(No Model.) 2 Sheets—Sheet 1.

J. SPERRY.

ROTARY ENGINE.

No. 462,282. Patented Nov. 3, 1891.

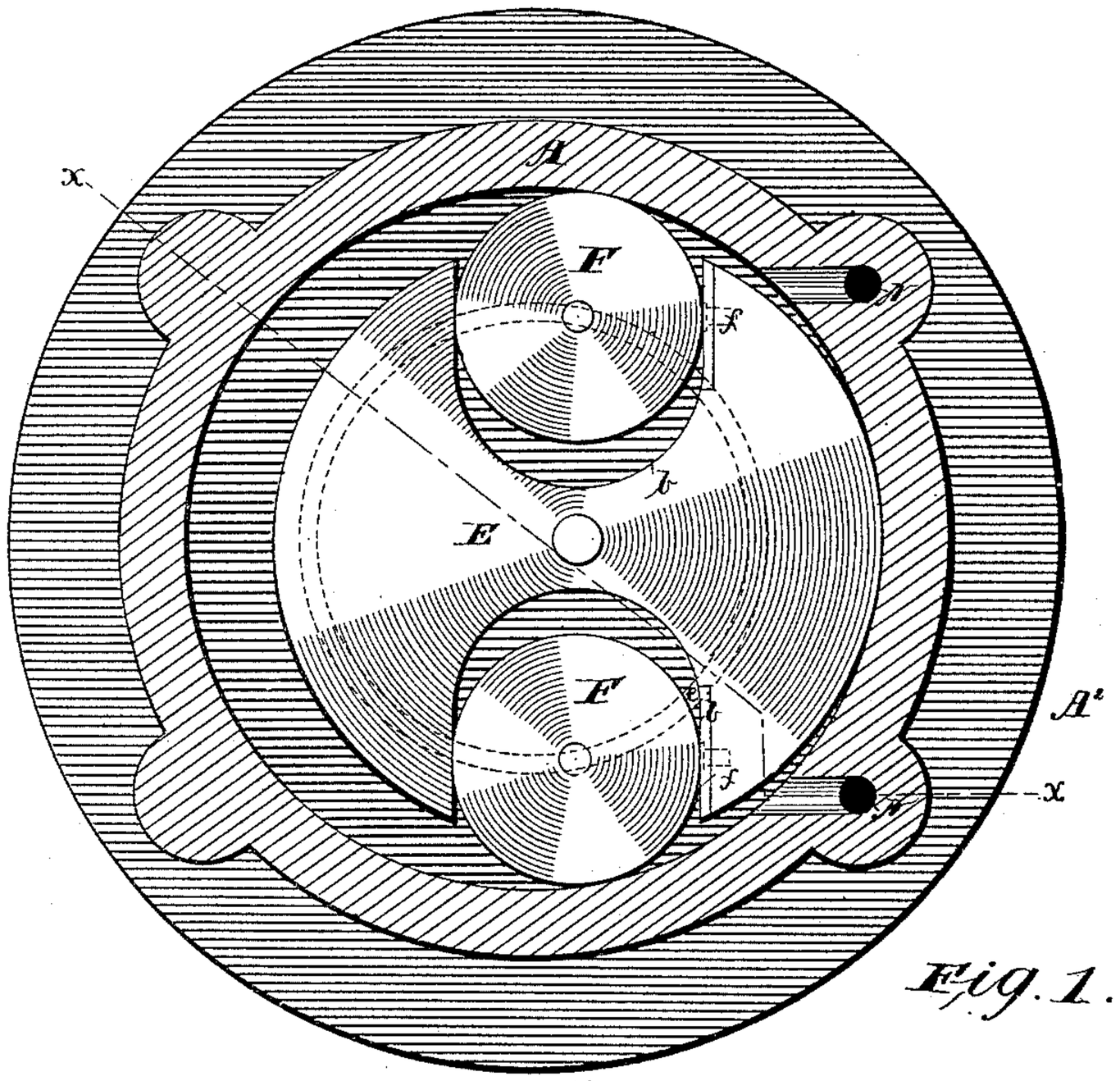

Fig. 1.

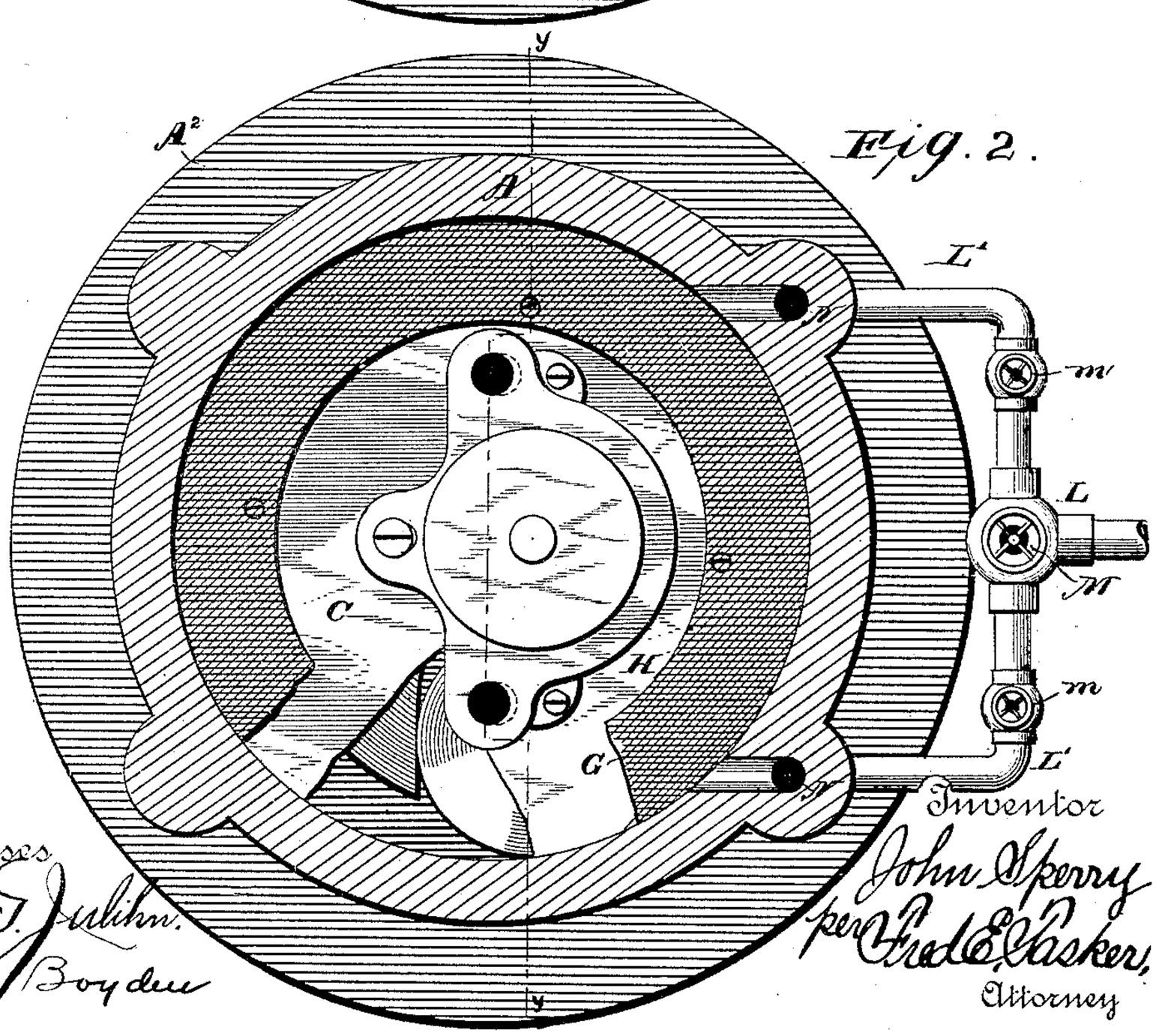

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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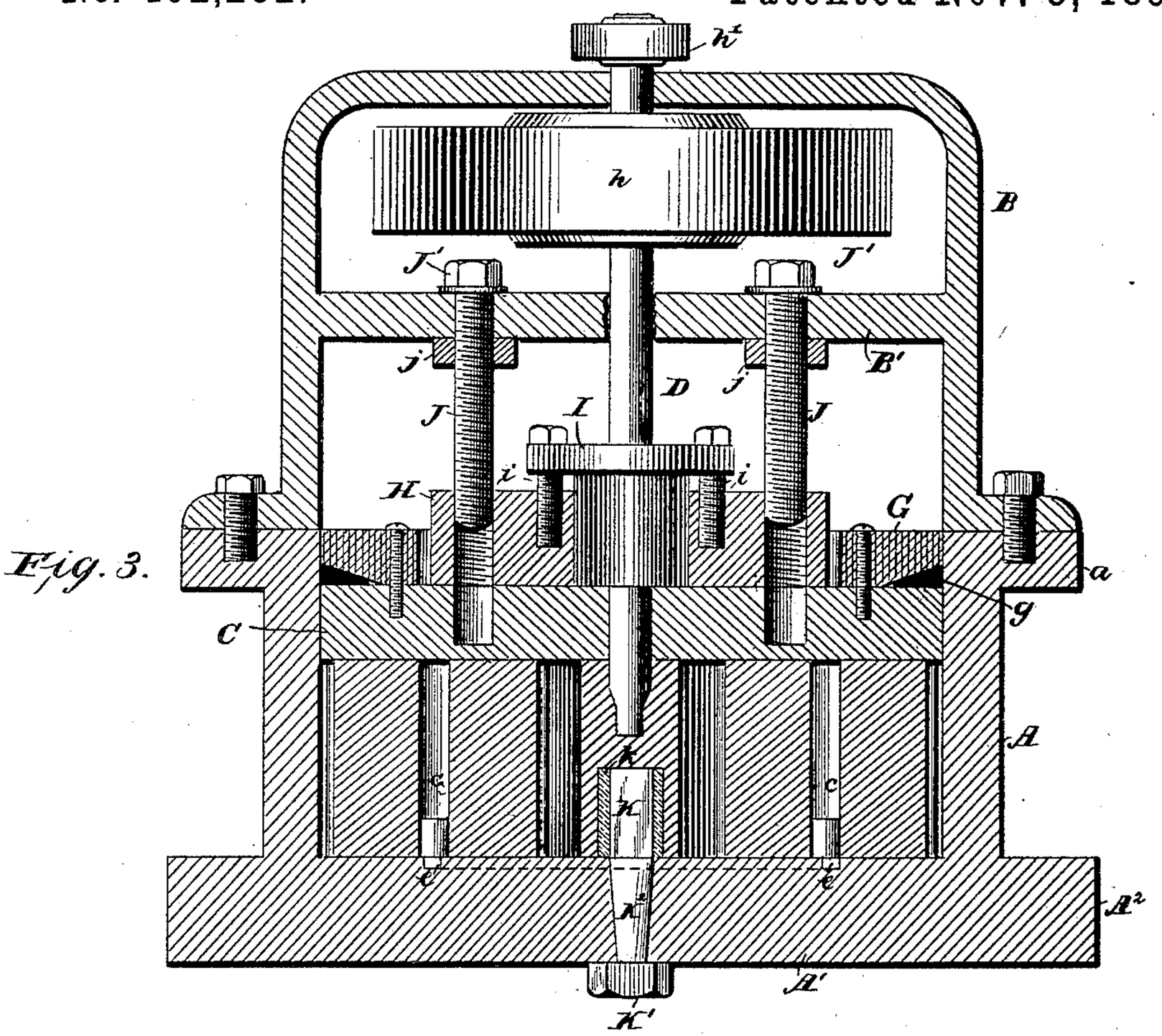

Fig. 3.

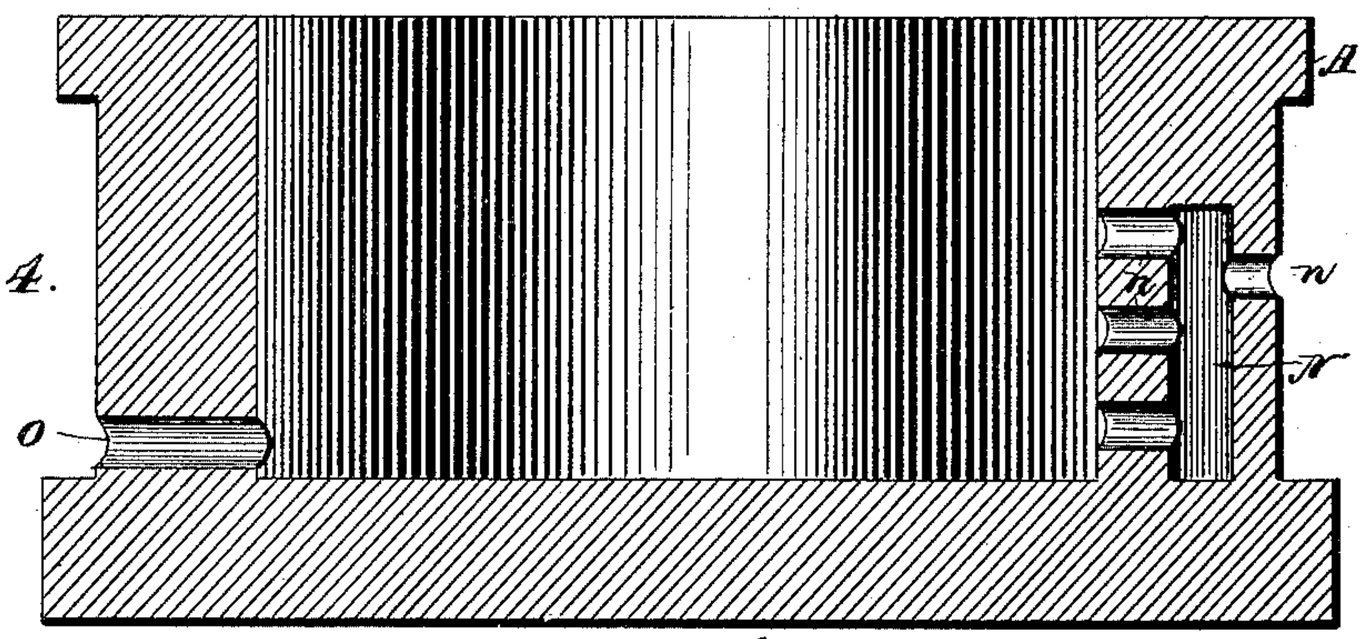

Fig. 4.

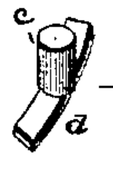

Fig. 5.

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UNITED STATES PATENT OFFICE.

JOHN SPERRY, OF NEW YORK, N. Y., ASSIGNOR TO CARRIE M. LANE, MARIETTA T. ELGAR, AND KATE A. SPERRY, OF SAME PLACE, AND CLARA BLOODGOOD, OF MORRIS PLAINS, NEW JERSEY.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 462,282, dated November 3, 1891.

Application filed February 11, 1891. Serial No. 381,060. (No model.)

To all whom it may concern:

Be it known that I, JOHN SPERRY, a citizen of the United States, residing at New York, in the county of New York and State of New York, 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 an improvement in that class of rotary steam-engines in which a revolving piston-carrier is arranged eccentrically to the circle which forms the inner surface of the cylinder. In engines of this class as heretofore constructed the pistons have commonly consisted of plates shaped to conform to radial sections of the cylinder and sliding out and in through suitable grooves or slots formed in the piston-carrier, the periphery of said carrier coming in contact with the inner surface of the cylinder at some point between the steam-inlet and the exhaust-opening, thus forming an abutment to receive the reactive force of the steam entering the cylinder as it fills the space between said point and the piston. These piston-plates have sometimes been connected so that the two diametrically opposite each other should move together. In other cases they have been allowed to move independently; but in all it has been found necessary to pack them to prevent the leakage, since leakage has been the common difficulty and disadvantage attending the use of them, and this packing generally causes excessive friction both in the slots of the piston-carrier and also at those points which come in contact with the interior cylinder, and this friction, absorbing a large percentage of the power developed by the engine as well as producing excessive wear, causes this class of engines, although theoretically advantageous, to be thrown aside as practically worthless.

The object of the present invention is therefore to so construct the engine as to avoid this excessive friction by the employment of rolling surfaces instead of sliding surfaces for the pistons, thus obviating wholly or to a great extent the need of packing for use at these points and preventing the wear to which the corresponding parts of this class of engines have heretofore been exposed, rendering them fully equal or superior to the best types of reciprocating engines in the amount of effective power produced, while the cost of construction per horse-power as compared with the reciprocating engine is greatly diminished; and, also, the object of the invention is to make perfect the several adjustments of the different parts of the engine, so that whenever the least looseness takes place in any part as the result of wear or from any other cause said part may be readily and easily tightened, so that the engine may at all times be kept in perfect operative trim, capable of doing its full duty, and never becoming useless from any of the causes just indicated.

The invention may therefore be said to consist in a rotary engine having a piston-carrier supporting rolling piston-rolls, whose rolling surfaces impinge against the piston-carrier or the inner circumference of the cylinder at points where they would be exposed to great friction and correspondingly excessive wear, and also in the numerous necessary adjustments for the different parts of the engine to take up all wear and looseness that might occur, so as to keep the engine tight and in complete operative condition at all times, and also in numerous arrangements, constructions, and combinations of parts and the details thereof made necessary by the change of construction above stated, substantially as will be hereinafter described, and then more particularly pointed out in the appended claims.

In the annexed drawings, illustrating my invention, Figure 1 is a horizontal sectional plan view of my improved rotary engine, th upper head being removed and the piston-carrier, with its rolling pistons, being plainly exposed to view. Fig. 2 is a top plan view of my improved engine with the upper frame, the vertical shaft, and its pulley removed. Fig. 3 is a vertical section of the entire engine having a vertical shaft and provided with my improved piston-carrier, piston-rolls, and th

several adjustments, said section being taken on the line *y y* of Fig. 2. Fig. 4 is a vertical section of the cylinder, showing the steam-passages in the wall thereof, said section being taken on the line *x x* of Fig. 1. Fig. 5 is a detail perspective view of one of the pin-provided shoes on which the piston-rolls slide and rotate.

Like letters of reference designate corresponding parts throughout all the different figures of the drawings.

A designates the cylinder of my improved rotary steam-engine. It is generally designed to occupy a vertical position, although it may of course be used, if preferred, in a horizontal or any other position. It is provided at one end, preferably the bottom end, with the head A′, which is preferably cast integral with the side walls of the cylinder, said cylinder itself forming an engine-frame, and said head A′ projects beyond the sides of the cylinder sufficiently to provide a flange or rim A^2, by means of which the cylinder can be bolted or otherwise secured to any suitable bed or support. By this plan of construction strength is insured, as well as a saving of the expense ordinarily incurred in fitting and securing these several parts together. At the upper end of the cylinder is formed a flange *a*, to which is bolted the upper frame B, that carries the drive shaft and pulley and certain of the adjustments of the engine, said frame being of any suitable and desirable shape and pattern and being readily removable from the cylinder.

Within the cylinder A is the piston-carrier E, (see Figs. 1 and 3,) which consists of a suitable metallic cylinder of less diameter than the internal diameter or bore of cylinder A, so placed eccentrically to the latter as to come in contact with the bore of the cylinder at a suitable point. (See Fig. 1.) In this piston-carrier E are formed two or more recesses *b b*, having the semicircular bottom adjacent to the point where the drive-shaft D is connected to the piston-carrier, and said recesses extending to the periphery of the piston-carrier E, with walls which form a tangent to the semicircle at the bottom of said recess.

Within the recesses *b* of the piston-carrier E are placed the cylindrical pistons or piston-rolls F F, the diameter of which is equal to the width of the slot *b*, while their length vertically is the same as the length of the piston-carrier—that is to say, the distance between the bottom head of the cylinder and its upper head or cover. Each of these piston-rolls F F revolves upon a stem or journal *c*, projecting upward from a guide block or shoe *d*, (see Fig. 5,) which is received into a circular groove *e*, formed in the bottom head A′ of cylinder A. This groove is of less diameter than the piston-carrier and is always covered by it. The block *d* fills a short section of the groove. The stem or journal *c* enters the central hole in the piston-roll, which hole or passage extends upward through the piston-roll to the top and is open at the top end. The groove *e* is at such a distance from the inner surface of the cylinder as to always keep the peripheries of the cylindrical piston-rolls F F in contact with the inner surface of the cylinder, and the depth of the aforesaid recesses *b* in the piston are just sufficient to receive the piston-rolls when they pass the point where the eccentric bearing of the piston-carrier is nearest to the wall of the cylinder. It will therefore be evident that the piston-rolls will always be kept in contact with the inner surface of the cylinder by means of the guide blocks or shoes *d*, sliding within the circular groove *e*, which groove is concentric with the cylinder-surface, but that the said piston-rolls will also have an apparent reciprocating movement within the recesses *b* of the piston-carrier as the latter revolves, and also the piston-rollers F F will revolve freely upon the journals *c* of the guide-shoes; but this revolution will cause only a rolling frictional movement upon the sides of the recesses *b*, as well as upon the inner surface of the cylinder A.

C denotes the other piston head or cover, which is of the same diameter as the cylinder-bore and is received neatly into the upper end of the cylinder, so as to have a nice fit against the top side of the piston-carrier E and the piston-rolls F F. On top of this cylinder-cover C is an annular packing-ring G, which fits down neatly over the packing *g*, by means of which the packing is expanded to form a close joint at the point where the periphery or edge of the cylinder-cover C comes in contact with the cylinder-bore, and the packing-ring G is secured in place by means of suitable screws, as shown in Fig. 3. Thus ring G can be removed whenever it may be desired to do so.

H denotes a plate having any suitable and desirable form or shape—as, for instance, the form indicated in Fig. 2—which is supported on the cover C and connected thereto by means of suitable screws or other means, which plate forms a support for a stuffing-box I, the follower of which is provided with the screws *i* for adjusting it, which stuffing-box receives the vertical shaft D, which constitutes the main drive-shaft of the engine, having its lower end passing down through the stuffing-box or cover C and entering with a close fit the central opening in the piston-carrier E, it being also noted that this shaft D is held in a suitable bearing in the upper frame B and that it carries the pulley *h* and the pulley *h′* or any other arrangement of pulleys that may be preferred for the purpose of transferring and applying power from said shaft to any work and where it may be desired to utilize the same. Further, the lower end of the shaft D is flattened, so as to be square or rectangular in cross-section, and the receiving-recess is correspondingly shaped, so that the shaft will rotate with the piston-carrier. The embossment H is provided with screw-threaded perforations (two

or more, as the case may be) bored vertically therein to receive the lower ends of vertical adjusting-screws J J, having the heads J′ J′ squared or shaped for the application thereto of a wrench. These screws J J are supported in the horizontal bar B′, which forms a part of the upper frame B. The frame being rigid after once it is fixed in position behind the cylinder, it will be manifest that by rotating the adjusting-screws J J in one direction or the other the embossment H may be moved up or down, as the case may be, and consequently the cover C adjusted up or down, and hence when any wear has taken place between the upper surface of the piston-carrier and the piston-rolls and the under surface of the cover C this wear can be readily taken up and the joint kept tight and all looseness prevented by simply adjusting the screws J J and seating the cover tightly upon the piston-carrier. The adjusting-screws J J are provided with the nuts *j j*, which are situated close up against the under side of the cross-bar B′.

The piston-carrier E rotates upon a pin K, projecting upwardly from the bottom of the lower cylinder-head A′ at a point eccentric to the cylinder-bore. This pin or journal K is provided with a tapered part K^2, which is driven into a tapered hole in the bottom head A′, the lower end of the said part K^2 being provided with a nut K′, located on the under side of the cylinder-head, so that in this way the pin K is firmly and immovably stationed in the cylinder-head A′. When the parts of the engine are being assembled for the purpose of putting it into operative condition, this journal or pin K′ will first be fixed in place, and then the piston-carrier, having a suitably-prepared recess therein, will be dropped over the said pin, which will enter the aforesaid recess loosely. Then through the opening in the upper side of the piston-carrier Babbitt or other molten metal will be poured through until a sufficient amount of babbitt *k* encircles the pin K and forms a neat tight joint, with only sufficient looseness or play to allow the piston-carrier to easily rotate. In this way the piston-carrier can be adjusted so that the point thereof which bears against the cylinder-bore will bear tightly and neatly. If at any time said bearing should become loose or in consequence of the friction wear should be occasioned, which would be detrimental, the Babbitt metal can be replenished at *k*, so as to keep the bearing at this point firm and in the proper condition.

Referring again to the pin-provided guide blocks or shoes on which the piston-rolls revolve and slide, it will be noted that they may be made of any suitable metal or material, such as Babbitt metal, or anything else. Whenever they become slightly worn, a little babbitt can be supplied through the central vertical perforations of the piston-rolls, and thus the guide-shoes tightened, strengthened, and made perfect; also, when the guide-shoes are worn and loose they can be removed, and new ones can readily be supplied by pouring a sufficient amount of Babbitt metal into the vertical central perforations of the piston-rolls, the result of which will be to form a stem or journal *c* to the curved slide-section *d* of the guide-shoe. Thus the adjustment of the piston-rolls can be kept perfect and their movements made easy and correct at all times.

Referring again to the recesses *b b* of the piston-carrier, it is to be observed that the vertical opposing faces thereof which come in contact with the peripheries of the piston-rolls are preferably faced with metal plates *f f*, which make a close fit and prevent the roll from vibrating in the recess of the piston-carrier during reversal. When these faces *f* are too much worn, they can be removed and packed or new ones supplied in their place.

L denotes the main steam-supply pipe, which branches into two parts L′ L′, one leading to one point in the wall of cylinder A and the other leading to another point in the wall of cylinder A. At the intersection of the main pipe L with the branches L′ L′ a valve M is located, and each of the branches L′ is provided with a valve *m*. When the engine is to be reversed, the steam, instead of being directed into one of the branches L′, will be directed into the other, and thus the steam caused to enter the cylinders at different points.

By referring to Fig. 4 we will notice the arrangement of the inlet and exhaust ports for the steam, gas, air, or other motive power which is used to drive my improved rotary engine, for it will be observed that any kind of motive power can be used in this engine. N denotes a vertical recess or space in the side wall of the cylinder A, having the inwardly-extending lateral openings *n n*, which communicate with the cylinder-bore and the outwardly-extending lateral openings *n′ n′*, to which the steam-pipe L′ is coupled, as shown in Fig. 2. O denotes the exhaust-port. The exhaust and inlet ports will be properly situated with relation to each other, being diametrically opposite each other.

The operation of the engine may be described, briefly, as follows: Steam being admitted into the cylinder through one or the other of the inlet-ports, of which there may be two or any other number, it will impinge upon the opposite cylindrical piston, inasmuch as it cannot pass directly through the exhaust-port, owing to the interposition of the piston-carrier and its pistons, and the result of this impingement upon the rolling pistons will be to rotate the piston-carrier, the piston being pushed before the steam, and as the piston-carrier rotates the drive-shaft will be rotated also. When the piston upon which the steam may at this time be acting reaches the exhaust-port and passes beyond it, then the said steam will be allowed to exhaust through port O, for instance; but at the same time that this first-mentioned piston-roll passes

the exhaust-port the other piston-roll will have passed the inlet-port, thus placing itself in advance of the steam, allowing the latter to impinge and act thereupon, and thus the piston-carrier and shaft will be kept continuously rotating so long as the supply of steam is kept on. The engine can be easily reversed by allowing steam to enter through the other inlet and act upon the piston in a reverse direction, and it will be noted that by means of the several adjustments of the several mechanical parts of the engine which I have already described tight joints may be kept, all the wear taken up, and the engine kept in good, reliable, and effective working order at all times. As a further adjustment it will be noted that in order to keep the piston-carrier close against the inner surface of the cylinder at the point where it contacts therewith it will be desirable to slightly adjust said carrier in order to take up any wear that may occur at this point, and therefore the perforations in the ears on the embossment through which the securing-screws pass, as shown in the drawings, are made elongated or of a slot form, so that there may be a sufficient play to permit of this slight adjustment. Likewise, the perforation in the cover C, through which the shaft D passes, is similarly elongated, and said hole after the shaft has been adjusted will be filled with Babbitt metal. Also, the cover is provided with elongated recesses at points below the lower ends of the screws J J, so that when the aforesaid adjustment takes place the embossment may have room for movement without shifting the cover. Also, the perforations in the bar B′, through which the screws pass, are similarly elongated. Again, it will be observed that the concentric grooves in which the guide-blocks slide can be provided in one or in both heads, as may be preferred. In the drawings I have shown it in the bottom head of the cylinder; but a similar groove may be placed in the cover, and particularly so when the engine is placed in a horizontal position.

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

1. The combination of the steam-clyinder, the eccentrically-located piston-carrier therein, having peripheral recesses, the rolling pistons operating in said recesses, the guide-blocks therefor having stems that enter central vertical perforations in the pistons, a shoe that slides in a circular recess in the bottom cylinder-head, and the stuffing-box plate with its stuffing-box for the shaft, together with the adjusting-screws for the said plate and the cylinder-cover, substantially as described.

2. The combination, with a rotary engine having a piston-carrier peripherally recessed, and rolling pistons located within said recesses, of the guiding-shoes having stems *c*, that enter the lower ends of vertical perforations extending centrally through the pistons from end to end, so that Babbitt metal may be introduced at the upper end, said guide-blocks having also the curved parts *d*, which operate within a groove in the head of the cylinder, substantially as described.

3. The combination of the cylinder, the piston-carrier, and piston-rolls within the same, the adjustable cover C, the frame B, having cross-piece B′, the shaft D, connected to the piston-carrier, the embossment H, carrying stuffing-box I, said plate being connected to the cover C, and the adjusting-screws J J for regulating the adjustment of the cover C to take up wear, &c., substantially as described.

4. The combination, with the cylinder A and the piston-carrier and rolling pistons within the same, of the cover C, packing-ring G, connected thereto, embossment H, removably connected to the cover and carrying packing-box I for shaft D, the frame B, having the bar B′, and the adjusting-screws J J′, entering screw-threaded perforations in the embossment H for adjustment, substantially as described.

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

JOHN SPERRY.

Witnesses:
E. N. WATERS,
WM. L. BOYDEN.