No. 873,596. PATENTED DEC. 10, 1907.

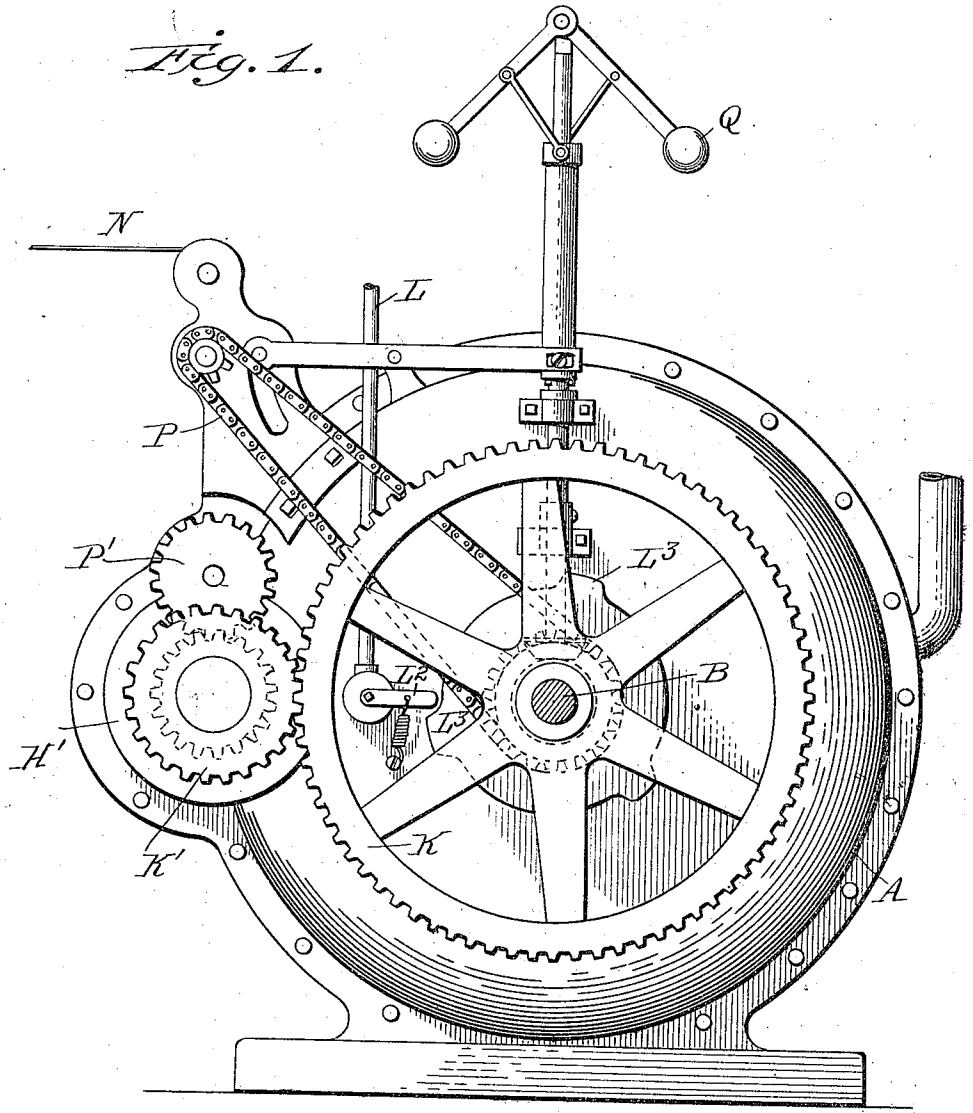
V. PINGRET.

ROTARY ENGINE.

APPLICATION FILED APR. 25, 1904. RENEWED JUNE 5, 1906.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

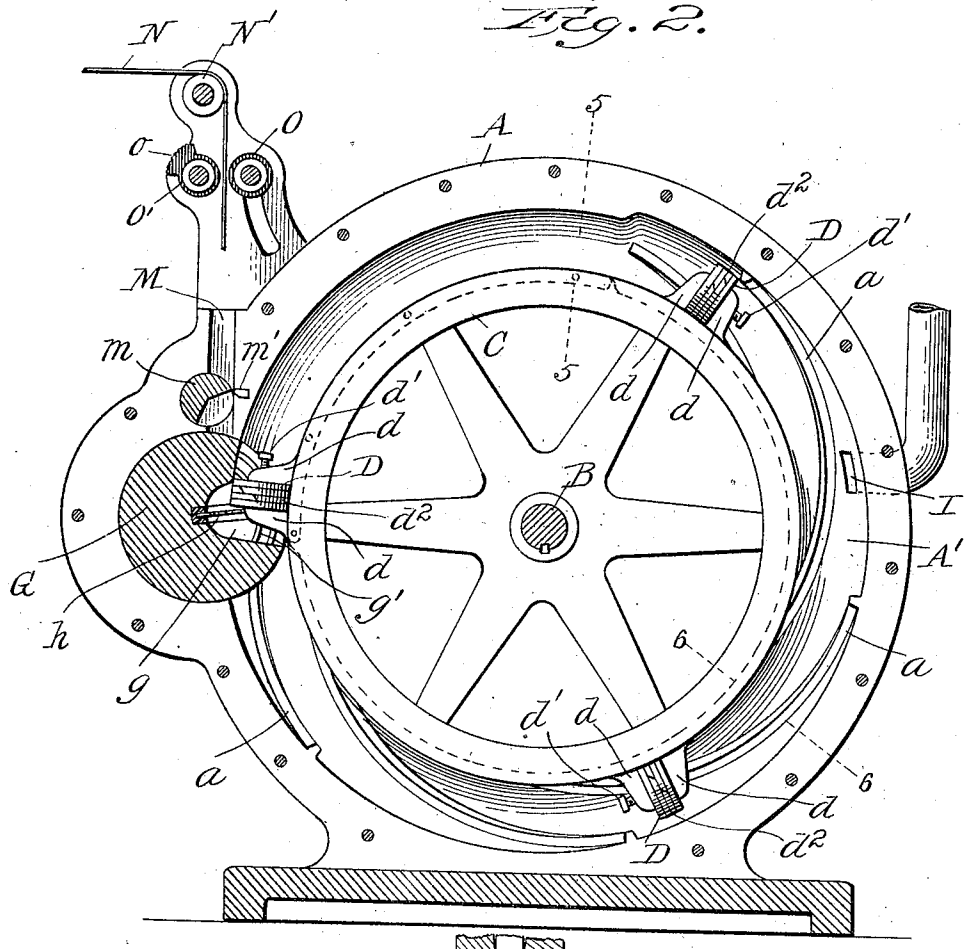
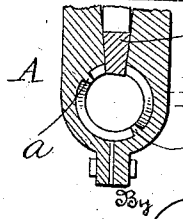


Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 3.

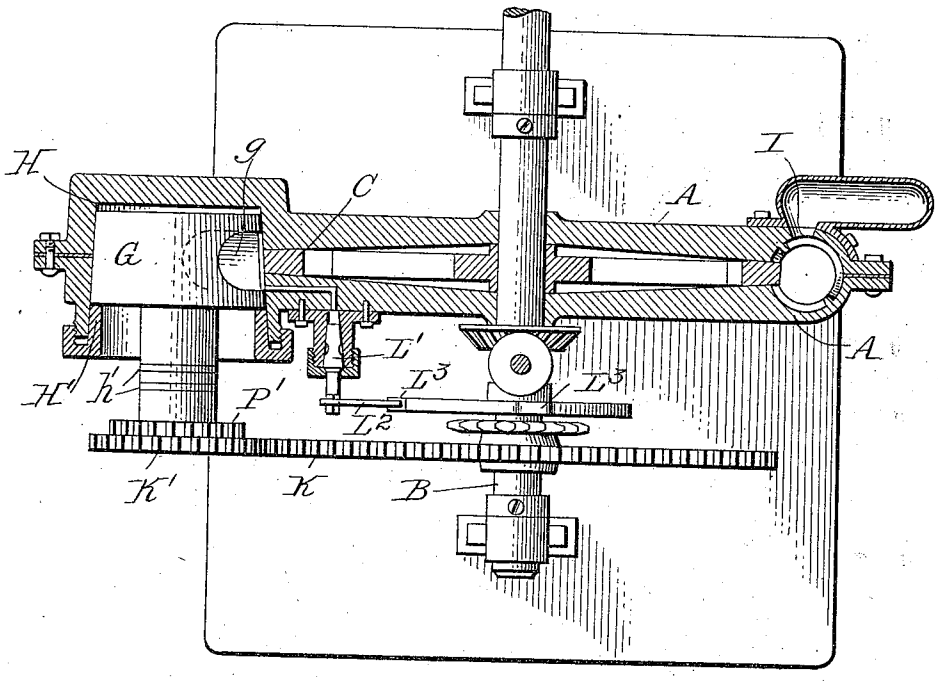


Fig. 4.

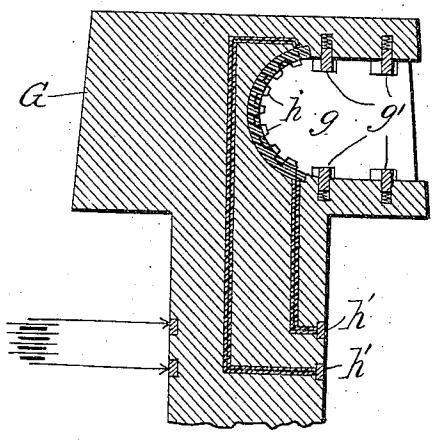
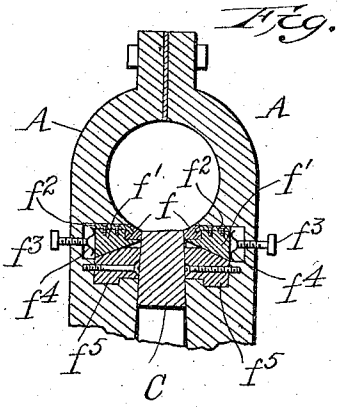


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ROTARY ENGINE.

No. 873,596. Specification of Letters Patent. Patented Dec. 10, 1907.

Application filed April 25, 1904, Serial No. 204,849. Renewed June 5, 1906. Serial No. 320,305.

To all whom it may concern:

Be it known that I, VICTOR PINGRET, a citizen of the Republic of Brazil, and a resident of Rio Grande do Sul, in the State of Rio Grande do Sul, Brazil, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of the same, and to the figures and letters of reference marked thereon.

This invention relates to improvements in rotary engines and more particularly to that type of rotary engine embodying a concentric piston carrier and pistons with a movable abutment for closing the cylinder behind each piston after the latter has passed the abutment.

The objects of the invention are to provide a highly efficient engine of simple design in which the working parts will be subject to a minimum wear and the necessity for employing packings throughout an extended area will be obviated.

Another object of the invention is to provide an engine of the rotary type which may be energized by an elastic fluid under pressure, said fluid being put under pressure either externally to the engine or within the engine itself, in other words, the engine may be run as a steam engine or as an internal combustion engine.

The invention consists in certain novel details of construction and combinations and arrangements of parts all as will be now described and pointed out particularly in the appended claims.

Referring to the accompanying drawings—Figure 1 is an elevation of a rotary engine embodying the present improvements. Fig. 2 is a vertical section in a plane at right angles to the drive shaft and taken centrally of the cylinder. Fig. 3 is a horizontal section taken centrally of the engine with portions in elevation. Fig. 4 is a sectional view through the rotary abutment in substantially the plane of the section in Fig. 3. Fig. 5 is a section on the line 5—5, of Fig. 2. Fig. 6 is a section on the line 6—6, of Fig. 2.

Like letters of reference in the several figures indicate the same parts.

The casing or cylinder of the engine adopted for illustrating the present improvements, is preferably formed into two sections lettered A in the accompanying drawings, in order to facilitate the formation of the concentric cylinder therein. The drive shaft B is journaled in bearings carried by the casing and its base and is adapted to have keyed thereupon a rotary carrier or piston C the latter in turn supporting the pistons proper or movable abutments D. These movable abutments or pistons proper are preferably cylindrical in form, in this respect corresponding to the construction of the piston of an ordinary reciprocating engine. They are mounted between projections d on a piston carrier C and held in position by centrally arranged bolts d'. Said pistons D may be of any desired number, but, as shown, three are employed, spaced equal angular distances apart, and each may embody in its construction ordinary split packing rings d^2 for preventing leakage or escape of fluid pressure past the same in the working part of the cylinder. The working part of the cylinder, which preferably corresponds to substantially the distance between adjacent pistons is made circular or cylindrical in cross-section and of a size for the pistons D to fit accurately therein.

The rim of the carrier C closes the inner side of the working portion of the cylinder and in order to prevent leakage at this point packings shown in detail in Fig. 5 are provided for bearing against each side of the carrier. These packings are preferably mounted in chambers or recesses in the sections A of the cylinder and each consists of a wear piece f which may be of soft metal and adapted to contact with the carrier C and also with the portion of the piston D lying adjacent to said carrier on each side. This wear piece f may be mounted in a block f' and held by a plate f^2 so as to be adjustable with said block and plate, the adjustment being effected by set screws f^3 bearing against the block f' preferably, however, through the medium of pressure springs f^4. For convenience in locating the packing, the chamber in the cylinder A may be made of sufficient size to admit the packing from the inside and filling pieces f^5 may be employed for closing said chamber or retaining the packing in place.

The portion of the cylinder through which the pistons D travel outside of the working

area before described and indicated at A′ in Fig. 2, may be made of larger diameter in cross section than said pistons, but in order to retain the packing rings d^2 on the pistons compressed, the said enlarged portion of the cylinder is preferably provided with ribs *a*, the inner edges of said ribs forming a chamber substantially coinciding in diameter with the diameter of the working area of the cylinder. In order to prevent unequal wear of the packing rings the ribs are arranged spirally as shown clearly in said Fig. 2 and their working faces may be of sufficient area to give the desired results, without creating any detrimental friction such as would materially affect the power output of the engine.

The abutment which closes the entrance end of the working area of the cylinder is a rotary abutment and is in the form of a tapering plug or body G which seats in a corresponding tapered chamber H of the sections A of the casing. The object of tapering the abutment and its chamber is to provide for taking up wear and to enable this adjustment to be effected, the said abutment may be held in its chamber by an adjustable retaining bearing in the form of an annulus H′ best seen in Fig. 3 of the drawing. The periphery of the abutment G is adapted to make rolling contact with the edge of the carrier C which contact will be sufficient to maintain a steam tight joint between the two without the creation of friction, and hence the peripheral surface of the carrier C is inclined to correspond to the inclination of the surface of the abutment and the diameter of the abutment and carrier C are so proportioned that the abutment will make one complete rotation during a movement of the carrier equal to the distance between pistons mounted thereon. In the engine shown, the proportion is one to three.

In the side wall of the abutment a cavity or chamber *g* for the reception and passage of the pistons is provided, said chamber, however, may be of relatively large size inasmuch as the pistons are not intended to fit accurately therein, the only contact between the pistons and abutment being such as will be presently described for retaining the packing rings compressed. The chamber *g* should, however, be of such size as to permit the abutment to close the entrance end of the working area of the cylinder immediately after the entrance of the piston into said area and where the engine is designed for running as an internal combustion engine, the said chamber *g* may serve not only as the admission chamber for the combustible but it may carry the igniting mechanism therefor. The chamber *g* should be so proportioned that the effect of pressure in the same does not tend to rotate the abutment in either direction, and the igniting mechanism is preferably located in a curved cavity or recess at the bottom of the chamber *g*. As shown, high resistance points, such as a series of sections of platinum wire *h*, are mounted in the base of the chamber and connected in series in an electric circuit which may be established through contact rings *h′* on the stem of the abutment. (See Fig. 4.)

An exhaust opening such as indicated at I may be provided at a convenient point in the enlarged area of the cylinder, it being preferred to locate the same near the exit end of the working area.

In the preferred construction, the abutment is rotated positively by gear wheels K and K′ on the drive shaft B and abutment stem or shaft as will be seen in Fig. 1, and where the engine is designed for running as a steam engine steam may be admitted from any suitable source of supply connected with a pipe L and admitted through a valve L′ controlled by a valve mechanism embodying an operating lever L^2 and a cam or series of cam-like projections L^3 carried by the drive shaft, said projections L^3 coöperating with the lever L^2 to open the valve and admit steam to the working area immediately after the abutment has closed the entrance end of said working area behind each piston. Obviously, the projections L^3 may be so proportioned as to cut off the steam at any desired point permitting said steam to act expansively throughout a greater or less proportion of the working area of the cylinder.

Instead of being operated as a steam engine the engine may be operated as an internal combustion engine in which instance the explosive may be admitted directly into the chamber *g* through a passage M (Fig. 2) having a cut-off *m* therein for closing said passage after the explosive has been delivered into the chamber *g*. It will be noted from said Fig. 2 that the chamber *g* does not open communication with the passage M until the piston has passed into the working area of the cylinder and the abutment has closed the entrance end of said area and consequently the explosive may be ignited immediately upon its entrance into the chamber *g*. The construction is such that it permits of the use of an explosive of a solid or semi-solid nature, for instance, a strip N of gun cotton. This strip N is fed over a roller N′ down through the passage M and is adapted to be severed so as to drop the proper length or quantity into the chamber *g*, by the cut-off *m* and its coöperating cutting member or jaw *m′*.

To regulate the feed of the strip of explosive a feeding and controlling mechanism may be employed, and for illustration, a pair of feed rolls O and O′ are shown in the drawings, both of said rolls being rubber covered and one of them being provided with a gripping projection *o* which will grip the strip of explosive and advance the same

into the channel M at the proper time for being severed by the cutter *m*. A driving mechanism for the roller O′ and cutter *m* may consists of a chain and sprocket drive P, on the one hand, and a gear wheel drive P′ on the other. The gear wheel drive P′ preferably coöperates with the abutment, while the sprocket wheel and chain drive cooperates with the drive shaft and is proportioned to feed the explosive at the proper time with relation to the piston movement and opening of the channel M and chamber *g*. To regulate the feed proportional to the speed of the engine a centrifugal governor Q driven from the engine shaft by any proper gearing may be provided for moving the feed roller O to a greater or less extent out of the path of the projection *o* on the feed roller O′. The movement of the feed roller O is preferably a diagonal movement with respect to the plane of feed and toward the direction of feed. As a consequence, a slight movement of the feed roll O under the influence of the governor will reduce the length of material fed and as the movement of the roller increases the length of material fed will constantly decrease until it is stopped altogether and will not commence again until the speed of the engine is reduced.

To retain the packing rings d^2 compressed during the passage of the pistons through the chamber *g* of the abutment, said chamber *g* is provided with spring pressed ribs *g′*, the proximate faces of which will contact with the said packing rings before said rings have moved out of engagement with the ends of the ribs *a* and will remain in engagement with said rings until the latter have partially entered the reduced working area of the cylinder and consequently at no time are the packing rings unrestrained or free to expand and cause wear or breakage by engaging or striking other portions of the cylinder wall.

In operation, the expansive fluid becomes effective in the operative portion of the cylinder and behind the piston at about the instant the piston leaves the chamber in the abutment and continues its action on the piston until the latter passes through the operative portion of the cylinder when the fluid is free to pass out into the enlarged portion of the cylinder and thence to exhaust. The effective operation is the same regardless of whether the engine is run as an internal combustion engine or as a steam engine and with the mechanism shown, the engine is equipped for running with either source of power although it will be understood that either may be omitted if so desired.

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

1. In a rotary engine, the combination with the concentric cylinder having a reduced working area, a rotary carrier having pistons fitting said working area and of less diameter than the remaining portion of the cylinder and a rotary abutment adapted to contact with the piston carrier and having a chamber for the passage therethrough of the pistons mounted on the carrier; substantially as described.

2. In a rotary engine, the combination with the cylinder, the piston carrier mounted concentrically therein, and having a concentric tapering periphery, pistons mounted on said carrier and admission and exhaust ports in the cylinder, of a rotary abutment having a tapering peripheral surface adapted to contact with the periphery of the carrier, a chamber in said abutment for the passage therethrough of the pistons on the carrier, gearing connecting said abutment and carrier and imparting a coextensive peripheral movement to the contacting surfaces whereby friction between the contacting surfaces of the carrier and abutment is prevented; and means for adjusting the piston carrier and abutment longitudinally with relation to each other to take up wear, substantially as described.

3. In a rotary engine, the combination with the cylinder having an annular piston chamber the working area of which is substantially cylindrical in cross-section and of less diameter than the remainder of the chamber, a carrier mounted concentrically in said cylinder, cylindrical pistons mounted on said carrier and fitting the working area of the piston chamber, a rotary abutment adapted to contact peripherally with the carrier and having a chamber therein for the passage of the pistons on the carrier, gearing interposed between said carrier and abutment for imparting uniform peripheral movement thereto whereby friction between their contacting faces is prevented and packings in the cylinder walls concentric with the working area and coöperating with the sides of the carrier; substantially as described.

4. In a rotary engine, the combination with the cylinder, piston carrier mounted concentrically therein and pistons mounted on said carrier, of a rotary abutment having a chamber therein for the passage of the pistons and having its exterior wall tapered, a tapered chamber in which said abutment is mounted and means for adjusting said abutment longitudinally of its axis in the chamber to compensate for wear; substantially as described.

5. In a rotary engine, the combination with the cylinder, the piston carrier mounted concentrically therein and having a tapered periphery, and pistons on said carrier, of a rotary abutment having a tapered periphery adapted to make rolling contact with the periphery of the carrier, a tapered chamber in which said abutment works and means for

adjusting said abutment longitudinally of its axis in said chamber to compensate for wear; substantially as described.

6. In a rotary engine, the combination with the cylinder having an annular piston chamber with a reduced working area and an enlarged area with ribs in said enlarged area, of a piston carrier mounted concentrically in said cylinder, pistons mounted on said carrier and coöperating with the walls of the piston chamber throughout the working area and with said ribs throughout the idle portion of their movement; substantially as described.

7. In a rotary engine, the combination with the cylinder having an annular piston chamber with a working area of reduced cross section and an intermediate area of larger cross section and spiral ribs in said larger area, of a piston carrier mounted concentrically in said cylinder, and pistons on said carrier coöperating with the wall of the piston chamber throughout the working area and with the spiral ribs throughout the remaining portion of the chamber; substantially as described.

8. In a rotary engine, the combination with the cylinder having an annular piston chamber with its working area of reduced cross section and spiral ribs arranged to form guides of substantially the dimensions of the cross section of the working area, of a piston carrier mounted concentrically in the cylinder, pistons on said carrier having packing rings confined and held by said ribs, a rotary abutment having a chamber for the passage of said pistons and means for holding the packing rings compressed during the passage of the pistons through the abutment chamber; substantially as described.

9. In a rotary engine, the combination with the cylinder having an annular piston chamber with its working area of substantially circular cross section and spiral ribs between the ends of said working area, of a piston carrier mounted concentrically within the cylinder, circular pistons mounted on said carrier and having expansible packing rings thereon adapted to be confined by the ribs when the piston is outside of the working area, a rotary abutment having a chamber for the passage of said pistons and ribs in said chamber for confining the packing rings during the passage of the pistons through the abutment chamber; substantially as described.

10. In a rotary internal combustion engine, the combination with the cylinder, concentric piston carrier, and pistons mounted on the latter, of the rotary abutment journaled in the casing and having a chamber therein for the passage of the pistons through the abutment and constituting the inlet for the explosive, an electric igniter for the explosive charge located in the chamber in the rotary abutment and connections for establishing a circuit through the igniter; substantially as described.

11. In a rotary engine the combination with the rotary concentric piston carrier having a narrow periphery, cylindrical pistons of greater diameter than the width of the periphery mounted on said carrier outside of its periphery and a cylinder having a concentric piston chamber for the pistons and engaging the sides of the carrier adjacent its periphery, of a rotary abutment intersecting the piston chamber and having a chamber therein for the passage of the pistons and adapted to contact with the periphery of the piston carrier, and gearing between the carrier and abutment to impart uniform surface speed to the said contacting surfaces; substantially as described.

12. In a rotary engine, the combination with the cylinder, rotating pistons and abutment having a chamber for permitting the passage of said pistons, of a feeder for explosive material embodying feed rolls and a governing mechanism controlling the operation of said feed rolls on the explosive materials; substantially as described.

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