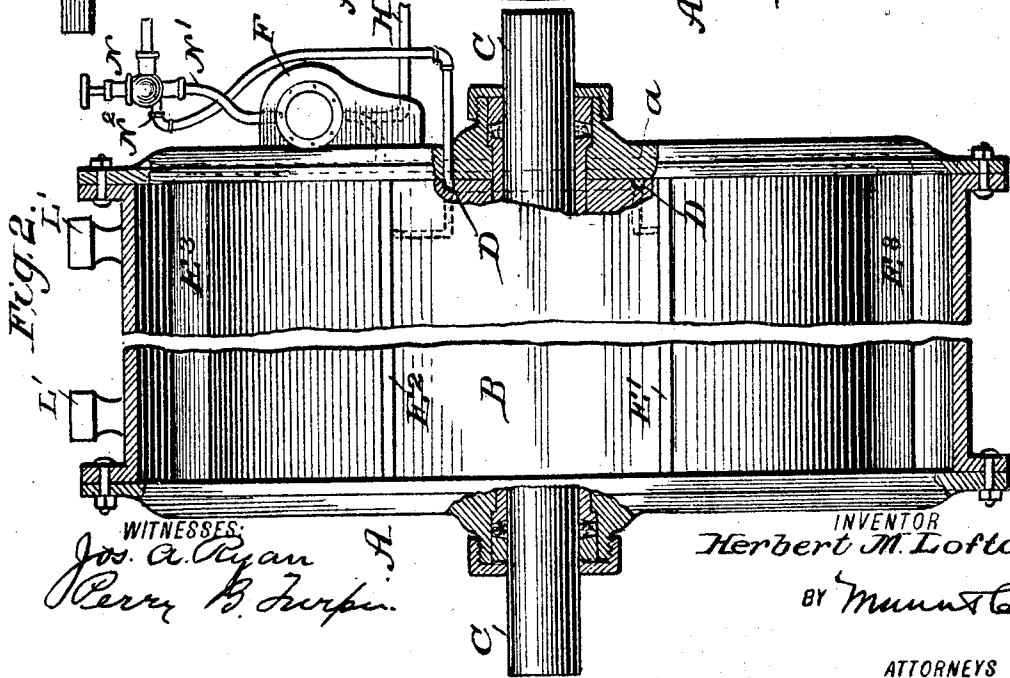
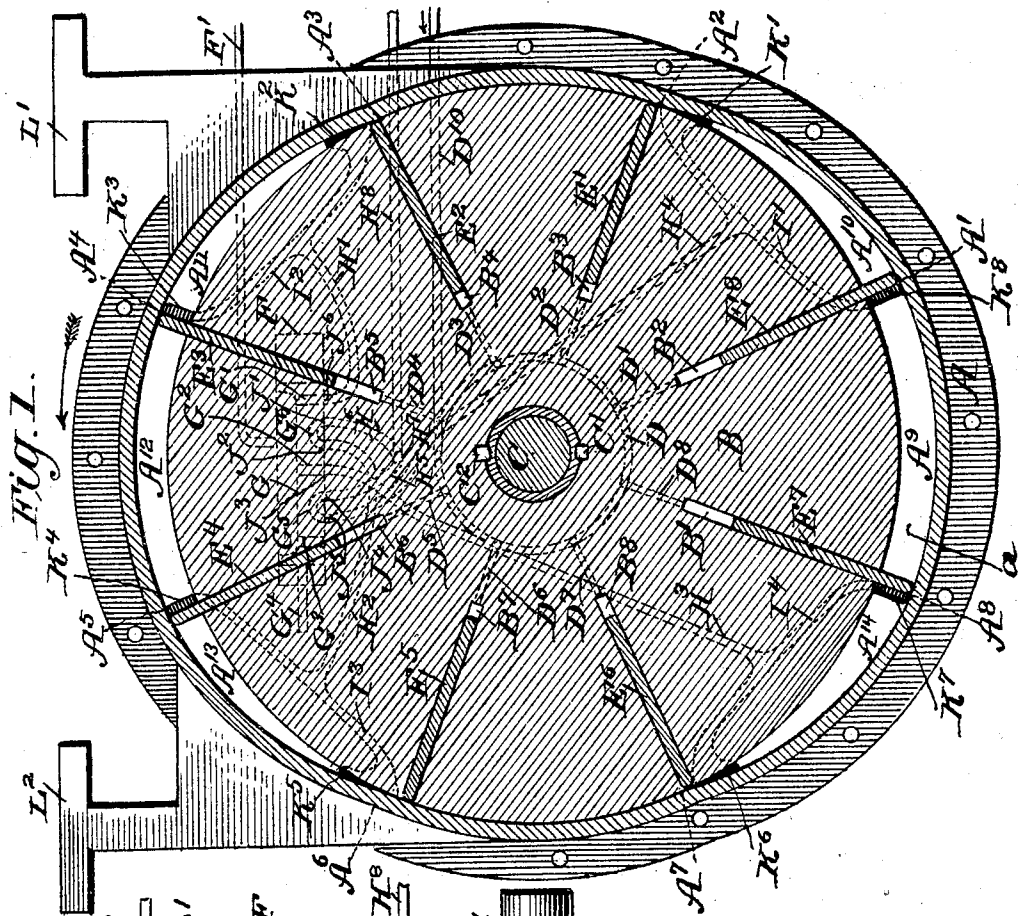


H. M. LOFTON.
ROTARY ENGINE.

APPLICATION FILED OCT. 29, 1904.

5 SHEETS—SHEET 1.



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5 SHEETS—SHEET 2.

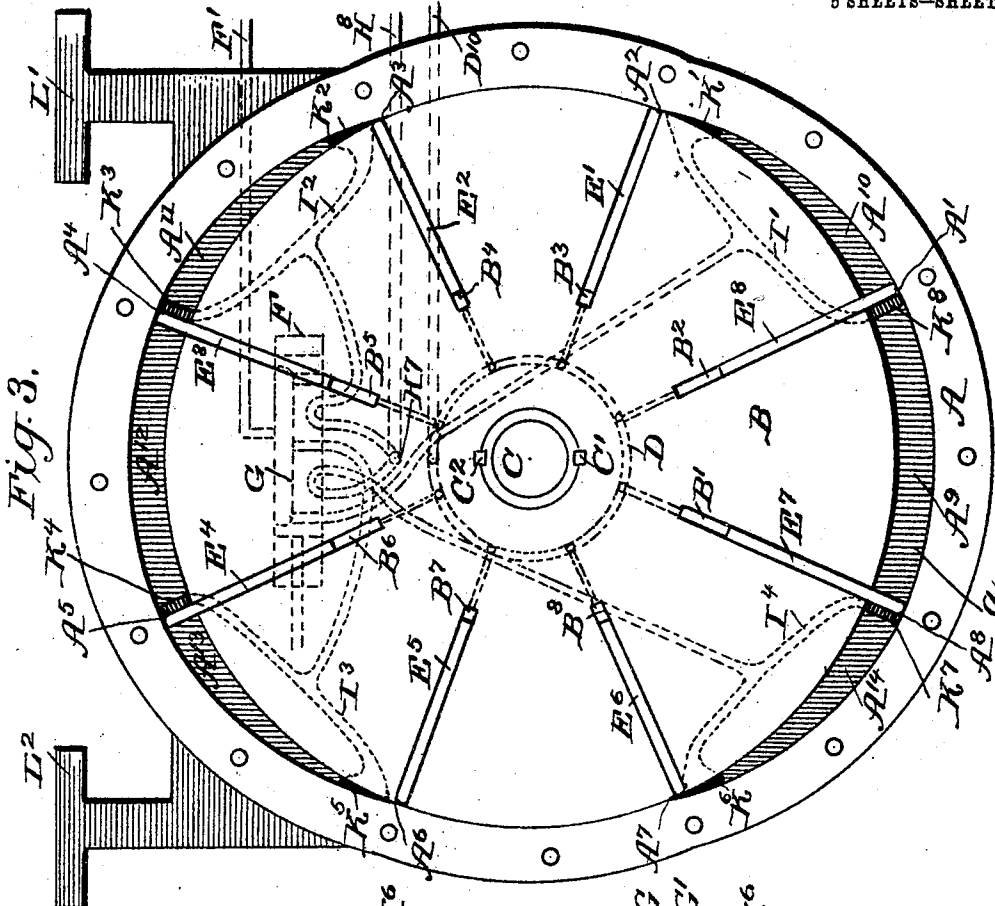


Fig. 1a

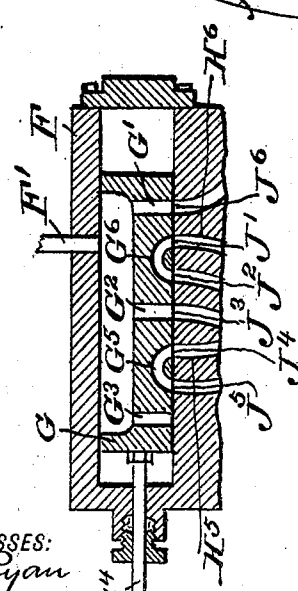
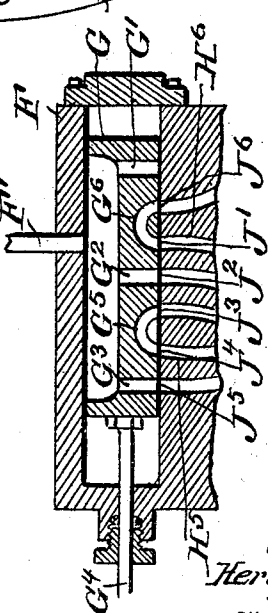


Fig. 3a



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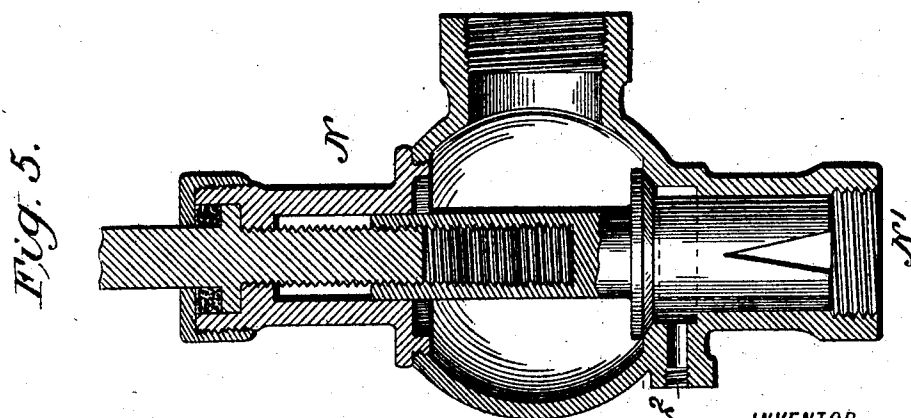
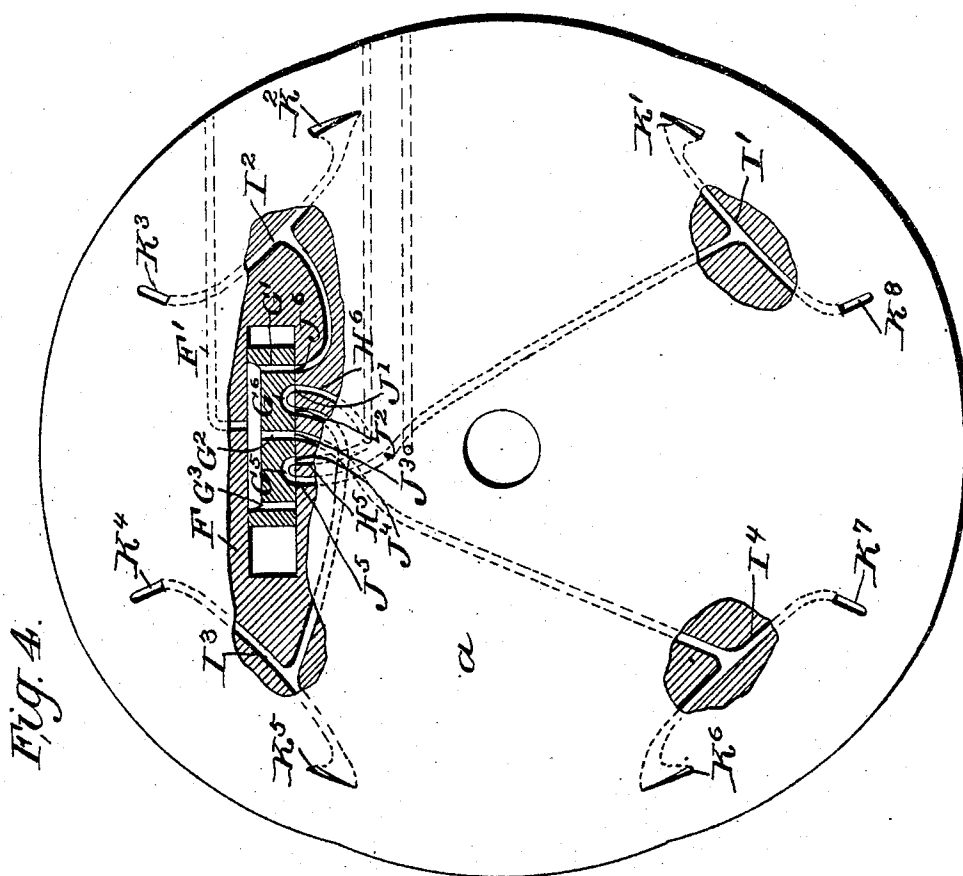
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ROTARY ENGINE.

APPLICATION FILED OCT. 29, 1904.

5 SHEETS--SHEET 3.



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No. 794,723.

PATENTED JULY 18, 1905.

H. M. LOFTON.
ROTARY ENGINE.

APPLICATION FILED OCT. 29, 1904.

5 SHEETS—SHEET 4.

Fig. 6

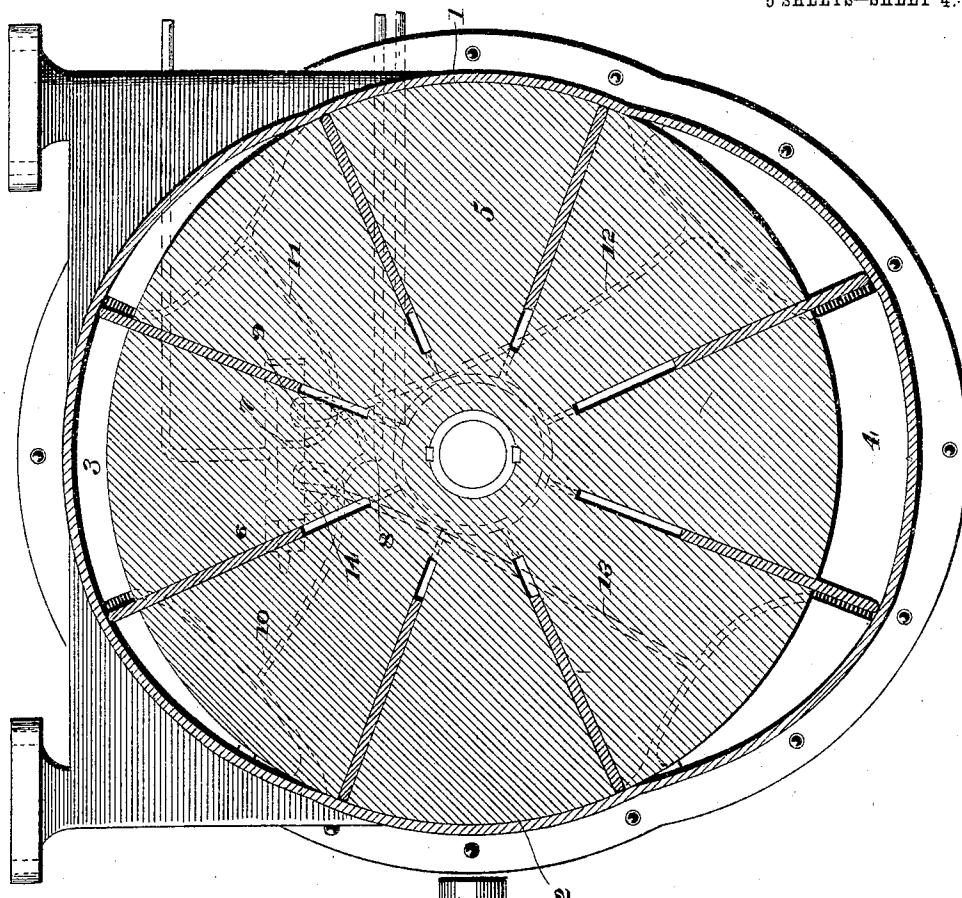
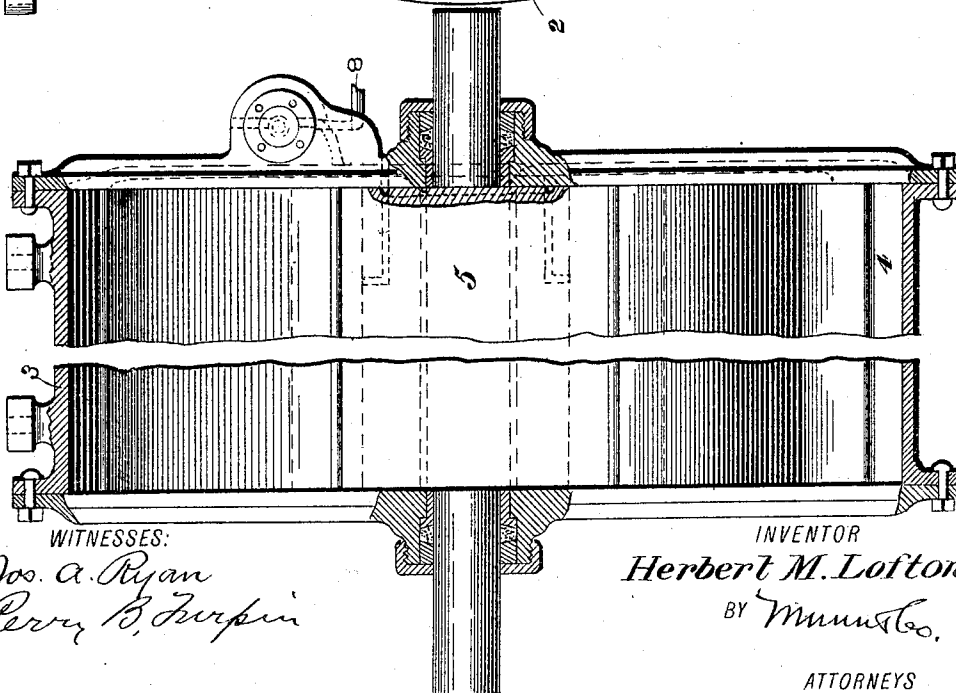


Fig. 7



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APPLICATION FILED OCT. 29, 1904.

5 SHEETS—SHEET 5.

Fig. 9

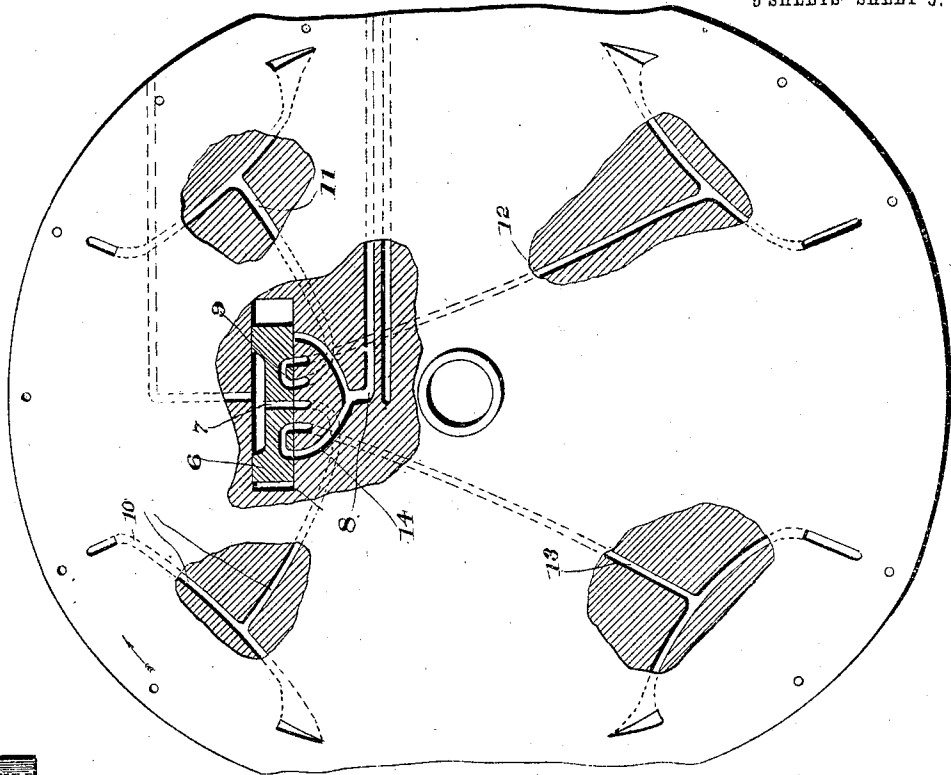
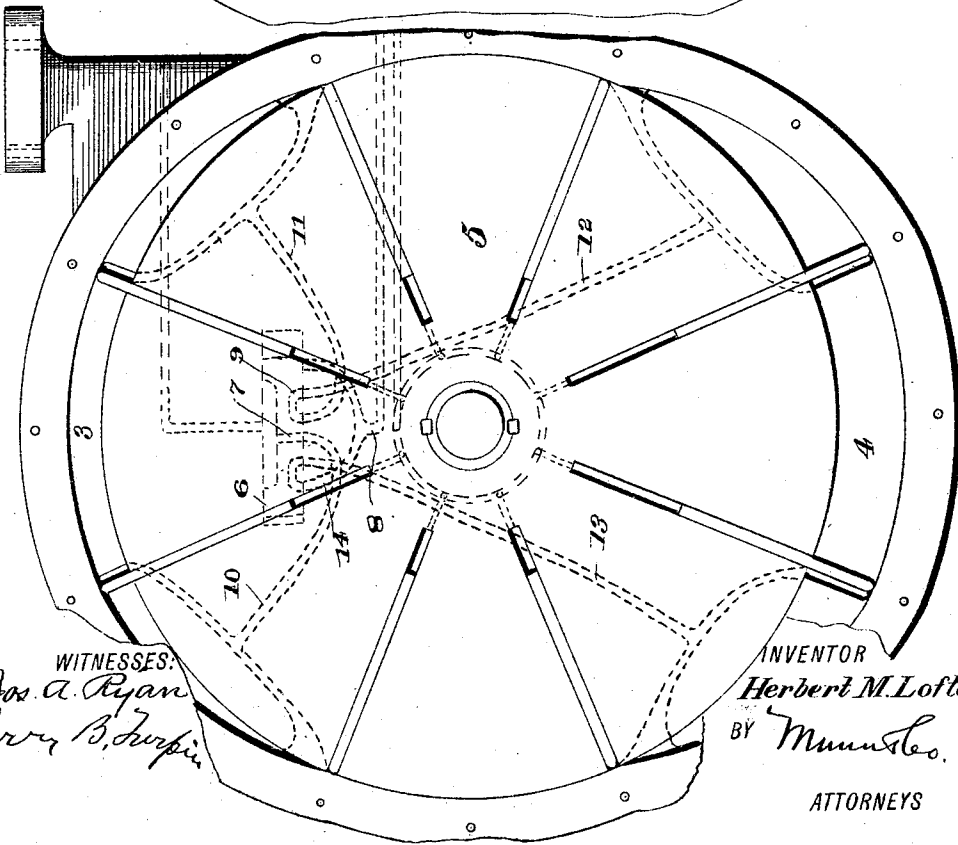


Fig. 8



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UNITED STATES PATENT OFFICE.

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ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 794,723, dated July 18, 1905.

Application filed October 29, 1904. Serial No. 230,509.

To all whom it may concern:

Be it known that I, HERBERT M. LOFTON, a citizen of the United States, residing at Atlanta, in the county of Fulton and State of Georgia, have made certain new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention is an improvement in rotary engines, and relates particularly to that class of such engines in which a revolving piston, provided with blades which may be projected from and drawn into its rim, operates within a casing to which steam is admitted and exhausted; and the present invention has for an object to provide means whereby to secure an efficient operation of the steam upon the blades and to relieve any tendency of the steam to press the blades tightly against the walls of their guide-grooves in such manner as to impede the free operation of the blades in the piston; and the invention has for further objects other improvements; and it consists in certain novel constructions and combinations of parts, as will be hereinafter described and claimed.

In the drawings, Figure 1 is a cross-section of my engine. Fig. 2 is a side elevation of the engine, partly broken in section. Fig. 3 is an end elevation of the engine, showing the valve in the reverse position from that shown in Fig. 1. Fig. 1^a is a detail sectional view of the valve, showing the same in the position indicated in Fig. 1. Fig. 3^a is a detail section of the valve, showing the same in the position indicated in Fig. 3. Fig. 4 is a detail elevation, partly in section, of the inner face of the head-plate of the engine, showing the ports for the admission and discharge of the steam. Fig. 5 is a detail section of the throttle-valve. Fig. 6 is a cross-section; Fig. 7, a side elevation, partly broken in section. Fig. 8 is an end elevation, partly broken away, of a compound engine embodying my invention; and Fig. 9 is a detail elevation of the inner side of one of the head-plates, partly broken in section to show the passages for steam and exhaust employed in the compound form of engine.

In carrying out my invention I construct

the engine with a piston which is circular in cross-section, is provided with radial slots opening at its rim, and in which the blades operate, and fit such piston in a casing having a rim portion and heads at the opposite ends thereof with its rim bored to provide two opposite circular concentric segments which conform to and closely fit the piston, so the latter can turn in said opposite concentric portions, the spaces between the ends of the concentric piston fitting portions on opposite sides of the piston forming steam-spaces and having their walls formed with intermediate portions of greater diameter than the piston-fitting segments before described and made concentric therewith and with curved eccentric portions which connect said larger concentric portions with the smaller piston fitting concentric portions before referred to, ports for the admission of live steam and for the exhaust-steam being provided at the juncture of the smaller concentric portions with the eccentric portions and of the larger concentric portions with said eccentric portions for purposes which will be more fully described hereinafter.

In Figs. 1 and 3 the piston B is shown in position in the case A, the latter being bored into as many subdivisions of radii as there are blades in the piston B, which are preferably eight, as shown. From A² to A³ and A⁶ to A⁷ the radius of casing is the same as piston B and is bored to fit neatly, allowing the piston B to revolve. From A⁴ to A⁵ and A⁸ to A¹ the radius is the same as the piston, but is bored to allow the space A⁹ and A¹². From A¹ to A² and A³ to A⁴ and A⁵ to A⁶ and A⁷ to A⁸ the radius is bored to form eccentric portions for the projection and retraction of the blades E' E⁸.

The piston B is circular in cross-section in shape and revolves in the casing A. This piston is supported in position by a shaft C, which has keys C' and C². The piston B has slots B' to B⁸ on a line with the center of the axis and in which work the blades E' to E⁸. The piston B is provided in its inner face with an annular groove D, which groove is

kept constantly supplied with live steam from the boiler by means of the steam-pipe D¹⁰. This groove in turn supplies the inner ends of the slots B' B⁸ with live steam by means of the passages D' to D⁸. The steam in slots B' B⁸ then exerts a pressure upon the inner ends of the blades E' E⁸, which keeps them constantly pressing against the inner walls of the cylinder A.

10 The head a of the cylinder A fits neatly against the end of the piston B. This head is provided with a series of steam-passages, (shown by dotted lines H' H⁴.) which in turn branch out into the passages I' I⁴. These passages in turn lead into the steam-ports K' K⁸.
15 This head is also provided with the exhaust-passages H⁵ H⁶, which lead into the exhaust-pipe H⁸ at a point shown by H⁷. This head is also provided with the valve-chamber F, in
20 which the cylindrical valve G works. The valve-chamber F has leading into it the various steam and exhaust passages at the ports J' J⁶. The valve G is moved longitudinally by means of a suitable lever connected to the
25 valve-rod G⁴.

I find it desirable in practice to admit the steam to the groove D so it will pass to position to operate the blades E' E⁸ outwardly in advance of the admission of the steam to
30 operate against the outer projecting portions of the blades to turn the cylinder, and I do this by providing a throttle-valve which has a branch outlet which may be opened for the passage of steam in advance of the main outlet of the valve, the main outlet being connected with the steam-chest F and the branch
35 outlet being connected with the steam-pipe D¹⁰, which delivers steam to the groove D. In Figs. 2 and 5 I show the throttle-valve N, having a main outlet N' and a branch outlet N² and a valve arranged for operation to permit the passage of steam to the branch outlet in advance of the passage of steam to the main outlet and the operation of which valve
40 will be understood from Figs. 1 and 5. This throttle-valve forms the subject-matter of a separate application for patent filed by me of even date herewith. As shown in Figs. 1, 3, and 4, the ports K³, K⁴, K⁷, and K⁸ are preferably rounded at their outer ends, conforming to the rounded outer ends of the blades,
45 so that when the blades overlap the said ports steam cannot escape from the ports in either direction, so there will be no passage of the steam to both sides of the blades at the moment of passing the ports. The casing A is supported by brackets L' and L², cast as an integral part of same.

In operation steam from boiler enters the
60 annular groove D and thence through the passages D' D⁸ into the slots B' B⁸, forcing the blades outwardly against the inner walls of cylinder A, as shown in Fig. 1. Steam from boiler then enters valve-chamber F, through
65 steam-pipe F', and fills chamber in concaved

space on top of valve G. To revolve piston in direction of arrow, Fig. 1, steam would pass through openings G' and G² in valve into passages H' and H³, and would then enter cylinder through the ports K² and K³ and K⁶ and
70 K⁷. After entering the cylinder thus the steam would exert a pressure against the portions of the projected blades E³ and E⁷ projecting beyond the circumference of the piston. This pressure would then force the blades
75 around until they had passed the points A⁵ and A⁷. The steam that had forced the blades into this position would then exhaust through the ports K⁴, K⁵, K⁸, and K' into the exhaust-pipe H⁸ by passing through the cavities G⁵
80 and G⁶ in valve G, and out into common exhaust-pipe through the passages H⁵ and H⁶. While the blades E³ and E⁷ are being forced around in the manner described the next two
85 blades shown by E² and E⁶ are being brought around to the same relative positions first occupied by the blades E³ and E⁷. The blades E² and E⁷ then perform in the same manner as the previous set of blades just described. It will be noted that no steam can leak between the piston
90 and wall of cylinder from the points A³ to A² and A⁶ to A⁷, as there is at all times one of the blades pressing against the wall of cylinder between the points named.

The object in providing the double ports
95 shown at K² K³ and K⁶ K⁷ is to balance the pressure against the blades E² and E⁵ while they are traveling from the points of the radius A³ to A⁴ and A⁷ to A⁸. Except for this the pressure of steam against the blades while
100 traveling from the last points mentioned would have a tendency to press the blades against the sides of the slots so tightly that no reasonable pressure would force them out against the walls of the cylinder, as desired.
105 By means of the double ports mentioned the blades are perfectly balanced from the points of travel A³ to A⁴ and A⁷ to A⁸. In this operation there is no actual work being done by the blades until after they pass the ports K³
110 and K⁷. In other words, there are two separate eighths of duty being performed by blades in their rotation, one from A⁴ to A⁶ and the other from A⁸ to A⁷, and these parts of the radius are true or concentric with the radius
115 of the piston B, so that the blades after reaching the parts of travel mentioned do not have to expand any more, as they have then reached their greatest points of expansion, and therefore do not have to be balanced, as already
120 mentioned.

In traveling around from point A' to A² and A⁵ to A⁶ a certain amount of back-pressure exhaust-steam will follow the blades, and were it not for the exhaust-ports shown at A²
125 and A⁶ the next blade following would jam or compress this exhaust-steam in between the points shown in the space A¹⁰ and A¹³ and cause a considerable back pressure, so much, in fact, that it would stop the engine; but by
130

providing the exhaust-ports A^2 and A^6 the steam so caught in the spaces A^{10} and A^{13} is allowed to pass out the passages H^3 and H^4 without undue back pressure. These double exhaust-ports also serve to keep the blades balanced while they are receding in traveling from the points A^5 to A^6 and A^7 to A^2 , respectively.

To reverse the movement of engine, the valve G is shifted from the position shown in Figs. 1 and 1^a to that shown in Figs. 3 and 3^a , in which the steam-passages G^3 and G^2 come directly over the steam-ports J^5 and J^2 , which will cause the engine to revolve in the opposite direction and to operate in identically the same manner as previously described. In shifting the valve in the manner mentioned the exhaust-cavities G^5 and G^6 will overlap the ports J^4 and J^3 and J^7 and J^6 , respectively, thus allowing the exhaust-steam to pass out in the same manner as previously described for reverse movement of the piston B . In other words, the ports K^2 K^3 and K^6 K^7 are steam-entrance ports and the ports K^4 K^5 and K^8 K^1 are exhaust-ports when engine is revolving in direction of arrow, Fig. 1, while with the reverse motion of piston the ports K^4 K^5 and K^8 and K^1 become steam-ports and the ports K^2 K^3 and K^6 K^7 become exhaust-ports.

To compound this engine, all that is necessary is to provide two or more engines on the same shaft, with the succeeding engine having greater area of blades and steam-spaces, and the exhaust-pipes H^8 lead directly from each engine into the steam-valve chamber of the succeeding compounding engines, as is shown in Fig. 1, the exhaust-steam from high-pressure or initial engine being compounded against the greater area of the compound-engine blades. The operation and construction of low-pressure or secondary engines would be identically the same as the engine just described.

While, as suggested, the engine may be compounded by providing two or more engines on the same shaft, it may be preferred to compound the engine in the same casing and with the same piston and blades, and this may be carried out by the construction shown in Figs. 6, 7, 8, and 9. In this construction the casing has the opposite concentric segments 1 and 2 to fit the piston for a portion of its circumference and is also provided with operating-sections 3 and 4 between the concentric segments 1 and 2 and formed like the operating-sections of the simple form of engine before described, except that the section 4 is of greater area than the section 3, and the valves are arranged so that the exhaust discharged from the section 3 may operate expansively in the section 4. In this construction the piston 5 may be similar to that employed in the simple form of engine, and the valve 6 has a feed-port 7 and exhaust-

ports 8 and 9 and may be adjusted, as shown in Fig. 9, to drive the engine in the direction indicated by the arrow in said figure, and in which adjustment the feed-port 7 will deliver steam through the passage 10 to the smaller operating-section 3, and the exhaust from said section 3 will be discharged through the passage 11 and through the exhaust-port 9 to pass through the passage 12 to the operating-section 4, wherein it will operate expansively, and the final exhaust from the section 4 will pass through the passage 13 and the valve-port 8 to the final exhaust 14, as will be understood from Fig. 9 of the drawings. In the construction of engine shown in Figs. 6, 7, and 8 it will be understood that the operating-sections 3 and 4 are formed with intermediate circular or concentric portions and with the eccentric connecting portions similar in form to the corresponding parts employed in the simple form of engine illustrated in Figs. 1 to 5, inclusive, of the drawings.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A rotary engine comprising a piston circular in cross-section and provided with radial slots, with blades operating therein and with an end groove communicating with the blade-slots, the casing having its rim formed with the opposite concentric segments conforming to and fitting the piston for a portion of its circumference, and with an operating-section between the said concentric sections, said operating-section having an intermediate portion concentric with those fitting the piston and curved eccentric portions connecting said intermediate concentric portion with the concentric portions fitting the piston, the casing-heads one of which has steam-passages opening adjacent to the rim of the casing and at the opposite ends of the eccentric portions of such rim, a throttle-valve having a main discharge connected with the steam-passages of the said head, and a branch passage in communication with the annular groove in the end of the piston, and a valve controlling the feed of steam to and its exhaust from the steam-passages of the casing-head, substantially as set forth.

2. The combination in a rotary engine with a piston having sliding blades, a casing having opposite concentric portions conforming to and fitting said piston for a portion of its circumference, and also having concentric operating portions opposite each other and between the concentric portions fitting the piston, eccentric portions connecting the concentric operating portions and the concentric portions fitting the piston, main steam feed and exhaust passages with feed-ports and exhaust-ports opening adjacent to the intersection of the eccentric portions with the smaller and larger concentric portions, whereby the pressure on the blades will be balanced while

they are traveling from the smaller to the larger concentric portions in expanding, and in traveling from the larger to the smaller concentric portions in receding, thus allowing
5 the blades to move outwardly or inwardly without undue friction.

3. The combination in a rotary engine with a piston having moving blades, a casing having opposite concentric portions fitting the
10 piston for a portion of its circumference, and opposite operating concentric sections located between the concentric sections fitting the piston, eccentric sections connecting the operating-sections with the sections fitting the
15 piston, a cylinder-head having steam-passages with branch outlets or ports opening at the intersections of the eccentric sections with the concentric sections fitting the piston and the concentric operating-sections, said outlets or
20 ports being located adjacent to the ends of the eccentric sections, whereby the pressure of live steam will be against both sides of the blades while they are moving outwardly or expanding, and the back pressure from ex-
25 haust-steam will be against both sides of the blades while they are receding, thus balancing the blades at all times while they are traveling over the curved eccentric portions or sections of the casing in both advancing and
30 receding.

4. A rotary engine comprising a casing, a piston having blades and ways in which said blades operate, whereby they may slide in and out to their different positions, steam-
35 spaces being provided at the inner ends of the blades, and a valve having means whereby to control the passage of steam to operate upon the inner edges of the blades, and means for controlling the supply of steam to drive
40 the engine.

5. The combination in a rotary engine with the casing and the piston having sliding blades, of means controlling the passage of steam to expand the blades independently of the pas-
45 sage of steam to drive the engine, whereby the steam may be admitted to project the blades in advance of the admission of steam to drive the engine.

6. The combination of the piston and the
50 casing having its rim provided with a concentric portion and with an eccentric portion leading up to said concentric portion, and provided with steam-ports opening at the opposite ends of the eccentric portion whereby pressure may be balanced on the piston-blades
55 in the passage of same to the concentric portion of the casing-rim, to prevent the binding of said blades in the body of the piston.

7. The combination in a rotary engine, of
60 the piston circular in cross-section and provided with sliding blades, and the casing having its rim formed with opposite concentric segments conforming to and fitting the piston for a portion of its circumference, and also
65 having the operating-sections between said

concentric segments, said operating segments forming, outside of the piston, spaces for steam and being constructed with the intermediate portions concentric with and larger
70 than those fitting the piston and with curved eccentric portions connecting said larger intermediate concentric portions with the smaller concentric portions which fit the piston and provided at the opposite ends of said curved
75 eccentric portions with ports for the admission of pressure and the discharge of exhaust.

8. In a rotary engine, the combination with the casing having an exhaust-port, and a feed-port and provided with opposite concentric
80 portions to fit a piston and with an operating-section between said concentric segments and formed with an intermediate portion concentric with and of greater diameter than the opposite concentric portions and with a seg-
85 mental portion connecting the said larger concentric portion of the casing with the opposite concentric portions and with steam-passages having ports opening adjacent to the ends of the eccentric connecting portions, and a valve
90 controlling the steam supply and exhaust passages, leading to the opposite ends of the eccentric portion of the casing whereby a reversal of the engine may be effected.

9. The combination with a circular piston
95 having blades, of a casing having opposite concentric portions fitting the piston, and a connecting-section extended between said concentric portions and provided with an intermediate portion concentric with the opposite
100 concentric portions and with curved eccentric portions connecting the ends of said intermediate concentric portion with the concentric portions fitting the piston, and steam-passages having branches opening at their ends adjacent to the opposite ends of the curved eccentric
105 portions of the casing.

10. The combination in a rotary engine, of the feed-valve having exhaust-ports open at their opposite ends at the same side of the
110 valve and feed-ports opening at one end at the same side of the valve with the open ends of the exhaust-ports, and a recess in the opposite side of the valve and with which the other ends of the feed-ports communicate, and the steam-passages opening at one end in com-
115 munication with the casing of the engine and at their other ends in position to register with the ports of the feed-valve in the different positions thereof.

11. The combination in a rotary engine, of
120 the piston having the sliding blades, and a casing having intermediate steam-ports opening laterally adjacent to the side edges of the outer ends of said blades and arranged to be entirely closed by the side edges of the blades
125 as the latter pass the ports.

12. A rotary engine having a piston provided with sliding blades curved at their outer edges, and a casing having its head provided in its inner face with a port in the path of the
130

piston, and curved at its outer end to conform to the curvature of the piston-blade and the width of the port not exceeding the thickness of the sliding blade, whereby the latter may entirely close the port in passing the same.

13. A rotary engine comprising a piston circular in cross-section and provided with radial slots and with blades operating therein, and a casing having a rim portion and heads at the ends thereof and having its rim provided with two opposite concentric sections which conform to and closely fit the piston and having the spaces between the ends of the said concentric portions forming steam-spaces on opposite sides of the piston and having their walls consisting of intermediate concentric portions of greater diameter than those fitting the piston, and end portions connecting said intermediate concentric portions with the smaller concentric portions which fit the piston, and having said casing provided with steam-passages opening adjacent to the opposite ends of said eccentric connecting portions, and a valve controlling the passage of live and exhaust steam to the passage of the casing.

14. The combination in a rotary engine, of the piston circular in cross-section and provided with sliding blades, the casing having its rim formed with opposite concentric portions fitting the piston and with operating-sections between said concentric portions and having intermediate portions concentric with and larger than those which fit the piston, and curved eccentric portions connecting said larger and smaller concentric portions and having steam-ports opening at the juncture of the eccentric portions with the concentric por-

tion, the ports opening adjacent to the smaller concentric portions being flared or enlarged, steam-passages being provided in the casing for the passage of steam to the said ports to the inner ends of the piston-blades, and means whereby steam may be admitted to operate upon the inner ends of the blades in advance of the admission of steam to operate the engine.

15. A rotary engine comprising a piston having sliding blades, and a casing having a steam-space provided with a portion in which the steam operates to drive the piston and with a segmental portion leading up to said operating portion and having feed-ports adjacent to both ends of said leading-up portion of the casing, whereby pressure may be balanced on opposite sides of the blade as it approaches its driving position.

16. The combination in a rotary engine with a piston having sliding blades, a casing with cylinder-heads, said heads having steam and exhaust passages with outlets or ports opening at the outer ends of said blades, the width of said ports not exceeding the thickness of the sliding blades and the two intermediate ports being located on a line with and a distance apart equal to two adjoining blades whereby said blades will entirely close the intermediate ports as the blades pass over same, thus preventing the live steam from blowing through into exhaust-passage without performing its duty of forcing the piston into revolution.

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