(No Model.) 2 Sheets—Sheet 1.

L. S. HAYES.

ROTARY STEAM ENGINE.

No. 587,202. Patented July 27, 1897.

Fig. 1,

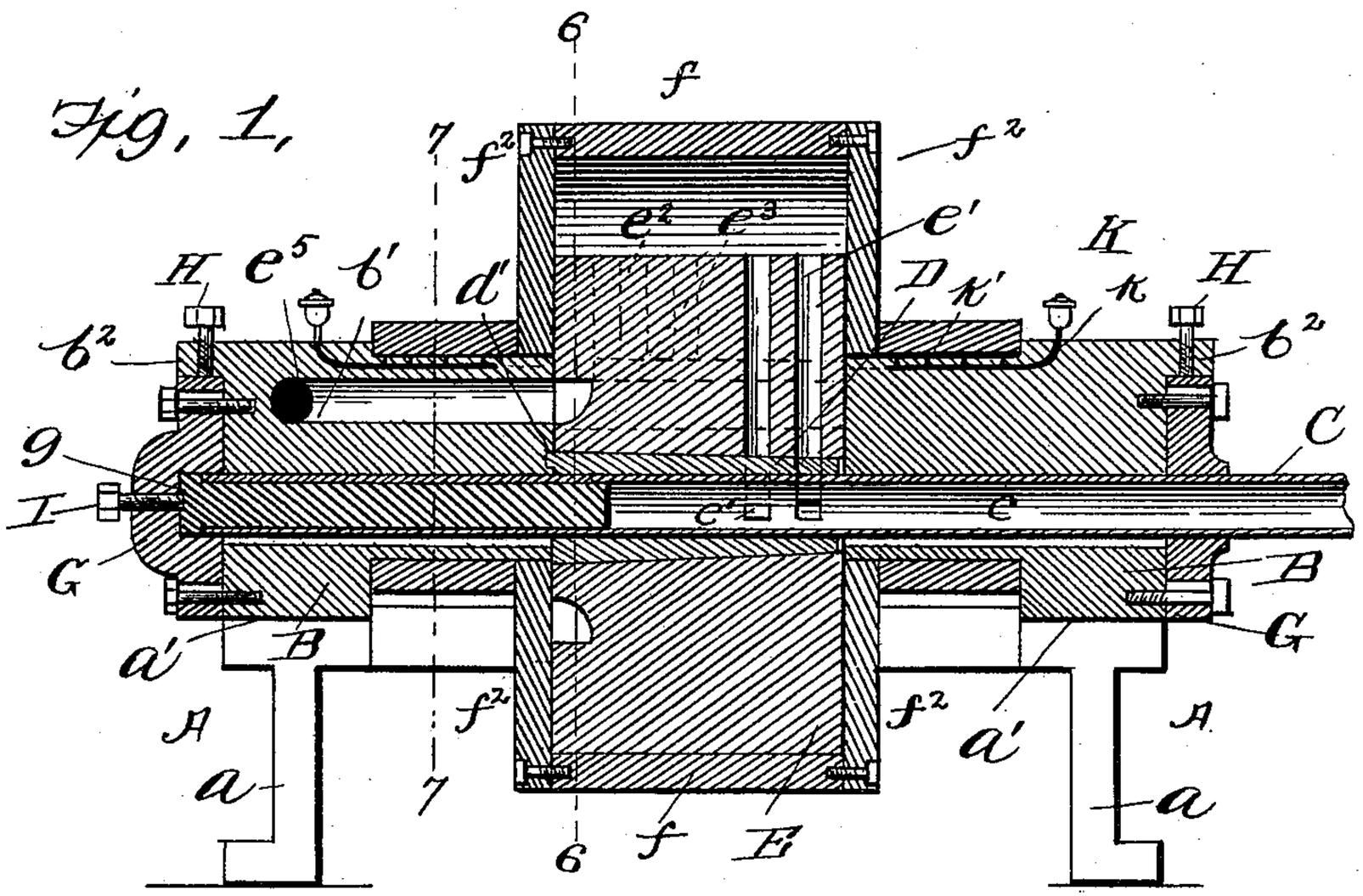
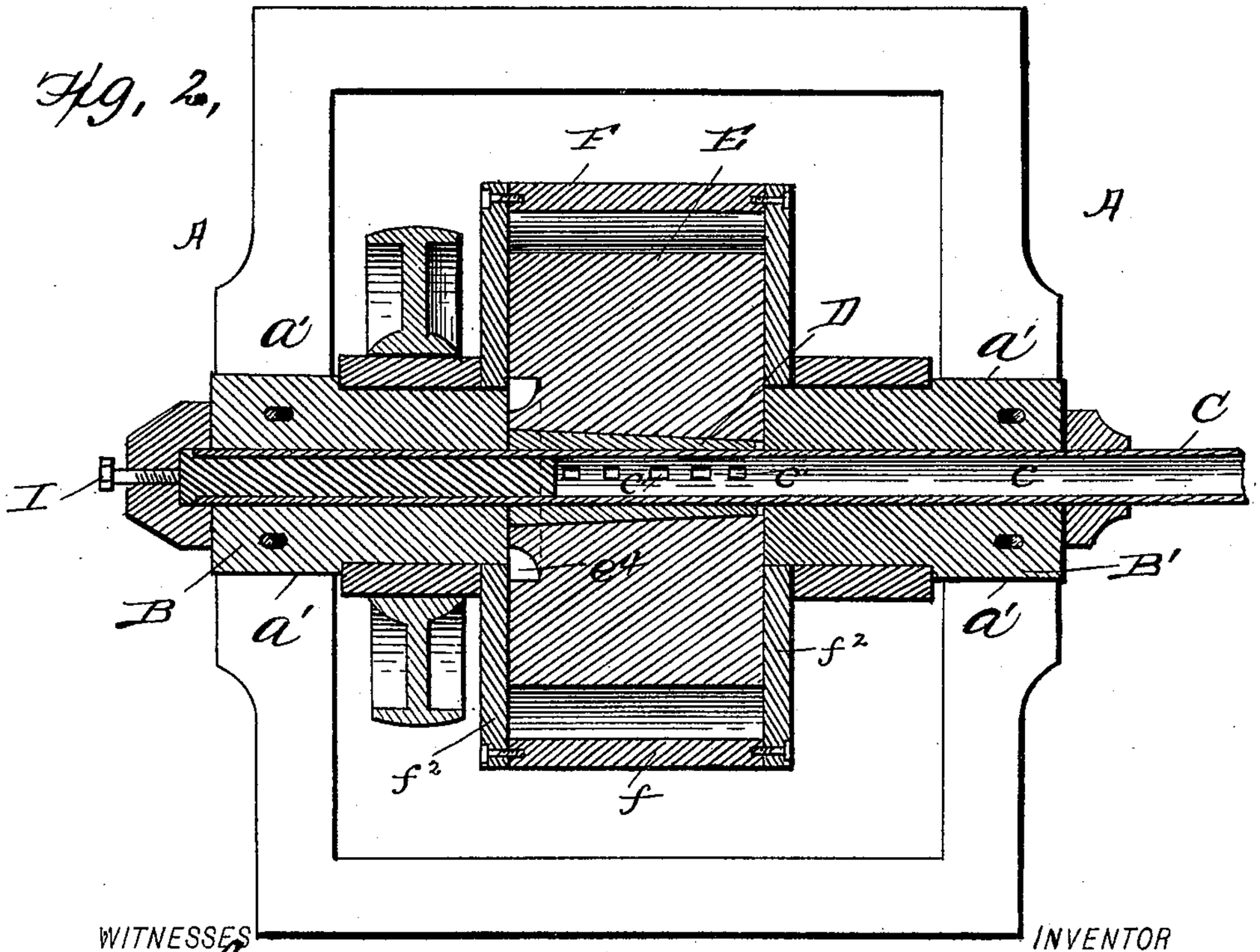


Fig. 2,



WITNESSES

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E. A. Ryan.

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(No Model.) 2 Sheets—Sheet 2.

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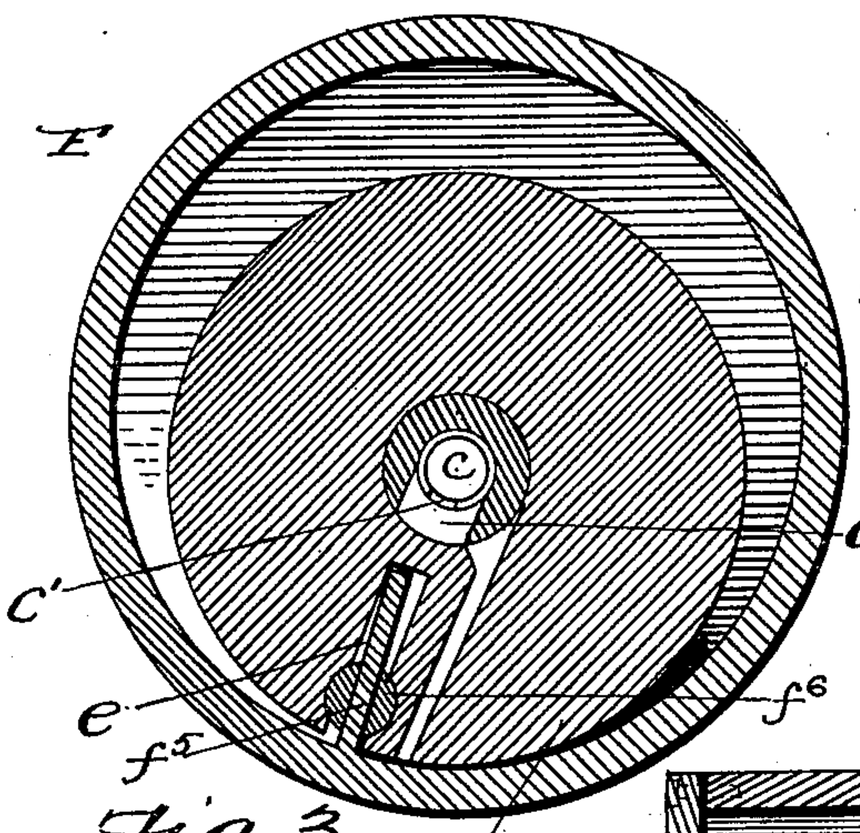


Fig. 3.

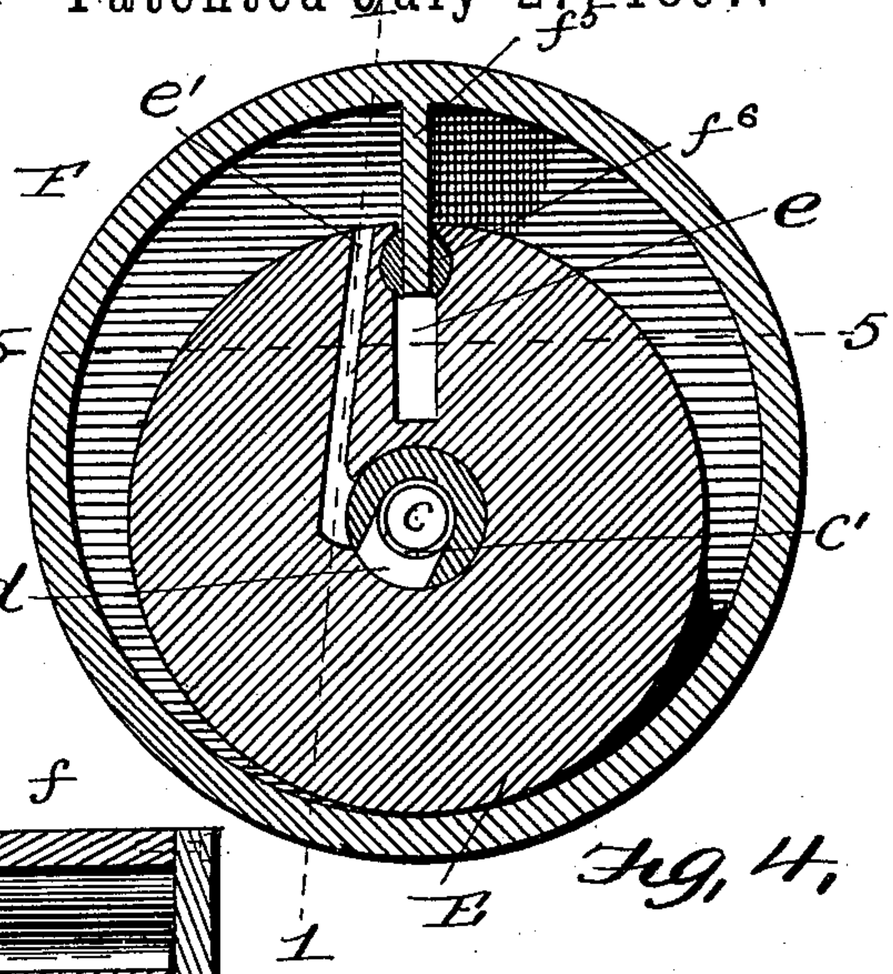


Fig. 4.

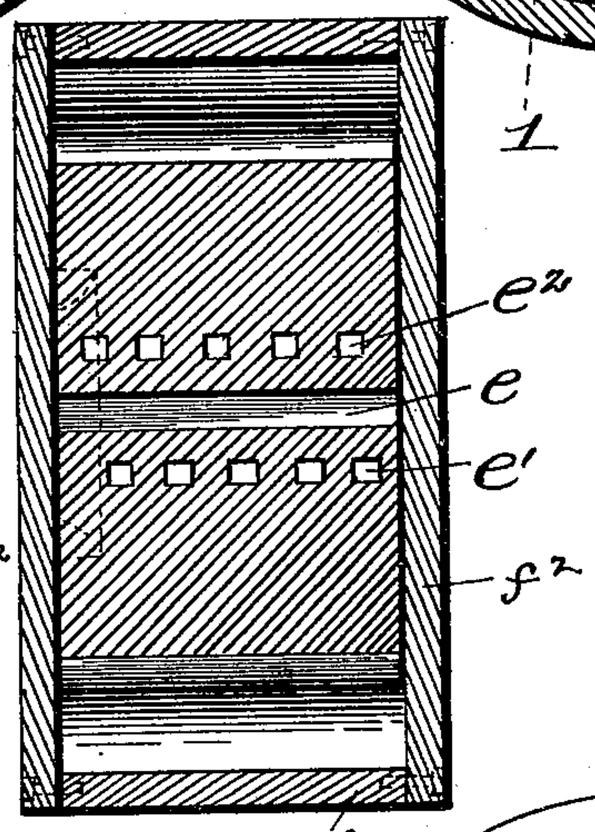


Fig. 5.

Fig. 6.

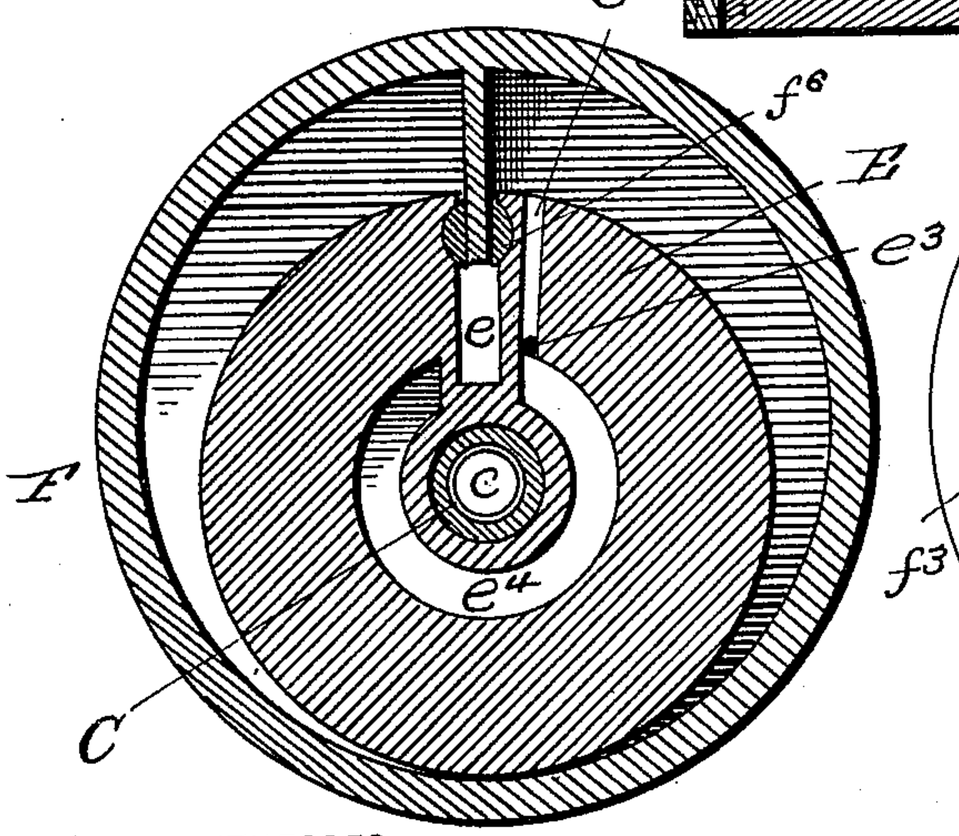
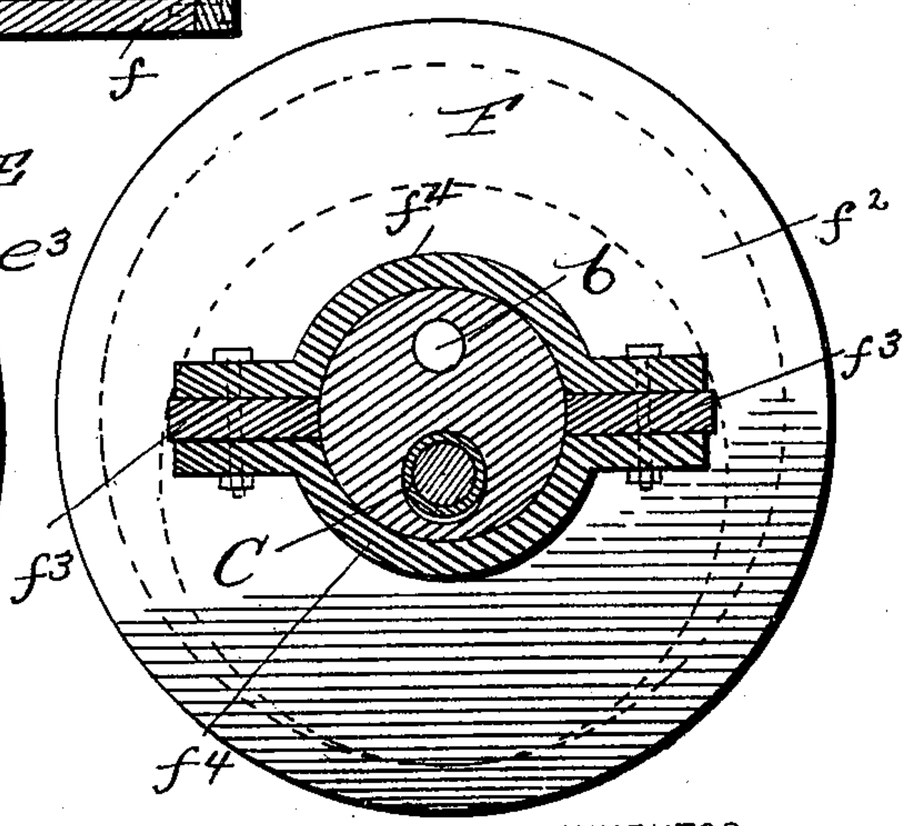


Fig. 7.



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LEWIS S. HAYES, OF CORTLAND, NEW YORK.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 587,202, dated July 27, 1897.

Application filed April 5 1897. Serial No. 630,810. (No model.)

To all whom it may concern:

Be it known that I, LEWIS S. HAYES, a citizen of the United States, residing at Cortland, in the county of Cortland and State of New York, have invented certain new and useful Improvements in Rotary Steam-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 that class of rotary steam-engines known as "eccentric piston;" and it consists in the general combination and arrangement of the various parts, as will be hereinafter explained, and particularly set forth in the claims.

One of the principal objects of the invention is to so construct an engine of the type mentioned that the strain and friction of the reciprocating parts incident to engines of the ordinary class will be avoided and the great wear and consequent leakage between the piston and cylinder overcome, thereby greatly prolonging the life of the engine and rendering repairs rarely needed.

Another object of the invention is to simplify and cheapen the cost of construction of the engine without in any manner detracting from its efficiency in operation.

These objects are attained by means of the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of my improved engine, the section through the frame and supporting pillow-blocks being central and the section through the cylinders taken on line 1 1 of Fig. 4; Fig. 2, a horizontal central section; Fig. 3, a transverse section through the cylinders, showing the same in position to take steam; Fig. 4, a similar section showing the position of the cylinders when the steam is cut off; Fig. 5, a horizontal section on line 5 5 of Fig. 4; Fig. 6, a transverse section of the cylinders in the position shown in Fig. 4, taken on line 6 6 of Fig. 1, and Fig. 7 a transverse section on line 7 7 of Fig. 1.

Referring to the several views, the letter A indicates a suitable frame, preferably rectangular, upon which the engine is supported. This frame is suitably supported upon legs *a*, and its upper surface at opposite sides is provided with central depressions *a'*, into which are received the outer square ends of the pillow-blocks B B'. These pillow-blocks are bolted firmly to the frame, the bolts passing through elongated holes in said blocks, whereby the blocks may be longitudinally adjusted for the purpose hereinafter explained. Each pillow-block is longitudinally bored eccentrically to receive a non-revoluble shaft C, which is provided for a greater portion of its length with a steam-channel *c*, having outlet-ports *c'*.

Mounted on the shaft C is a cone-shaped valve D, which is provided with a series of steam-ports *d*, adapted to register with the ports *c'* in the shaft, and said valve is prevented from revolving by means of a lug or projection *d'*, which enters a recess in the inner end of the pillow-block B, and mounted concentrically on the cone-shaped valve is a solid revoluble cylinder E, which is provided with a longitudinal peripheral pocket or deep groove *e* and a series of steam-passages *e'*, which have their outlets arranged at one side of the pocket and are adapted to register with the ports *d* in the valve. The cylinder E is also provided with a series of exhaust-ports e^2, having their inlets arranged at the other side of said pocket (see Fig. 5) and their outlets opening into a channel e^3, which communicates with a ring-port e^4 in one of the cylinder ends, as shown in Fig. 6. This ring-port communicates with a channel *b'* in the pillow-block B, and said channel connects with an outlet-passage e^6 through the side of the pillow-block.

The pillow-blocks being adjustable longitudinally toward each other, it will be seen that should there be any lost wear it can be readily taken up by advancing one or both of the pillow-blocks toward the sides of the cylinder, the elongated holes through which pass the securing-bolts permitting such adjustment.

The letter F indicates a hollow revoluble cylinder which is mounted upon the respective inner circular ends of the pillow-blocks B and B'. This cylinder is preferably constructed of a ring *f* and disk side pieces f^2, bolted together, as shown in Figs. 1, 2, and 5. The cylinder is mounted concentric with its pillow-block axis, but eccentric with the

shaft of the solid cylinder E, and it is firmly held against longitudinal movement by means of two lugs f^3, projecting from the outer face of each disk f^2 on opposite sides of the pillow-blocks and two box-caps f^4, which fit between the ends of the cylinder and the shoulders b of the pillow-blocks and are bolted through said lugs, as shown in Fig. 7. These caps may, if desired, constitute the webs of a split pulley, from the face of which a belt may run, and the wear may be taken up in the usual and well-known manner by removing liners from between the caps and the projecting lugs.

The cylinders E and F are arranged to revolve together on their respective axes, and this is accomplished by means of a web-shaped piston f^5, which is rigidly attached to the inner wall of the cylinder F and works in the pocket e in the solid cylinder through a suitable packing f^6.

The vertical diameter of the shaft-bearing in each of the pillow-blocks is slightly greater than that of the shaft, so that should the point of peripheral contact of the inner cylinder with the inner peripheral wall of the outer cylinder become separated by wear the contact may be easily reëstablished by forcing the shaft downward until the contact is again made. In order to provide for the reestablishment of the contact of the cylinders, I form the outer end of each pillow-block with a top flange b^2, and below the flange I securely bolt an adjusting-block G, one of which is provided with a recess g to receive one end of the shaft, while the other is bored through, so that that end of the shaft may extend through to the boiler or other source of steam-supply. The holes in the adjusting-blocks, through which the securing-bolts pass, are elongated to permit the proper vertical adjustment. A set-screw H passes through the flange b, engaging the top of the adjusting-block, and when it is required to take up the lost wear of the cylinders the securing-bolts are loosened and the set-screws turned to force down the adjusting-blocks, which carry with them the shaft. These adjusting-blocks are fitted steam-tight to the shaft and the ends of the pillow-blocks, thus preventing leakage.

The lost wear between the cone-shaped valve and the bore of the inner cylinder is taken up by forcing the shaft and valve, which is keyed to the shaft, as before stated, endwise by means of the set-screw I in the face of the adjusting-block, as shown in Figs. 1 and 2.

The bearings of the outer cylinder are lubricated by means of suitable lubricant-cups K which communicate with channels k and grooves k', made in the pillow-blocks. The bearing of the inner cylinder on the valve is lubricated with the steam which passes through the ports in the valve.

The operation of my invention will be readily understood from the foregoing description, it only being necessary to state that steam enters through the axial inlet in the shaft, passes through the ports in the shaft and valve, into and through the inlet-ports of the inner cylinder or eccentric piston, and enters the steam-space between the two cylinders at a point between the contact-points of the two cylinders and the web-shaped connecting-piston. The steam fills the steam-space and drives or forces the web away from said contact-point, thus generating circular motion. This action is continued until the revolution of the cylinders reaches the point of cut off of the steam-supply, which in the drawings is shown at half a revolution. From that point forward the impulse is continued by the expansion of the steam just admitted until the full revolution is completed and the steam-space between the two cylinders becomes enlarged to its greatest capacity. At this point the revolution of the inner cylinder will have carried the exhaust-ports of said cylinder past the contact-point of the two cylinders and will now open them into the steam-space filled with the above-expanded steam, when the exhaust begins and continues with the revolution of the cylinders, said exhaust being through the passages e^2, channel e^3, ring-port e^4, and channel b' into open air.

It will be noted that when the cylinders have made a certain portion of a revolution—that is, where it is determined to cut off the supply of steam from the boiler—the revolution of the cylinders closes the ports of the valve by carrying the ports of the cylinder beyond the ports in the valve, said ports remaining closed until opened by the next revolution of the cylinders.

The construction and arrangement of the valve and ports insure a prompt and complete cut off of the steam-supply, ample expansion, and at the same time prevents any compression of the exhaust-steam. As the valve will be constructed for a definite point of cut-off, that which may be found most economical and satisfactory, it will be evident that it cannot be displaced from its proper position, thus avoiding the necessity of resetting said valve and insuring efficient and economical working of the engine under any and all circumstances.

The pocket in which the web-shaped piston operates may be connected with the exhaust and thereby prevent any compression or vacuum in it.

The inlet portions of the ports e are preferably made in the shape shown in Figs. 3 and 4, and their peculiar shape permits the governing of the point of cut off by varying their length around the valve, affording a free entrance of the steam when the engine is running at the rate of one thousand to two thousand revolutions per minute under any and all circumstances.

Various modifications in the detail construction and arrangement of the parts of my invention may be made without departing

from the spirit of the invention or sacrificing the principle thereof, and I do not wish to be understood as limiting myself to the specific construction and arrangement herein shown and described. It will be apparent that this construction is equally well adapted for use as a pump when driven by a belt or gearing on the split pulley, the only modification required being to extend the inlet-ports of the inner cylinder farther around the valve, so as to permit a continuous inflow of liquid to be pumped. It will also be apparent that instead of constructing the valve separate from the shaft it may be made a part of said shaft and the steam-ports of the shaft continued therethrough, always provided that the bearing for the inner cylinder shall be cone-shaped.

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

1. In a rotary engine, the combination of a stationary shaft, having an axial steam-inlet and provided with a cone-shaped bearing having steam-inlet ports, a revoluble inner cylinder mounted on said cone-shaped bearing, means for adjusting the shaft and cone-shaped bearing with respect to said cylinder, a revoluble outer cylinder having its inner wall in contact with the periphery of the inner cylinder, and means connecting the two cylinders, whereby they are caused to revolve together.

2. In a rotary engine, the combination of a stationary shaft, having an axial steam-inlet and provided with a cone-shaped bearing having steam-inlet ports, a revoluble inner cylinder mounted on said cone-shaped bearing, means for adjusting the shaft and cone-shaped bearing with respect to said cylinder, a revoluble outer cylinder, eccentrically mounted, with its inner wall in contact with the periphery of the inner cylinder, and a web-shaped piston attached to the outer cylinder and loosely connected with the inner cylinder, whereby both cylinders are caused to revolve together.

3. In a rotary engine, the combination of a stationary shaft having an axial steam-inlet for a portion of its length and provided with steam-outlet ports, a revoluble inner cylinder concentrically mounted on the shaft, an outer revoluble cylinder mounted on bearings eccentric with said shaft whereby the inner wall of said cylinder will be in contact with the periphery of the inner cylinder, and means connecting the two cylinders to cause them to revolve together.

4. In a rotary engine, the combination with a stationary shaft inclosed in suitable bearings and provided with a steam-inlet, a cone-shaped valve secured on said shaft, and a revoluble inner cylinder mounted on the cone-shaped valve, of means for adjusting the shaft and valve with respect to the cylinder, to compensate for wear.

5. In a rotary engine, the combination with a stationary shaft inclosed in suitable bearings and provided with a steam-inlet, a cone-shaped valve secured on said shaft, and a revoluble inner cylinder mounted on the cone-shaped valve, of a set-screw arranged in an adjustable cap-block, whereby the shaft and valve may be adjusted with respect to the cylinder.

6. In a rotary engine, the combination of a stationary shaft provided with a cone-shaped bearing having steam-inlet ports, a revoluble inner cylinder mounted on said cone-shaped bearing, a revoluble outer cylinder mounted eccentrically to said inner cylinder, and means for preserving the peripheral contact of the two cylinders.

7. In a rotary engine, the combination with a stationary shaft mounted in suitable bearings and provided with a steam-inlet, a valve secured on the shaft, a revoluble inner cylinder mounted on the valve, and a revoluble outer cylinder mounted on said bearings, of means for adjusting the peripheral contact of said cylinders.

8. In a rotary engine, the combination of a stationary shaft provided with a cone-shaped bearing, said shaft mounted in suitable pillow-blocks which have the longitudinal bore for the shaft extended in the direction of the plane of contact between the cylinders, of a revoluble inner cylinder mounted on the cone-shaped bearing, an outer revoluble cylinder mounted on said blocks, eccentrically to said inner cylinder, and means for adjusting said shaft and bearing to preserve the peripheral contact of said cylinders.

9. In a rotary engine, the combination with a stationary shaft mounted in elongated bearings in suitable pillow-blocks and provided with a steam-inlet, a valve secured on the shaft, a revoluble inner cylinder mounted on the valve, and an outer revoluble cylinder mounted on said blocks, of adjusting-blocks and means for adjusting the same to preserve peripheral contact between said cylinders.

10. In a rotary engine, the combination with a stationary shaft mounted in elongated bearings in suitable pillow-blocks and provided with a steam-inlet, a valve secured on the shaft, a revoluble inner cylinder mounted on the valve, and a revoluble outer cylinder mounted on said blocks, of an adjusting-block adjustably secured at the outer end of each pillow-block and provided with set-screws, whereby the inner cylinder may be adjusted to preserve contact with the inner periphery of the outer cylinder.

11. In a rotary engine, the combination with the pillow-blocks, a shaft journaled in said blocks and provided with a cone-shaped bearing, steam-passages in the shaft and cone-shaped bearing, and a revoluble cylinder mounted on the cone-shaped bearing and provided with two sets of steam-passages said outer cylinder loosely connected to the inner cylinder, of a steam-passage extending through one of the pillow-blocks.

12. The combination, in a rotary engine,

with the supporting-frame provided with suitable pillow-blocks, a stationary shaft, mounted in said blocks, having a cone-shaped bearing and provided with steam-inlet and steam-outlet ports and a revoluble inner cylinder mounted on said cone-shaped bearing, provided with passages for the admission of steam and with passages for the exit of steam, of means for taking up lost wear between said inner cylinder and the cone-bearing, and an exhaust-steam passage through one of the pillow-blocks.

13. In a rotary steam-engine, the combination of a stationary shaft mounted in suitable pillow-blocks, said shaft provided with a cone-shaped bearing and with inlet and outlet ports, a revoluble inner cylinder, mounted on said cone-shaped bearing an outer cylinder, revoluble eccentrically to the inner cylinder and loosely connected thereto, said inner cylinder provided with inlet and outlet passages so arranged that the solid portion of said cylinder will cut off the power-supply at each revolution of the cylinders and means for taking up the lost wear between the cone-shaped bearing and the inner cylinder.

14. In a rotary engine, the combination of a stationary shaft, mounted in suitable pillow-blocks provided with a cone-shaped bearing and inlet and outlet ports, an inner cylinder, revoluble on said cone-shaped bearing and provided with inlet and outlet passages, and an outer cylinder revoluble eccentrically to said inner cylinder and in unison therewith, of means for adjusting the peripheral contact of the cylinders, and means for taking up the lost wear between the inner cylinder and the cone-shaped bearing, whereby leakage is prevented.

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

LEWIS S. HAYES.

Witnesses:
J. R. NOTTINGHAM,
E. A. RYAN.