

APPLICATION FILED DEC. 31, 1910. RENEWED MAR. 31, 1915.

2 SHEETS.—SHEET 1.

2 SHEETS—SHEET 1.

Fig. 1

Fig. 2

WITNESSES:  
 Cornelius Jahischie  
 Francis A. Hodgett

INVENTOR  
 Charles R. Pratt

ATTORNEY.  
 Russell M. Everett

WITNESSES:

Cornelius Fabrikie  
Frances W. Blodgett.

INVENTOR

Charles R Pratt,  
BY  
Russell M Everett,  
ATTORNEY.

C. R. PRATT.  
ROTARY PISTON ENGINE.

APPLICATION FILED DEC. 31, 1910. RENEWED MAR. 31, 1915.

1,158,554.

Patented Nov. 2, 1915.

2 SHEETS—SHEET 2.

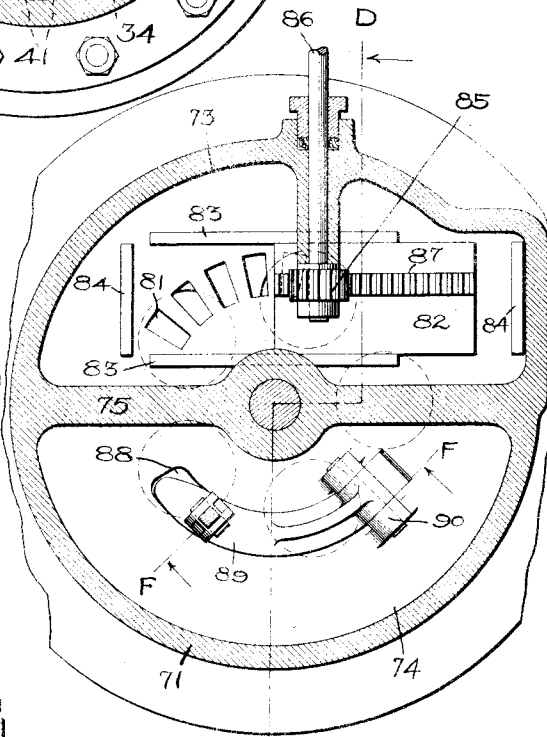
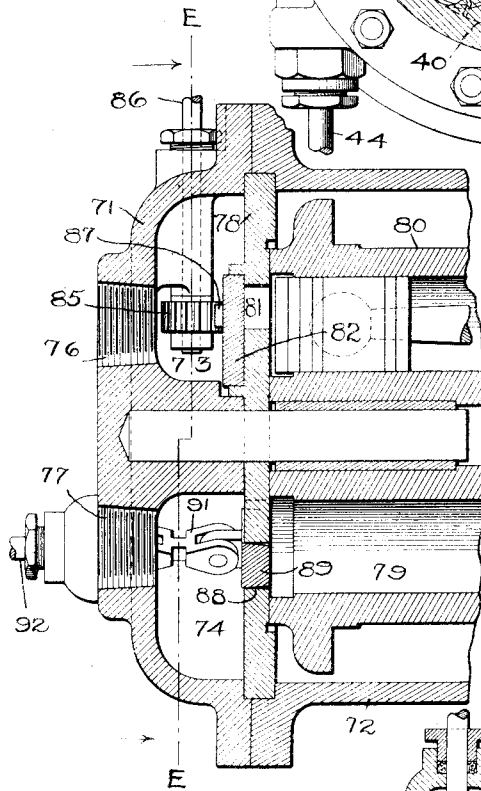
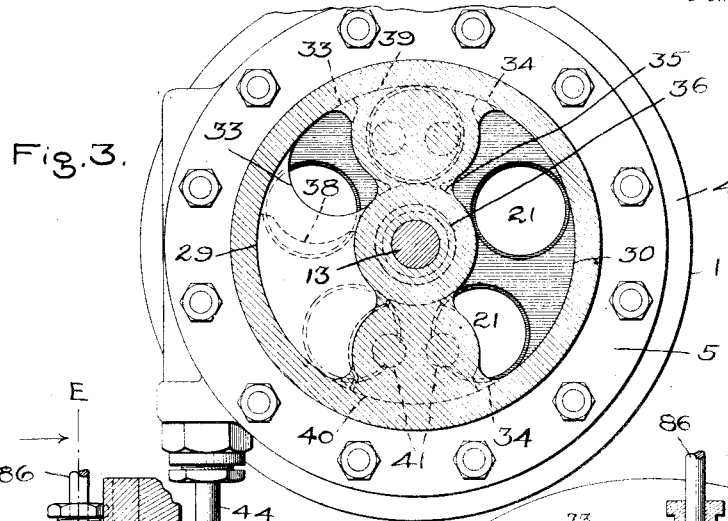


Fig. 4.

Fig. 5.

WITNESSES:

*Cornelius Galusha*

*Frances E. Blodgett*

Fig. 6

INVENTOR

*Charles R. Pratt*

BY *Russell M. Everett*,  
ATTORNEY.

# UNITED STATES PATENT OFFICE.

CHARLES R. PRATT, OF MONTCLAIR, NEW JERSEY, ASSIGNOR TO THE UNIVERSAL SPEED CONTROL COMPANY, A CORPORATION OF NEW YORK.

## ROTARY-PISTON ENGINE.

1,158,554.

Specification of Letters Patent.

Patented Nov. 2, 1915.

Application filed December 31, 1910, Serial No. 600,218. Renewed March 31, 1915. Serial No. 18,411.

*To all whom it may concern:*

Be it known that I, CHARLES R. PRATT, a citizen of the United States, residing at Montclair, in the county of Essex and State of New Jersey, have invented certain Improvements in Rotary-Piston Engines, of which the following is a specification.

This invention relates to rotary piston engines adapted to be driven by steam or other expansive fluid, and more especially the invention relates to such engines in which a group of cylinders revolves about an axis with pistons reciprocating in said cylinders and traveling through space in an elliptical path.

The objects of the invention are to secure in such an engine a cut-off for controlling the admission of pressure fluid to the cylinders; to thus vary the admission of the pressure fluid during different parts of the piston stroke; to provide a suitable means for operating said cut-off; to enable the cut-off to be applied to a reversing engine; to provide means for controlling the cut-off from a driven part of the engine, whereby an automatic cut-off is secured, and to obtain other advantages and results as may be brought out in the following description.

Referring to the accompanying drawings, in which like numerals of reference indicate the same parts throughout the several figures, Figure 1 is a central, vertical longitudinal section as on line A—A, Fig. 2, of a rotary piston engine having my improved cut-off, means being also shown for automatically operating said cut-off; Fig. 2 is a cross-section on line B—B of Fig. 1, looking in the direction indicated by the arrow; Fig. 3 is a cross-section on line C—C of Fig. 1, looking in the direction indicated by the arrow; Fig. 4 is a section on line D—D, Fig. 5, of the cylinder-seating end of an engine having modified forms of my cut-off applied to both the inlet and outlet ports so that the engine can be reversed if desired, the cylinder barrel being sectioned centrally and shown with diametrically opposite cylinders for greater clearness; Fig. 5 is a cross-section, taken on line E—E of Fig. 4, looking in the direction indicated by the arrows, and Fig. 6 is a side view of the cut-off plug shown in the lower part of Figs. 4 and 5, the casing being sectioned upon line F—F, Fig. 5, and

looking in the direction indicated by the arrows.

In said drawings, and particularly Figs. 1, 2 and 3, 1 indicates the engine casing composed of cast sections 2, 3, 4 and 5 suitably bolted together, and having feet 6 and 7 which provide a suitable base for said casing to stand upon. Said casing 1 provides at its end section 2 interior bearings 8, 9 and 10 for a shaft 11 which will be described as the driven shaft and which at its outer end may transmit power and motion to any suitable mechanism (not shown). The opposite end of the casing 1 incloses a cylinder barrel 12 which seats against the end section 5 and is centrally supported by a stud 13 projecting from said end section rotatably into the barrel. The barrel has a peripheral and annular shoulder 14 and a ring 15 circumferentially threaded to screw into the casing section 4 which is adapted to exert pressure upon said shoulder 14 to seat the cylinder barrel, an antifriction bearing 16 being preferably inserted between said shoulder and ring. This cylinder seating means is fully shown and described in my prior application filed July 26, 1910, Serial No. 573,970, together with means for turning the said ring 15 and therefore will not be further described here.

Fast upon the inner end of the driven shaft 11 is a disk or head 17, and to this disk are connected in annular series by ball and socket joints 18, the ends of piston rods 19 which extend to pistons 20 in the cylinders 21 of the barrel 12, said piston rods being preferably also connected to said pistons by ball-and-socket joints 22. In order to insure synchronous rotation of the disk 17 and cylinder barrel 12, I have shown a pin 23 projecting centrally from the cylinder barrel 12 and having a ball-and-socket connection 24 with the center of the disk, a sleeve 25 on said pin having at one end a bevel gear 26 meshing with a corresponding gear 27 on the disk and at its other end 28 being adapted to non-rotatably engage the cylinder barrel 12. The details of this connection are fully set forth in my prior application, Serial No. 535,646 filed December 30, 1909, to which reference may be had if desired, and said connection is also shown in my prior application, Serial No.

573,970, previously referred to herein. It will be understood that as is common in rotary piston units of this type, each piston makes a complete stroke during each rotation of the cylinder and thus travels through space in an elliptical path in a plane oblique to the cylinder or substantially so. Furthermore, all the several pistons travel in the same elliptical path, as will be clear from an inspection of Fig. 1.

The end section 5 of the casing 1 against which the cylinder barrel 12 seats, has two interior chambers 29 and 30, respectively, through one of which, as 29, pressure fluid is admitted to the cylinders 21, while exhaust from said cylinders takes place through the other chamber 30. Said chambers open outwardly through bosses or the like on the casing section and which afford means for the connection of suitable pipes or conduits (not shown), said bosses being marked 31 and 32. At their inner sides next to the cylinder barrel 12, the said chambers 29 and 30 have ports 33 and 34, respectively, the port 34 for exhaust being curved in the line of the series of cylinders and long enough to communicate with a plurality of cylinders at once. In fact, said exhaust port is as long as its chamber 30, and said chambers are shown separate at their ends by solid portions or walls a little thicker than the diameter of the cylinders, although this thickness can of course be varied. The other or inlet port 33 is small or adapted to communicate with only one or a few cylinders at a time, and is located at that end of the chamber 29 which is first reached in the rotation of the cylinder barrel.

Upon the inner face of the end piece 5 and forming the seat for the cylinder barrel 12, is a plate 35 which is adapted to turn upon a central hub 36 of said end-piece 5. This plate 35 has a slot 37 curved on a circle concentric with the center of the plate extending almost completely around, the radial entire portion between the ends of said slot lying between the inlet port 33 and opposite end of the chamber 29 and being of less width than the distance therebetween so that it can swing back and forth between said points. Upon that part of the inner face of the end-piece 5 which is exposed by the slot 37 between the inlet port 33 and nearer end of the exhaust port 34 is a fixed block 39 filling said slot and diametrically opposite is another block 40 also filling the slot 37 transversely at that point. These blocks are flush at their inner faces with the inner face of the plate 35, and are shown as secured by screws or bolts 41 although they might of course be integral with the end piece. It will be seen that they leave the slot 37 always open to the exhaust port 34 for its entire capacity, while obviously the cylinders passing out of registration

with the inlet port 33 will remain in communication therewith a shorter or longer time according as the radial arm 38 of the plate 35 is nearer to or farther away from said inlet port. Thus by said plate the admission of pressure fluid to each cylinder can be cut off at any point within limits and the expansive power of the fluid utilized for the rest of the distance the cylinder travels before reaching the exhaust port 34.

I wish it clearly understood that the cut-off plate or member 35 can be operated or turned in any suitable manner whatever, either by hand or any mechanism, and mechanism for that purpose can be manipulated by hand or from the engine itself so as to provide an automatic cut-off.

In the drawings, still referring especially to Figs. 1, 2 and 3, I have shown for purposes of illustration means for automatically operating the cut-off from the engine with a pilot motor, and have accordingly provided the plate 35 for a peripheral segment 42 with teeth adapted to mesh with a worm 43 on a shaft 44 which extends outside the engine casing to a bracket 45 in which it has supplemental journal bearings. Fast upon this shaft is a frame 46 carrying planetary gears 47 which mesh with fulcrum gears 48, 49 at opposite sides of said frame 46 and loose on the shaft 44. One of said fulcrum gears, as 48, is driven by means of a shaft 50 from the driven shaft 11 of the engine, said auxiliary shaft 50 having at one end of itself a gear 51 engaging a gear 52 on the driven shaft 11 and at its other end a bevel gear 53 meshing with corresponding gear teeth upon the fulcrum gear 48 separate from its teeth which connect with the planetary gears 47. The other fulcrum gear 49 has fast to itself a worm wheel 54, by which it is driven through a worm 55 upon the shaft 56 of the pilot motor 57. Obviously by this arrangement if the rotary piston engine lags behind the pilot motor, or its fulcrum gear 48 runs slower than the fulcrum gear 49, the shaft 44 will be rotated to turn the plate 35 and adjust the cut-off to increase the speed of the engine. On the other hand, if the engine is running faster than the pilot motor, or the fulcrum gear 48 is traveling faster than the fulcrum gear 49, the shaft 44 will be turned to adjust the cut-off to slow down the engine. When the cut-off arm 38 reaches the limit of its movement to increase the speed of the engine, or away from the inlet port 33, it is desirable that the pilot motor 57 be stopped or thrown out of connection with the planetary gear system, so as to avoid breakage or strain by a continued tendency to swing the cut-off plate still further. For this purpose I arrange in the circuit of the pilot motor 57 contact points 58, 59 (adapted to vary the resistance), opposite a continuous contact

plate 60 and provide a switch 61 adapted to connect said points and plate or swing entirely clear thereof to break the circuit as shown in full lines in Fig. 1. Said switch 61 is pivoted, as at 62, and normally held closed against a stop 63 by a spring 64. Beneath said switch 61, concentric therewith, but separate therefrom, is a bevel gear 65 which carries a pin 66 projecting upward to engage the switch 61 and swing it open. A small bevel gear 67 meshing with the gear 65 is carried by a shaft 68 which at its other end has a worm wheel 69 meshing with a worm 70 on the shaft 44 before described. The arrangement of all said parts is such that as the cut-off arm 38 approaches the limit of its movement to increase the speed of the engine, the switch 61 begins to open, reducing the speed of the pilot motor as it passes from point to point and finally stopping the pilot motor entirely when it breaks the circuit. This provides for the speed of the engine being reduced by an abnormally heavy load or by abnormal reduction in its motive power.

In Figs. 4, 5 and 6 I have shown other forms of cut-off plates or members which might be employed, the construction of the end-piece or casing of the engine being modified accordingly, and for greater compactness I have shown different forms applied to the exhaust and inlet ports of the engine, although obviously either form could be employed for both exhaust and inlet if the engine were desired to be reversible or to only the inlet port, the exhaust port being left wide open in a single action engine. In said Figs. 4, 5 and 6, 71 indicates an end-piece of the engine casing 72 which provides chambers 73 and 74 for the inlet and exhaust of pressure fluid, said chambers being separated by a partition 75 and having outwardly opening apertures 76 and 77, respectively to receive conduits or pipes (not shown). Held between said end piece 71 and the body of the casing is a stationary plate 78 against which the cylinders 79 of the barrel 80 seat and in which are the ports affording communication between the said chambers 73, 74, respectively and said cylinders. The port between the chamber 73 and the cylinder barrel 80 I have shown consisting of a series of apertures 81 arranged in a curve concentric with the cylinder barrel, and which apertures permit the pressure fluid to pass to or from as many cylinders as they are opened into. If this side of the engine were the exhaust side all of the ports would be left open, but when it is the inlet side a cut-off is secured by closing more or less of said apertures 81. To effect such closing, a cut-off plate or member 82 slides upon the outside of the end plate 78, between guides 83, 83 and stops 84, 84, said plate being slid by a

pinion 85 upon a shaft 86 engaging a rack 87 on the said cut-off plate 82. Obviously any suitable means may be employed for turning the shaft 86 analogous to the means for operating the shaft 44 in the first described construction. The port between the chamber 74 and the cylinder barrel 80 I have shown consisting of a single aperture 88 elongated and curved concentric with the cylinder barrel, and which aperture permits the pressure fluid to pass to or from as many cylinders as it opens into. If this side of the engine were the exhaust side the said aperture 88 would stand wide open, but when it is the inlet side a cut-off plug or member partially closes said aperture. This plug or member 89 fits the aperture 88 as closely as is practicable and normally lies therein, being hinged at one end to the partition 78, as at 90. To the other end of the plug or member is pivoted a link 91 which at its other end is pivoted to a rod or plunger 92 extending through the wall of the end-piece 71 outside of the engine casing. Obviously as said rod or plunger 92 is moved in or out by any suitable means whatever, the cut-off plug 89 will close the port 88 to a greater or less extent and admit pressure fluid to the cylinders for a shorter or a longer period accordingly.

I wish it to be clearly understood that my cut-off plate or member can assume a great many different forms, of which those herein specifically shown are only an illustration, and furthermore that in many of these forms the cut-off can be applied to both the inlet and the exhaust ports of the engine, any suitable link motion or similar mechanism which mechanical skill may suggest being used to throw either one idly open and the other into use, as desired.

Having thus described the invention, what I claim is:

1. In a rotary piston engine, the combination of a barrel adapted to revolve around its longitudinal axis and having an annular series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, a seat for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders thereof, inlet and exhaust passages leading to said ports respectively, and adjustable means in one of said ports flush with the said seat for varying during different parts of the stroke of said pistons the amount of pressure fluid passing through said port.

2. In a rotary piston engine, the combination of a barrel adapted to revolve around its longitudinal axis and having an annular series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, a seat for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders

thereof, inlet and exhaust passages leading to said ports respectively, and an adjustable member in one of said ports flush with the said seat adapted to vary the period during which the cylinders are in communication with the passage corresponding to said port at each revolution.

3. In a rotary piston engine, the combination of a barrel adapted to revolve around its longitudinal axis and having an annular series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, a seat for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders thereof, inlet and exhaust passages leading to said ports respectively, and means in one of said ports flush with said seat for varying the effective length of port opening between said cylinders and one of said passages.

4. In a rotary piston engine, the combination of a barrel adapted to revolve around its longitudinal axis and having an annular series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, a seat for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders thereof, inlet and exhaust passages leading to said ports respectively, a member in one of said ports flush with said seat adapted to cut off said cylinder successively from one of said passages, and means for shifting said member.

5. In a rotary piston engine, the combination of a barrel adapted to revolve around its longitudinal axis and having an annular series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, a seat for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders thereof, inlet and exhaust passages leading to said ports respectively, an adjustable member in one of said ports flush with said seat adapted to vary the period during which the cylinders are open to one of said passages during each revolution, and means for moving said member into different positions and holding it there.

6. In a rotary piston engine, the combination of a barrel adapted to revolve around its longitudinal axis and having an annular series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, a seat for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders thereof, inlet and exhaust passages leading to said ports respectively, a member in one of said ports flush with said seat adapted to cut off said cylinders successively from one of said passages, and means for adjusting said cut-off member from the engine itself.

7. In a rotary piston engine, the combina-

tion of a barrel adapted to revolve around its longitudinal axis and having an annular series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, a seat for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders thereof, inlet and exhaust passages leading to said ports respectively, an adjustable member in the inlet port flush with said seat adapted to cut off said cylinders successively from the inlet passage, and means for adjusting said cut-off member to different positions.

8. In a rotary piston engine, the combination of a barrel adapted to revolve around its longitudinal axis and having an annular series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, blocks for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders thereof, an end piece contiguous to said blocks and providing inlet and exhaust passages leading to the said ports respectively, one of said passages being smaller than the port to which it leads, a cut-off member in said last-mentioned port between the cylinder and end piece, and means for adjusting said cut-off member.

9. In a rotary piston engine, the combination of a barrel adapted to revolve around its longitudinal axis and having an annular series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, blocks for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders thereof, inlet and exhaust passages leading to said ports respectively, and an angularly adjustable cut-off projecting radially with respect to the axis of revolution of the cylinder barrel into the last-mentioned port between the cylinder barrel and end piece.

10. In a rotary piston engine, the combination of a barrel adapted to revolve around its longitudinal axis and having an annular series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, blocks for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders thereof, inlet and exhaust passages leading to said ports respectively, a cut-off plate between the cylinder barrel and said end piece having an annular portion slidably engaging said blocks and a radial arm lying in the said port which is larger than the passage leading thereto.

11. In a rotary piston engine, the combination of a barrel adapted to revolve around its longitudinal axis and having an annular series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, blocks for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders thereof, inlet and exhaust passages leading to said ports respectively, a cut-off member in one of said ports flush with said seat adapted to cut off said cylinders successively from one of said passages, and means for adjusting said cut-off member from the engine itself.

der barrel providing both inlet and exhaust ports adapted to communicate with the cylinders thereof, inlet and exhaust passages leading to said ports respectively, a plate  
5 between said cylinder barrel and end piece having outer and inner annular portions with a radial arm connecting said annular portions and lying in the said port which is larger than the passage leading thereto.

10 12. In a rotary piston engine, the combination of a plurality of cylinders adapted to revolve about an axis, pistons in said cylinders adapted to travel through space in an elliptical path as the cylinders revolve,  
15 inlet and outlet passages adapted to communicate with said cylinders by curved ports, sealing blocks at the opposite ends of the outlet port, and a rotatably adjustable arm projecting radially with respect to the  
20 axis of revolution of the cylinders between the said sealing blocks adjacent to the inlet port.

13. In a rotary piston engine, the combination of a plurality of cylinders adapted  
25 to revolve about an axis, pistons in said cylinders adapted to travel through space in an elliptical path as the cylinders revolve, inlet and outlet passages adapted to communicate with said cylinders by curved ports,  
30 sealing blocks at the opposite ends of the outlet port, one of said blocks forming a fixed end for the inlet port, and a radial adjustable arm between the inlet port and the other sealing block and forming an adjustable  
35 end for said inlet port.

14. In a rotary piston engine, the combination of a plurality of cylinders adapted to revolve about an axis, pistons in said cylinders adapted to travel through space in an  
40 elliptical path as the cylinders revolve, inlet and outlet passages adapted to communicate with said cylinders by ports in the plane of the ends of the cylinders curved upon a circle whose center is in the axis of revolution,  
45 and means in the plane of said ports for adjusting the forward end wall of the inlet port at which a cylinder cuts off from the port toward and away from the opposite or rear end wall.

50 15. In a rotary piston engine, the combination of a plurality of cylinders adapted to revolve about an axis, pistons in said cylinders adapted to travel through space in an elliptical path as the cylinders revolve,  
55 inlet and outlet passages adapted to communicate with said cylinders by ports in the plane of the ends of the cylinders curved upon a circle whose center is in said axis of revolution, an arm projecting radially  
60 from said axis of revolution in the plane of the ports across the inlet port, and means for swinging said arm to adjust its position with respect to the ends of the port.

16. In a rotary piston engine, the combination of a plurality of cylinders adapted

to revolve about an axis, pistons in said cylinders adapted to travel through space in an elliptical path as the cylinders revolve, inlet and outlet passages adapted to communicate with said cylinders by curved ports,  
70 sealing blocks at the opposite ends of the outlet port, and a plate pivoted on the axis of revolution of the cylinders with a rim extending around said sealing blocks and a radial arm between said blocks adjacent to the inlet port.  
75

17. In a rotary piston engine, the combination of a plurality of cylinders adapted to revolve about an axis, pistons in said cylinders adapted to travel through space in an elliptical path as the cylinders revolve,  
80 inlet and outlet passages adapted to communicate with said cylinders by curved ports, sealing blocks at the opposite ends of the outlet port, a plate pivoted on the axis of revolution of the cylinders with a rim extending around said sealing blocks and a radial arm between said blocks adjacent to the inlet port, and means for turning said plate.  
85

18. In a rotary piston engine, the combination of a plurality of cylinders adapted to revolve about an axis, pistons in said cylinders adapted to travel through space in an elliptical path as the cylinders revolve, inlet and outlet passages adapted to communicate with said cylinders by curved ports, sealing blocks at the opposite ends of the outlet port, a plate pivoted on the axis of revolution of the cylinders with a rim extending around said sealing blocks and a radial arm between said blocks adjacent to the inlet port, and means operatively connecting said plate to the engine to turn the same.  
90

19. In a rotary piston engine, the combination of a plurality of cylinders adapted to revolve about an axis, pistons in said cylinders adapted to travel through space in an elliptical path as the cylinders revolve, inlet and outlet passages adapted to communicate with said cylinders by curved ports, sealing blocks at the opposite ends of the outlet port, a plate pivoted on the axis of revolution of the cylinders with an exteriorly toothed rim extending around said sealing blocks and a radial arm between said blocks adjacent to the inlet port, and means driven from the engine engaging said toothed rim of the plate.  
100  
105  
110  
115

20. In a rotary piston engine, the combination of a barrel adapted to revolve around its longitudinal axis and having an annular series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, blocks for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders thereof, an end piece contiguous to said blocks and providing inlet and exhaust passages leading to the said ports respectively,  
120  
125  
130

one of said passages being smaller than the port to which it leads, a cut-off member in said last-mentioned port between the cylinder and end piece, and means operatively  
5 connecting said cut-off member to the engine to adjust the same.

21. In a rotary piston engine, the combination of a barrel adapted to revolve around its longitudinal axis and having an annular  
10 series of cylinders parallel to said axis, pistons adapted to reciprocate in said cylinders, blocks for the end of said cylinder barrel providing both inlet and exhaust ports adapted to communicate with the cylinders  
15 thereof, an end piece contiguous to said blocks and providing inlet and exhaust passages leading to the said ports respectively, one of said passages being smaller than the  
20 said last-mentioned port between the cyl-

inder and end piece, and means for causing variations of speed between the engine and pilot motor to adjust said cut-off.

22. In a rotary piston engine, the combination of a plurality of cylinders adapted to  
25 revolve about an axis, pistons in said cylinders adapted to travel through space in an elliptical path as the cylinder revolves, inlet and outlet passages adapted to communicate with said cylinders by ports in the plane  
30 of the ends of the cylinders curved upon a circle whose center is in said axis of revolution, and means in the plane of said ports for adjusting one of the angularly separated  
35 end walls of the inlet ports with respect to the other or opposite end wall.

CHARLES R. PRATT.

In the presence of—

CORNELIUS ZALRESKIE,  
FRANCES E. BLODGETT.