No. 689,251. Patented Dec. 17, 1901.

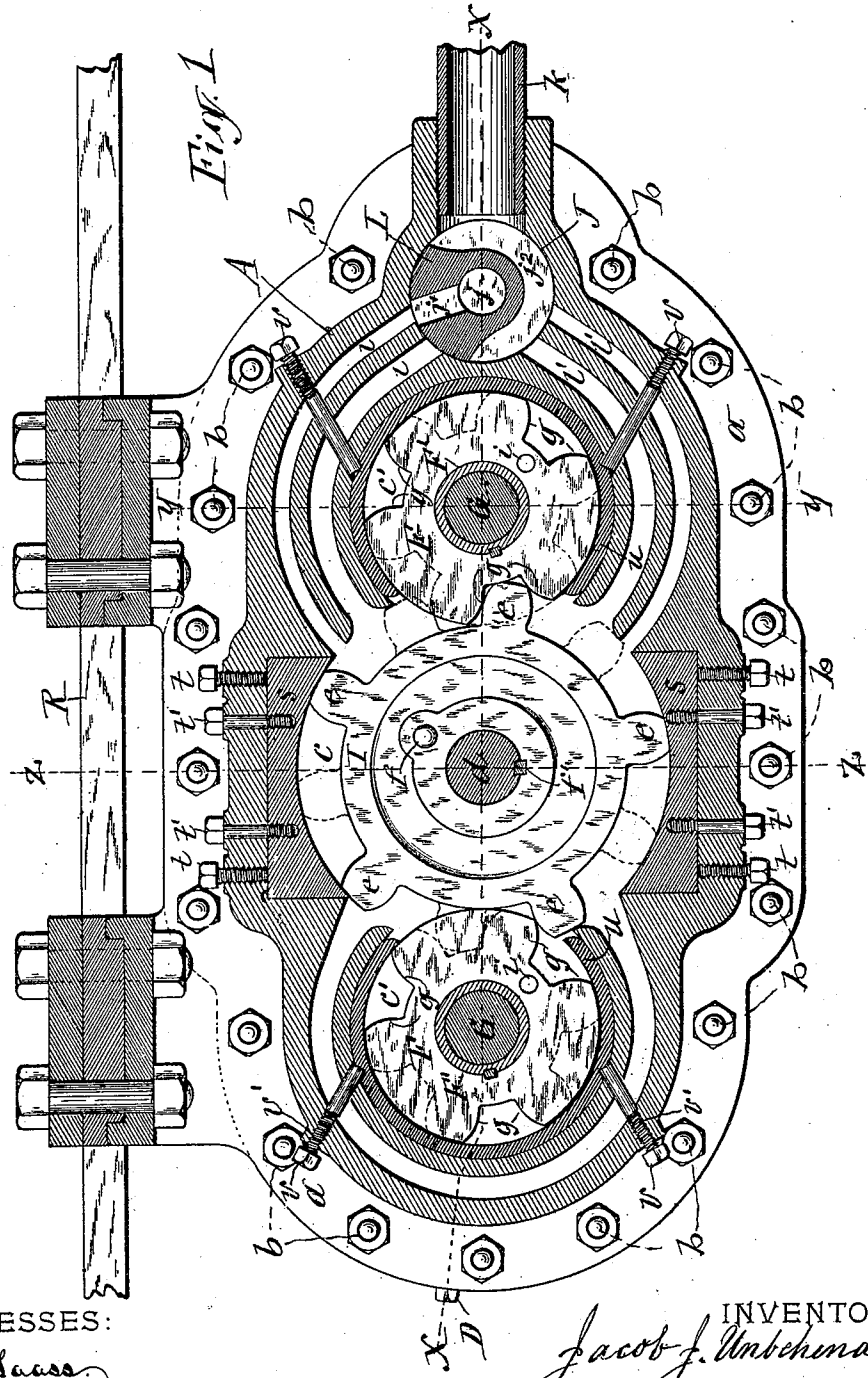
J. J. UNBEHEND.

ROTARY ENGINE.

(Application filed Dec. 18, 1900.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



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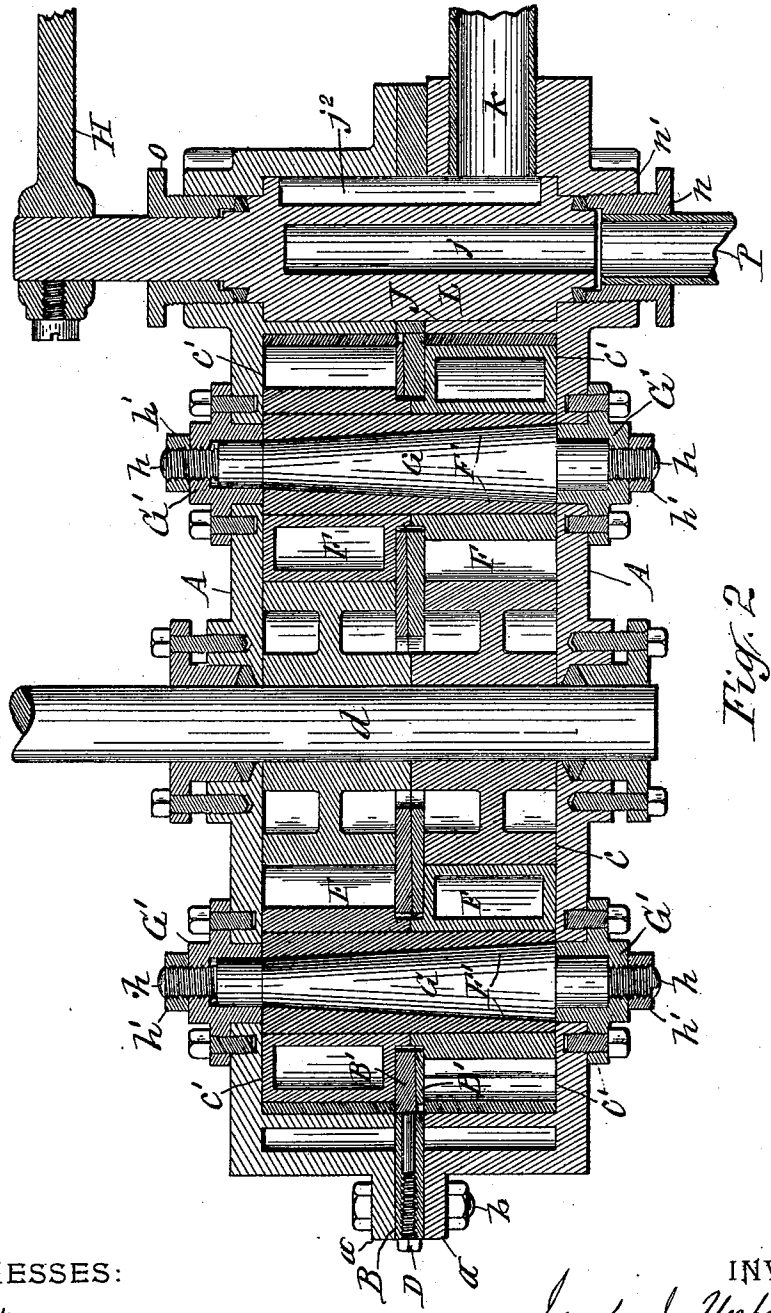

Fig. 2

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Fig. 4

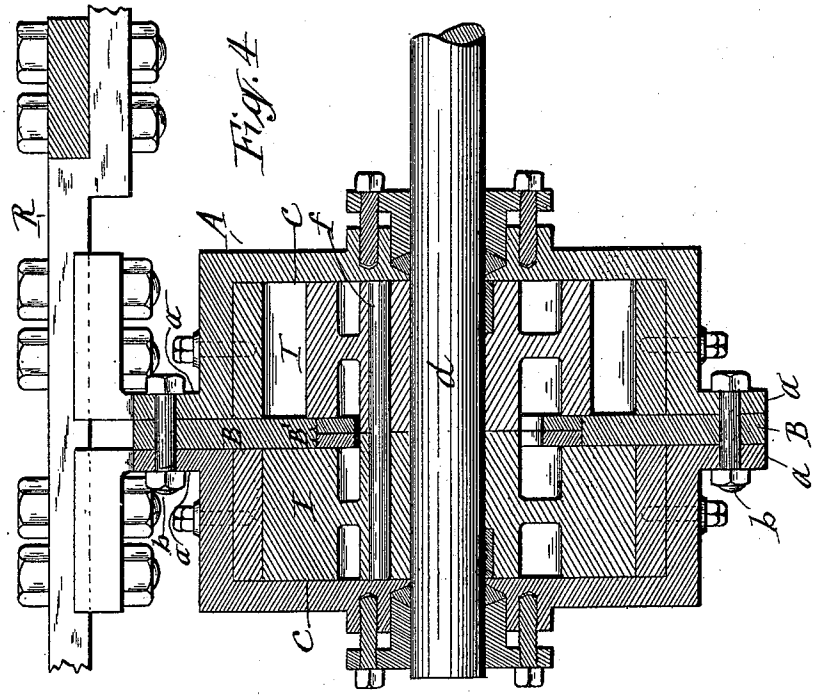

Fig. 5

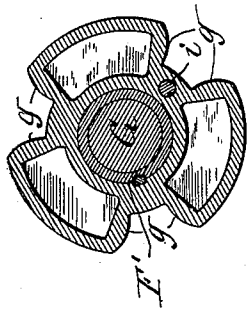

Fig. 3

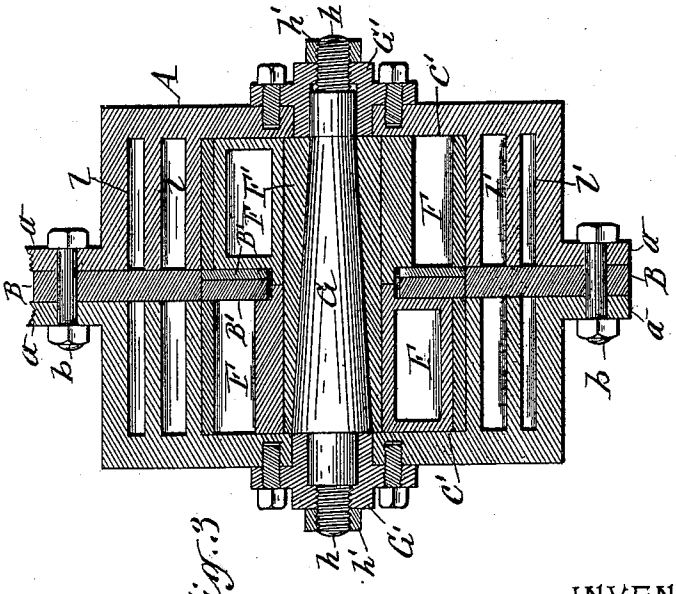

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Fig. 6.

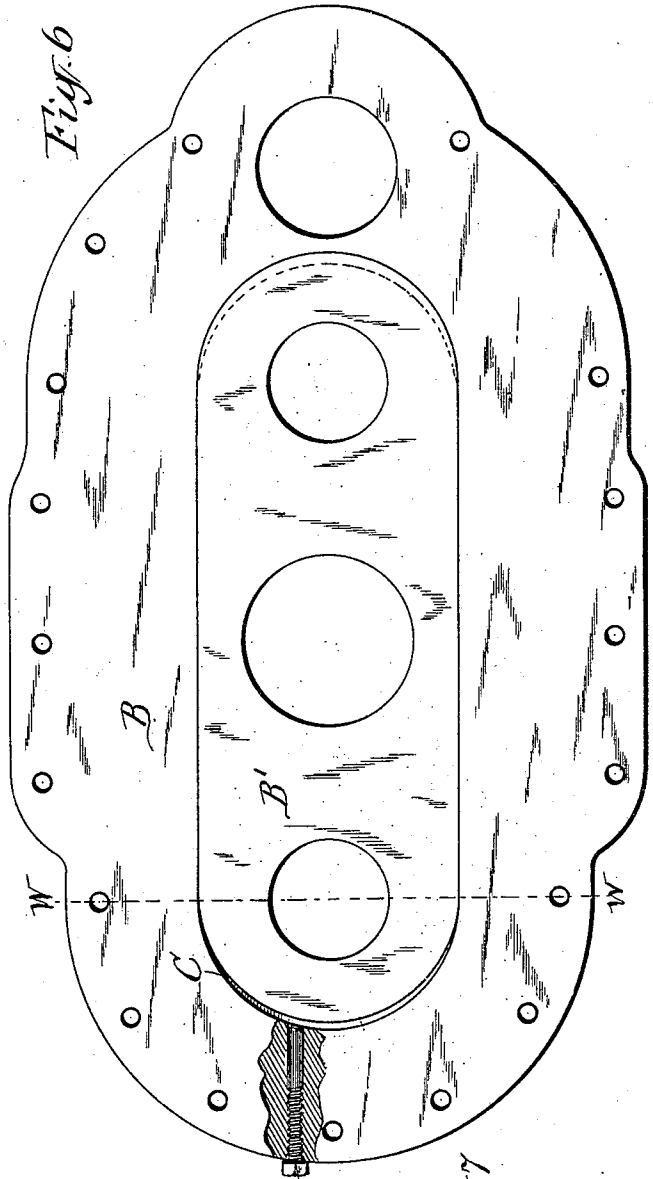
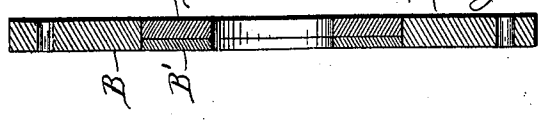


Fig. 7.



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UNITED STATES PATENT OFFICE.

JACOB J. UNBEHEND, OF SYRACUSE, NEW YORK.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 689,251, dated December 17, 1901.

Application filed December 18, 1900. Serial No. 40,288. (No model.)

To all whom it may concern:

Be it known that I, JACOB J. UNBEHEND, a citizen of the United States, and a resident of Syracuse, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Rotary Engines, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates more particularly to the type of rotary engines shown in my Letters Patent No. 606,606, dated June 28, 1898.

The object of my present invention is to simplify the construction of the engine and at the same time increase its efficiency; and to that end the invention consists in the improved construction and combination of the component parts of the engine, as hereinafter described, and summed up in the claims.

The invention is fully illustrated in the annexed drawings, in which—

Figure 1 is a vertical longitudinal section of the engine, with end views of the piston-head and cut-offs. Fig. 2 is a horizontal longitudinal section on line X X in Fig. 1. Figs. 3 and 4 are tranverse sections, respectively, on lines Y Y and Z Z in Fig. 1. Fig. 5 is a transverse section of one of the cut-offs. Fig. 6 is a detached side view of the partition of the engine, and Fig. 7 is a transverse section on line W W in Fig. 6.

Similar letters of reference indicate corresponding parts.

A represents the frame of the engine. This frame is divided longitudinally into two equal parts, between which is placed a longitudinal partition B B′. All of said parts are firmly united by bolts *b b*, passing through flanges *a a*, formed on the exteriors of the frame-sections and through the intervening margin of the partition. This partition I preferably form of a main plate B, which is formed with a longitudinal opening C, containing two plates B B′, which are fitted closely to the top and bottom edges of the opening to properly sustain said plates in position. Said plates are tapered from end to end and in opposite directions from each other for the purpose hereinafter explained. By means of a screw D, passing through a correspondingly-threaded channel in the end of the main plate B and bearing on the thicker end of one of the plates B′, said plate can be shifted longitudinally independent of its companion plate, as represented in Fig. 6 of the drawings, this causing the two plates B′ B′ to jointly produce an increased thickness of that portion of the partition.

The two halves of the frame A are each formed with a steam-cylinder *c* in the center and with annular chambers *c′ c′* at opposite sides of and in the same plane with the cylinder *c* and intersecting the periphery of said cylinder, as shown in Fig. 1 of the drawings.

Through the centers of the steam-cylinders *c c* at opposite sides of the partition B B′ passes the main shaft *d*, to which are fastened the two drums I I, located in the two cylinders. Each of these drums has a plurality of pistons *e e* projecting from its periphery and arranged intermediate the pistons of the companion drums, thus steadying more effectually the movement of the main shaft *d* and rendering the engine more efficient in its operation.

f denotes a dowel-pin which is inserted into the hubs of the two drums to maintain them in their requisite positions in relation to each other. The dowel-pin is required more especially during the operation of cutting the key-seats *f′* in the drums. After the drums are keyed to the shaft said dowel-pin may be removed.

In each of the annular chambers *c′ c′* is arranged one of the rotary cut-offs F, formed at its periphery with notches forming abutments *g*, which closely embrace the successive pistons during the operation of the engine and transmit motion from the drum I to the cut-off F. Each pair of cut-offs at opposite sides of the partition B is mounted on a sleeve F′, embracing a shaft G, secured at its ends to the sides of the frame A. In order to allow the wear of the bearings between the sleeve and shaft to be taken up, so as to maintain the cut-off F in concentricity to the shaft, said shaft and interior of the sleeve are tapered correspondingly from end to end, as shown in Fig. 2 of the drawings. The shaft G is mounted in bearings G′ G′, detachably secured to the sides of the frame A to allow said shaft to be removed when required for repairs or renewal. The extremities of said shafts are formed with screw-threaded extensions *h*,

which protrude through the bearings G′ and are provided with nuts h', by means of which the shaft is retained longitudinally adjustable in its position.

J represents a cylindrical valve-seat, in which is fitted a correspondingly-shaped valve L, formed with a steam-channel j, extending longitudinally through the axis thereof, and with a radial steam-channel j', extending from the axial channel through the side of the valve. The exterior of said valve is formed with a segmental exhaust-channel j^2, extending around the greater portion of the periphery of the valve.

From the valve-seat J extend passages l and l', either of which will serve as steam-induction passages, while the others serve as exhaust-passages, according to the position of the valve in relation to said passages. The channels l l' extend through the walls of the adjacent chamber c', so as to separate them from said chamber, and communicate with the cylinder c at the intersections of the chamber c'. By providing two passages at each side of the chamber c', as shown at l l and l' l' in Fig. 1 of the drawings, a freer exhaust is permitted when said passages are used for that purpose. Furthermore, by the arrangement of the passages of each pair at different distances from the axis of the chamber c' and tapping the valve-seat at different parts of its periphery the exhaust-channel j^2 is compelled to invariably communicate with two passages, while the live steam is admitted only through one passage, which is most remote from the chamber c', and thus obviates unduly heating the walls of said chamber.

k denotes the exhaust-outlet leading from the valve-seat J. The axial steam-channel j extends through one end of the valve and communicates with the steam-pipe P, which is secured in the gland n of a stuffing-box n', attached to the case A. The opposite end of the valve is formed with an extension which passes through a stuffing-box o on the side of the frame A and is provided with a suitable handle H, by which to turn the valve to its requisite position for rotating the engine in the desired direction. By turning the valve to carry the steam-channel j' from the passage l l at one side of the adjacent annular chamber c' to the passages l' l' at the opposite side of said chamber the motion of the engine is reversed.

The ends of the drums and the ends of the cut-offs are maintained steam-tight on the inner walls of the case A by the hereinbefore-described adjustment of the combined thickness of the partition-plates B′ B′.

To further render my improved engine adjustable to compensate for the wear on the aforesaid parts of the engine, I form the peripheral wall of the steam-cylinder c of segmental sections s s, which are sustained adjustably toward the drum I, preferably by means of set-screws t, which pass through screw-threaded holes in the frame A and abut with their inner ends upon the backs of the segments, and screws t', passing freely through smooth-bored holes in the frame A and engaging screw-threaded sockets in the segments, as shown in Fig. 1 of the drawings. Said adjustment of the segments compensates for the wear on the ends of the pistons e e. To permit of a similar adjustment of the annular chamber c' in relation to the periphery of the cut-off F, I form the inner peripheral wall of said chamber of a flexible segmental band u and pass through the adjacent wall of the frame A adjusting-screws v, which work in screw-threaded passages v' in the frame and bear with their inner ends on the band u and are thus adapted to compress said band, so as to fit closely to the periphery of the cut-off F.

I do not limit myself to the use of both cut-offs F F at opposite sides of the steam-cylinder c, as shown, inasmuch as the cut-off F most remote from the valve L may be dispensed with and another segment, similar to the segments s, may be substituted for the annular chamber c' to continue the peripheral wall of the cylinder c thereat.

My invention is designed for either portable engines or stationary engines. Fig. 1 of the drawings shows one of the means by which my improved engine may be applied to a suitable part R of the frame of an automobile.

I claim—

1. The combination, with the steam-cylinder, the main shaft passing through said cylinder, and the drum fastened to said shaft and having pistons projecting from its periphery, of an annular valve-seat situated remote from the steam-cylinder, an interposed annular chamber communicating with said cylinder, a rotary cut-off in said chamber provided with notches engaging the pistons, two pairs of passages located at opposite sides of the aforesaid chamber and with the passages of each pair at different distances from the chamber and extending from different parts of the periphery of the valve-seat to the steam-cylinder, and a normally stationary valve in the aforesaid seat provided with an axial and radial steam-channel, and a peripheral exhaust-channel substantially as described and shown.

2. The combination with the steam-cylinder, annular chamber in the same plane with said cylinder and intersecting the periphery thereof, and the main shaft extending through the axis of the cylinder, of a partition composed of a plurality of plates disposed side by side and each tapered longitudinally from end to end and in opposite direction from the other, means for shifting longitudinally one of said plates, piston-heads located in the cylinder at opposite sides of the partition and fastened to the main shaft, cut-offs disposed in the annular chamber at opposite sides of the partition, steam and exhaust passages communicating respectively with the cylinder at opposite sides of the intersection of the

annular chamber, and a valve controlling said passages as set forth.

3. In combination with the rotary piston-head having pistons projecting from its periphery, and the rotary annular cut-off formed with abutments closely embracing the successive pistons during the operation of the engine, of a steam-cylinder having its peripheral wall composed of segmental sections sustained adjustably toward the piston-head, and an annular chamber inclosing the cut-off and having its inner peripheral wall composed of a flexible segmental metallic band, and means for compressing said band circumferentially to compensate for the wear of the aforesaid cut-off as set forth.

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