No. 704,637. Patented July 15, 1902.

H. E. HODGSON.

ROTARY ENGINE.

(Application filed July 27, 1900.)

(No Model.)

Fig. 1

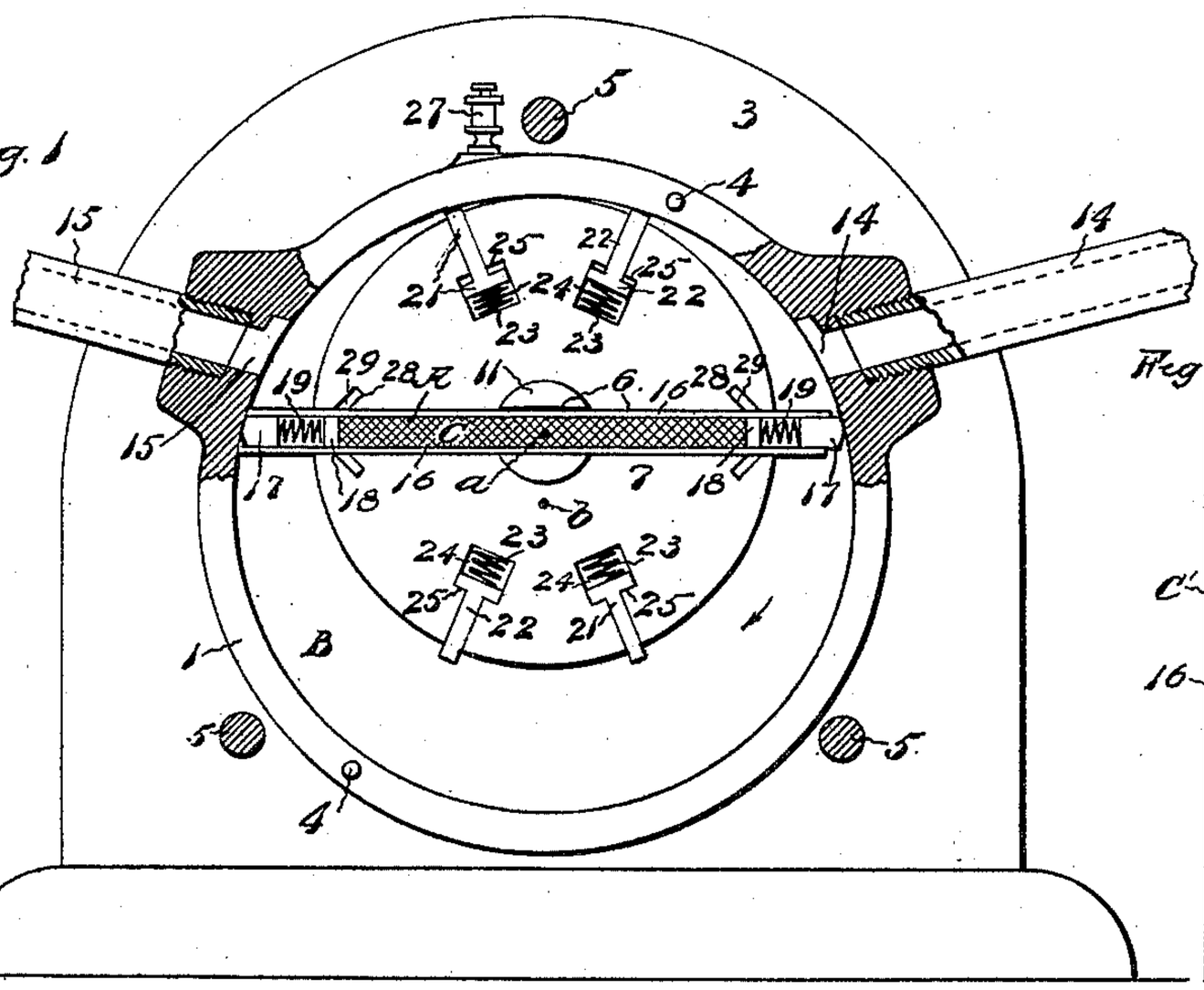


Fig 8

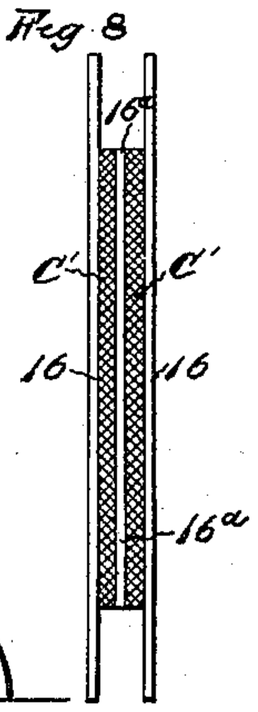


Fig 2

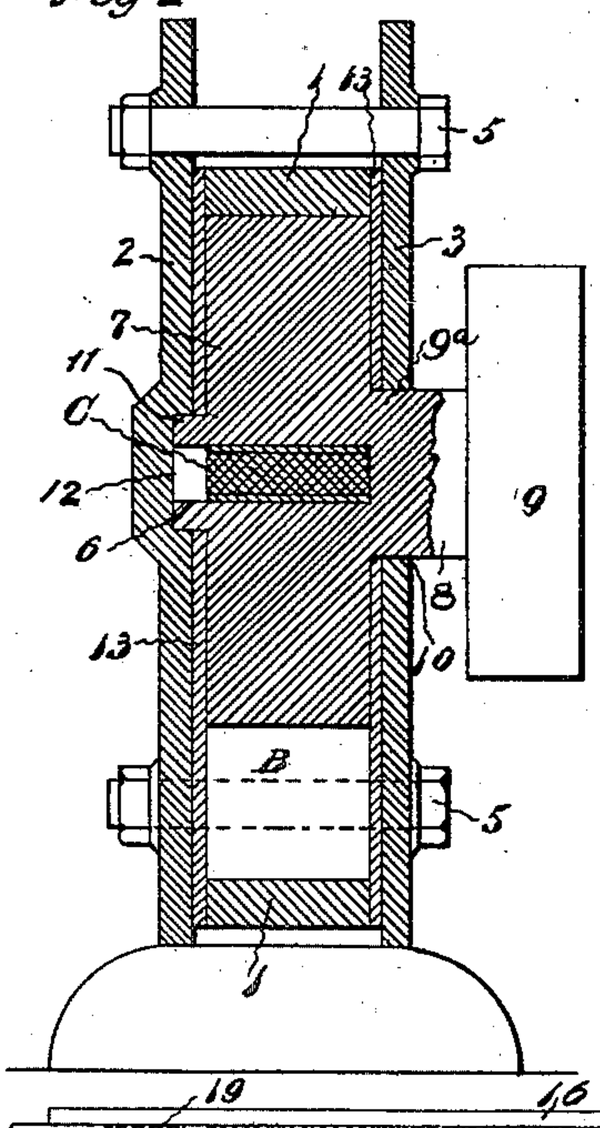
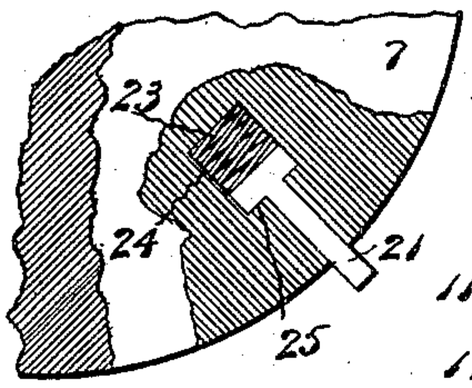


Fig. 4.



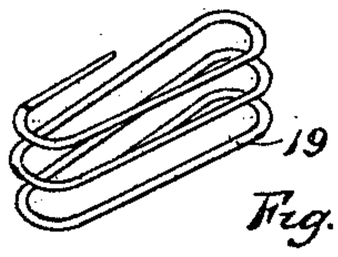


Fig. 5.

Fig. 3

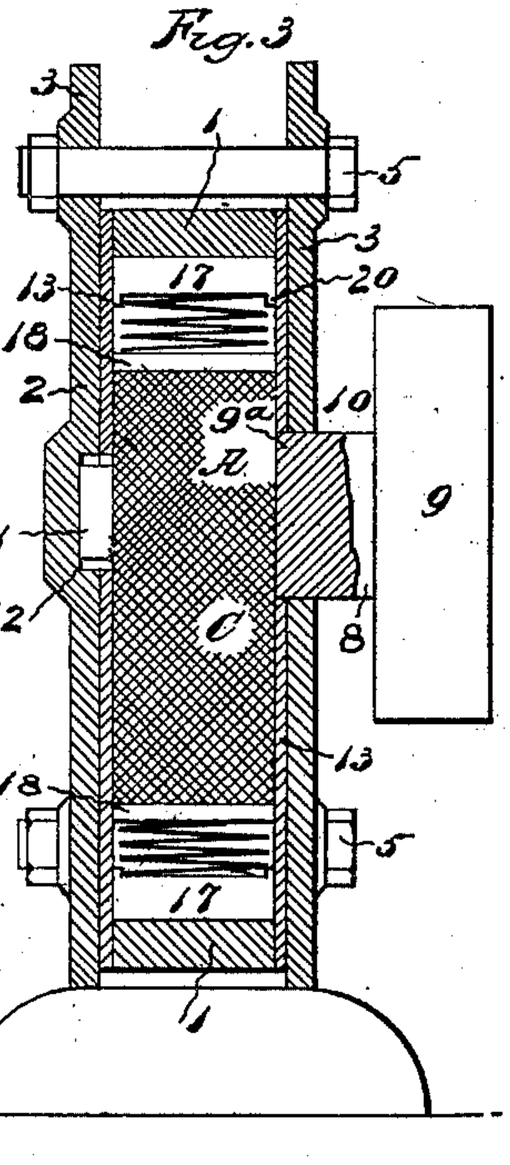


Fig 6

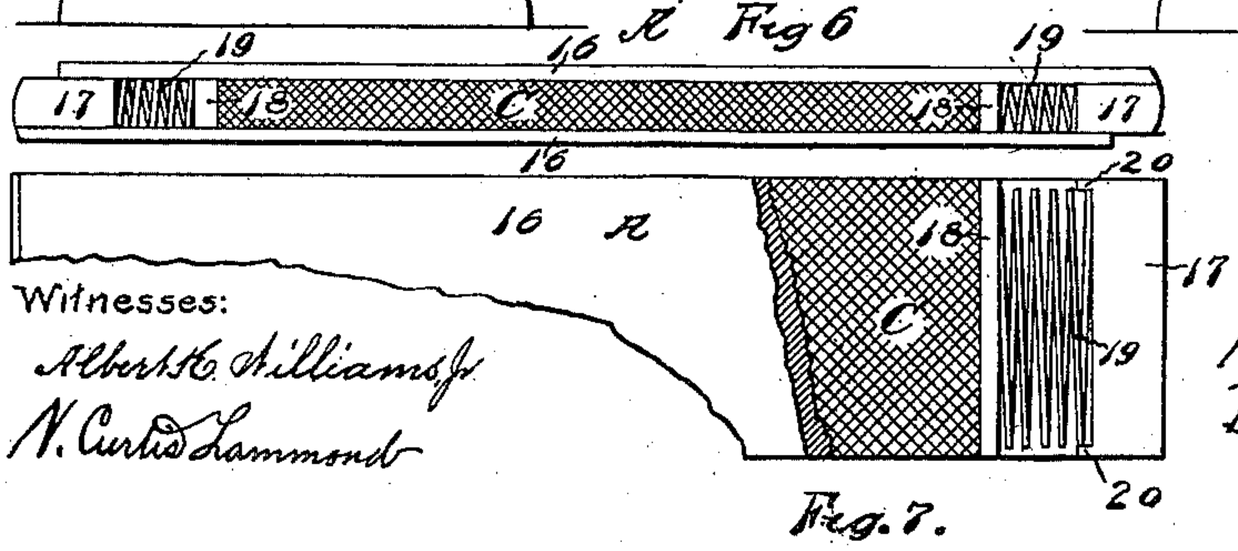


Fig. 7.

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UNITED STATES PATENT OFFICE.

HERBERT E. HODGSON, OF NORFOLK, VIRGINIA, ASSIGNOR OF ONE-HALF TO WM. W. OLD, OF NORFOLK, VIRGINIA, EXECUTOR OF HENRY D. VAN WYCK, DECEASED.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 704,637, dated July 15, 1902.

Application filed July 27, 1900. Serial No. 25,009. (No model.)

To all whom it may concern:

Be it known that I, HERBERT E. HODGSON, a citizen of the United States, residing at Norfolk, in the county of Norfolk and State of Virginia, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is an elevation of a rotary engine embodying my invention, one of the sides or heads of the cylinder being removed. Fig. 2 is a transverse sectional view. Fig. 3 is a similar view taken with the piston in such position that it appears in elevation. Fig. 4 is a detail view showing a section of the rotary-piston-carrying part and one of its steam-obstructing valves or packings. Fig. 5 is a perspective view of the spring for supporting said valve or packing or the packing of the piston. Fig. 6 is an edge view of the piston. Fig. 7 is a face view of the same, partly broken away. Fig. 8 shows a modification of the piston.

Referring to the drawings, A is a diametrical sliding and rotating piston mounted eccentrically within a casing or cylinder B and adapted to extend in all of its positions within said casing substantially from one to the other of the peripheral walls thereof. The cylinder B preferably consists of a ring 1, the inner surface of which forms the peripheral walls above mentioned, against which the piston is adapted to bear, and heads 2 3, properly located on said ring by means of a steady pin or pins 4. Said heads are strongly connected or clamped together and against opposite sides of the ring 1 by means of bolts 5 or other suitable fastening. It will be understood, however, that the cylinder may be constructed in any other well-known or suitable manner.

6 is a guide or guiding slot or way for the piston A, by which the latter is directed in its transverse sliding motion within the cylinder. This guide is preferably formed in a rotary head 7, mounted eccentrically within the cylinder, the mean center of the cylinder being indicated at *b* and the center of rotation of the piston being indicated at *a*. I refer to the center *b* as a "mean" center, because while the inner surface of the cylinder may under some conditions be a true cylinder, as when the eccentricity (the distance between the points *a* and *b*) is comparatively small I prefer to form the cylinder and the inner surface of the ring 1 of a more or less oval contour, the principle of such oval figure being that all of the straight lines drawn diametrically through the center of rotation *a* from wall to wall of the cylinder shall be of equal length.

Connected with the rotary head 7 is a power-shaft 8, carrying a pulley 9 or other means for transmitting the power of the engine for driving such machinery as may be desired, said pulley being typical of any power-transmitting means, other varieties of which are gear-wheels, cranks, &c. The head 7 is preferably connected with said shaft through the medium of a hub or boss 9^a, cast with or attached to the two parts of the head and fitting in an aperture or stuffing-box 10 in the head 3. The piston and head are adapted for rotation at very high speed, and said rotary parts are preferably steadied by bearing in the other head 2, as by forming the head 7 with a journal 11, fitting in a bearing-recess 12 in the inner face of the head 2. For durability and convenience of repair it is desirable that the principal wear of the rotary parts A and 7 shall not be taken directly by the inner surface of the heads 2 and 3, and I therefore interpose on the inner faces of the heads of the cylinder relatively thin disks or plates 13, securely clamped by the bolts 5 between said heads and the edge of the ring 1. This construction makes it convenient to form the piston and the plates 13 of one metal, such as steel, while the heads 7 and ring 1 (or the inner face of the latter) are made of another metal, such as brass, thus lessening the friction and aiding in the smooth running of the engine at high speeds.

14 and 15 indicate the steam admission and the exhaust ports, respectively; but it will be understood that in reversing the engine, which may be accomplished by a three-way valve of

known construction or other suitable means, the port 15 will become the steam-port and that at 14 the exhaust-port.

Beyond or without the reversing-valve above referred to I provide in the main steam-pipe a cut-off valve adapted to be closed when sufficient steam has been admitted, so as to utilize the expansion of the steam for the completion of the stroke, such a cut-off valve being actuated positively from the shaft 8 or by means of a centrifugal governor on or actuated from said shaft. The situation of such cut-off valve so that the reversing-valve is between the cut-off valve and the engine enables the cut-off valve to govern the engine in either direction of motion; but the present application relating to the construction and organization of the engine itself and the foregoing brief description of such valve being sufficient for an understanding of the operation of the engine I do not deem it necessary to herein illustrate or further describe the particular construction of said reversing and cut-off means, the engine being capable of use with any suitable or preferred devices of that character.

For the best results the ports 14 and 15 should be located substantially as shown—that is to say, one on each side of the head 7 toward that side of the cylinder at which the head is situated—and said ports are preferably elongated toward the point at which the head 7 most closely approaches the interior of the cylinder. This construction prevents the formation of a vacuum in the cylinder near the said point and between the same and the steam-admission port, and at the other side of the head 7 it prevents the confining of the steam between the said point and the exhaust, resulting in a smoother running of the engine without knocking or pounding or waste of power.

It has been heretofore proposed to employ in rotary engines of the class thus far described diametrical pistons adapted to rotate and slide relative to the inclosing cylinder; but where such pistons have been made steam-tight in the revolving head they have been so subject to jamming and binding in said head and between the same and the cylinder as to be entirely impractical, especially for running at high speeds. The undue wear also incident to their use has seriously detracted from the durability of the engine. To remedy these defects, it has been proposed to mount such plates in the revolving head by means of antifriction or roller bearings; but with such bearings it has been impossible to prevent the leaking of steam past the piston-plate to a serious extent. An important feature of my invention consists in the construction of the piston A. It comprises two or more independent plates 16, preferably of steel and each adapted to neatly fit the interior of the cylinder from head 2 to the head 3. Each plate is also of a length substantially equal to the interior diameter of the ring 1 measured through the center *a*. With said plates 16 I combine means for separating them or holding them apart with a yielding pressure, said means consisting, preferably and in the construction illustrated, of an interposed yielding, elastic, or semi-elastic body C. This I preferably make of asbestos; but it will be understood that I describe this material as typical of any material capable of withstanding the actions of heat and steam and adapted to keep separated the plates 16, but capable also of yielding whenever necessary to permit sufficient approach of said plates toward each other to prevent any binding of the same in the head 7. I thus produce a diametrical piston-plate which is steam-tight in the revolving head, the body C acting as a steam-tight packing for this purpose and which is also freely movable longitudinally in said head in the guide 6. It will also be observed that the plates 16 are adapted to move individually one without regard to the other, as may be required in the revolution of the engine to maintain contact with the curved walls of the cylinder. That end of the piston which is approaching the exhaust is normally in contact with the interior curved wall of the cylinder and by the action of said wall is being pressed toward the head 7 and caused to slide in the guide 6. At the other end of the piston A, I allow a little clearance between the ends of the piston and the wall of the cylinder; but the space thus left is closed by metallic packings 17, freely movable inward and outward in the end of the piston, so as to always be in contact with the walls of the cylinder. This freedom of movement allows the packing 17 at the other end of the piston A, where the plates 16 are in contact with the cylinder, to be pressed backward by the walls of the cylinder entirely within or between the plates 16. The preferred mode of constructing and mounting the packing 17 with relation to the plates 16 is as follows:

18 18 indicate bearings and separating plates or blocks of metal fitted between the plates 16 at the ends of the packing and separating body C. These blocks are sufficiently thin so that they will not spread the plates 16 to cause the latter to bind in the guide 6 and at the same time afford a positive means for separating the plates 16 to prevent the undue compression of the body C. The block 18 at that end of the piston which is receiving the steam-pressure further serves to communicate the steam-pressure on the rear plate 16, where it extends beyond the guide 6 to the forward plate, and distribute the steam-pressure to the two or more parts of the piston. The block 18 further constitutes a bearing for a spring 19, interposed between the block and the packing 17, the latter being provided with inwardly-extending end lugs 20, between which the spring is confined. The packing

17, springs 19, blocks 18, body C, and the plates 16 are all freely movable relative to each other toward and from the center of rotation to prevent friction or binding at any point, and said parts are kept in place in the directions of the axis of the engines by the heads 2 and 3, with which they have a steam-tight contact.

It will be observed that the body C, in addition to the functions already described, forms a steam-tight packing for the piston-plates 16 along their edges where they move in contact with the heads of the cylinder.

The construction of the springs 19 is somewhat peculiar, each spring consisting of a series of coils or turns, each of which is substantially rectangular, so that the spring practically fits the rectangular space bounded by the inner surfaces of the plates 16 and of the lugs 20, the inner coil of the spring bearing upon the block 18 and the outer coil upon the inner face of the packing 17. The compression of the springs 19 also results in an inward reactionary pressure upon the ends of the packing C, which causes a longitudinal compression of said packing and maintains the outward pressure of the same against the piston-plates 16.

At certain periods in the rotation of the piston the piston itself serves as a packing means to prevent the leakage of live steam direct to the exhaust through the space where the head 7 is close to the wall of the cylinder; but at other times the piston will not so serve, and it is necessary to provide a special packing means for that purpose. It is practically impossible to prevent such leakage by any attempted close fitting of the head 7 against the cylinder or by means of any stationary packing fixed in the cylinder and adapted to engage the rotary head. The wear of the parts and especially of the plates 16 upon any such fixed packing rapidly impairs any attempted steam-tight joint of the nature above referred to. I, however, entirely obviate this difficulty by providing the head 7 at a suitable point or points between the ends of the piston with movable packing mounted in and carried with the head 7 in such manner that said packings may always be in contact with the wall of the cylinder to effectually cut off the short passage-way of live steam to the exhaust when the piston itself is in such position as to be inoperative for that purpose. By such construction I may employ a rigid metallic spring-mounted packing in the nature of a valve and of a very smooth-working and durable character. Such packings are indicated at 21 22 and are preferably of T shape, having their heads mounted in suitable elongated radial slots in the rotary head 7. The packings 21 22 are pressed outward by springs 23, mounted in the slots 24 of the rotary head behind the packings, and are limited as to their outward movement by overhanging lips 25 of the rotary head, which engage the transverse heads or flanges of the packing. The springs 23 are confined at their ends by the cylinder-heads 2 and 3 and are preferably of the same construction as the springs 19, already described. The packings 21 22 are preferably arranged, as shown, somewhat remote from the ends of the piston and near that point of the rotary head which is midway between the ends of the guide 6. It will be understood that one of such packings instead of the two shown may be employed at each side of the rotary head, in which case the packings will be situated on that diameter of the rotary head which is at right angles to the guide 6 and the piston.

It will be understood that my invention is well adapted for causing the compression or flow of fluids (air, gas, water, and other liquids) by applying external power to the shaft 8 to rotate the piston within the cylinder, in which case the fluid will be drawn in through one of the ports 14 15 and forced out through the other.

The necessary lubrication of the parts may be effected by any well-known or preferred oiling device suitably situated to supply oil in proper quantity to the moving parts of the engine, one form of such a device being indicated at 27.

It will be understood that my invention includes the employment of more than two piston-plates, such as the plates 16, and more than one of the packing-bodies C. Thus in large engines I may construct the piston of alternating plates and packing-bodies. In Fig. 8 I have illustrated such construction with two packing-bodies C′, separated by a metallic plate 16^a. The latter may be made shorter than the plates 16 to give room for the radially-movable packings 17 and their mountings.

Although not necessary to the successful operation of the parts hereinbefore described, I may form in the head 7 at the sides of the guide 6 slots 28 and fill the same with yielding steam-tight packings 29, adapted to engage the sides of the plates 16.

What I claim is—

1. In a rotary engine, the combination of a rotary guide, a piston transversely movable therein and an inclosing cylinder, said piston consisting of separate plates and means for holding said plates apart in directions transverse to the piston with a yielding pressure.

2. In a rotary engine, the combination of a rotary guide, separate piston-plates transversely and independently movable therein and extending to the surface of the cylinder, a packing-body between the said plates adapted to hold the latter against the sides of said guide, and an inclosing cylinder.

3. In a rotary engine, the combination of a rotary guide, a piston transversely movable therein and an inclosing cylinder by the action of which the piston is moved longitudinally in the guide, said piston consisting of

separate plates movable independently of each other, and a yielding packing C between said plates.

4. In a rotary engine, the combination of a rotary guide, separate piston-plates movable independently of each other in said guide and engaging the same by sliding contact, means for holding said plates apart with yielding pressure toward and against the walls of said guide, and an inclosing cylinder.

5. In a rotary engine, the combination of a rotary guide, a piston transversely movable therein and an inclosing cylinder, said piston consisting of separate plates individually movable longitudinally and extending from side to side of the cylinder, and means for holding said plates apart in directions toward the engaging surfaces of said guide with a yielding pressure.

6. In a rotary engine, the combination of a rotary guide, a piston transversely movable therein and an inclosing cylinder by the action of which the piston is moved in the guide, said piston consisting of separate disconnected and individually-movable plates and a yielding packing-body between said plates adapted to hold the latter against the sides of said guide.

7. In a rotary engine, the combination of a rotary guide, piston-plates movable in said guide, a yielding packing between said plates, holding the latter in contact with the guide and furnishing a steam-tight packing along the edges of said plates at the heads of the cylinder, and an inclosing cylinder.

8. In a rotary engine, the combination of a rotary guide, a piston movable therein and an inclosing cylinder, said piston consisting of separate plates, means for holding said plates apart in directions transverse to the plates and in contact with the guide with a yielding pressure and endwise-movable packing-plates confined between the ends of said piston-plates.

9. In a rotary engine, the combination of a rotary guide, separate piston-plates individually movable therein, a packing-body between the said plates, endwise-movable packing-plates between the ends of said piston-plates, and an inclosing cylinder, said piston-plates extending from side to side of the cylinder, being movable relative to and adapted to engage the cylinder independently of said packing-plates.

10. In a rotary engine, the combination of a rotary guide, a piston transversely movable therein and an inclosing cylinder by the action of which the piston is moved in said guide, said piston consisting of separate plates, a yielding packing C between said plates and endwise-movable packing-plates at the ends of the piston, said piston-plates extending from side to side of the cylinder, being movable relative to and adapted to engage the cylinder independently of said packing-plates.

11. In a rotary engine a piston composed of plates 16 adapted to engage a suitable guide, a packing C between said plates, blocks 18 at the ends of said packing, metal packings 17 between said plates and having lugs 20 and springs 19 between said lugs.

12. In a rotary engine, the combination of a rotary guide, a piston transversely movable therein and composed of separate plates adapted to slide longitudinally relatively to each other, each plate being substantially of a length equal to the operative diameter of the cylinder, extending from side to side of the latter and directly engaging the wall of the same, said plates being spaced apart, situated one at each side of the center of rotation and adapted to both engage the cylinder simultaneously at the same end of the piston and operate alternately as the steam-pressure-receiving means, substantially as set forth.

13. In a rotary engine, the combination with a cylinder, of a rotary guide, and a piston transversely movable therein comprising separate piston-plates extending from side to side of the cylinder and movable thereby, and packing-plates held and guided radially between the ends of said piston-plates, all of said plates being individually free and movable radially relative to each other.

14. In a rotary engine, the combination with a cylinder, of a rotary guide, a piston transversely movable therein, comprising separate piston-plates extending from side to side of the cylinder and movable thereby, packing-plates held and guided radially between the ends of said piston-plates, all of said plates being individually free and movable radially relative to each other, and a packing carried by said guide intermediate of the ends of the piston and adapted to engage the cylinder.

15. In a rotary engine, a piston consisting of separate plates, a yielding packing-body between the same and springs acting inwardly on said packing-body whereby its outward pressure against said plates is maintained.

16. In a rotary engine, the combination, with a rotary-piston carrier and inclosing cylinder, of separate piston-plates mounted and freely and individually movable radially in said carrier, each plate being situated in a transverse plane outside the center of rotation and both plates being adapted to engage the cylinder simultaneously at the same end of the piston in such planes.

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

HERBERT E. HODGSON.

Witnesses:
N. CURTIS LAMMOND,
ALBERT K. WILLIAMS, Jr.