber, and this operation is continued as the machine runs. It will be obvious that by setting the core differently within the plates 14 or

the latter differently around the core the cams and grooves $14^b$ and $14^c$ can be adjusted so that their action on the cut-off may be timed as desired in order to give greater expansion or less to the steam within the steam-chambers, according to the pressure maintained and the speed and power desired.

Various changes in the details of construction might be made without departing from the principle of my idea. It is obvious that the steam might be admitted and exhausted through other sources than the shaft, that the oil-cups might be dispensed with or differently located, that packing may be used where necessary, and that a greater or less number of steam-chambers than shown may be employed. The reversing mechanism may necessitate the addition of certain details, but these will be obvious to any one skilled in this art. The cut-off might be used on the engine without the cylinder-heads, and thus furnish a certain degree of expansion therein, or the heads could be used in certain instances without the cut-offs. I have called the form described my "preferred" form simply because it embodies the principle of expansion as well as that of impact of the steam. Obviously in many instances other fluids than steam could be used to advantage, and hence the device might become a rotary air-engine or gas-engine and the like.

What I claim as new is—

1. In a rotary engine, the combination with a shaft, a support, a core fast on the shaft and having internal radial passages, chambers in rear thereof, and other passages in rear of the chambers, all opening through the periphery of the core, an inlet and an exhaust communicating respectively with said passages, and cylinder-heads in the chambers; of a rim surrounding the core, said rim and core rotating the one on the other and the core having internal pockets to receive the tips of said heads, a cut-off in each passage, casing-plates at the sides of the core, and cams thereon for operating said cut-offs, as and for the purpose set forth.

2. In a rotary engine, the combination with a fixed core having truly radial passages, an axial inlet communicating with them, substantially radial outlets in the core in rear of said passages, an axial exhaust communicating with them, chambers in the core between the passages and outlets and parallel with the former, expansive springs in the chambers, and cylinder-heads resting on the springs and provided with fine ports throughout their lengths; of a rotary rim having pockets of a shape to receive the outer ends of the heads, the rear sides of the latter and rear ends of the pockets being cam-shaped, as and for the purpose set forth.

3. In a rotary engine, the combination with a shaft having angular extremities, a support for the latter, a core fast on the shaft and having internal radial passages, chambers in rear thereof, and outlets in rear of the chambers, all opening through the periphery of the core, an inlet communicating with the passages, an exhaust communicating with the outlets and cylinder-heads in the chambers; of a rim surrounding the core and having internal pockets to receive the tips of said heads, a cut-off in each passage, casing-plates at the sides of the core, cams thereon for operating said cut-offs, and bolts adjustably connecting the plates with the rim, as and for the purpose set forth.

4. In a rotary engine, the combination with a shaft axially adjustable within a support, a core fast on the shaft and having substantially radial passages, chambers, and outlets, cut-offs in the chambers, and cylinder-heads within and normally projected radially from the chambers; of an inlet communicating with said passages from a source of compressed fluid-supply, a rim surrounding the core and having pockets, casing-plates journaled on the shaft at the sides of the core, bolts adjustably connecting said plates with the edges of the rim, and cams on the plates for actuating said cut-offs, as and for the purpose set forth.

5. In a rotary engine, the combination with a fixed core with internal passages communicating with an inlet and internal pipes communicating with an outlet, plates sliding in openings within said core across its passages and having ports through their bodies and rounded ends, and a rim surrounding the core and having pockets; of casing-plates attached to the edges of the rim and standing against the sides of the core, and cam-shaped grooves in the inner faces of the plates forming a way receiving the extremities of said perforated plates, as and for the purpose set forth.

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

DAVID M. DEARING.

Witnesses:

MARY HAMPTON LLOYD,

JOHN S. GIBONS.