C. F. SLEIGH.

DUPLEX ROTARY ENGINE.

APPLICATION FILED APR. 30, 1912.

1,049,615.

Patented Jan. 7, 1913.

4 SHEETS—SHEET 4.

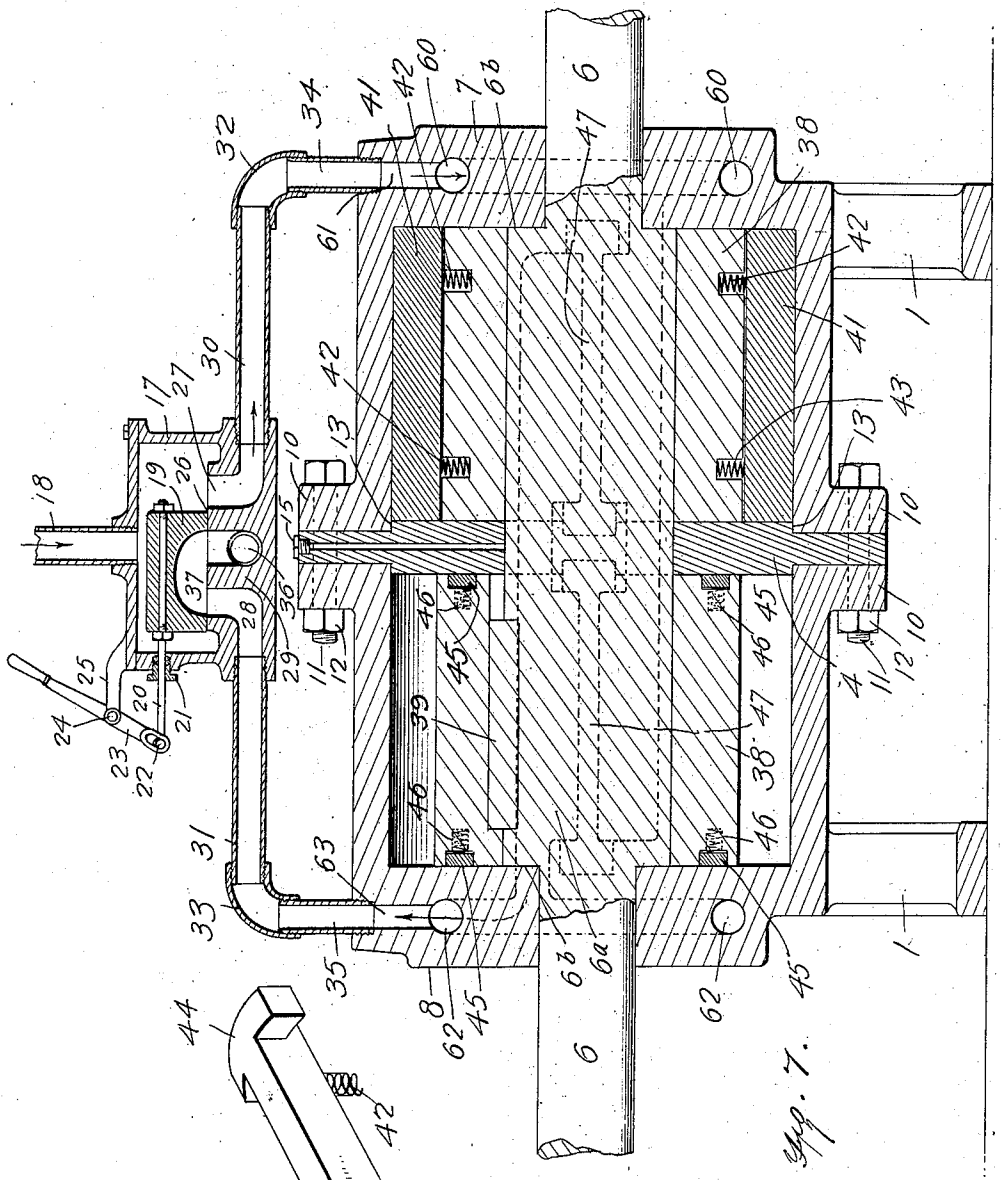

Fig. 7.

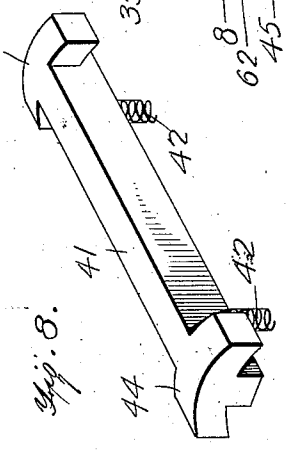

Fig. 8.

Witnesses

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4 SHEETS—SHEET 1.

Fig. 1.

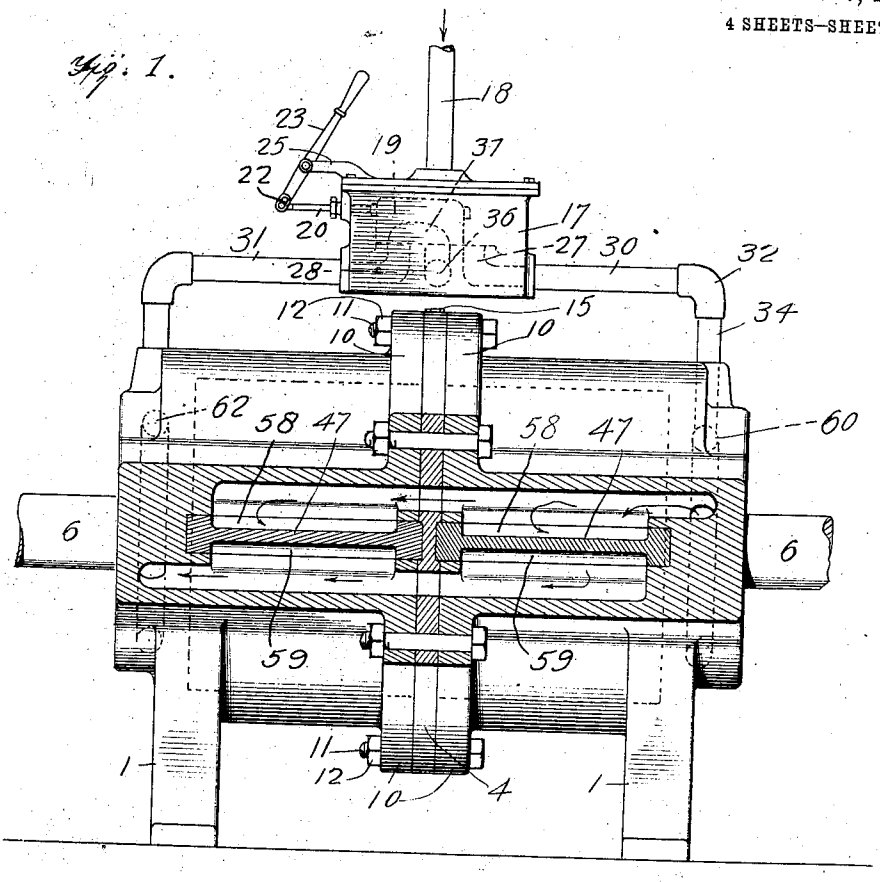
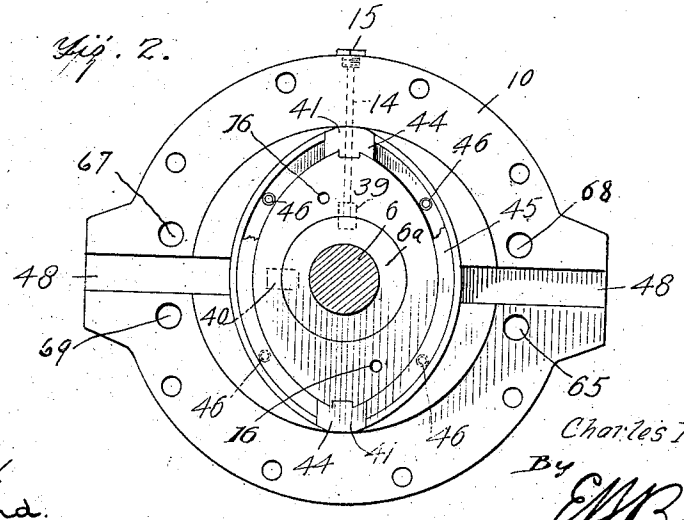


Fig. 2.



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4 SHEETS—SHEET 2.

Fig. 3.

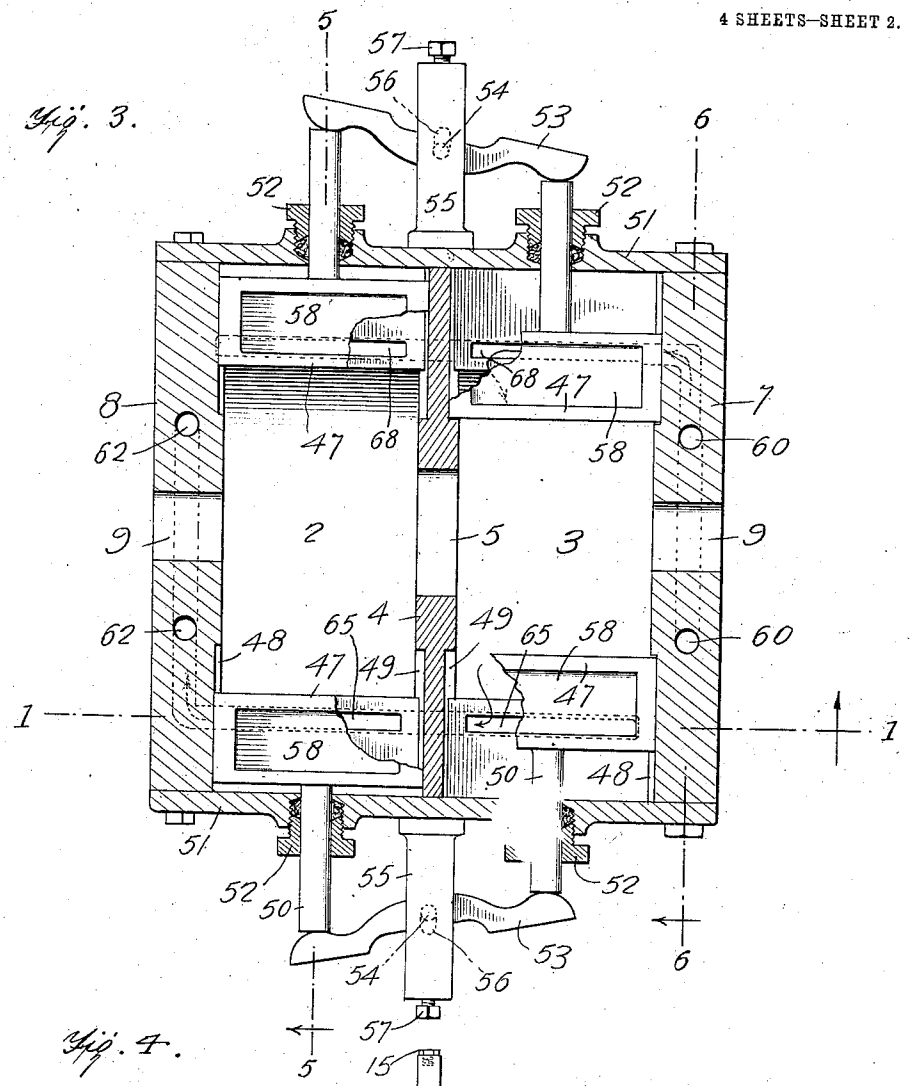
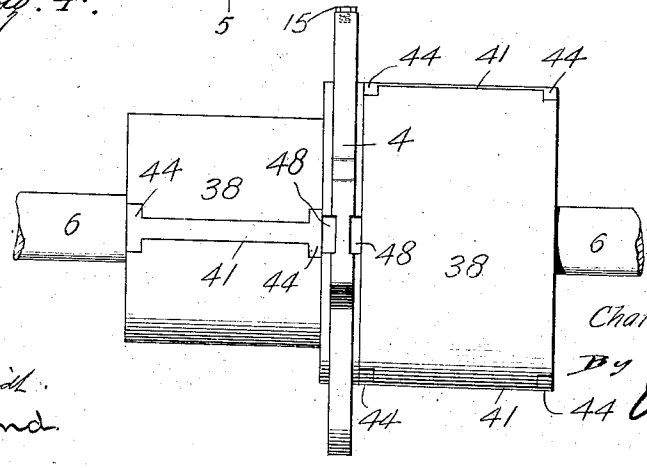


Fig. 4.



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4 SHEETS—SHEET 3.

Fig. 5.

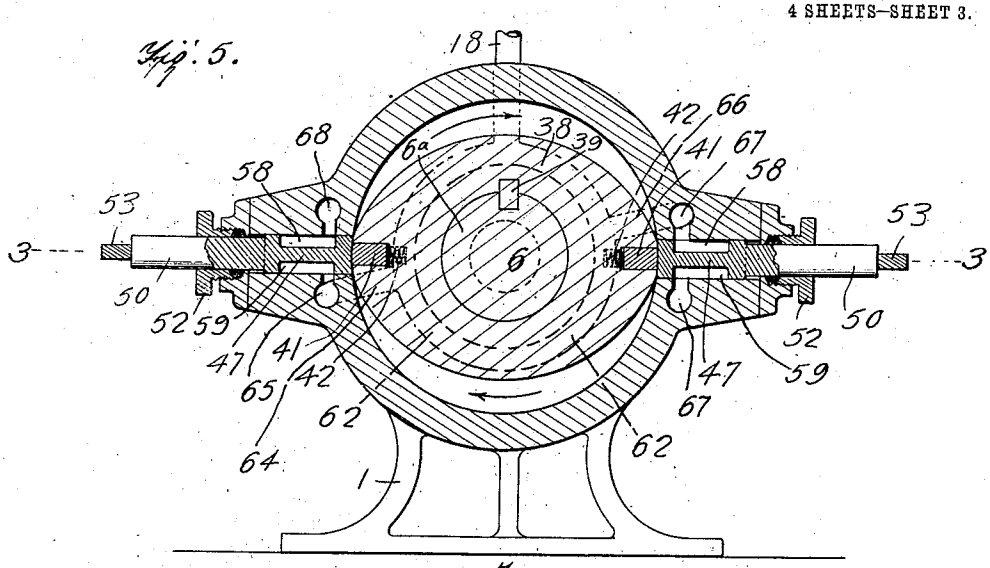
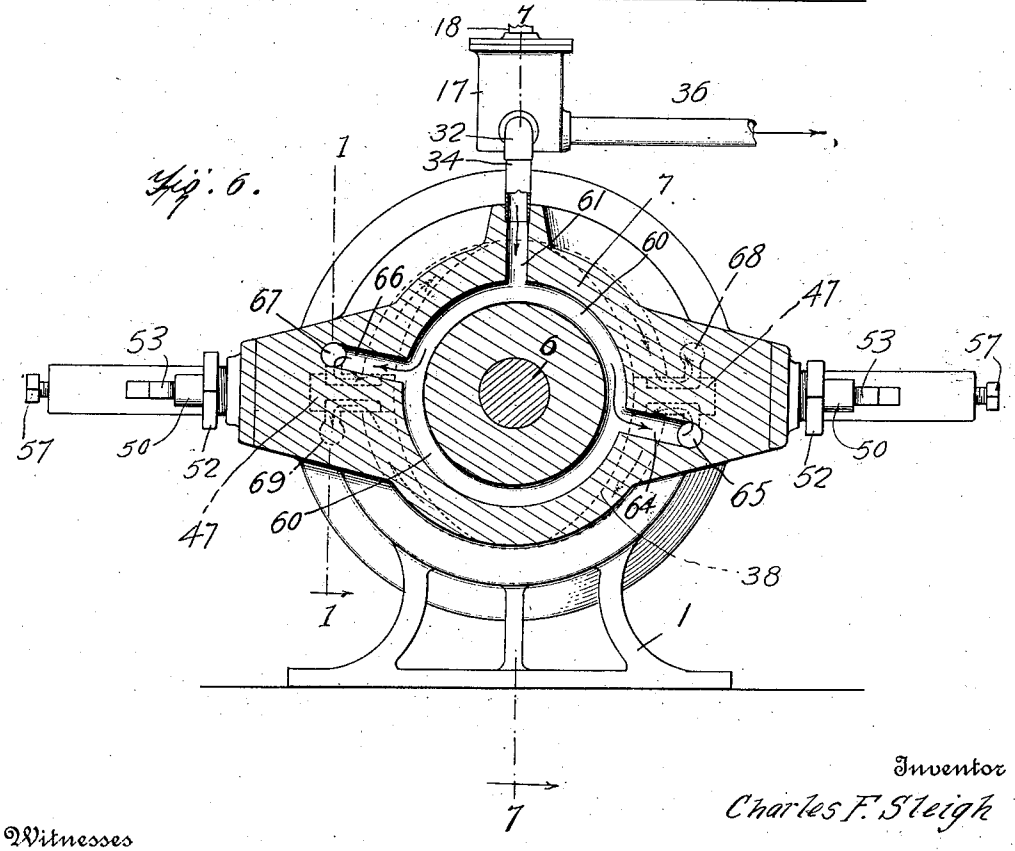


Fig. 6.



Witnesses

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UNITED STATES PATENT OFFICE.

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DUPLEX ROTARY ENGINE.

1,049,615. Specification of Letters Patent. Patented Jan. 7, 1913.

Application filed April 30, 1912. Serial No. 694,055.

To all whom it may concern:

Be it known that I, CHARLES F. SLEIGH, a citizen of the United States of America, and resident of Fort Smith, in the county of Sebastian and State of Arkansas, have invented certain new and useful Improvements in Duplex Rotary Engines, of which the following is a specification.

This invention relates to certain new and useful improvements in rotary engines and it has for its objects among others to provide a simplified and improved duplex rotary engine composed of few parts and in which the employment of cams, eccentrics and gears is dispensed with. I employ two cylinders with steam ports passing through both cylinders, the pistons being both on the same shaft, in connection with a throttle valve serving also for the purpose of reversing the engine when necessary. I employ four valves which serve also as abutments, the same working automatically.

By my particular construction, I equalize the pressure, avoid dead centers, avoid wearing of a groove in the cylinder and provide for reversal by a simple movement of the throttle valve. The port passages extend through both cylinders and across the face of the valves, the valves being the same on both sides and serving as abutments as before mentioned. The valves are so disposed that when one set of valves is opening, the other is closing; when one is using steam on expansion, the other is opening on full. Each valve has a lap and shuts off the ingress of steam before the piston makes its full stroke.

I aim further at improvements in the details of construction whereby cheapness of manufacture is attained, ready assemblage of the parts assured, together with minimum likelihood of derangement or injury from wear as well as compactness and surety of action.

Other objects and advantages of the invention will hereinafter appear and the novel features thereof will be particularly pointed out in the appended claims.

The invention is capable of embodiment in a variety of forms, that herein shown being for the purpose of illustration and practical demonstration of the operation and practicability of the same, but it is to be understood that the invention is not restricted to the precise form illustrated. The invention in such preferred form is clearly illustrated in the accompanying drawings, which, with the numerals of reference marked thereon, form a part of this specification and in which—

Figure 1 is an end elevation with parts in section as on the line 1—1 of Figs. 3 and 6, looking in the direction of the arrows in said figures. Fig. 2 is an end elevation of parts removed and the shaft in cross section. Fig. 3 is a horizontal section as on the line 3—3 of Fig. 5 with the pistons removed. Fig. 4 is a side elevation showing the shaft and the pistons removed. Fig. 5 is a cross section on the line 5—5 of Fig. 3 looking in the direction of the arrow. Fig. 6 is a cross section on the line 6—6 of Fig. 3 looking in the direction of the arrow. Fig. 7 is a vertical longitudinal section on the line 7—7 of Fig. 6 looking in the direction of the arrow. Fig. 8 is a perspective view of one of the piston packing strips removed.

Like numerals of reference indicate like parts throughout the different views.

Referring to the drawings, 1 designates a suitable base upon which are supported the two cylinders 2 and 3 separated by a partition 4 having an opening 5 for the passage of the shaft 6 which has a bearing in the cylinder heads 7 and 8 respectively, said bearings being shown at 9 in Fig. 3 where the shaft and the pistons are omitted for the purpose of better illustrating the parts. These cylinders are arranged end to end, as seen in Fig. 7, having flanges 10, 10 between which the partition 4 is received and the whole firmly clamped together by bolts 11 provided with suitable nuts 12, whereby adjustment is provided for as well as permitting of ready separation of the cylinders when desired for the purpose of repairs. As seen in Fig. 7, this partition is provided with shoulders, as at 13, to prevent radial displacement of the partition. This partition is provided with an oil passage 14 controlled by a removable plug or the like 15, as seen best in Fig. 7, which oil passage extends inward to the shaft in order that the pistons may be properly lubricated. There are also passages through the heads inside of or between the shaft and the packing strips of the pistons for the purpose of releasing any end friction or leaks that might pass said strips, as seen at 16 in Fig. 2.

17 is a valve chest with which connects the pipe 18 leading thereto from a suitable source of supply. Within this valve chest is a slide valve 19, seen best in Fig. 7, adapted to be shifted in its position by means of the rod 20 connected with the valve and movable through a suitable stuffing box 21, its outer end having limited loose connection, as by pin and slot engagement, as seen at 22, with the controlling lever 23 pivotally mounted, as at 24, on a suitable bracket or support 25. This valve is fitted to a seat 26 and is adapted to control the ports 27 and 28, as will be clearly seen in Fig. 7. These ports extend through the member 29 and laterally in opposite directions where they are connected by pipes 30 and 31 respectively with the elbows 32 and 33 and these elbows connected by pipes 34 and 35 or their equivalents with ports in the heads 7 and 8, as will soon be described.

36 is the exhaust port extending through the member 29 and in communication with the chamber 37 in the under face of the sliding valve 19.

On the shaft 6 are the pistons 38, one in each cylinder, and arranged at right angles to each other, as seen in Figs. 4 and 7. These pistons are, in cross section, substantially elliptical in form being struck from three different centers. They are keyed upon the shaft, as seen at 39 and 40, and are each provided at their peripheries at their longest diameters with packing strips 41 movable in suitable longitudinally disposed grooves in the opposite faces of the piston, being backed by springs or the like 42 tending to at all times force said packing strips outward. These packing strips are curved to conform to the curvature of the adjacent wall of the piston, as seen in Figs. 2, 5 and 8, the springs being seated in suitable cavities 43 in the piston, as seen clearly in Figs. 5 and 7. These packing strips have substantially T-ends 44, as seen in Figs. 4 and 8, fitting correspondingly shaped openings in the opposite faces of the piston so as to prevent lateral and longitudinal movement of the strips as will be evident. These pistons are also provided with packing strips 45 at their ends and adapted to bear against the adjacent walls of the heads of the cylinders and the central partition 4, as seen best in Fig. 7. These packing strips are normally forced outward by means of springs 46 seated in suitable recesses in the ends of the pistons, as seen also in Fig. 7. Attention is also directed to Fig. 2.

47 are valves of which there are four, two for each cylinder for coöperation with each piston. These valves are guided in suitable grooves or ways 48 and 49 in the inner faces of the heads of the cylinders and the partition 4, as seen best in Fig. 3. Each valve has a stem 50 projecting through the adjacent wall 51 of the cylinder and through a suitable stuffing box 52 suitably held in said wall, as seen best in Fig. 3.

53 are oscillating tappets mounted upon suitable fulcrums 54 held in the extensions 55, opposite ends of each tappet engaging the ends of the stems 50 of the valves 47 at one end of the engine. These fulcrums are mounted in elongated slots 56 in said extensions and provision is made for adjustment or for wear by the employment of the screws 57 mounted in said extensions, as seen best in Figs. 3 and 4. These valves and tappets are so arranged that when the two valves of the one cylinder are inward, the valves of the other cylinder are outward, as seen in Fig. 3, that is, the two valves of the one cylinder move simultaneously inward or outward, in the one direction by the tappets and in the other direction by the pistons 38, as will be clearly understood upon reference to Figs. 3 and 5, in which latter view the two valves are shown in their outermost position. The valves 47 are provided upon opposite sides with the depressions or chambers 58 and 59, as seen clearly in Figs. 1 and 5 and also in dotted lines in Fig. 7.

In the head 7 is an annular port or passage 60 in communication with which is the port 27 through the members 30, 32 and 34 and the port 61 in the head 7, as seen in Fig. 7. In the head 8 is a similar annular port 62 which, by means of the passage 63 in said head, is placed in communication with the port 28 through the members 35, 33 and 31, as seen clearly in said Fig. 7. This annular passage 60 is in communication, by means of the lateral and downwardly inclined passage 46, with the port 65 which extends entirely through both cylinders and across the face of the valves, as seen clearly in Figs. 1 and 3. An upwardly and outwardly inclined port or passage 66 affords communication between the annular port or passage 60 and the port 67 which extends through both cylinders and across the face of the valves, as will be understood upon reference to Figs. 1, 3, 5 and 6. 68 and 69 are similar horizontal ports or passages extending through both cylinders and across the face of the valves opposite the passages 65 and 69, as seen best in Figs. 5 and 6. The ports 65, 67, 68 and 69 communicate with the chambers 58 and 59 of the valves 47, as shown best in Figs. 1, 5 and 6.

As seen in Figs. 4 and 5, the strips 41 conform to the shape of the piston so as not to wear a groove in the cylinder. It is further to be noticed that they are so constructed and held in place as not to be accidentally disengaged or displaced in any direction.

The shaft 6 is enlarged within the cylinders, as seen at 6^a, and provided at the end

of such enlargement with shoulders 6^b, as seen clearly in Fig. 7, against which the cylinder heads abut, as seen in said view. This not only prevents endwise movement of the shaft but also permits of the ready application or removal of the pistons when desired.

With the parts constructed and arranged substantially as hereinbefore described, the operation will be readily understood, and, briefly stated, is as follows: With the parts shown for instance in the position seen in Fig. 7 and the throttle valve moved so that steam entering through the inlet 18 following the direction of the arrows seen in said figure will pass through the valve chest, and the port 27 and parts 30, 32, 34 and port 61 in the head 7 into the annular passage 60, thence passing through the ports at that end of the cylinder, it being noted that there are two ports at each end but on opposite sides of the cylinder and that the steam passes to both of these at the same time, passes through both cylinders on opposite sides of the valve making an equalizing pressure on four points of the piston at the same time. The pistons revolve as indicated in Fig. 4 and the steam is exhausted through the port 28, the chamber 37 in the valve and the exhaust port 36. Now, if the throttle valve be moved to the right, the engine will be reversed as the ports are the same at both ends and sides as are also the valves, which valves act also as abutments for the pressure of steam. It is to be noted that when one set of valves is opening, the other is closing, or, in other words, when one is using steam, on expansion, the other is opening on full. It will be noted that the main valve has a lap and closes or shuts off the steam before the piston makes its full stroke. There is no vibration at any point of the stroke. The steam passes from the valve chest to one end of the cylinder where it performs its work and then passes out through the cavity in the valve out through the other end of the cylinder and out through the exhaust passage 37 in the under side of the valve and the exhaust 36.

From the foregoing, it will be seen that I have devised a simple and efficient form of duplex rotary engine and while the structural embodiment of the invention as herein disclosed is what I at the present time consider preferable, it is evident that the same is subject to changes, variations and modifications in detail, proportion of parts, etc., without departing from the spirit of the invention or sacrificing any of its advantages. I, therefore, do not intend to restrict myself to the exact construction hereinbefore disclosed, but reserve the right to make such changes, variations and modifications as come properly within the scope of the protection prayed. Parts may be used without the whole. Some of the features herein disclosed may be used in connection with cooperating features somewhat modified or different from those in connection with which they are herein set forth.

What is claimed as new is:—

1. In a duplex rotary engine, a multiplicity of cylinders, valves in pairs in said cylinders, steam ports passing longitudinally through both of said cylinders and cooperating with said valves and pistons in said cylinders with which said valves cooperate.

2. In a duplex rotary engine, a multiplicity of cylinders, valves in pairs in said cylinders, steam ports passing longitudinally through both of said cylinders and cooperating with said valves and pistons in said cylinders with which said valves cooperate, said valves serving also as abutments.

3. In a duplex rotary engine, a multiplicity of cylinders, valves in pairs in said cylinders, steam ports passing longitudinally through both of said cylinders and cooperating with said valves, pistons in said cylinders with which said valves coöperate, and means whereby the valves in one cylinder are automatically controlled by those in the other.

4. In a duplex rotary engine, a multiplicity of cylinders, oppositely disposed valves in pairs in said cylinders, steam ports passing longitudinally through both of said cylinders and coöperating with said valves, a rotary piston in each cylinder coöperating with and actuating said valves, one piston being disposed between each pair of valves and constructed to simultaneously actuate both valves of said pair.

5. In a duplex rotary engine, a multiplicity of cylinders, valves in pairs in said cylinders, steam ports passing longitudinally through both of said cylinders and cooperating with said valves, pistons in said cylinders with which said valves coöperate, and means in position to be actuated by said valves for controlling the movement of the valves in another cylinder.

6. In a duplex rotary engine, a multiplicity of cylinders, valves in pairs in said cylinders, steam ports passing longitudinally through said cylinders and coöperating with said valves, said valves being oppositely disposed in pairs, rotary pistons in said cylinders, one piston being disposed between each pair and constructed to simultaneously actuate both valves of said pair, said pistons being upon a common shaft and fixedly mounted thereon at right angles to each other.

7. In a duplex rotary engine, a pair of cylinders, a shaft common thereto, pistons on said shaft one within each cylinder, and oppositely disposed valves in each cylinder

operable by the pistons, said valves being recessed upon opposite faces.

8. In a duplex rotary engine, a pair of cylinders, a shaft common thereto, pistons on said shaft one within each cylinder, and oppositely disposed valves in each cylinder operable by the pistons, said valves being recessed upon opposite faces, the heads of said cylinders being provided with channels leading to said recesses.

9. In a duplex rotary engine, a pair of cylinders, a piston in each cylinder, oppositely disposed valves in each cylinder between which the pistons move, fluid passages in the cylinder heads, steam inlets thereto, and passages leading from said fluid passages to the valves.

10. In a duplex rotary engine, a multiplicity of cylinders with passages extending therethrough, annular passages in the cylinder heads communicating with said passages, and valves across the face of which said passages extend.

11. In a duplex rotary engine, a multiplicity of cylinders with passages extending therethrough, annular passages in the cylinder heads communicating with said passages, valves across the face of which said passages extend, and pistons coöperating with said valves, the latter serving as abutments.

12. In a duplex rotary engine, a multiplicity of cylinders with passages extending therethrough, annular passages in the cylinder heads communicating with said passages, valves across the face of which said passages extend, and pistons coöperating with said valves, the latter serving as abutments, the cylinder heads being provided with guides for said valves.

13. In a duplex rotary engine, cylinders having annular fluid passages and a partition between the cylinders, a shaft mounted in the cylinder heads and in said partition, valves in said cylinders guided in the cylinder heads and partition, pistons on said shaft coöperating with said valves and passages leading from the first-named passages across the faces of the valves.

14. In a duplex rotary engine, a pair of cylinders, a pair of valves in each, a piston in each cylinder coöperating with said valves, each cylinder having an annular fluid passage with oppositely inclined passages, and ports extending longitudinally through both of the cylinders.

15. In a duplex rotary engine, a pair of cylinders, a pair of valves in each, a piston in each cylinder coöperating with said valves, each cylinder having an annular fluid passage with oppositely inclined passages, and ports extending longitudinally through both of the cylinders and across the faces of the valves.

16. In a duplex rotary engine, a pair of cylinders, a pair of valves in each, a piston in each cylinder coöperating with said valves, each cylinder having an annular fluid passage with oppositely inclined passages, and ports extending longitudinally through both of the cylinders and across the faces of the valves, said valves having recesses upon their opposite faces.

17. In a duplex rotary engine, a pair of cylinders, a pair of valves in each cylinder acting as abutments, a piston in each cylinder coöperating with its valves, said valves being recessed upon opposite faces, the cylinders having longitudinal ports extending entirely through the same and in communication with the recesses of the valves, and a throttle valve controlling the flow of motive fluid to said passages.

18. In a duplex rotary engine, a pair of cylinders, a pair of valves in each cylinder, steam ports passing longitudinally through both of said cylinders and coöperating with said valves, and a rotary piston in each cylinder, said pair of valves coöperating with and actuated by said pistons.

19. In a duplex rotary engine, a pair of cylinders, a pair of valves in each cylinder, steam ports passing longitudinally through both of said cylinders and coöperating with said valves, a rotary piston in each cylinder, said pair of valves coöperating with and actuated by said pistons, and means whereby the valves in the one cylinder operate those in the other.

20. In a duplex rotary engine, a pair of cylinders, a pair of valves in each cylinder, steam ports passing longitudinally through both of said cylinders and coöperating with said valves, a rotary piston in each cylinder, said pair of valves coöperating with and actuated by said pistons, and a slidable throttle valve for controlling the flow of motive fluid to the cylinders.

21. In a duplex rotary engine, an elliptical piston provided with packing strips at the periphery of its longest axis, said strips provided with lateral portions to prevent displacement of the strips.

Signed by me at Eureka Springs, Arkansas, this 25th day of April, 1912.

CHARLES F. SLEIGH.

Witnesses:
HENRY B. MORRISON,
R. MALONEY.