

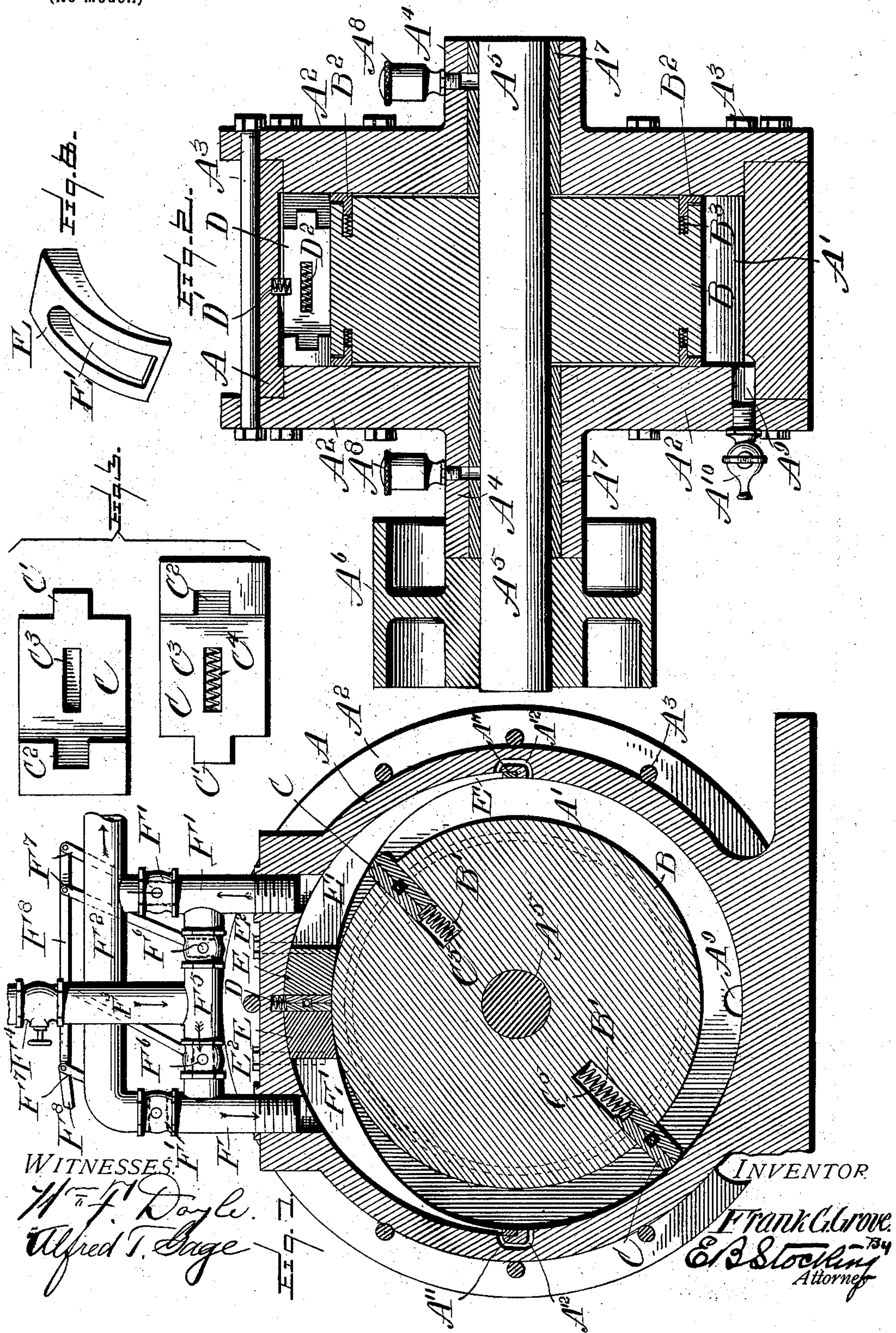
**No. 705,835.**

**Patented July 29, 1902.**

**F. G. GROVE.**  
**ROTARY ENGINE.**

(Application filed Mar. 14, 1902.)

(No Model.)





# UNITED STATES PATENT OFFICE.

FRANK G. GROVE, OF LURAY, VIRGINIA.

## ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 705,835, dated July 29, 1902.

Application filed March 14, 1902. Serial No. 98,207. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK G. GROVE, a citizen of the United States, residing at Luray, in the county of Page, State of Virginia, have  
5 invented certain new and useful Improvements in Rotary Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to a rotary engine,  
10 and particularly to an engine of that character having an eccentric piston and cam portions for actuating said piston in one direction.

The invention has for an object to provide  
15 an improved construction of rotary engine in which the cam portions at opposite sides of the abutment are removably mounted within the casing and adapted to convey the steam-feed to the piston after the same has been  
20 fully projected.

Further objects of the invention are to provide an improved form of piston or gate and cam for use in an engine of this character.

Other advantages and objects will be here-  
25 inafter set forth, and the novel features of the invention specifically defined by the appended claims.

In the drawings, Figure 1 is a vertical longitudinal section through the engine. Fig.  
30 2 is a vertical section at a right angle to Fig. 1. Fig. 3 is a detail of one of the pistons with the parts separated. Fig. 4 is a detail perspective of one of the cams.

Like letters of reference indicate like parts  
35 in the several figures of the drawings.

The letter A designates a casing, which may be of any desired construction to form an interior cylinder A' and is provided with opposite heads A<sup>2</sup>, secured together by tie-  
40 bolts A<sup>3</sup> and provided with bearing-sleeves A<sup>4</sup> for the driving-shaft A<sup>5</sup>, which carries at one end a pulley A<sup>6</sup>. The sleeves A<sup>4</sup> are provided with bearing-collars A<sup>7</sup>, of suitable metal, and with oil-cups A<sup>8</sup>, as usual. One  
45 of the heads A<sup>2</sup> is provided with a discharge-passage A<sup>9</sup> and cock A<sup>10</sup> for withdrawing any water of condensation which may collect at the bottom of the casing. Within the cylinder A' a cylindrical piston-holder B is secured  
50 to the shaft A<sup>5</sup> and provided with pistons C, slidably mounted in recesses or transverse slots B' of the holder. The opposite side

edges of the piston-holder are provided with L-shaped packings B<sup>2</sup>, normally pressed outward by springs B<sup>3</sup>, so as to contact with the  
55 inner faces of the heads A<sup>2</sup> and form a steam-tight packing with an extending area. The holder B is provided with an annular recess, into which these packings may seat, so that the outer edge thereof will be flush with the  
60 ends of the holder.

The piston C, of which one or more may be used, is composed of opposite members similar in construction and adapted to be placed  
65 together face to face, so that the tongue C' upon one section will enter the recess C<sup>2</sup> upon the opposite section and permit a longitudinal sliding of the sections upon each other without any liability to a lateral movement  
70 relatively to each other. Each section is provided with a recess C<sup>3</sup>, in which a projecting spring C<sup>4</sup> is located, which spring is of a greater diameter than the depth of either recess and extends partially into both, so as to  
75 normally hold outer ends of the sections in a projected position away from each other and permit a compression of the parts under tension. It will thus be seen that this novel  
80 form of piston obviates the necessity of using any end packings, as the single projecting spring holds the opposite ends of the piston in contact with the heads of the casing, while  
85 one edge of the piston is forced outwardly from the holder B by means of the ordinary projecting spring C<sup>5</sup>, located at the base of the recess B', to bear on the inner end of the piston C.

At the upper portion of the casing an abutment D is disposed and normally forced downward into contact with the periphery of the  
90 piston-holder B by means of a spring D'. The abutment D is similar in construction to the piston C, and the two sections of the abutment are held in contact with the heads of the cylinder by means of the projecting spring  
95 D<sup>2</sup>. At opposite sides of the abutment cam-blocks E are provided and formed with an aperture or channel E' through the same. These are fitted within the upper portion of the cylinder A' and rest at their lower ends  
100 upon a seat A<sup>11</sup>. Communicating with the aperture E' of the cam and with the cylinder A' below the seat is a by-pass or channel A<sup>12</sup>. This cam is secured at its upper end by means



of a screw E<sup>2</sup>, passing through the casing and by means of which the two sections of the cam are held in position adjacent to the abutment D. The aperture E' permits the feed of the steam or motive power from the pipe connection F through the cam and discharges beyond the seat A<sup>11</sup>, so as not to exert the full expansive pressure thereof until the piston C has become fully projected, as when this piston is in contact with the cam only a small area is presented, and the full pressure of steam thereon would interfere with the free sliding of the piston.

This engine is adapted to be reversed in operation by introducing the motive power at either side of the abutment and exhausting from the opposite side. For this purpose the pipe-sections F, communicating with each of the cams, are provided with rotating stop-cocks F', one of which will be closed as the other is opened and both of which communicate with an exhaust-pipe F<sup>2</sup>. The steam-pipe F<sup>3</sup> is provided with a throttle-valve F<sup>4</sup> and at its lower end with a cross-pipe F<sup>5</sup>, having stop-cocks F<sup>6</sup> therein, one of which is opened as the other is closed and both of which communicate with the pipes F. For the purpose of operating these several valves in their relative relation and position to each other levers F<sup>7</sup> are extended upward therefrom, connected to a reversing-bar F<sup>8</sup>.

The general operation of the engine will be apparent from the foregoing description, and by reference to Fig. 1 and the position of the stop-cocks in the feeding and exhausting connections, as shown by dotted lines, it will be seen that the steam entering the pipe F<sup>3</sup> passes through the cock F<sup>6</sup> and pipe F into the left cam E, and if a piston be in contact with this cam a portion of the steam will pass around the by-pass A<sup>12</sup> to act on the piston in advance. In the rotation of the piston through the cylinder the exhaust begins at the by-pass A<sup>12</sup> and continues as the piston passes over the right cam, from whence it passes through the pipe F, cock F' to the exhaust-pipe F<sup>2</sup>. It will be at once seen that by shifting the reversing-gear the exhaust connection at the left will be opened and the exhaust connection at the right closed, while the steam connections are respectively closed and opened to operate the engine in the opposite direction. The form of sectional cam herein shown permits the ready substitution of a new block when repairs are necessary and the reversal of the blocks when the engine has been running continuously in one direction for an extended period of time. As is well known in this art, the wear upon these cam-blocks is very uneven and increases at the point of initial contact with the piston, so that it is highly important for the economical operation of the engine that these cams should be readily removable and interchangeable. The particular construction of piston used permits the formation thereof in two similar sections, so that they can be readily reversed to equalize

the wear, and all necessity for end packings thereon is obviated, so that the projection of the end of the piston to form a steam-tight contact with the heads is effected by a single spring.

It is obvious that changes may be made in the details of construction and configuration of the engine without departing from the spirit of the invention as defined by the appended claims.

Having described my invention and set forth its merits, what I claim, and desire to secure by Letters Patent, is—

1. In a rotary engine, a cylinder and piston-holder, a piston therein, an abutment at the upper portion of said cylinder, apertured cam-blocks at opposite sides of said abutment, and a by-pass extending from the aperture in said cam around the end thereof substantially as specified.

2. In a rotary engine, a cylinder and piston-holder, a piston therein, an abutment at the upper portion of said cylinder, cam-blocks at opposite sides of said abutment having apertures therethrough, by-passes extending from said apertures around the lower ends of said cam-blocks, conducting-pipes communicating with each of said cams, a steam-pipe communicating with said conducting-pipes and provided with cocks which are alternately opened and closed, and an exhaust-pipe communicating with said conducting-pipes and provided with valves which are alternately opened and closed, substantially as specified.

3. In a rotary engine, a cylinder and piston-holder, a piston therein, an abutment at the upper portion of said cylinder, cam-blocks at opposite sides of said abutment having apertures therethrough, conducting-pipes communicating with each of said cams, a steam-pipe communicating with said conducting-pipes and provided with cocks which are alternately opened and closed, an exhaust-pipe communicating with said conducting-pipes and provided with valves which are alternately opened and closed, levers extending from said cocks, a reversing-bar connecting said levers, and L-shaped packings disposed within an annular recess on the opposite ends of said piston-holder to bear against the piston-heads, substantially as specified.

4. A piston for a rotary engine, comprising opposite sections each having at one end a thickened portion provided with a recess and at the opposite end a tongue to fit the recess in the corresponding section and provided with a spring-recess between its ends, and a coiled spring of sufficient diameter to extend within the recess of each section, substantially as specified.

5. In a rotary engine, a casing having at opposite sides a seat, apertured cam-blocks adapted to rest at their lower ends upon said seats and having their upper ends secured to said casing, a by-pass extending from the aperture in said block around said seat, a cylindrical piston-holder, and pistons carried by



said holder and normally projected therefrom under spring tension, substantially as specified.

5 6. In a rotary engine, a casing having at opposite sides a seat, apertured cam-blocks adapted to rest at their lower ends upon said seats and having their upper ends secured to said casing, a by-pass extending from the aperture in said block around said seat, a cylindrical piston-holder, pistons carried by said holder and normally projected therefrom under spring tension, an abutment between upper ends of said cam-blocks and comprising longitudinally-movable sections normally  
10 projected in opposite directions to each other,  
15 substantially as specified.

7. In a rotary engine, a casing having at opposite sides a seat, apertured cam-blocks adapted to rest at their lower ends upon said  
20 seats and having their upper ends secured to said casing, a by-pass extending from the aperture in said block around said seat, a cylindrical piston-holder, pistons carried by said holder and normally projected therefrom under spring tension, an abutment between upper  
25 ends of said cam-blocks and comprising longitudinally-movable sections normally

projected in opposite directions to each other, segmental L-shaped packings disposed within similar recesses provided in the ends of  
30 said piston-holder, and means for admitting motive power to the aperture in one of said cams and exhausting from the opposite one, substantially as specified.

8. In a rotary engine, a cylinder having an  
35 apertured cam portion within its upper segment, feed and exhaust connections communicating with the said cam portion, an abutment between said connections, by-pass channels extending from the apertures at the opposite  
40 ends of the cam portion and around the ends thereof, a piston-holder provided with a transverse slot, a piston comprising separate members located within said slot, a spring between said members for projecting the ends  
45 thereof beyond said slot, and a spring beneath extending between the base of said slot and piston, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

FRANK G. GROVE.

Witnesses:

L. R. OGDEN,

L. T. BERRY.