No. 607,684. Patented July 19, 1898.

S. H. DRAPER.

ROTARY ENGINE.

(Application filed June 9, 1897.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 2.

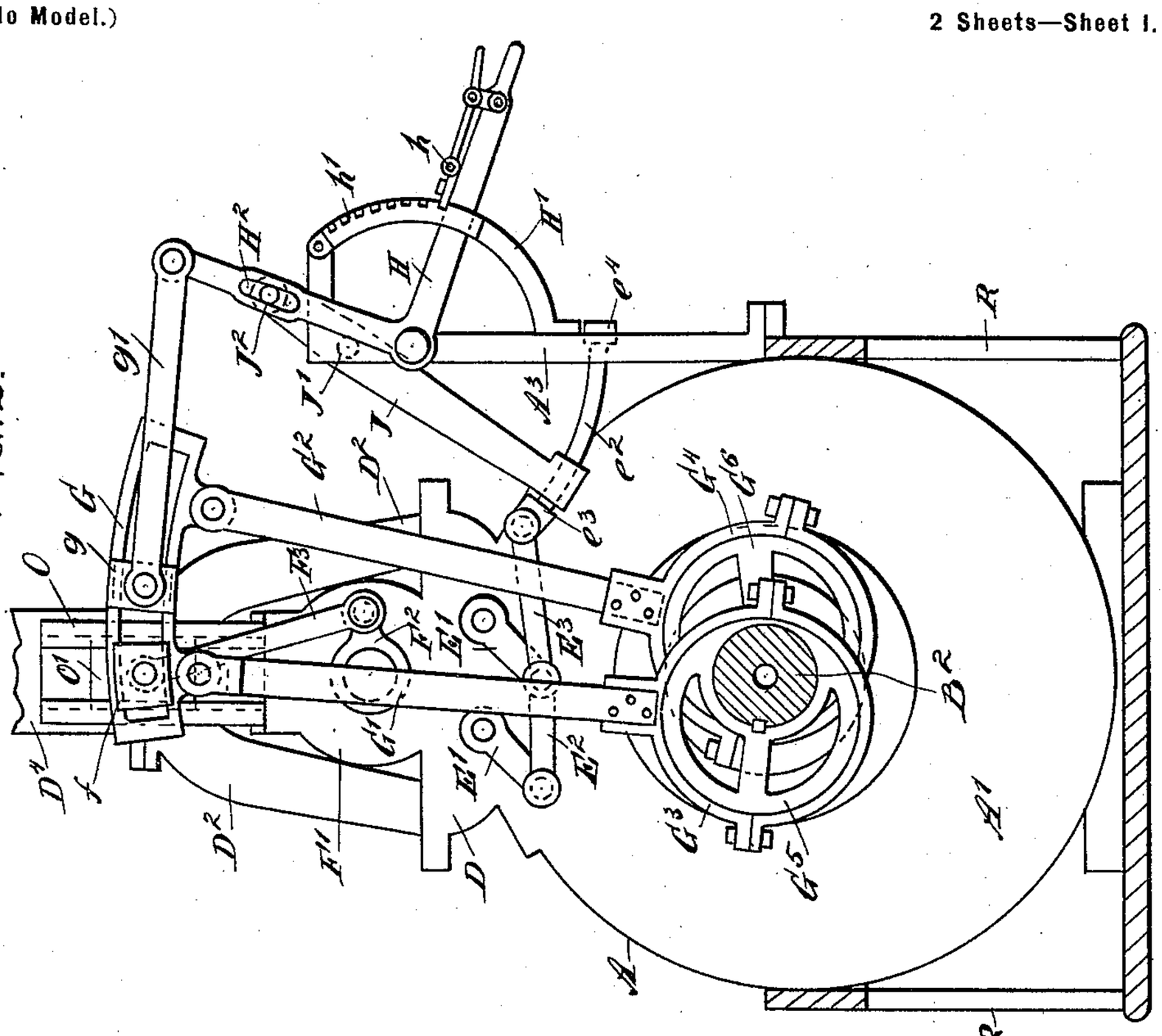
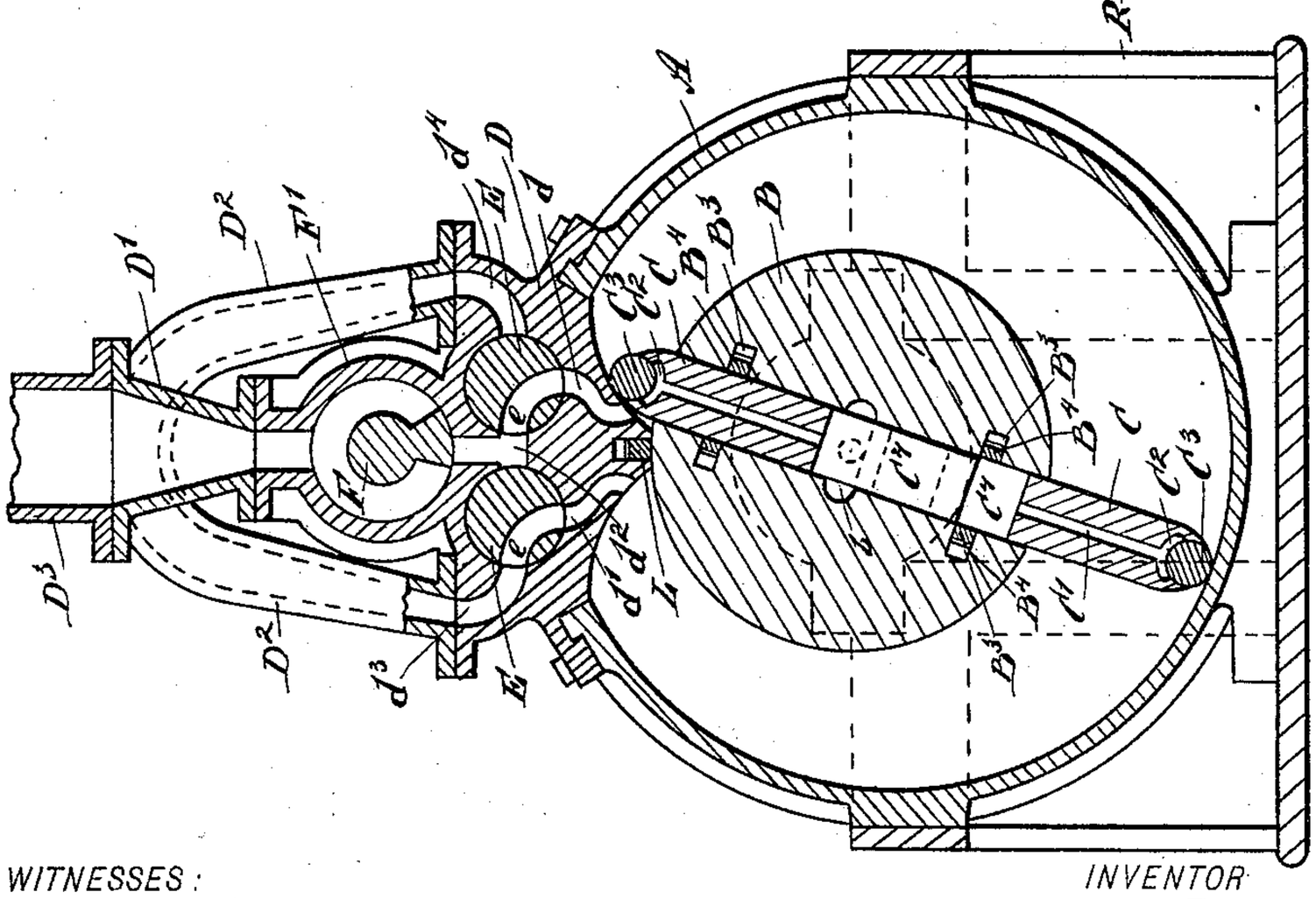


FIG. 1.



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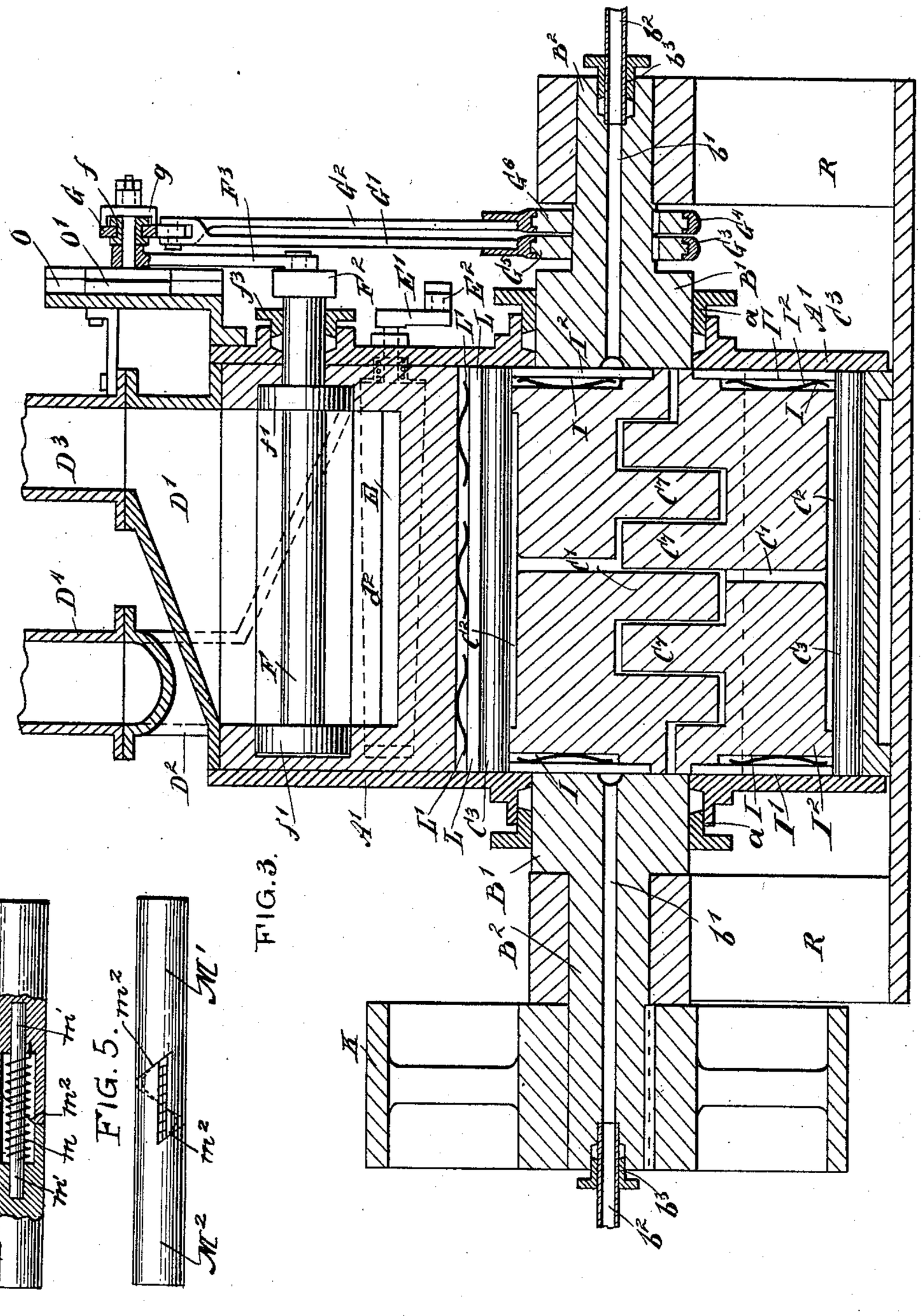

FIG. 3.

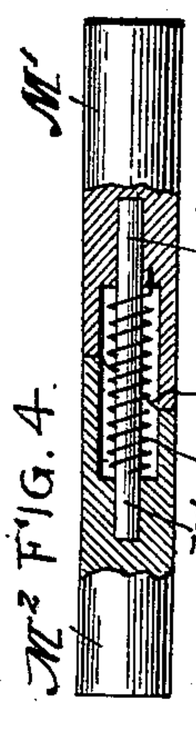

FIG. 4.

FIG. 5.

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SUTTON H. DRAPER, OF MISSOULA, MONTANA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 607,684, dated July 19, 1898.

Application filed June 9, 1897. Serial No. 639,994. (No model.)

To all whom it may concern:

Be it known that I, SUTTON H. DRAPER, of Missoula, in the county of Missoula and State of Montana, have invented a new and Improved Rotary Engine, of which the following is a full, clear, and exact description.

My invention relates to certain improvements in rotary steam-engines, comprising novel valves and operating mechanisms therefor and also novel friction-rollers or packing devices operating in connection with the movable heads to secure a tight joint between the piston and the cylinder.

It also consists in numerous improvements in details, which will be pointed out and claimed in the following specification.

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 views.

Figure 1 is a cross-sectional elevation of my device, taken through the cylinder and valves. Fig. 2 is an end elevation showing the valve operating and controlling mechanism. Fig. 3 is a longitudinal section through the piston and shaft. Figs. 4 and 5 are partial section and elevation of the packing-roller and its adjusting means.

The form of the device shown in Figs. 1, 2, and 3 is intended for generating power and is reversible. It is also capable of using the steam expansively to any extent desired. The cylinder proper, A, is made circular in cross-section, but has a large segment taken from its upper side. This section is then filled by a removable casting D, which contains the valve-seats and forms the steam-chest or valve-chamber. Said casting is provided with an inwardly-projecting ridge which acts as an abutment or head for the cylinder. This method of construction enables the cylinder proper to be readily bored out true and also enables the finishing operations to be more easily carried out upon the inserted section which contains the valve-seats.

The casting D has a strip or bar L placed within a notch in its apex and held outwardly against the cylinder by means of springs L′, as clearly shown in Fig. 3. Upon each side of the center of the casting are ports *d* and *d′*, one of which acts as an exhaust-port and the other as a steam-inlet port. In function these ports are reversible, depending upon the position of the reversing-valves E, which are cylinders occupying circular recesses in the steam-chest and have passages *e* through them, their openings being substantially at right angles with each other.

Between the seats of the two valves E is a steam-passage d^2, which is connected with each of the valve-seats. When one of the valves is placed so that its passage *e* registers with the port opening into the steam-passage d^2, it forms a direct connection with one of the passages *d* or *d′*. At the same time the other valve E has its passage extending in a corresponding direction and connecting the other port *d* or *d′* with one of the exhaust-ports d^3 or d^4. One of these ports then acts as a steam-admission port and the other as an exhaust-port. The two valves E have stems extending through the end wall of the steam-chest and are provided with crank-arms E′, which are connected by a link E^2. When one of the valves E is rotated, the other is correspondingly rotated. If the valves E be thus rotated a quarter of a turn, they will be brought into a position so that the steam connection is through the opposite one of the ports *d* or *d′*, or if changed from the position shown in Fig. 1 the port *d′* will become the steam-admission port and the port *d* will become the exhaust-port.

Located above and between the valves E is a steam-valve F. This valve F is located within a circular chamber F′ and has a stem extending through the end wall of the steam-chamber and provided with a crank F^2, which is connected by means of a link F^3 with the block *f* in a link G. This link G is connected at opposite ends by means of the bars G′ and G^2 to eccentric-straps G^3 and G^4 upon eccentrics G^5 and G^6. The block *f* is connected to the slide O′, working in vertical guides O upon the frame of the machine. In the position shown in Fig. 2 the eccentric G^5 operates the valve F. This valve has an oscillating motion to open and close the end of the passage d^2, and by shifting the link G the time of closing of the valve and the extent of its stroke may be varied, so that the steam will be admitted for a short portion of the stroke or permitted to follow throughout as large a percentage of the stroke as desired.

This corresponds with the action of the link-controlled valves in ordinary steam-engines. The reversal of the engine may be accomplished simply by reversing the two valves E E. It is preferred, however, at the same time to shift the link G, so that the block *f* operates in the opposite end of the link. This shifting is done by means of the link *g'*, connected at one end to a block *g*, sliding on the link G, the other end of the link *g'* being connected with one end of the bell-crank lever H, pivoted at its angle to a bracket A^3, fastened to the frame of the machine. A quadrant H' is also attached to the frame of the machine and provided with notches *h'*, which are engaged by the locking mechanism *h*, mounted upon one of the arms of the lever H. The other arm of the bell-crank lever H is provided with a longitudinal slot H^2, which engages a pin J^2 in one end of a lever J, pivoted at J' to the bracket A^3. The opposite end of the lever J surrounds the bar e^2, which is curved as a segment of a circle. This bar e^2 is provided at each end with stops e^3 and e^4 and is connected at one end by means of an extension E^3 to the link E^2 and crank-arms E', which control the position of the reversing-valves E E. The lever J is free to oscillate between the stops e^3 and e^4 without affecting the position of the crank-arms E' and the reversing-valves E E. As a consequence the position of the link G and its block *f* may be changed from any point of cut-off without changing the position of the reversing-valve E. As soon, however, as the link is shifted, so as to bring the opposite eccentric into play, the end of the lever J contacts with one of the stops e^3 or e^4 and shifts the crank-arms E', and consequently the valves E.

The exhaust-passages d^3 and d^4 connect with a yoke D^2, which is hollow in each arm, the passages formed thereby being enlarged in one direction and converged in another, so as to bring the exhaust to a common point, where it is connected to an exhaust-pipe D^4. A similar chamber D' is connected with the upper side of the steam-valve chamber F' and converges so as to make a convenient connection with the steam-pipe D^3.

The revolving piston consists of a cylinder B, having a diametrical and axial slot through the same, and within this slot are placed two sliding plates or piston-heads C. These heads are of such a width as to slide readily in the slots and have their inner edges formed as alternate notches and projecting fingers C^7, as shown in Fig. 3. These notches and fingers interlock with each other, and thus give a longer bearing in the slot when the plate is projected than would otherwise be secured. The outer edges of the plates C have a concavity adapted to receive a friction-roller C^3, which acts as a packing to insure a tight joint between the edge of the head C and the surface of the cylinder. Beneath the roller C^3 is formed a recess C^2, which is connected, by means of a passage C', with the space lying between the two heads at the center of the piston. The shaft B^2 of the cylinder B, extending outside of the cylinder, is provided with a passage *b'* at its center and is connected by a steam-gland b^3 with a steam-pipe b^2, by means of which steam is introduced into the space between the heads C. This serves to hold the heads outward and in contact with the surface of the cylinder.

The sides of the heads C are packed against steam-leakage by the longitudinal bars B^4, which lie in grooves B^3 and are held out by springs which are placed behind them (not shown) similarly to the springs L', previously described. The ends of the plates C are packed against leakage of the steam between them and the head ends of the cylinder by means of plates I', lying in grooves I and held out by springs I^2. The construction of all these packing-strips is similar.

The cylinder B, forming the piston, may be extended through the heads A' of the cylinder without any reduction in size, or, as shown in Fig. 3, it may be somewhat reduced in size. The shaft B^2 is packed against leakage of steam by the use of a gland *a*. The shaft B^2, which may be formed as a part of the same casting, if desired, extends through bearings in the frame R, which latter embraces the cylinder A, and consequently holds the same in place. The heads A' of the cylinder B are removable, so that the cylinder may be removed whenever desired. A fly or band wheel K is attached to one or both ends of the shaft, as desired.

Figs. 4 and 5 show a preferred form of friction-roller, which is used as a packing in the outer edges of the piston. These rollers are made in two parts M' and M^2, having their ends in contact. The contacting ends of these parts are formed as spiral cam-surfaces m^2, so that if given a relative rotation from the normal position their combined length will be increased. A pin *m'* enters a central socket in each and is secured against rotation in the part M^2, while free to rotate in the socket in the part M'. A spirally-coiled spring *m* surrounds the pin within a cavity formed in the roller and is attached at one end to the pin *m'* and at the other end to the half M' of the roller. This spring is placed under tension tending to rotate the parts, so as to lengthen the rollers. This results in keeping a tight joint at the ends.

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

1. A rotary-engine piston, having a sliding head provided with a cavity in the outer edge thereof, and a friction-roller within said cavity, composed of two sections having their ends joined by spiral cam-surfaces, and means for rotating one section relatively to the other, substantially as described.

2. A rotary engine, having a piston consisting of a sliding head having a cavity in its outer edge, and a friction-roller in said

cavity, composed of two sections having their ends joined by spiral cam-surfaces, said sections being hollowed and having a spring in said hollows acting to rotate one upon the other, substantially as described.

3. A rotary engine, having two reversing-valves, and a steam-admission valve, a reversing mechanism attached to said steam-valve, an operating-lever therefor, a pivoted lever attached at one end of said operating-lever, a link connected to the reversing-valves to operate them, and having stops engaging said pivoted lever at each end of its swing, whereby the movement of the reversing-valves occurs at each end of the swing of the reversing-lever and the steam-valve may be put on its center without affecting the reversing-valves.

4. A rotary engine, having two reversing-valves and a steam-admission valve, a reversing mechanism attached to said steam-valve, an operating-lever therefor, a pivoted lever attached at one end to said operating-lever, and the other end having a hole therethrough, a curved rod extending through this hole and having a stop thereon at each end, a link connecting this rod with the reversing-valves whereby the reversing-valves are shifted at the termination of the reversal of the steam-valve.

5. A rotary engine having a steam-supply port and two exhaust-ports located one on each side of the steam-port, said ports being comparatively long and narrow, an exhaust-pipe connection consisting of a yoke, the legs of which are hollow and taper from a long, narrow section at their base to an approximate circular section at their junction, said junction being above one end of the ports, and a steam-pipe connection consisting of a hollow casting similarly tapering from a long and narrow section at its base to an approximate circular section at its upper end, the taper being from one end and opposite that of the exhaust-yoke, whereby it is enabled to lie between the arms of the exhaust-yoke.

6. In a rotary engine, a cylinder having two steam-ports opening therein, a central supply steam-passage, and two exhaust-passages in the body thereof, the exhaust-passages being located one at each side of the steam-passage and all outside of the steam-ports, reversing and admission valves controlling said steam-passages, an exhaust connection consisting of a yoke having hollow legs, the passages therein tapering from the shape of the port at their lower end to an approximate circular section at the junction of the legs, said junction being formed above one end of the ports, and a steam-pipe connection having a passage therein, the base of said section being long and narrow and tapering upward and toward one end of the port to approximately a circular section, said connection lying between the arms of the exhaust-yoke.

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Witnesses:
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