No. 825,361. PATENTED JULY 10, 1906.

E. ULLAND.

ROTARY ENGINE.

APPLICATION FILED OCT. 2, 1905.

4 SHEETS—SHEET 1.

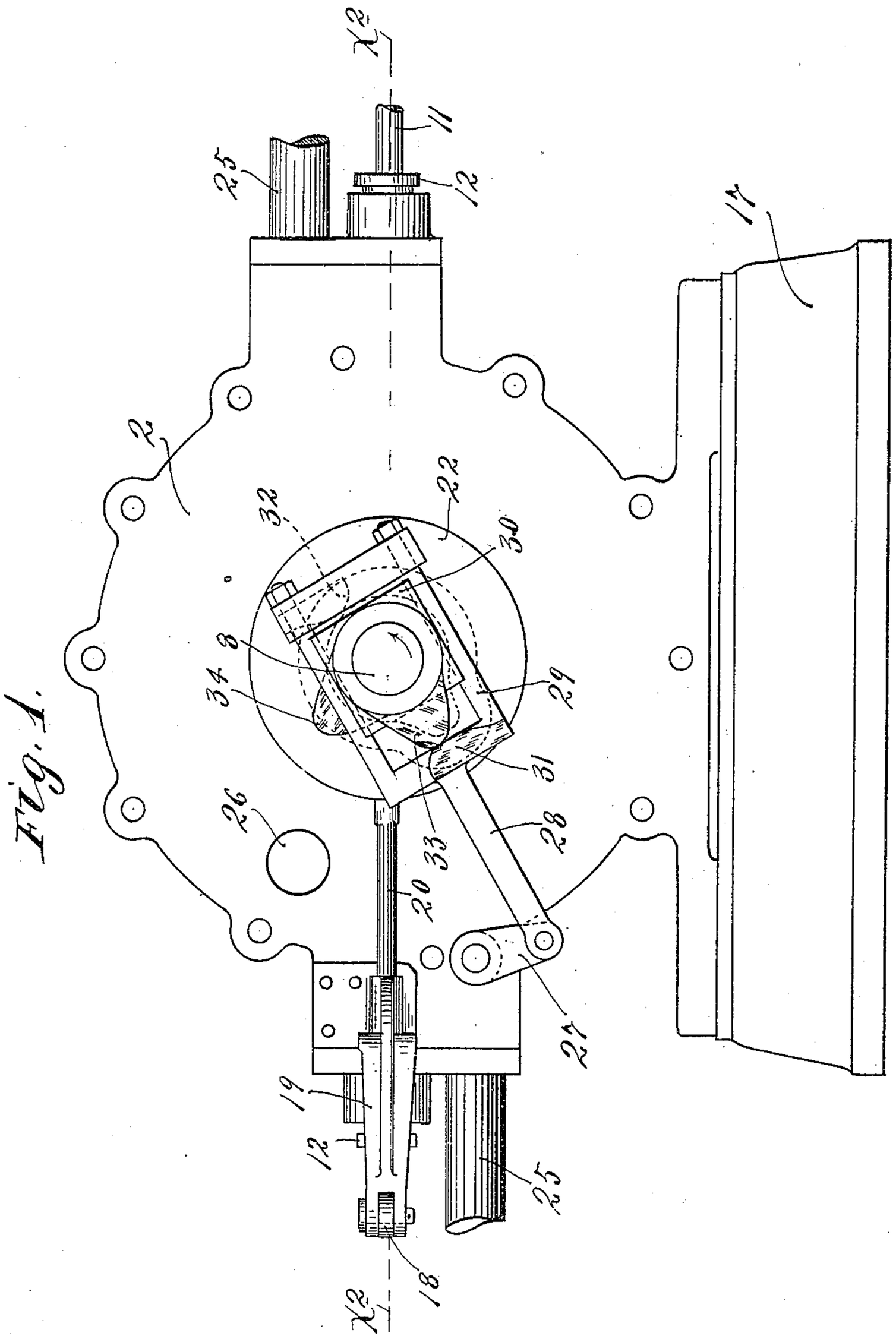

Fig. 1.

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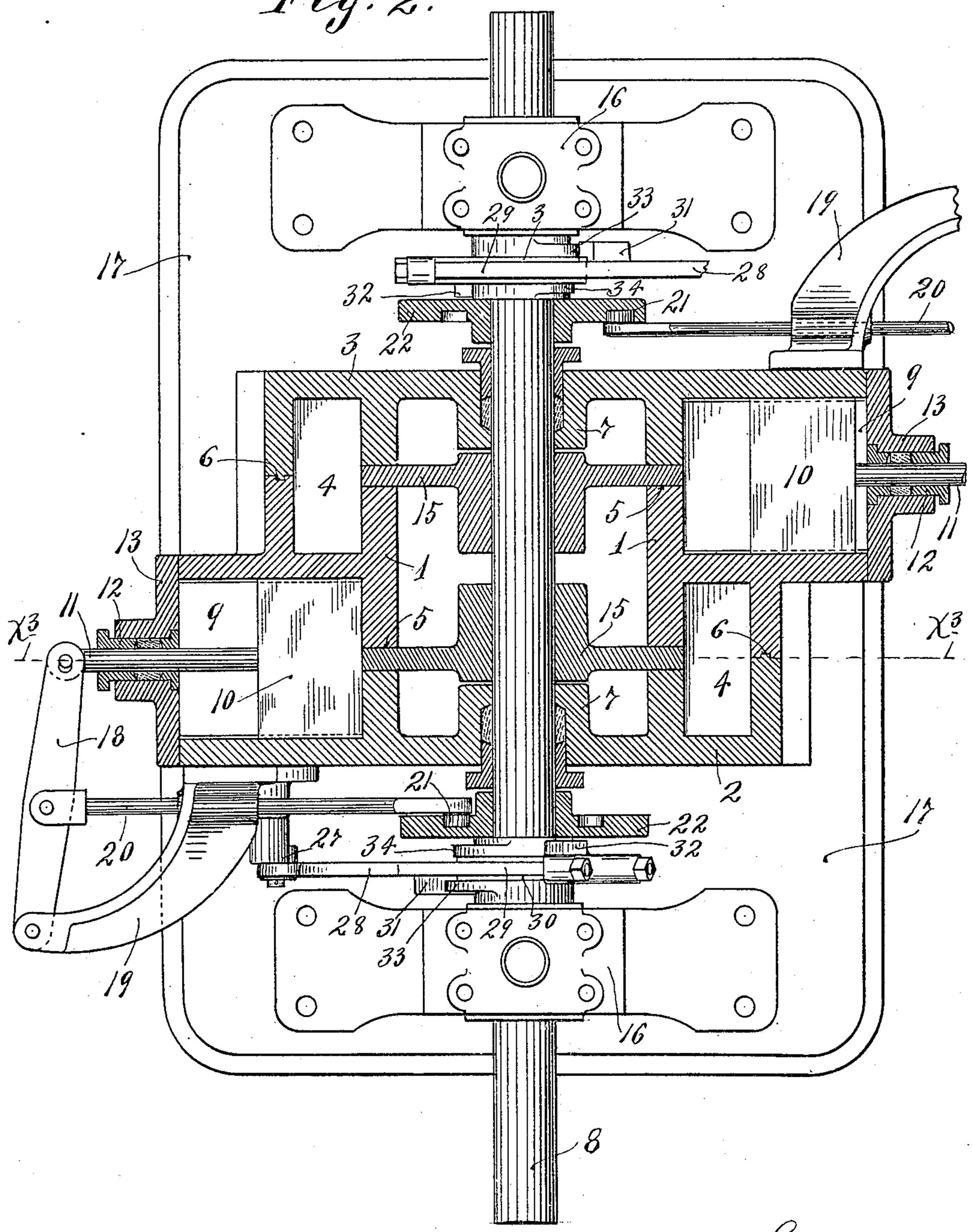
4 SHEETS—SHEET 2.

Fig. 2.



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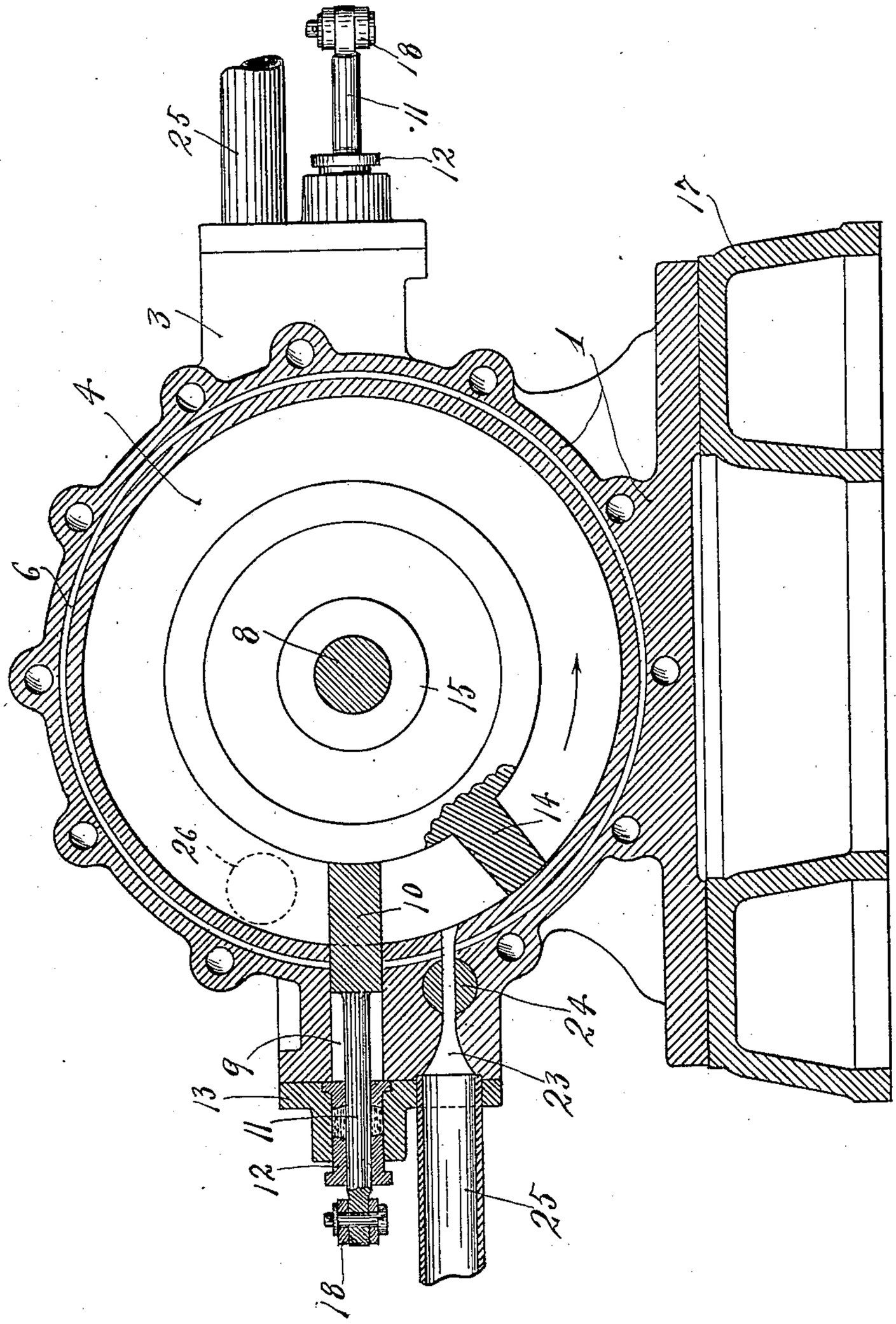
4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

Fig. 4.

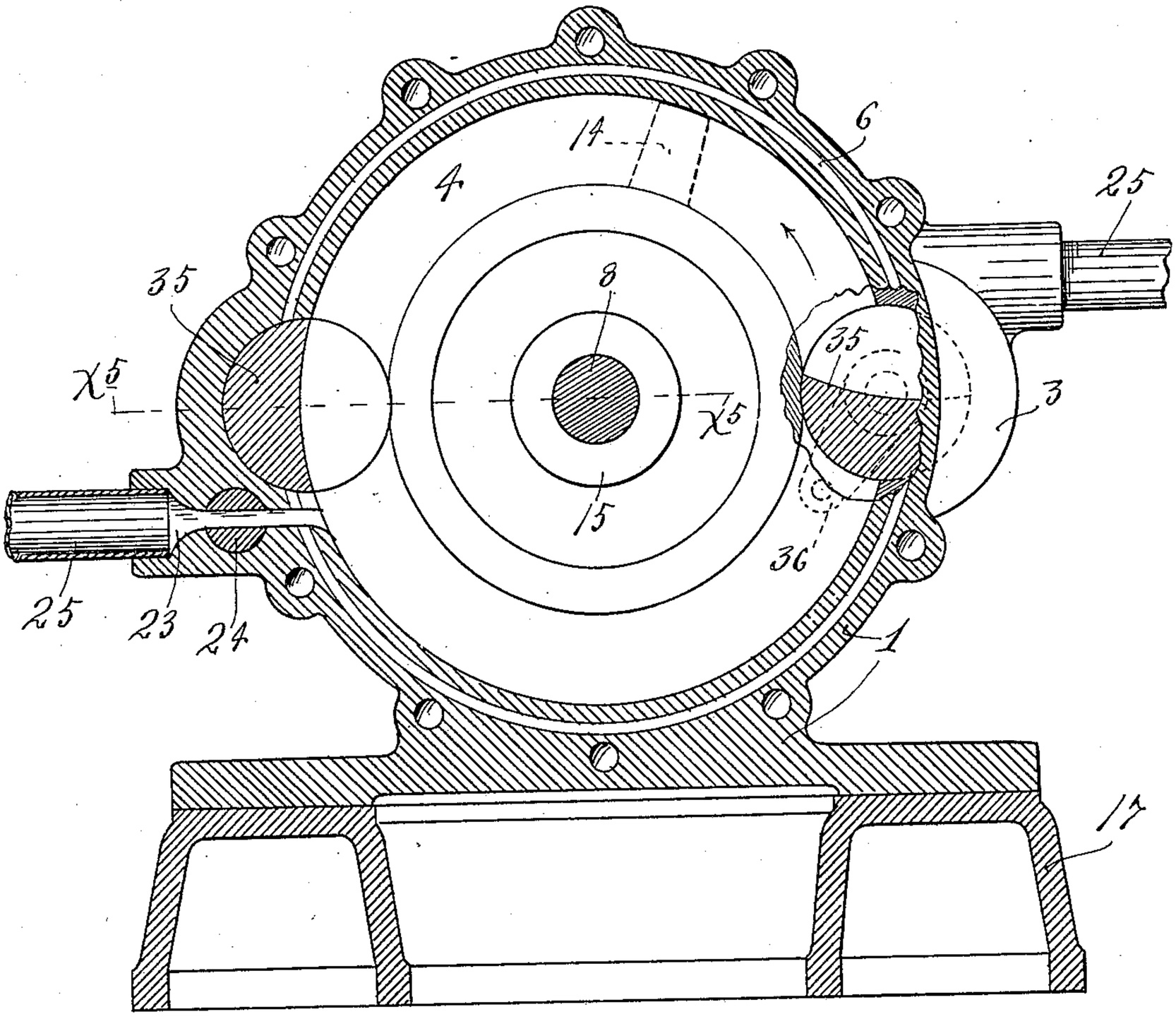
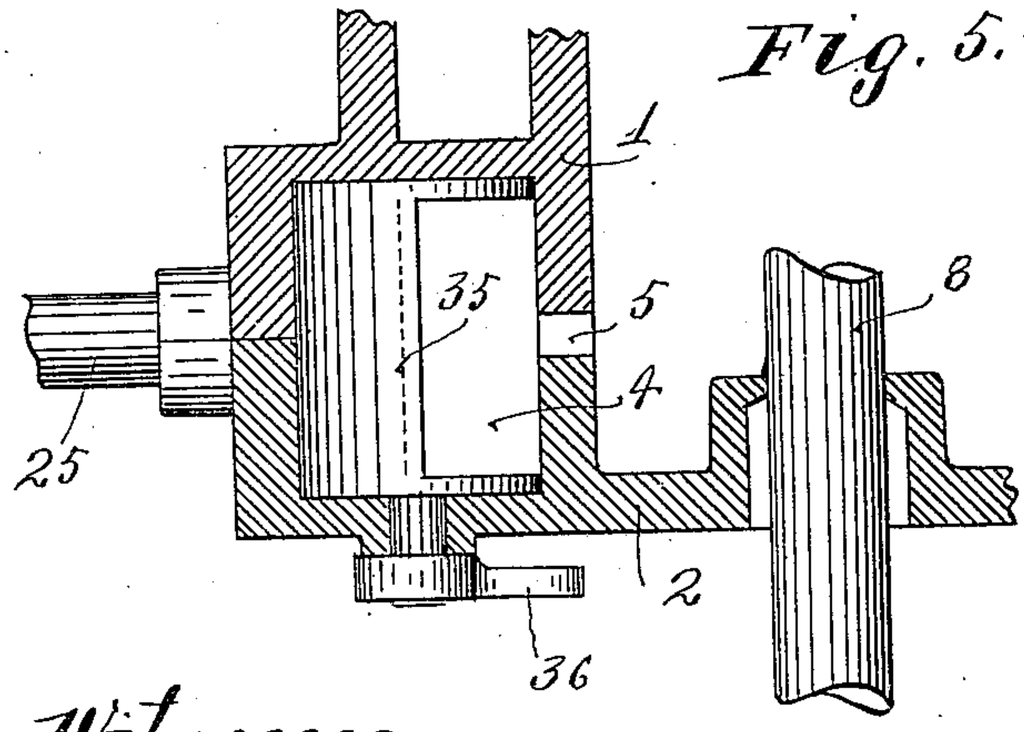


Fig. 5.



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UNITED STATES PATENT OFFICE.

EVEN ULLAND, OF MINNEAPOLIS, MINNESOTA.

ROTARY ENGINE.

No. 825,361. Specification of Letters Patent. Patented July 10, 1906.

Application filed October 2, 1905. Serial No. 280,956.

To all whom it may concern:

Be it known that I, EVEN ULLAND, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, 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.

My invention relates to rotary engines, and has for its object to improve the same in the several particulars hereinafter noted.

The invention consists of the novel devices and combinations of devices hereinafter described, and defined in the claims.

In the accompanying drawings, which illustrate my invention, like characters indicate like parts throughout the several views.

Figure 1 is a view in side elevation, showing the improved engine. Fig. 2 is a view, partly in plan and partly in horizontal section, on the line x^2 x^2 of Fig. 1. Fig. 3 is a vertical section taken on the line x^3 x^3 of Fig. 2. Fig. 4 is a view corresponding to Fig. 3, but illustrating a modified construction; and Fig. 5 is a fragmentary view, chiefly in horizontal section, on the line x^5 x^5 of Fig. 4, but with some parts shown in full.

The engine is preferably a double or two cylinder engine, and the cylinder-casting is made up of three sections 1, 2, and 3 and is formed with a pair of annular piston-seats 4. The three sections 1, 2, and 3 are bolted or otherwise detachably secured, and at their inner portions they are spaced apart at 5 to form narrow annular passages for the piston disks or wheels presently to be described. The outer portions of the three sections 1, 2, and 3 are fitted together by tongue-and-groove joints 6. The outer cylinder-sections 2 and 3 are formed with centrally-located hubs 7, through which extends and in which is journaled a heavy shaft 8. The composite cylinder-casting is formed with two radially-extended abutment-seats 9, located at diametrically opposite points and opening one into each of the annular piston-seats 4. Working radially in each abutment-seat 9 is a rectangular abutment 10. The abutments 10 are provided with outwardly-extended stems 11, that work through stuffing-boxes 12, applied, as shown, to removable caps 13, that normallly close the outer extremities of the said seats 9.

Fitting in each annular piston-seat 4 is a rectangular piston-head 14, that is rigidly secured to and carried by a piston disk or wheel 15, rigidly secured to the shaft 8 between the bearing-hubs 7 of the said casting. The disks or wheels 15 closely fit the contracted annular passages 5, and, if desired, packing-rings may be applied between these parts. The piston-disks 15 keep the annular passages 5 always tightly closed and afford connections between the shaft 8 and the two piston-heads 14, so that when the said piston-heads are caused to travel in the annular piston-seats the said shaft will be rotated. The shaft 8 is also journaled in pedestal-bearings 16, which pedestal-bearings and the composite cylinder-casting are, as shown, rigidly secured to a common base 17. The outer ends of the abutment-stems 11 are connected by levers 18 to brackets 19, fixed on the adjacent sides of the cylinder-casting. A plunger-rod 20 works through each bracket 19 and is pivotally connected at its outer end to the intermediate portion of the corresponding lever 18. At their inner ends the plunger-rods 20 are, as shown, provided with laterally-projecting rollers 21, that work in the grooves of corresponding profile cams 22, carried by the shaft 8.

Opening in each annular piston-seat 4 is an admission-port 23, that is adapted to be intermittently opened and closed by an oscillatory valve 24. The numeral 25 indicates steam-supply pipes which open one into each of the admission-ports 23. Each annular piston-seat is also provided with an exhaust-port 26. Referred to with reference to the direction of rotation of the rotary pistons 14 15, the admission-ports 23 are located just ahead of the respective abutments 10, and the admission-ports are located just behind the said respective abutments.

Each oscillatory admission-valve 24 has a crank-arm 27 secured to its stem outside of the cylinder-casting, and each crank-arm 27 is connected to the arm 28 of a rectangular cross-head 29. The cross-heads 29 are mounted to slide on bearing-blocks 30, which in turn are loosely journaled on the shaft 8 and are located between the adjacent pedestal 16 and cam 26. Each cross-head 29 is provided with two striking-surfaces 31 and 32, which striking-surfaces are located one at the front and the other at the rear of the shaft 8 and project laterally from the oppo-

site faces of said cross-head. For engagement with the striking-surfaces 31 the shaft 8 is provided with tappets or cams 33, and for engagement with the striking-surfaces 32 said shaft is provided with tappets or cams 34.

The arrangement is such that when the tappet 33 strikes the coöperating striking-surfaces 31 it will force the cross-head and connected parts into the position shown in Fig. 1, and thereby cause the corresponding admission-valve 24 to open the coöperating admission-port 23 and admit live steam into the corresponding piston-chamber, as shown in Fig. 3; but when the cam 34 strikes the coöperating striking-surfaces 32 it will force said cross-head in a reverse direction and move the admission-valve 24 into its closed position, thereby cutting off the supply of steam to the said annular piston-seat. The grooves of the profile cams 22 are so formed that they will cause the respective abutments 10 to move outward to allow the respective piston-heads 14 to pass and will then immediately throw the said abutments inward to the position shown in Fig. 3 after the said piston-head has passed. The cams 33 are so located with respect to the profile-cam wheels 22 that they will cause the respective admission-ports to open as soon as the corresponding abutments 10 have been moved inward to their operative positions back of the respective piston-heads 14. The cams 34, on the other hand, are so located that they will come into connection on the striking-surfaces 32 and close the respective admission-valves just before the respective abutments 10 are given their initial outward movements under the actions of the corresponding profile cams 22. Thus it will be seen that there is no waste of live steam while the piston-heads are passing the respective abutments.

The piston-heads 14 of the two pistons are located transversely in line with each other; but the abutments 10 are located one hundred and eighty degrees apart, and the associated parts are so arranged that the steam will be admitted into the two annular piston-seats 4 in alternate order, thereby giving a continuous application of power. It is of course obvious that when steam is admitted into one of the annular piston-seats between the abutment 10 and the piston-head 14 the rotary piston, together with the shaft 8, to which it is secured, will be rotated in the direction of the arrow marked on Fig. 3. In practice the shaft 8 will usually be provided with a pulley (not shown) by means of which and a coöperating belt power may be transmitted from the engine. The tappets or cams 33 and 34, arranged to operate upon the striking-surfaces of the cross-head connection, afford means for imparting extremely quick movements to the admission-valve, thereby giving a very quick application of the driving power—to wit, of the steam—and a correspondingly-quick cut-off of the steam at the proper times.

In the modified construction illustrated in Figs. 4 and 5 oscillatory segmental abutments 35, mounted in suitable seats in the cylinder-casting, are substituted for the sliding abutments 10. The stems of these abutments project outward and are provided with crank-arms 36, to which the outer ends of the respective plunger-rods 11 may be directly attached. The arrangement should be such that these oscillatory abutments 35 at the proper times will be oscillated from the position indicated at the left in Fig. 4 into the position indicated at the right in Fig. 4, and vice versa. These abutments are so formed that they are operative when turned into the position shown at the right in Fig. 4 and will permit the piston-heads to freely pass when turned into the position shown at the left in Fig. 4. Otherwise than noted the construction illustrated in Figs. 4 and 5 may be the same as that illustrated in the other views.

An engine constructed as shown in Figs. 1, 2, and 3 has been tested and found extremely efficient for the purposes had in view.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. In a rotary engine, the combination with a cylinder-casting having an annular piston-seat, an abutment-seat opening into said piston-seat, an admission-port opening into said piston-seat on one side of said abutment-seat, an exhaust-port opening from said piston-seat on the other side of said abutment-seat, an abutment working in said seat and movable into and out of said piston-seat, an admission-valve in said admission-port, a cam-actuated connection for moving said abutment to and from its operative position, a rotary piston having a head working in said annular piston-seat, a shaft on which said piston is secured, a guide-block loosely mounted on said shaft, a cross-head slidably mounted on said block and connected to said admission-valve, said cross-head having laterally-offset striking-surfaces located on opposite sides of said shaft, and tappets carried by said shaft and operative alternately on the respective striking-surfaces of said cross-head, to open and close said admission-valve with a properly-timed action, substantially as described.

2. In a rotary engine, the combination with a cylinder-casting having laterally-spaced annular piston-seats, said piston-seats having abutment-seats located at diametrically opposite points and having an admission and exhaust ports located on the opposite sides of the respective abutment-seats, a pair of rotary pistons having piston-heads working in said annular piston-seats, a shaft to which said two pistons are secured, and oscillatory valves 24 in said admission-ports provided with crank-arms 27, abutments in

the respective abutment-seats movable into and out of said piston-seats, profile cams 22 on said piston-shaft, rods subject to said cams 22 and connected to the respective abutments for operating them, the guide-blocks 30 loosely mounted on said piston-shaft, the cross-heads 29 slidably mounted on said guide-blocks and connected to the crank-arms 27 of the respective admission-valves, said cross-heads having the laterally-offset striking-surfaces 31 and 32, and the tappets 33 and 34 on said piston-shaft operative respectively on the striking-surfaces 31 and 32 of said cross-head, to open and close said admission-valves in alternate order, substantially as described.

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

EVEN ULLAND.

Witnesses:

MALIE HOEL,

F. D. MERCHANT.