B. DAHL.

ROTARY ENGINE.

APPLICATION FILED OCT. 28, 1910.

1,014,378.

Patented Jan. 9, 1912.

4 SHEETS—SHEET 1.

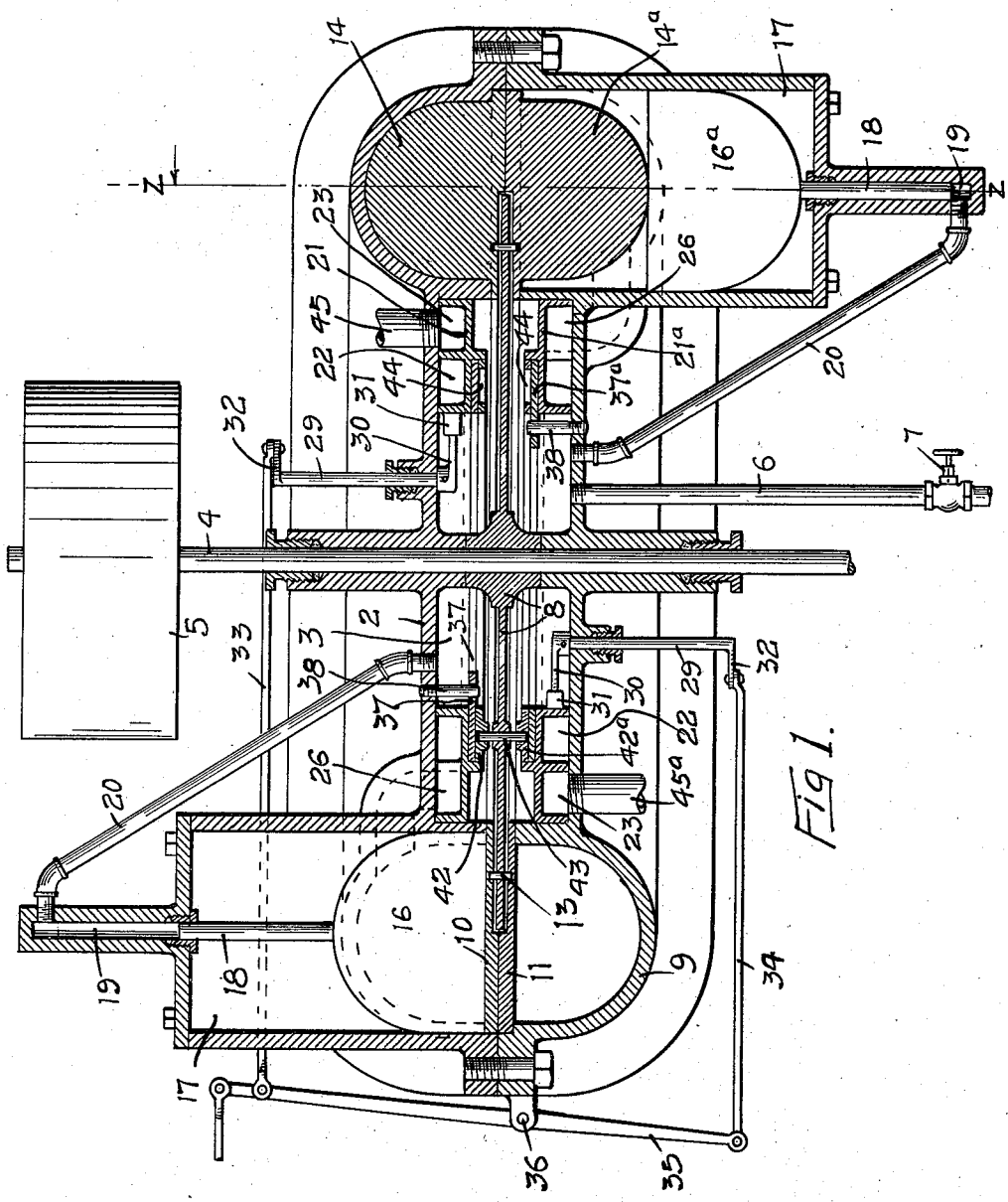

FIG 1.

WITNESSES

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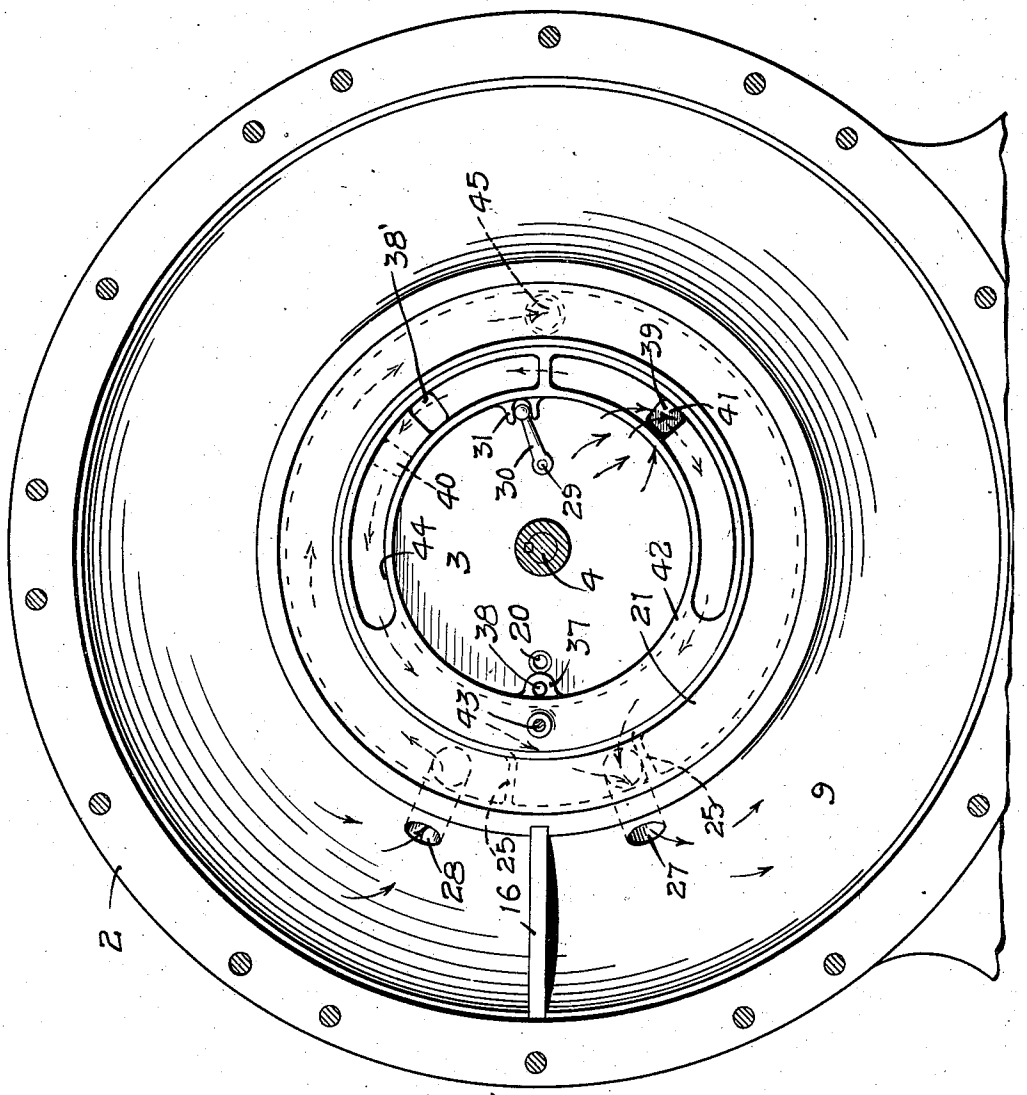

Fig 2.

WITNESSES
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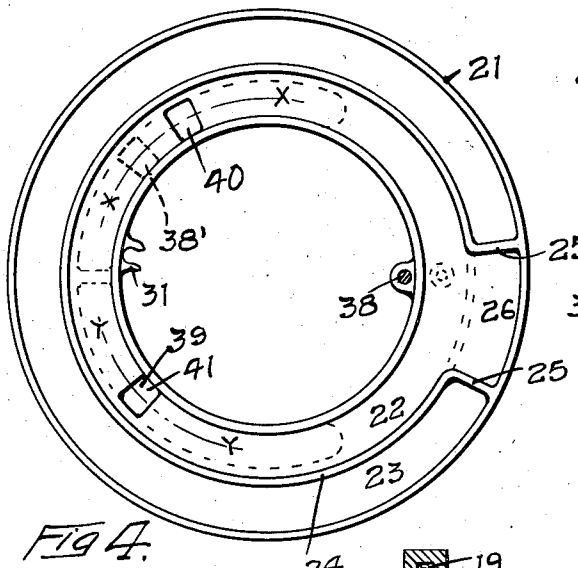

Fig 4.

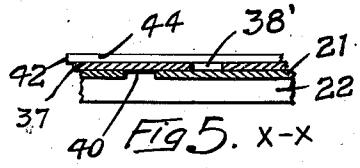

Fig 5. X-X

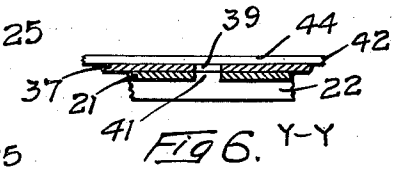

Fig 6. Y-Y

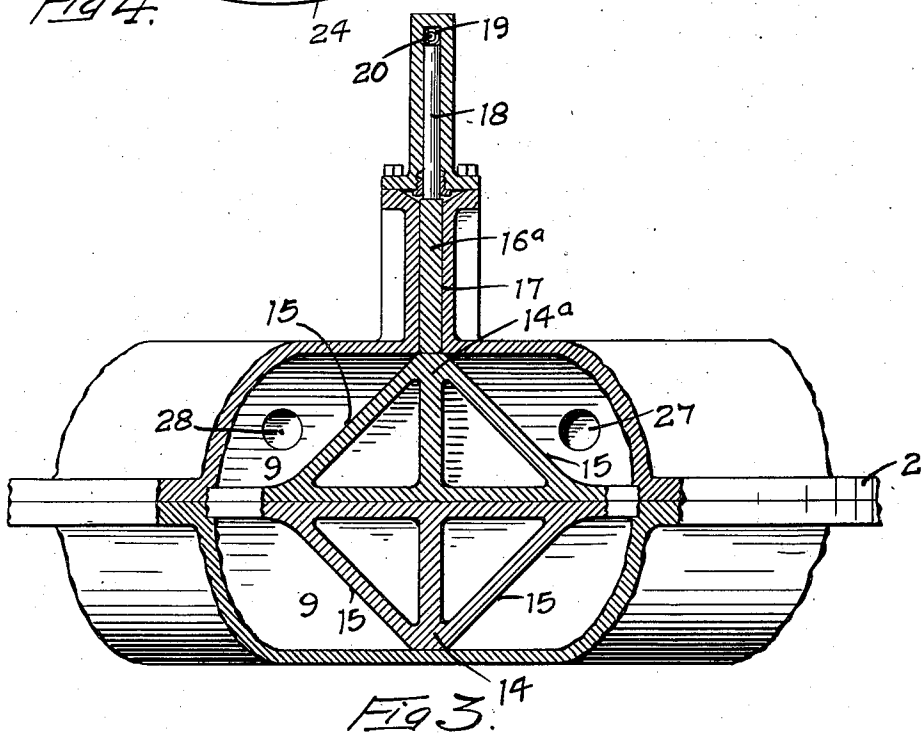

Fig 3.

WITNESSES

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4 SHEETS—SHEET 4.

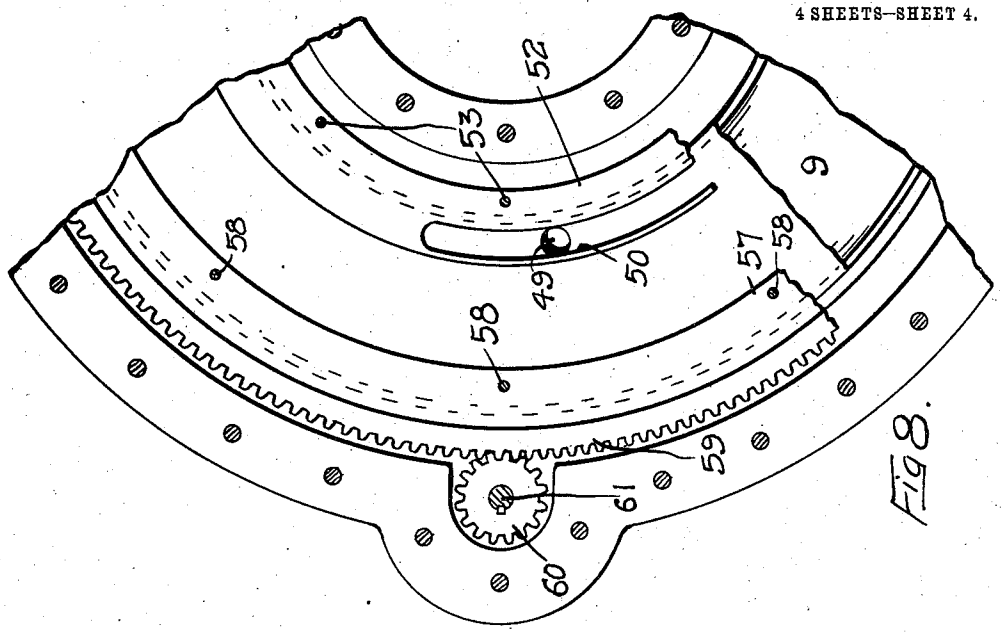

Fig 8.

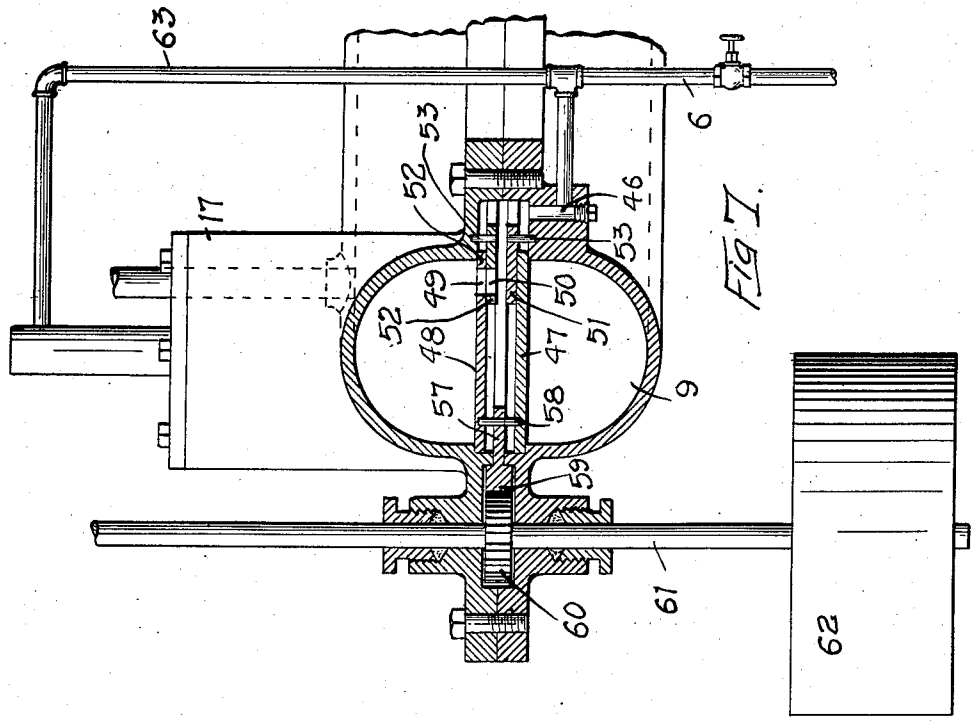

Fig 7.

WITNESSES

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UNITED STATES PATENT OFFICE.

BENJAMIN DAHL, OF MINNEAPOLIS, MINNESOTA.

ROTARY ENGINE.

1,014,378. Specification of Letters Patent. Patented Jan. 9, 1912.

Application filed October 28, 1910. Serial No. 589,631.

To all whom it may concern:

Be it known that I, BENJAMIN DAHL, of Minneapolis, Hennepin county, Minnesota, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

The object of my invention is to provide a rotary engine of simple, economical construction and one which will operate under a comparatively low pressure and with but little wear of the parts.

My invention consists generally in various constructions and combinations, all as hereinafter described and particularly pointed out in the claims.

In the accompanying drawings forming part of this specification, Figure 1 is a horizontal sectional view of a rotary engine embodying my invention, Fig. 2 is a vertical sectional view of the same, Fig. 3 is a sectional view taken on the section line *z—z* of Fig. 1, Fig. 4 is a detail plan view of one of the valve rings, Fig. 5 is a sectional view on the line *x—x* of Fig. 4, Fig. 6 is a sectional view on the line *y—y* of Fig. 4, Fig. 7 is a sectional view of a modified construction, Fig. 8 is a detail view of a modified construction.

In the drawing, 2 represents the casing having a steam chest 3. 4 is a driven shaft journaled in said chest and having a pulley 5 from which the power is transmitted in the usual way.

6 is a steam intake pipe having a valve 7.

8 is a disk journaled on the shaft 4 and adapted to revolve therewith.

9 is an annular cylinder into which the disk 8 projects.

10 and 11 are rings placed one above another and recessed to receive the periphery of the disk 8 and held thereon by means of pins 13. In taking the engine apart, these rings may be lifted off the disk without disturbing the shaft. These rings revolve in the annular cylinder 9 and mounted on these rings are pistons 14 and 14ª. These pistons, as indicated in Fig. 3, are triangular in form, presenting inclined surfaces 15 to the pressure in the cylinder 9. Slides 16 and 16ª are arranged to move in guides 17 on the annular cylinder and reciprocate therein at right angles substantially to the direction of movement of the pistons. These slides have stems 18 mounted thereon which project into passages 19 having pipes 20 communicating with the chest 3, so that when the steam is on the chamber 3 it will flow out into the passages 19 and normally hold the slides 16 and 16ª in their projected position. In the revolution of the pistons, the inclined surfaces 15 will contact with these slides, forcing them outwardly and allowing the pistons to move past them.

Within the steam chest 3 I provide annular or ring valves 21 and 21ª having annular passages 22 and 23 separated by a circular wall 24. This wall has outwardly turned ends 25 extending to the periphery of the ring and forming a recess or space 26 which is adapted to register with a port 27 leading to the interior of the cylinder 9 on one side of one of the slides. A second port 28 leads from the space 23 to the other side of the slide. Through these ports the live steam is admitted to the annular cylinder. These ring valves 21 and 21ª are capable of rotary adjustment and to operate them I provide shafts 29 having cranks 30 with ends projecting between lugs 31 mounted on said valves. The shafts 29 have crank arms 32 and links 33 and 34 connect them with an operating lever 35 that is pivoted at 36 intermediate to its ends. The operation of this lever will move one valve ring in one direction and the other valve ring in the opposite direction. Between these rings I provide stationary rings 37 and 37ª, held by pins 38 which project into the wall of the casing 2. These stationary rings have ports 38′ and 39 which are adapted to register with ports 40 and 41 in the valves 21 and 21ª to allow the free passage of the steam pressure through them. Between the valves 37 and 37ª are ring valves 42 and 42ª adapted to travel with the revolving disk 8 through the pins 43 connecting them. These rings 42 and 42ª have a semi-circular slot 44 therein extending preferably a little over one-half the circumference of the rings and adapted to register with the ports in the other valves, a portion of said slot being in register with one of the ports in the other valve rings for a predetermined distance in the revolution of the rings 42 and 42ª. The outer annular space 23 of the valves 21 and 21ª communicate with exhaust pipes 45 and 45ª, said pipes communicating with the ports 27 and 28 when the valves 21 and 21ª are adjusted to permit such communication. For instance, as is illustrated in Fig. 2, the valve 21 is adjusted to admit pressure to the space 26 and from thence through the port 27 into

the annular cylinder on one side of the slide. The port 28 on the other side of the slide is open to the exhaust, as indicated by the arrows. This would cause the piston to be driven in one direction. Upon rotating the valve 21, however, until the port 28 communicates with the space 26 the conditions will be reversed, live steam passing through the port 28 into the cylinder and the port 27 being on the exhaust. This will cause a reversal of the direction of movement of the piston. By a central adjustment of the rotary valves 21 and 21[a] it is evident that the steam pressure may be cut off and the device will take the place of the link motion mechanism by means of which, in an ordinary engine, the engine may be stopped or the direction of movement controlled. By removing the valve rings and substituting others having differently positioned ports and a longer slot, I am able to increase or decrease the period of expansion.

In Figs. 7 and 8 I have shown a modified construction which consists in providing an annular steam cylinder 9 with an intake passage 46 communicating with the steam intake 6 and with the interior of the cylinder. Rings 47 and 48 are provided within the cylinder having pistons mounted thereon corresponding to the pistons 14 and 14[a], shown in Fig. 3. These rings revolve in the cylinder and are provided each with a port 49 that is adapted to register with a curved slot 50 provided in rings 51 and 52. These rings are located between the rings 47 and 48 and are held against rotation by pins 53. A ring 57 is interposed between the rings 47 and 48 and revolves therewith through a pin connection 58. This ring 57 has a peripheral gear 59 which meshes with a pinion 60 on a driven shaft 61 having a pulley 62. The revolution of the rings 47 and 48 through the pressure of the steam of the pistons thereof transmits power through the rings 57 to the pinion 60 and the shaft 61. The slides arranged to reciprocate in the cylinder at right angles to the plane of travel of the pistons are substantially the same as shown in Fig. 1 and the passages in the rear of the slides have pipe connection 63 with the intake system pipe in a manner similar to the connection 20 in Fig. 1.

This engine will be efficient in its operation and will be comparatively inexpensive to manufacture and maintain.

I claim as my invention:—

1. A rotary engine comprising an annular cylinder, rings mounted to revolve therein, pistons carried by said rings, means for supplying fluid pressure to said cylinders in the rear of said pistons, said pistons having inclined faces, cut off slides operating in said cylinder at right angles substantially to said rings and contacting with said inclined faces, and a driven shaft operatively connected with said rings.

2. A rotary engine comprising an annular cylinder, rings mounted to revolve back to back therein, pistons carried by said rings, abutments between which and said pistons fluid pressure is admitted, means for supplying fluid pressure to said cylinder in the rear of said pistons, valves arranged to vary the time of cut off of said fluid pressure, a driven shaft and means operatively connecting said rings with said shaft.

3. A rotary engine comprising an annular cylinder, a shaft concentric therewith, a disk mounted on said shaft and projecting into said cylinder, rings carried by said disk, pistons mounted on said rings on opposite sides of said disk within said cylinder, reciprocating slides operating in said cylinder at right angles substantially to the plane of said disk, said disk having a steam chamber on each side thereof and means for admitting steam thereto, rotary valves arranged in said chamber and having ports leading to said cylinder, and means for operating said valves to admit steam to either side of said slides, substantially as described.

4. A rotary engine comprising an annular cylinder having a steam chamber and means for supplying steam thereto, a driven shaft, a disk mounted thereon within said steam chamber, rings carried by said disk within said cylinder, pistons mounted on said rings and having inclined faces, slides arranged to reciprocate in said cylinder at right angles substantially to said rings and contacting with said inclined faces, ring valves provided in said steam chamber and capable of rotating therein and having ports communicating with said steam chamber and with said cylinder, said ring valves also having exhaust outlets, means connecting said ring valves with said disk, and a lever mechanism operatively connected with said valves for shifting the same and varying the time of cut off.

5. A rotary engine having an annular cylinder, revolving rings placed back to back therein, pistons mounted on said rings, said pistons being triangular in form and having inclined faces exposed to the fluid pressure in said cylinder, said cylinder having intake and exhaust ports and reciprocating slides operating at right angles substantially to said pistons and contacting with said inclined surfaces.

6. A rotary engine comprising a casing having a steam chamber, a driven shaft extending therethrough, a disk mounted on said shaft, pistons connected with said disk, rotary valves having ports communicating with said cylinders and with suitable exhausts, stationary valves having ports there-

in, movable valves having slots therein adapted to register with the ports in said stationary valves and operatively connected with said disk to revolve therewith, an operating lever, and means connecting said operating lever with said first named valves to change their position and vary the time of cut off and means for supplying fluid pressure to said steam chamber.

7. A rotary engine comprising an annular cylinder having intake and exhaust ports and means for delivering fluid pressure thereto, rings placed back to back and arranged to revolve in said cylinder, A-shaped pistons mounted on said rings, reciprocating slides arranged to move back and forth in said cylinder at right angles substantially to the plane of said rings, the engagement of said pistons with said slides forcing them outwardly to allow the revolution of said rings and means for holding said slides toward said pistons with a yielding pressure.

8. A rotary engine comprising an annular cylinder having intake and exhaust ports and means for delivering fluid pressure to said intake ports, pistons, A-shaped in form, and revolving rings placed back to back whereon said pistons are mounted at intervals, slides operating in said cylinder at an angle to the direction of movement of said pistons, said slides having stems and fluid pressure passages therefor connected with said fluid pressure delivering means.

9. A rotary engine comprising an annular cylinder having intake and exhaust ports and means for delivering fluid pressure to said intake ports, pistons, A-shaped in form, and revolving rings placed back to back whereon said pistons are mounted, yieldingly held abutments projecting into the path of said pistons and constructed to be forced outwardly thereby, the fluid pressure being delivered to said cylinder between said pistons and said abutments, a driven shaft and means operatively connecting said shaft with said pistons.

10. A rotary engine comprising an annular cylinder having intake and exhaust ports, a fluid pressure chest encircled by said cylinder, means for supplying fluid pressure to said chest, means for regulating the delivery of pressure to said cylinder, a piston arranged in said cylinder and triangular in form and having its inclined faces exposed to the fluid pressure, and a sliding abutment in said cylinder in the path of said piston between which abutment and said piston the pressure is delivered to said cylinder.

11. A rotary engine comprising an annular cylinder, a fluid pressure chest encircled thereby, a ring valve provided within said fluid pressure chest and having annular, concentric fluid pressure chambers therein, said ring also having intake and exhaust ports communicating with said cylinder through said annular chambers respectively.

12. A rotary engine comprising an annular cylinder, a fluid pressure chest encircled thereby, a ring valve disposed within said chest and having annular fluid pressure chambers therein, said ring valve having passages communicating through said chambers respectively with said cylinder and with an exhaust, means for rotating said ring valve and means for regulating the delivery of fluid pressure to the passages therein.

13. In a rotary engine, the combination, with a fluid pressure chest, of a rotary engine valve having annular fluid pressure chambers concentrically arranged therein, said valve having ports communicating with said chambers and said chest and a suitable exhaust.

14. A rotary engine comprising an annular cylinder, a fluid pressure chest encircled thereby, a revolving disk mounted in said chest and projecting into said cylinder, pistons carried by said disk upon opposite sides thereof and oppositely arranged, cut off slides for said pistons, and means for admitting fluid pressure to said cylinder in the rear of one piston while the other piston is passing its slide, substantially as described.

15. A rotary engine comprising an annular cylinder, pistons mounted to revolve therein, said pistons being oppositely arranged, revolving means whereon said pistons are mounted, and oppositely and diagonally arranged abutments for said pistons.

16. A rotary engine comprising an annular cylinder, a fluid pressure chest inclosed thereby, rings mounted in said chest and projecting into said cylinder and forming a dividing wall therein, pistons carried by said rings and arranged on opposite sides thereof and oppositely and diagonally arranged abutments between which and said pistons the fluid pressure is admitted.

17. A rotary engine comprising an annular cylinder, a fluid pressure chest encircled thereby, a driven shaft, rings centrally disposed in said cylinder, one upon another, and dividing said cylinder into a plurality of chambers, pistons mounted on said rings and projecting into said chambers, cut off slides operating transversely with respect to said cylinder, said cylinder having intake and exhaust ports, means operatively connecting said rings with said driven shaft, said intake ports being disposed to admit fluid pressure in the rear of one piston while the other piston is passing its cut off slide.

18. A rotary engine comprising an annular cylinder having intake and exhaust ports, cut off slides disposed between said ports and said cylinder, oppositely arranged

pistons A-shaped and disposed back to back and revolving in said cylinder and constructed to contact with and project said slides outwardly, said slides and pistons forming fluid pressure chambers in said cylinder, and diagonally and oppositely placed abutments.

19. A rotary engine comprising an annular cylinder, pistons mounted to revolve therein and placed back to back, cut off means in the path of said pistons comprising oppositely and diagonally arranged abutments, said cylinder having intake and exhaust ports.

In witness whereof, I have hereunto set my hand this 24″ day of October 1910.

BENJAMIN DAHL.

Witnesses:

GENEVIEVE E. SORENSEN,

C. H. REHFUSS.