No. 873,201. PATENTED DEC. 10, 1907.

B. F. AUGUSTINE.

ROTARY ENGINE.

APPLICATION FILED DEC. 17, 1906.

3 SHEETS—SHEET 1.

Fig. 1.

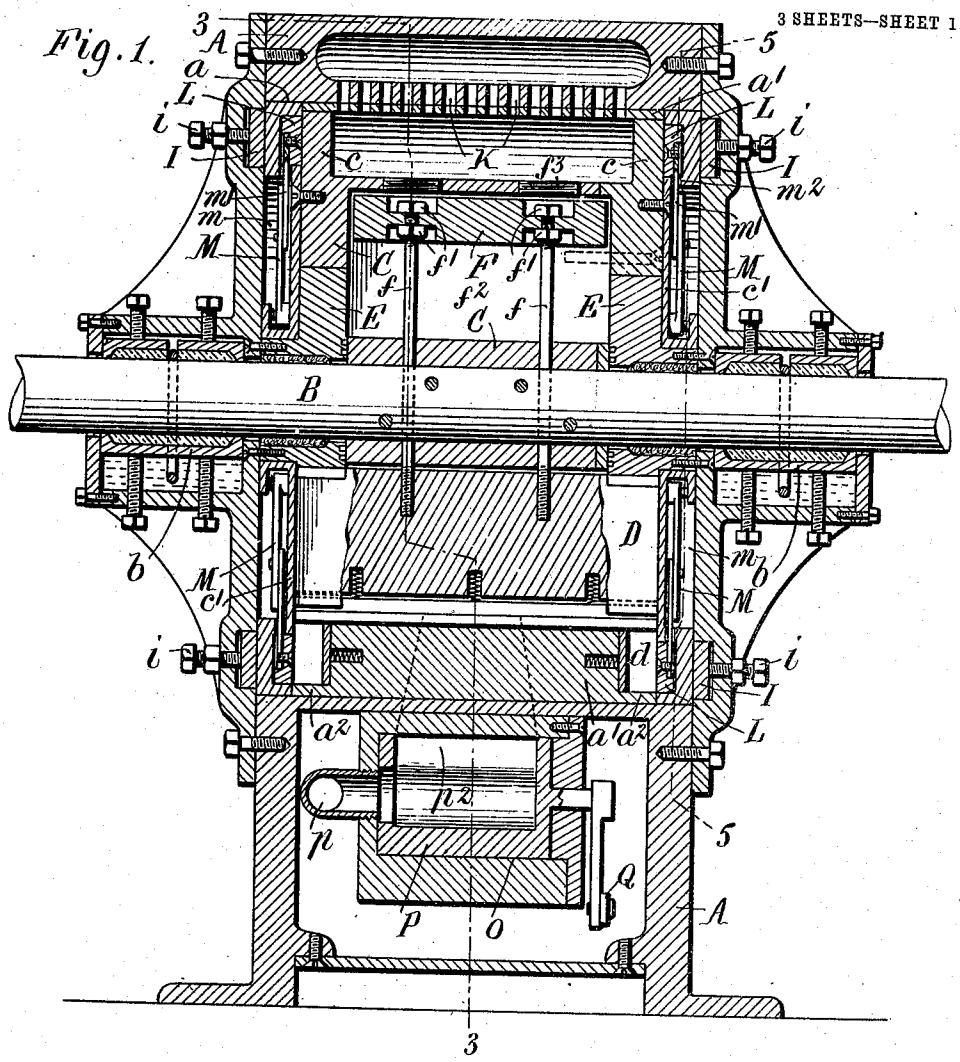
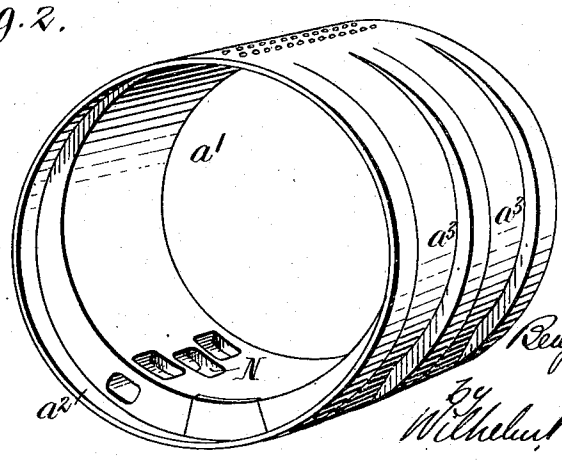


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3

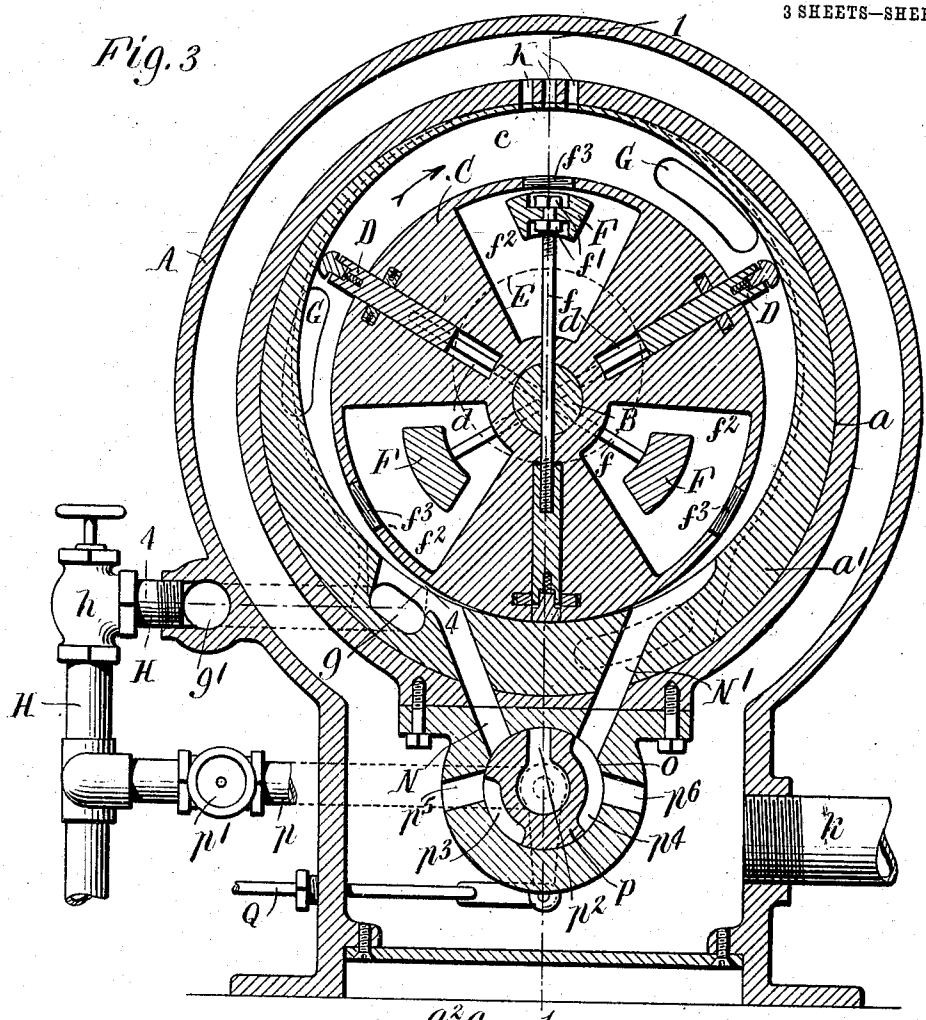
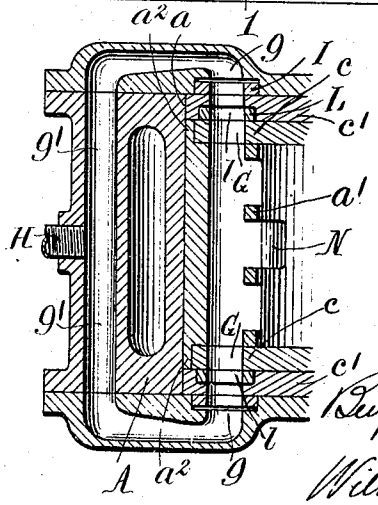


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

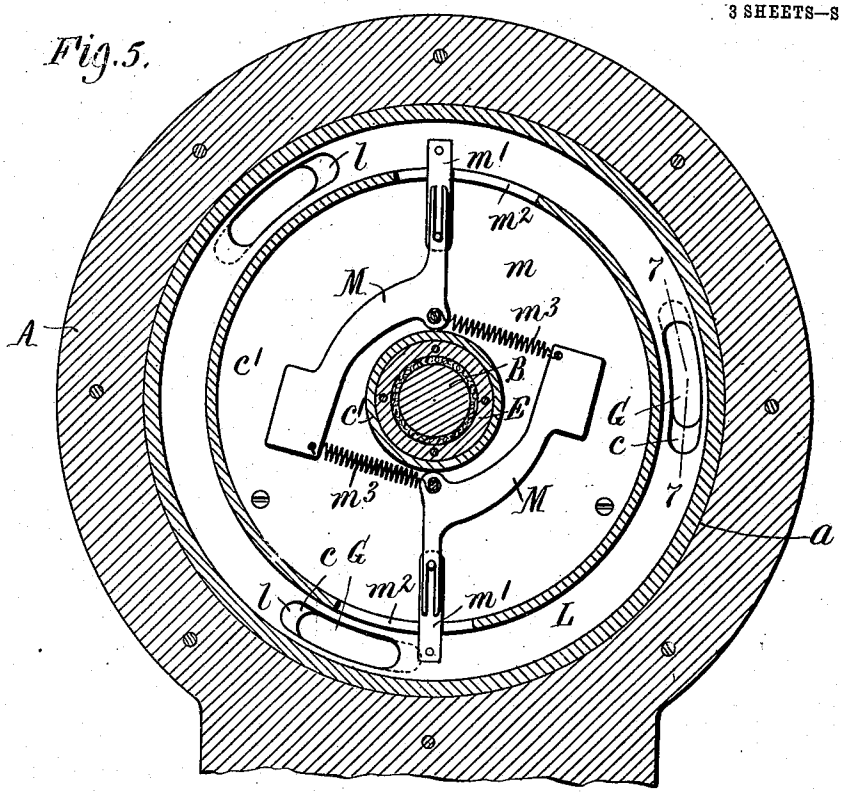


Fig. 6.

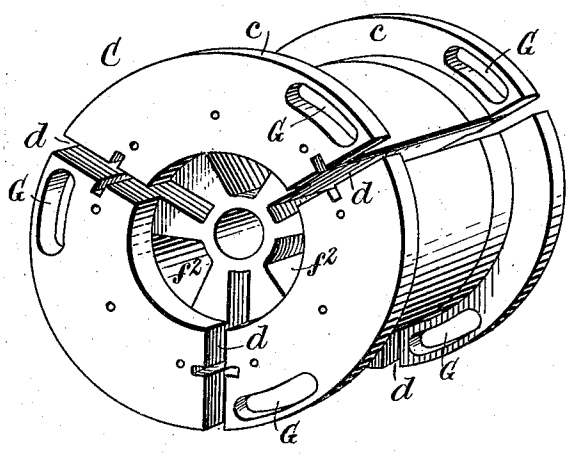
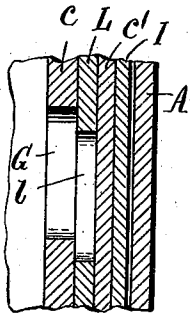


Fig. 7.



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UNITED STATES PATENT OFFICE.

BENJAMIN F. AUGUSTINE, OF BUFFALO, NEW YORK.

ROTARY ENGINE.

No. 873,201. Specification of Letters Patent. Patented Dec. 10, 1907.

Application filed December 17, 1906. Serial No. 348,275.

To all whom it may concern:

Be it known that I, BENJAMIN F. AUGUSTINE, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Rotary Engines, of which the following is a specification.

This invention relates more particularly to improvements in the rotary engine disclosed in U. S. Letters Patent No. 810,601, granted to me Jan. 23, 1906, and which, briefly stated, is constructed as follows: A rotary piston carrier or core is arranged to rotate in a stationary casing which contacts at one side with the core to form an abutment. The pistons or blades against which the steam or motive fluid exerts its pressure to drive the engine are arranged to move radially in chambers in the core and are held in sliding contact with the inner surface of the cylinder by stationary cams, counter-weights being connected to the pistons to reduce the friction and consequent wear on the pistons and cylinder. The cylinder is provided in its ends with supply passages for the motive fluid, and the flanged ends of the core are provided in rear of the pistons with admission ports which successively register with the supply passages to admit the motive fluid into the cylinder between the pistons and the abutment and cut off the fluid to act expansively. The fluid leaves the cylinder through main and supplemental exhaust ports in the casing.

The objects of the invention are to provide the cylinder with a separate abutment piece or wear piece which can be accurately made and fitted to the cylinder at small expense and can be readily replaced when worn; also to secure a better arrangement of the pistons or blades and counterbalancing weights; also to provide automatic cutoff means to coöperate with the admission ports of the rotary core to properly time the cut-off in accordance with variations in load on the engine; and to otherwise improve rotary engines of the type mentioned in the respects hereinafter described and set forth in the claims.

In the accompanying drawings, consisting of three sheets: Figure 1 is a longitudinal sectional elevation of an engine provided with the improvement, in line 1—1, Fig. 3. Fig. 2 is a perspective view of the abutment or wear piece removed. Fig. 3 is a transverse sectional elevation of the engine in line 3—3, Fig. 1. Fig. 4 is a fragmentary horizontal section thereof, on a reduced scale, in line 4—4, Fig. 3, showing the steam ports and passages. Fig. 5 is a transverse sectional elevation thereof in line 5—5, Fig. 1, showing the automatic cutoff mechanism. Fig. 6 is a perspective view of the piston carrier or core removed, without the end plates and pistons. Fig. 7 is a detail sectional view of the cutoff ring and associated parts, in line 7—7, Fig. 5.

Like letters of reference refer to like parts in the several figures.

A represents the stationary cylinder or casing; B, the power shaft which passes through the casing and is journaled in suitable adjustable bearings *b* on the opposite ends of the casing; C the rotary piston carrier or core which is fixed to the shaft to turn therewith and is arranged in the casing to contact at one side therewith, whereby is provided an abutment for the motive fluid to act against in driving the engine; D the pistons or blades which are arranged in piston pockets or chambers *d* in the rotary core to move in and out as the core rotates; and E the stationary cams or eccentrics which are fixed to the opposite ends of the casing and against which the ends of the pistons bear and by which they are held in sliding contact with the inner surface of the cylinder as the core rotates.

The cylinder or casing may be of the construction described in said patent or of any other suitable construction, except instead of having an inner surface formed partly by a portion of the body of the casing concentric with the axis of the core, and partly by an abutment block at one side of the cylinder and having an inner face eccentric with the axis of the core, the body of the casing has a cylindrical bore or hole *a* extending from end to end thereof concentric throughout with the axis of the power shaft and core, and a separate hollow cylindrical abutment piece or wear-plate *a'* is provided having a cylindrical outer surface and a cylindrical bore or inner surface eccentric to its outer surface and to the axis of the rotary core. The abutment piece is fitted in the cylindrical bore or hole of the casing and forms a lining or wear-piece therefor. As the bore of the cylinder body and the inner and outer surfaces of the abutment piece are all cylindrical, these surfaces can be turned and the abutment piece fitted in the casing with nice

precision at small expense, and, when worn, the abutment piece can be readily and cheaply replaced. The abutment piece is shorter than the body of the casing, or terminates short of the ends of the latter, see Fig. 1, and it has annular end flanges a^2 which are thinner than its thick side, see Figs. 1 and 2, and it is preferably, though not necessarily, cored out as shown at a^3 to make it lighter.

The rotary core C, Figs. 1 and 6, has enlarged ends or flanges c which, in the present engine, straddle the thick portion of the abutment piece and are surrounded by and form a running joint with the end flanges a^2 of the abutment piece, and circular plates c' which are secured to the opposite ends of the core and close the ends of the piston chambers d. These end plates are of larger diameter than the flanged ends of the core and extend between the end flanges of the abutment piece and the ends of the casing, against which the end plates bear.

As the inner surface of the abutment piece on which the pistons travel is cylindrical, the eccentrics E have circular peripheries on which the ends of the pistons or blades bear. The eccentrics are located, like the cams in said patent, in cavities in the ends of the core inside of the core end plates, being bolted or secured in any other suitable way to the opposite ends of the cylinder around the power shaft.

Three pistons or blades, instead of four, as in the patent, are preferably employed, as thereby the counterbalancing weight F for each piston can be arranged at the opposite side of the axis of the core from such piston between the other two pistons. The weights are connected to their respective pistons by rods or bolts f, Figs. 1 and 3, which pass through the power shaft, and nuts f', and the weights are located in cavities f^2 provided for them in the core. In this way more room is provided for the movements of both the pistons and the counter-weights and larger pistons and weights can be used and the weights can be located farther from the axis of the core where they will respond more readily to the centrifugal force. They can also be more readily adjusted when thus located, their securing bolts and nuts being reached through holes in the core which are opposite to the bolts and are normally closed by plugs f^3. The counterbalancing weights can be adjusted to hold the pistons on the abutment piece with just force enough to prevent leakage past the pistons, so that the wear on the pistons and abutment piece is greatly reduced.

G represents the admission ports extending through the end flanges and plates of the core in rear of the pistons and adapted in the rotation of the core to pass and successively register with the supply ports g in the ends of the cylinder, which are connected by branch passages or pipes g' with a main steam or motive fluid supply pipe H controlled by a throttle valve h.

I indicates the valve rings which are located in annular recesses in the ends of the cylinder opposite to the admission ports and are held against the end plates of the core by adjusting screws i or other means. The main exhaust port or ports K extend through the inner wall of the body of the cylinder, which is preferably hollow and communicates at its lower portion with the exhaust pipe k. When a pair of admission ports G registers with the supply ports g the steam or other motive fluid will pass through them into the cylinder in rear of the adjacent piston, and, acting between said piston and the abutment, will drive the piston, core and shaft forwardly, that is, to the right in Fig. 3, as indicated by the arrow When the admission ports pass the supply ports the steam will be cut off and will act expansively until the piston reaches the exhaust ports K and escapes from the cylinder. This action is repeated for each piston. The arrangement of the ports and action of the engine are substantially the same as in said patented engine.

The engine herein described is provided in addition with automatic cut-off means constructed as follows: L, Figs. 1, 5 and 7, represents movable cutoff rings arranged in annular recesses in the inner sides of the end plates of the core, against the core flanges c, and having ports or openings l registering with the admission ports in said flanges and end plates. By turning or shifting the cut-off rings slightly about their axes their ports will more or less restrict the effective size of the admission ports and so produce an earlier or later cut off of the steam admitted to the cylinder. In the construction shown, governor levers M are arranged between the ends of the cylinder and end plates of the core in chambers m, Fig. 1, provided for the purpose in the core end-plates. The levers are fulcrumed between their ends in any suitable manner to the end plates, and one arm of each lever is weighted and the other arms of the levers have pin and slot or other loose connections with arms m' projecting inwardly from the cutoff ring into the governor chambers through slots m^2 in the portions of the end plates, separating the governor chambers from the recesses for the cut-off rings. The weighted arms of the governor levers are preferably supplemented by springs m^3, Fig. 5, attached thereto and to suitable fixed parts on the core end plates. When the engine is in operation, the position of the governor levers will vary under the centrifugal action in accordance with the speed of the engine in a well known manner and through their connections with the cut-

off ring will shift the latter and properly time the cut-off in accordance with the conditions of load. Any other suitable automatic means could be employed for shifting the cut-off ring arranged and operating as described.

N N′ represent supplemental admission and exhaust ports leading from the cylinder at opposite sides of the abutment to the chamber O of the reversing valve P located in the hollow base of the cylinder. A cylindrical valve is shown arranged to oscillate in a correspondingly shaped valve chamber, the valve being hollow and connecting at one end with a passage or pipe p leading from the main steam or fluid supply pipe H and provided with a throttle valve p'. The reversing valve has a through port p^2 adapted to be placed in register with either of the supplemental ports N N′, and side grooves or passages p^3 p^4 adapted to connect the supplemental ports N and N′ respectively with discharge openings p^5 p^6 in the valve chamber in different positions of the valve. In the position of the reversing valve shown in Fig. 3, its steam port and the supplemental port N are closed and its passage p^4 connects the supplemental port N′ with the discharge opening p^6, in which case said port N′ serves as a supplemental exhaust port for clearing the cylinder of steam remaining in advance of the pistons after they pass the main exhaust port. By turning the reversing valve until its steam port p^2 registers with the supplemental port N′, its passage p^3 will connect the supplemental port N to the discharge opening p^5. The steam or motive fluid will then enter the cylinder through the supplemental port N′ and exhaust through the main exhaust port K and other supplemental port N, driving the engine in the opposite direction. When using the reversing valve to reverse the engine, the throttle valve h of the main steam supply valve will be closed and the valve p' of the pipe p leading to the reversing valve open. Any suitable handle or device Q, Fig. 3, can be employed for turning the reversing valve.

I claim as my invention:

1. The combination of a casing having a cylindrical bore, a hollow separate cylindrical abutment piece fitted in said cylindrical bore of the casing and having a cylindrical bore eccentric to its outer surface and end flanges concentric with said outer surface, a rotary core arranged in said abutment piece concentrically with the bore of said casing and with one side in contact with the thick side thereof and having end enlargements located within and concentric with said end flanges of the abutment piece, movable pistons carried by said core, means for holding said pistons in sliding contact with the inner surface of said abutment piece, and means for admitting fluid to and exhausting it from said casing, substantially as set forth.

2. The combination of a casing having a cylindrical bore, a hollow separate cylindrical abutment piece fitted in said cylindrical bore of the casing and terminating short of the ends of said casing, said abutment piece having cylindrical end flanges, and a cylindrical bore eccentric to its outer surface, a rotary core arranged in said abutment piece and contacting with the thick side thereof and having end enlargements located within said end flanges of the abutment piece, and end plates secured to said core and projecting between the end flanges of said abutment piece and the ends of said casing, movable pistons carried by said core, means for holding said pistons in sliding contact with the inner surface of said abutment piece, and means for admitting fluid to and exhausting it from said casing, substantially as set forth.

3. The combination of a casing, a rotary core therein, an odd number of pistons carried by said core and arranged to move radially toward and from the axis of the core, a counter-weight connected to each piston and located at the opposite side of the axis of the core therefrom, said counter-weights being arranged between adjacent pistons, and means for admitting fluid to and exhausting it from the casing, substantially as set forth.

4. The combination of a casing, a rotary core therein having an odd number of piston chambers therein and weight chambers between said piston chambers, pistons arranged to slide in said piston chambers toward and from the axis of the core, counter-weights arranged in said weight chambers and each connected to a piston at the opposite side of the axis of the core therefrom, and means for admitting fluid to and exhausting it from the casing, substantially as set forth.

5. The combination of a casing having an inlet port, a rotary core having an admission port at its peripheral portion which passes said port in the cylinder, a piston carried by said core, a cut-off ring which rotates with said core and is located near the periphery thereof and has an opening to register with said admission port, and means located in said casing within the space bounded by said cut-off ring for shifting said cut-off ring relative to said core, substantially as set forth.

6. The combination of a casing having inlet ports in its ends, a rotary core provided with end plates and having admission ports in its ends which pass through said end plates and register with said inlet ports in the ends of the cylinder in the rotation of the core, pistons carried by said core, cut-off rings

which are located inside of said end plates and rotate with said core and have openings to register with said admission ports, and means located between the ends of said core and the ends of the casing outside of said end plates and connected to said cut-off rings for shifting them relative to said core, substantially as set forth.

7. The combination of a casing having inlet ports in its ends, a rotary core provided with end plates and having admission ports in its ends which pass through said end plates and register with said inlet ports in the ends of the cylinder in the rotation of the core, pistons carried by said core, packing rings between the end plates of said core and the ends of the casing opposite to said admission ports, cut-off rings arranged in annular cavities in the ends of said core inside of said end plates and having openings to register with said admission ports, and means located within said casing for shifting said cut-off rings relative to said core, substantially as set forth.

8. The combination of a casing having inlet ports in its ends, a rotary core having admission ports in its ends which pass said inlet ports in the ends of the cylinder, pistons carried by said core, cut-off rings which are located in annular cavities in the ends of said core and have openings to register with said admission ports, and means located in chambers between the ends of said core and the ends of the casing concentrically within said cut-off rings for shifting said cut-off rings relative to said core, substantially as set forth.

Witness my hand, this fifth day of December, 1906.

BENJAMIN F. AUGUSTINE.

Witnesses:
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C. B. HORNBECK.