(No Model.) 5 Sheets—Sheet 1

F. MEYER, J. S. KIEHL & A. GRANT.

ROTARY ENGINE.

No. 492,360. Patented Feb. 21, 1893.

Fig 2.

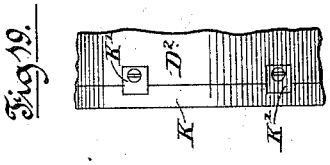

Fig 1.

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Fig. 4.

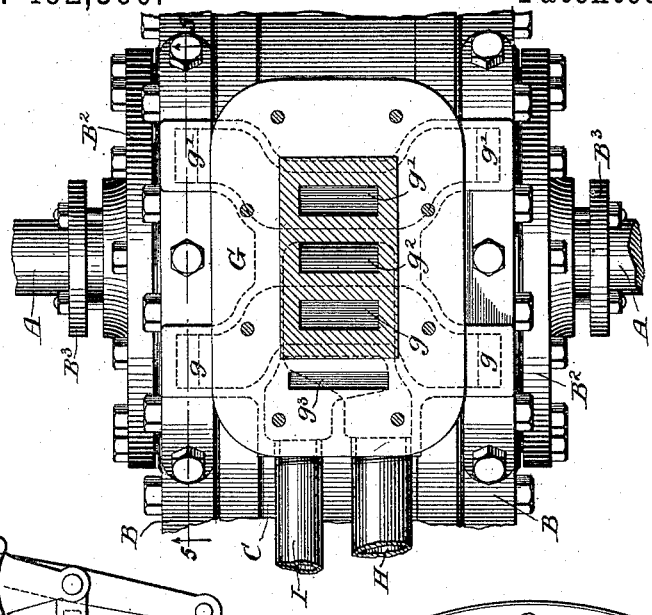


Fig. 5.

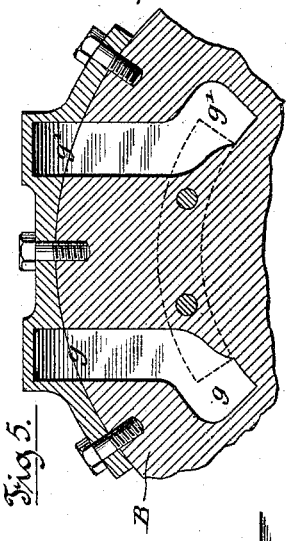
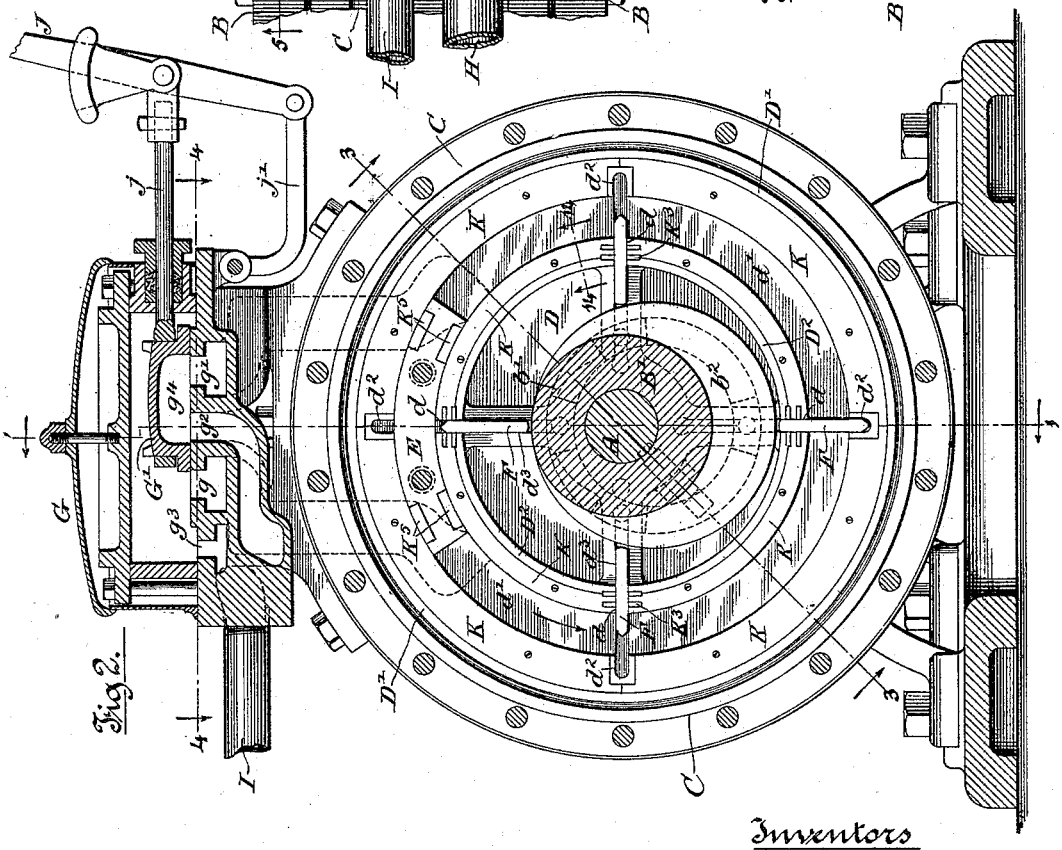


Fig. 2.



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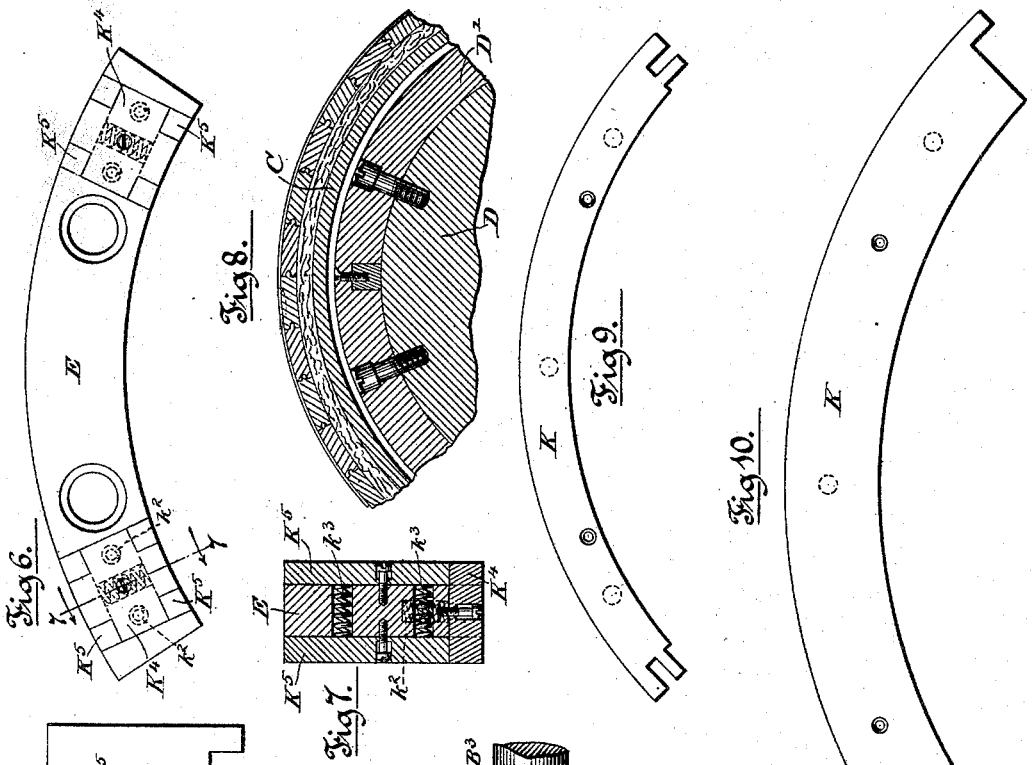

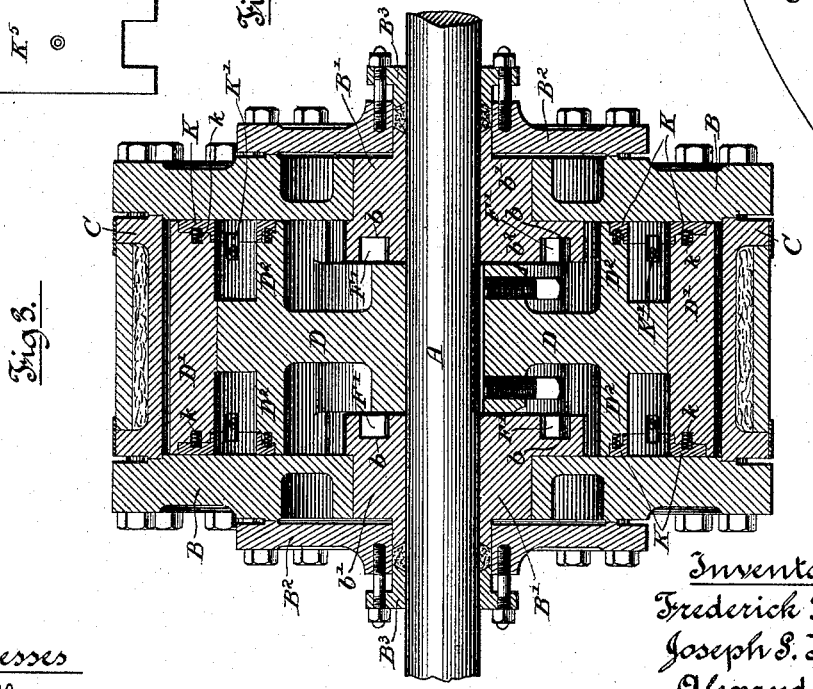

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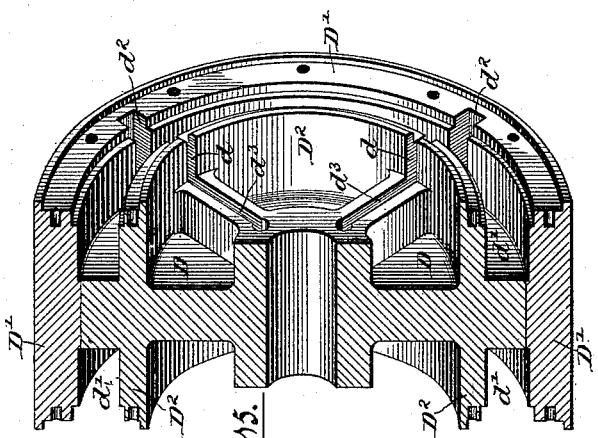

Fig. 15.

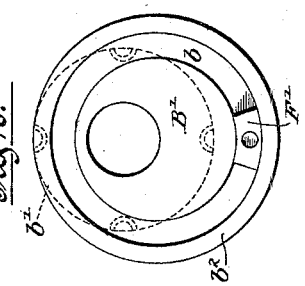

Fig. 18.

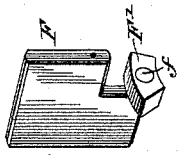

Fig. 17.

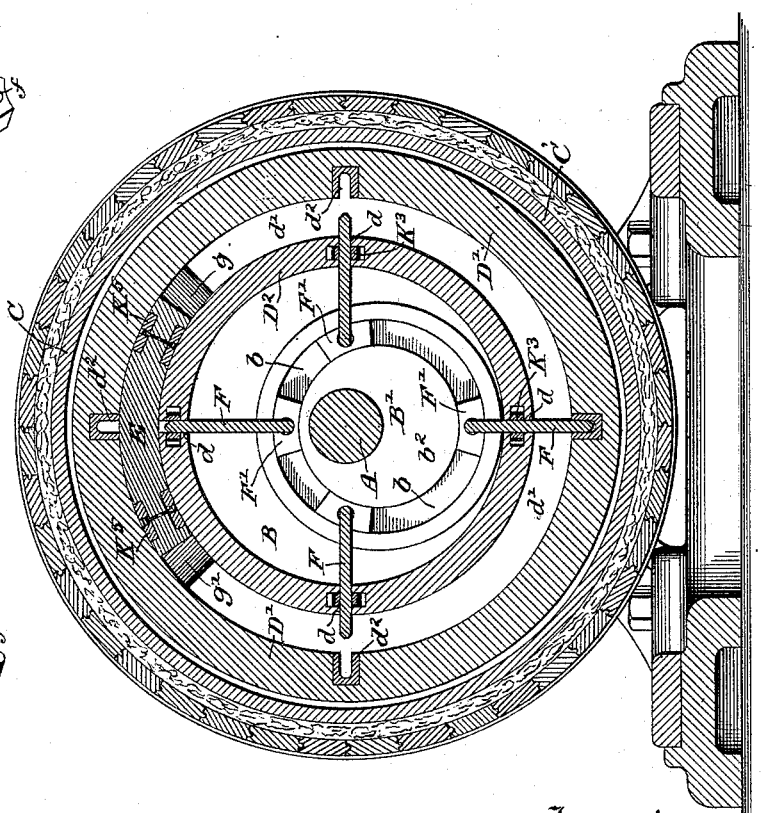

Fig. 3a.

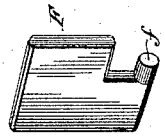

Fig. 16.

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Fig 14.

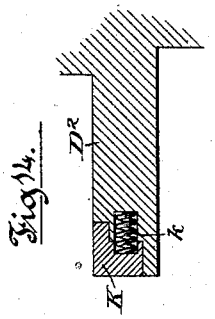


Fig 13.

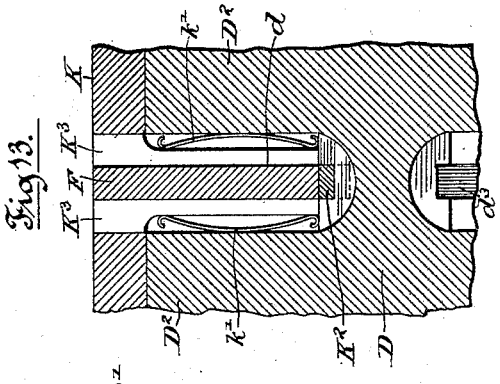


Fig 11.

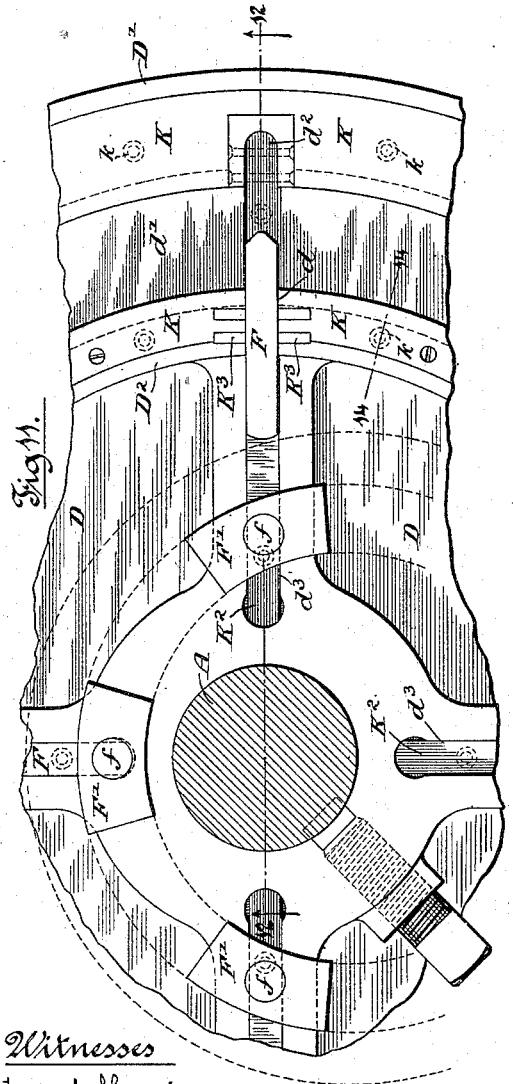
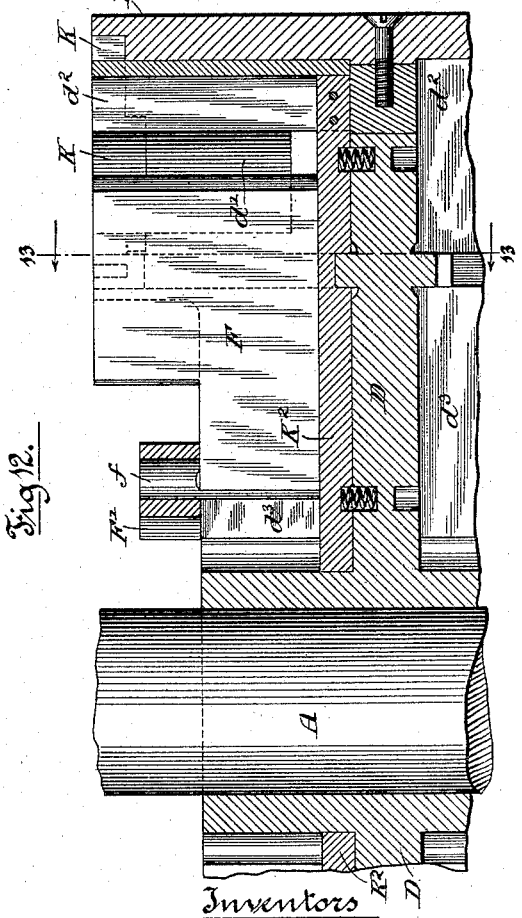


Fig 12.



Witnesses

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UNITED STATES PATENT OFFICE.

FREDERICK MEYER, JOSEPH S. KIEHL, AND ALEXANDER GRANT, OF CHICAGO, ILLINOIS, ASSIGNORS TO THE DUPLEX ROTARY ENGINE COMPANY, OF SAME PLACE.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 492,360, dated February 21, 1893.

Application filed November 29, 1889. Renewed March 16, 1891. Serial No. 385,166. (No model.)

To all whom it may concern:

Be it known that we, FREDERICK MEYER, JOSEPH S. KIEHL, and ALEXANDER GRANT, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Rotary Engines; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in rotary steam engines and more especially to improvements upon the construction in such engines set forth in our application for Letters Patent of the United States Serial No. 306,229, filed April 6, 1889, and allowed June 7, 1889.

The principal feature of improvement herein pointed out consists in the duplex form of the engine, the duplicated parts being arranged on opposite sides of a central revolving disk which is fixed to the power transmitting shaft and which is subject to an efficient steam pressure on both sides thereof so that end pressure upon the said shaft is obviated wholly or in part and the friction incident to such pressure is avoided or lessened.

The nature of our improvements will be understood from the accompanying drawings which show the duplex form of the engine together with several other features of improvement that will be hereinafter referred to.

Figure 1 is a vertical section in the plane of the axis of the engine shaft. Fig. 2 is a vertical section transverse to the shaft, in the indirect line 2—2 of Fig. 1. Fig. 3 is a section in the plane of the axis of the shaft and on the line 3—3 of Fig. 2. Fig. 3^a is a vertical section transverse to the shaft in the line 3^a—3^a of Fig. 1 but showing only the simple elements of the engine without adjunctive details. Fig. 4 is a horizontal section of the valve mechanism on the line 4—4 of Fig. 2. Fig. 5 is a fragmentary section on the line 5—5 of Fig. 4, cutting one of the side plates of the engine and showing the parts therein. Fig. 6 is a detached side view of the stationary block or abutment of the engine. Fig. 7 is a transverse section of the said stationary block in the line 7—7 of Fig. 6, showing the steam packing devices employed in connection therewith. Fig. 7^a is a plan view of one of the outer or inner cross plates which form part of the packing devices applied to the stationary block shown in Fig. 6. Fig. 8 is a fragmentary section of the central revolving disk on the line 8—8 of Fig. 1. Fig. 9 is a detached view of a section or part of the annular packing ring applied to each inner flange of the revolving disk. Fig. 10 is a detached view of a section of the annular packing ring applied to each outer flange of the revolving disk. Fig. 11 is an enlarged fragmentary, interior view of the engine, showing one of the radially sliding pistons, viewed edgewise, with its attachments, and adjacent parts of the engine. Fig. 12 is a section on the line 12—12 of Fig. 11. Fig. 13 is a detail section in the plane of the line 13—13 of Fig. 12. Fig. 14 is a detail section on the line 14—14 of Fig. 2 and of Fig. 11. Fig. 15 is a perspective view of one half of the revolving flanged disk stripped of its accessories. Fig. 16 is a perspective view of one of the sliding pistons detached. Fig. 17 is a detached view of one of the sliding pistons having a shoe pivoted thereon, which shoe runs in the eccentric circular groove of the cam by which the pistons are actuated. Fig. 18 is an elevation showing the inner and eccentrically grooved face of the cam by which the pistons are actuated, a shoe of one of the pistons being shown in the eccentric groove and dotted lines indicating the outer concentric portion of this cam plate which, in the construction shown in section in Figs. 1 and 3, passes through the side plates of the engine. Fig. 19 is a detail relating to the packing.

The arrows applied to the several section lines indicate the direction in which the several sections taken on said lines are viewed.

A represents a shaft which is to be driven by the engine.

B B are parallel disks or side plates forming the lateral walls of the inclosure which contains the rotating parts of the engine, C C being the annular or peripheral plate which

is placed between the side plates B B and surrounds the revolving parts of the engine.

D is a circular disk having annular flanges D′ and D², and keyed or otherwise fastened to the shaft A between the side plates B B. This disk is seen detached in Fig. 15.

E E are two segmental blocks secured to the side plates and reaching inward into contact with the disk D in the spaces d' d' between the annular flanges of said disk, which spaces form the steam chambers of the engine.

D′ D′ are the annular and cylindrical flanges at the margin of the disk D and running outside of the fixed blocks E, and D² D² are similar annular and cylindric flanges of the disk D, concentric with the flanges D′ and revolving inside the fixed blocks E E.

F F are radially sliding pistons arranged to slide through transverse slots d, in the inner flanges D² so as, in certain parts of their revolution, to extend across the space d' between the flanges D′ and D² and at other points of their revolution to be retracted inwardly out of said space in order that they may pass the fixed blocks E E.

B′ B′ are fixed cams, here shown as forming part of the side plates B and provided with circular grooves b eccentric to the shaft A and engaged with the pistons F F for producing the radial sliding movements of said pistons.

F′ F′ are curved shoes fitted to the grooves b and pivoted upon journals f on the inner ends of the pistons F F.

G is a valve chest through the valve seat of which lead the ports g g' and g^2, the ports g and g' being branched to connect with both the annular spaces d' d' (between the flanges D′ and D²) at opposite ends of the fixed blocks E E, one at one end and the other at the other end of said block, and the port g^2 (leading from the valve chest between the ports g g') communicating with the exhaust pipe H. The steam chest receives steam through the port g^3 which connects with the inlet pipe I. It will be observed that the spaces d' are separate chambers, not in communication with each other, and have independent inlet and exhaust passages, by means of which each side of the engine has a separate and efficient steam supply and exhaust.

G′ is a sliding D-valve arranged within the valve chest and adapted to open either of the ports g g' for the admission of steam to the engine while giving communication (through the recess g^4 of the valve) between the other of said ports and the exhaust port g^2. The valve chest G, when a single one is employed, is desirably placed on the periphery of the engine and the bifurcations of the ports g g' are prolonged in the side plates B B, as indicated by dotted lines in Figs. 2 and 4 and by the sectional Fig. 5.

J is a hand lever for moving the valve G′, said lever being pivoted to the rod j of the valve G′ and fulcrumed in any suitable manner, as for example, by the link j' which connects its lower end with the casting of the valve chest.

The pistons F F are of such number that at least one of them on each side of the disk D will always be extended across the space d' in the lower or longer arc between the inner ends of the ports g g' and the steam will manifestly act upon this piston to cause the rotation of the disk D and the shaft A, since the block E forms a fixed abutment preventing movement or escape of steam in the opposite direction. In the drawings four pistons F are shown in each side of the engine. In connection with the circular form of the cam groove b a slot or recess d^2 is formed in the inner surface of the outer cylindric flange D′ for the admission of the end of each of said pistons. It is to accommodate the slots d^2 of suitable depth that the said outer flange D′ is made of the thickness indicated. The protrusion of the outer ends of the pistons F into the recess d^2 is obviously a necessity in the use of circular cam grooves b for the actuation of said pistons where the shaft and disk are concentric with the shell or casing while the circular cam groove is eccentric with relation to the said shaft, disk and shell, as in the construction which we have devised. But the circular form of said grooves is desirabe for two other reasons; first, to give an easier motion to the pistons and, second, to permit the use of the shoes F′, pivoted to the pistons and fitted to the grooves. These shoes obviously require the grooves b to be circular.

The number of the pistons may be varied and a valve of other form than that shown may manifestly be employed without departure from our invention.

Any suitable packing devices may, for the general purposes of our invention, be employed to give tight joints between moving surfaces. We have, however, devised certain forms of metal packings which we have found efficient and durable and they are herein illustrated and next described. First describing the packing applied to the free edges of the flanges D′ and D² of the disk D, to run in contact with the side plates B B, K K are parts of metal rings sectionally in the angular form seen in Fig. 3 and applied to the inner edge of the outer flange D′ and to the outer edge of the inner flange D² so that they run in contact with the fixed block E as well as in contact with the adjacent side plate B. Behind these segmental packing rings are placed springs k of any suitable form arranged to throw them outward toward the side plates B. To cut off passage of steam between the inner edges of these angular packing rings and the body of the flange to which they are applied and past the stationary abutment or block E, small fixed blocks K′ (Fig. 19) may be set across this passage flush with the surface of the flange. These

segmental packing rings extend on the flange D′ from one slot d^2 to the next one and on the flange D^2 from one slot d to the next, as indicated in Fig. 2. The disk D has radial grooves d^3 in which the inner edges of the pistons are fitted to slide. In the bottoms of these grooves are placed metal packing strips K^2 bearing against the edges of the pistons. In the sides of the slot d of the inner flange D^2 are placed the metal packing strips K^3 (Figs. 11 and 13) backed by springs k', as shown in Fig. 13. The fixed blocks or abutments E have transverse packing bars such as are shown in Figs. 6, 7 and 7^a. That is to say, on the edge of the said fixed blocks which runs in contact with the bottom of the groove d' between the flanges D′ and D^2 is a T-shaped block K^4, forced outward by springs, indicated at k^2 of Fig. 7, and on the outer and inner surfaces of said fixed blocks are placed plates K^5 notched at one of their ends to overlap the arms of the T-shaped block K^4 and backed by springs k^3 which force them out against the flanges D′ D^2.

Other forms of packing devices may be employed without departure from our invention.

As a matter of convenience in construction the cams B′ are made separate from the side plates B and have the concentric portions b' which fit openings in the side plates B around the shaft, the cam portion b^2 being of greater diameter and standing inside the plane of the inner surface of said side plates. The parts B′ are secured from rotation in the parts B by means of screws b^3 let into holes drilled at the meeting edges of the parts B B′.

B^2 B^2 are external plates surrounding the shaft and screwed to the side plates B, as shown clearly in Fig. 1, forming the outer walls of stuffing boxes of which B^3 are the glands.

Various modifications can be made in the details of construction above described and we therefore do not limit ourselves to the particular form of details shown.

Obviously a separate valve may be provided for the admission and discharge of steam to and from each side of the engine, and steam admitted to one side may be under a different pressure from that admitted to the other. It follows that one side of the engine may be connected to take the exhaust steam from the other side, and thus the engine, as a whole, become a compound engine. Of course this would require the proper enlargement of one compartment to a greater size than the other. It is also obvious that some features of improvement herein described, as for example, the circular eccentric groove b in combination with the pistons provided with pivoted shoes fitted to said groove, may be employed in the single form of our engine shown in our former application as well as in the duplex form herein illustrated.

We claim as our invention—

1. The duplex rotary engine described, consisting essentially of a stationary shell supporting fixed blocks from its opposite sides and also supporting interior cams, an axial, rotatable shaft, a disk mounted on said shaft, peripherally and laterally inclosed within the shell, and provided with separate, circular steam chambers, having independent inlet and exhaust ports and containing the fixed blocks, and sliding pistons operated by the cams, whereby said pistons are retracted to pass the fixed blocks and are advanced after passing the same, substantially as described.

2. The combination, with a stationary shell and a revoluble shaft concentric with said shell, of a circular disk concentrically mounted on said shaft within the shell and provided with concentric flanges, with an intermediate annular steam groove, and with radial piston slots extending into the outer flange, a stationary abutment supported by one side of the shell between the flanges of the disk, a fixed cam provided with an eccentric circular groove, and radially sliding pistons engaging said eccentric circular groove and adapted to be projected across the steam groove into the piston slots in the outer flange of the disk all constructed and arranged substantially as described, and shown.

3. The combination, with a stationary shell and revoluble shaft concentric with said shell, of a circular disk mounted on said shaft within the shell and provided with concentric flanges, with an intermediate annular steam groove, and with radial piston slots extending into the outer flange, a stationary abutment supported by one side of the shell between the flange of the disk, a fixed cam provided with an eccentric circular groove, and radially sliding pistons, adapted to be projected across the steam groove into the piston slots in the outer flange of the disk, and having pivoted shoes of an equal width throughout their length, said width being equal to the width of the groove, and having a curvature corresponding with that of the groove, so as to fill and fit the same all constructed and arranged substantially as described and shown.

In testimony that we claim the foregoing as our invention we affix our signatures in presence of two witnesses.

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JOSEPH S. KIEHL.
ALEXANDER GRANT.

Witnesses:
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P. H. T. MASON.