No. 845,973. PATENTED MAR. 5, 1907.

W. A. C. PAPE.

ROTARY ENGINE.

APPLICATION FILED DEC. 15, 1906.

3 SHEETS—SHEET 1.

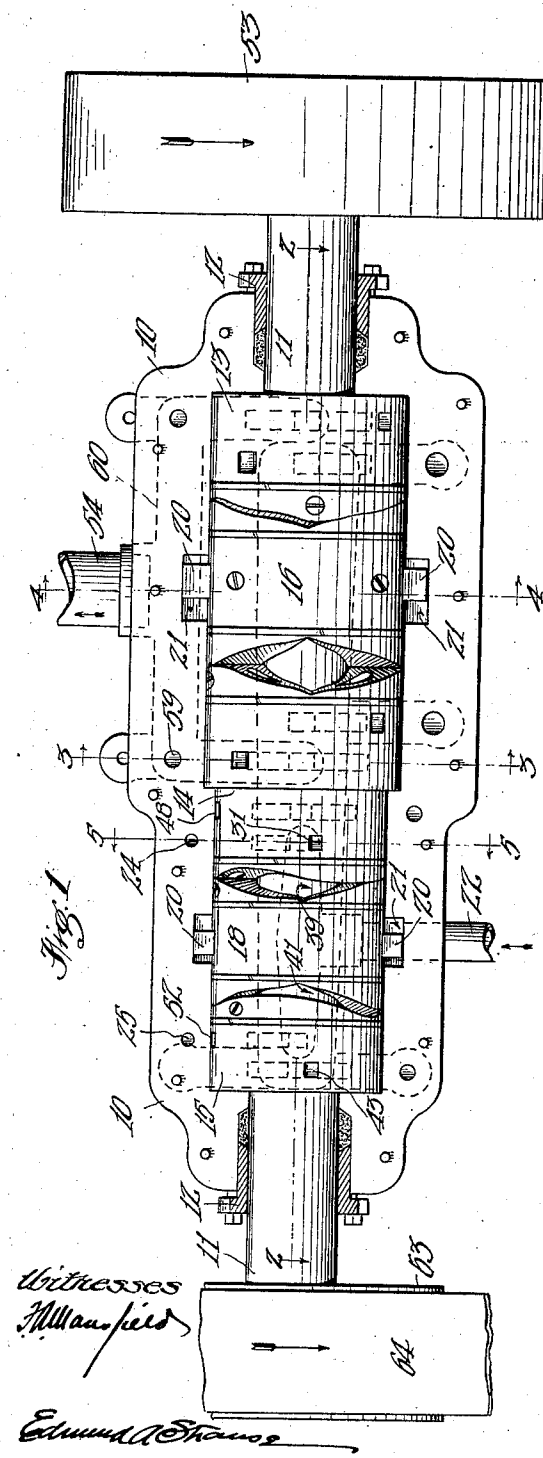

Fig. 1.

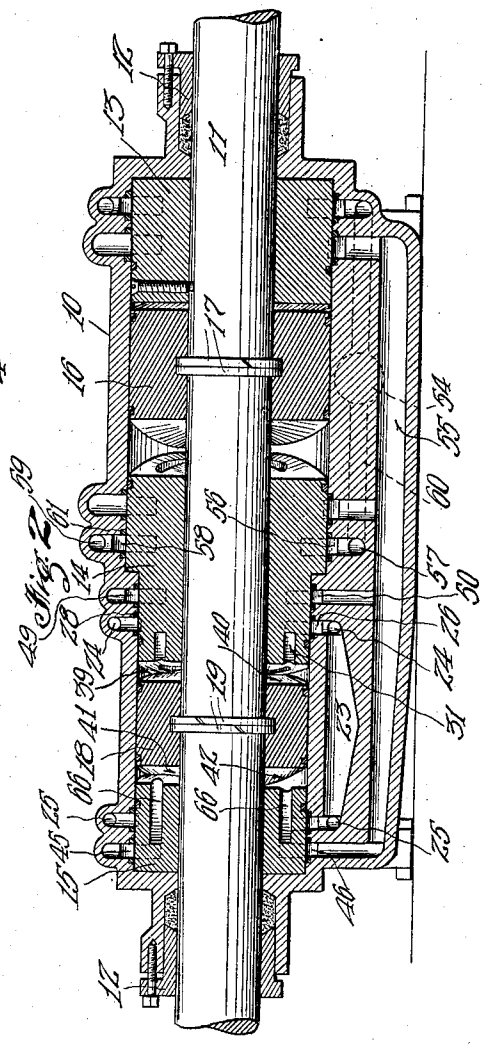

Fig. 2.

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3 SHEETS—SHEET 2.

Fig. 3

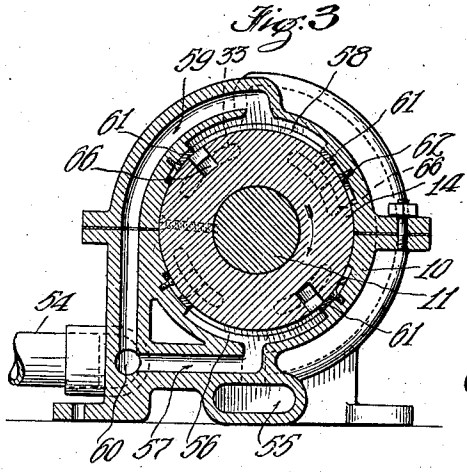


Fig. 4

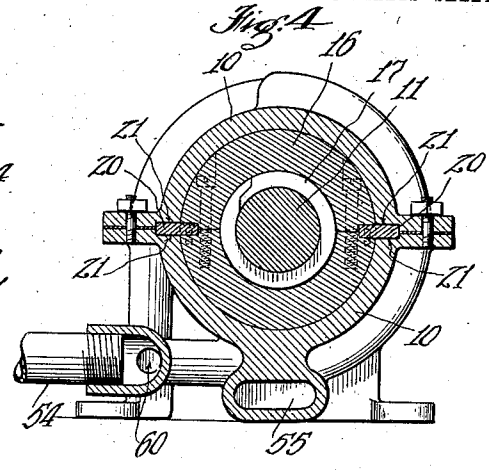


Fig. 5

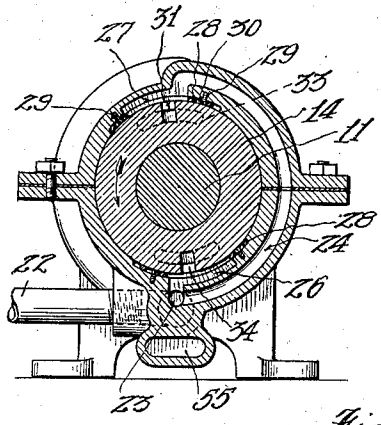


Fig. 7

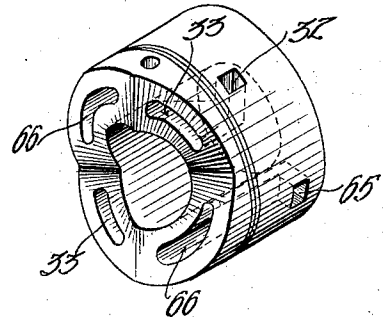
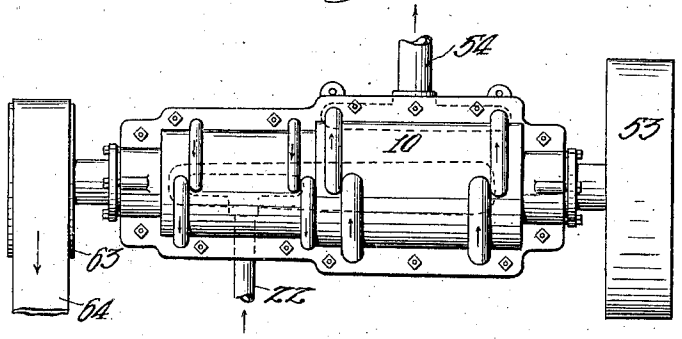


Fig. 6



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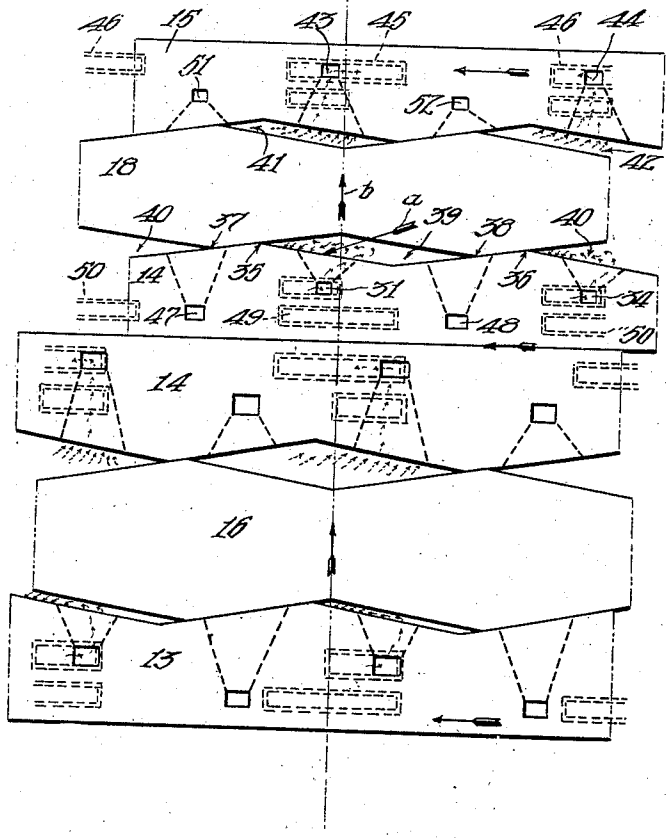
3 SHEETS—SHEET 3.

Fig. 8



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UNITED STATES PATENT OFFICE.

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ROTARY ENGINE.

No. 845,973. Specification of Letters Patent. Patented March 5, 1907.

Application filed December 15, 1906. Serial No. 347,934.

To all whom it may concern:

Be it known that I, WILLIAM A. C. PAPE, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention relates to a rotary engine in which the expansive fluid is led between a reciprocating annular non-rotatable abutment having curved or cam edges and wings secured to the shaft on each side of the abutment and having edges of a configuration to fit against the edges of the abutment, the wings being separated so as to form chambers on both sides of the abutment when it is centrally disposed between the wings, said chambers being alternately thrown to exhaust or pressure, whereby the movement of the abutment will expel the exhaust before a fresh charge is admitted.

Another object is to provide an engine with a plurality of high and low pressure chambers, the high-pressure chambers exhausting into the low-pressure chambers.

I accomplish these objects by the engine described herein and illustrated in the accompanying drawings, in which—

Figure 1 is a plan view, with one-half of the casing removed, of my improved engine. Fig. 2 is a central longitudinal section with the casing in place thereon, taken on line 2 2 of Fig. 1. Fig. 3 is a transverse section taken on line 3 3 of Fig. 1. Fig. 4 is a transverse section taken on line 4 4 of Fig. 1. Fig. 5 is a transverse section taken on line 5 5 of Fig. 1. Fig. 6 is a plan view of my complete engine. Fig. 7 is a perspective view of one of the rotating members. Fig. 8 is a diagrammatic view illustrating the relation of the various admission and exhaust ports of the engine.

It will be understood that my improved engine is made up of units and that each unit comprises an abutment and wings on each side thereof. In the drawings I have shown an engine composed of two units, one being a high-pressure unit and the other a low-pressure unit, and I will describe the same with reference to such construction.

In the drawings, 10 is the outer cylindrical casing of my engine, in which is revolubly mounted the driven shaft 11. At each end of the casing are the usual stuffing-boxes 12 to make a gas-tight joint between the shaft and the casing. Rigidly secured to the shaft within the casing are the annular wings 13, 14, and 15. Between wings 13 and 14 is the reciprocating annular non-rotatable abutment 16, which is provided with packing-rings 17 to provide a gas-tight joint between the shaft and the abutment. Between wings 14 and 15 is a like abutment 18, provided with packing-rings 19. Both ends of each abutment are formed of undulating curves composed of an even number of alternating right and left sections of a helix or variations of the same, and the ends of the wings fixed to the shaft are of a configuration to fit the faces of the abutment when brought in contact therewith. The curved faces of the ends of the abutment run in opposite directions—that is, a right helical section on one end of the abutment is opposed by a left helical section on the opposite end of the abutment. Each abutment is provided with lugs 20, as shown in Fig. 4, which have a working fit in grooves 21 in the casing, or, if desired, the lugs could be secured to the casing and work in grooves in the abutment, the object of the lugs in either case being to prevent the abutment rotating with the shaft.

22 is the supply-pipe through which the expansible fluid is led into the engine. This pipe connects with a chamber 23, from which lead channels 24 and 25. Channel 24 is in communication with a groove 26, formed in the inner surface of the casing on one side thereof and with a like groove 27 on the opposite side thereof. Regulating-plates 28 are provided at the ends of these grooves to regulate the length of the same, so as to provide a greater or a less length of time for the expansible fluid to pass into the wing, as hereafter explained. These plates are held in place by screws 29, which pass through elongated slots 30, which slots permit the plates to be moved longitudinally to make the opening from the inner side into the groove longer or shorter. In wing 14, adjacent to abutment 18, is an L-shaped channel 31, the inner end of which opens through the edge of the wing and is much broader than the outer end thereof. The shape of this channel is shown in full and dotted lines in Fig. 7, the outer end of the channel being marked 32 and the inner end 33. When the outer end of this channel is in register with either of the grooves 26 or 27, primary fluid-pressure or high pressure will pass through said channel, and the pressure thereof will be exerted between wing 14 and abutment 18 to drive abutment 18 against

wing 15. As soon as the abutment is in contact with wing 15 pressure will be exerted against the wing 14 to drive it in the direction of arrow *a* in Fig. 8, which will rotate the shaft in that direction, thereby carrying wing 15 with it and permitting the abutment to slide along the shaft. This movement of the abutment permits the line of the expansive force of the fluid to travel the helical curve, whereby wing 14 is subjected to maximum primary pressure as long as pressure is admitted between said wing and abutment. The pressure of the abutment against wing 15 also has a tendency to drive wing 15 in the same direction, as the contacting faces are on an inclined plane to each other with the pressure directed at an angle to the line of movement of the wing and in the direction of arrow *b*. On the opposite side of the wing is a channel exactly like channel 31, (shown diagrammatically in Fig. 8 and marked 34,) which receives high-pressure fluid at the same time that channel 31 receives it, so that the same amount and quality of pressure is simultaneously applied to abutment 18 at opposite points. At the time that channel 31 commences to register with groove 26 the apices 35 and 36 of the wing have passed the apices 37 and 38 of the abutment, as shown diagrammatically in Fig. 8, and fluid-chambers 39 and 40 are formed between the abutment and the wing, and the pressure of the fluid will be not only to drive abutment 18 longitudinally into contact with wing 15, but also to cause wing 14 to rotate the driven shaft in the direction of the arrow. It will be observed that there are also expansible fluid-chambers 41 and 42 formed on the other side of abutment 18, formed by the contact of that abutment with wing 15. A little before channel 31 receives pressure the chambers on the other side of abutment 18 are connected to exhaust through L-shaped channels in wing 15, which channels are shown diagrammatically in Fig. 8 and marked 43 and 44, which channels register with grooves 45 and 46. (Shown in dotted lines in Fig. 8.) These exhaust-grooves are preferably connected together by a channel 55, which leads to and forms the supply of the low-pressure unit, which is similar in construction and operation to the high-pressure unit before described. Wing 14 is also provided with exhaust-channels 47 and 48, which register with grooves 49 and 50, (shown in dotted lines diagrammatically in Fig. 8,) which are connected up to the low-pressure unit in the same manner as the other exhaust is connected. Wing 14 is also provided with high-pressure channels 51 and 52, which operate and are connected together in the same manner as the high-pressure channels of wing 14.

It will be understood that wings 14 and 15 and abutment 18 form a unit of high-pressure power and that when high pressure is being exerted on one side of the abutment it is exhausting on the other side, and as soon as that side is exhausted completely the exhaust-channel is cut off and the pressure-channel is connected to the source of supply, balance-wheel 53 carrying energy enough to bring the respective channels to pressure if there is only one unit. If there are a plurality, the units are staggered in their shaft connections. The low-pressure units are constructed and operated in the same manner as the high-pressure units, except that the exhaust is connected to pipe 54, which leads to the open air or to a condenser. The exhaust from the high and low pressure units is of the same form and operation except that from the low-pressure units the exhaust would be to pipe 54, which leads to the open air or a condenser, while the exhaust from the high-pressure unit would be to channel 55. In Fig. 3 exhaust-groove 56 is connected to channel 57 and exhaust-groove 58 is connected to channel 59, and these two channels are connected to channel 60, which opens into pipe 54. The exhaust-grooves are provided also with regulating-plates 61, longitudinally movable on screws 62 to regulate the time that the exhaust-ports shall be in communication with the exhaust-grooves. The different channels and grooves in the casing are formed when the same is cast in the usual well-known manner. On the other end of shaft 11 is pulley 63, from which power may be taken by means of a belt 64, connected up to the driven machinery, (not shown,) or the shaft may be connected directly thereto. The form of the exhaust-channels in the wings is shown in Fig. 7, the outer end being marked 65 and the inner end 66, the dotted lines showing the connection between the two ends.

Having described my invention, what I claim is—

1. A rotary engine comprising a reciprocating annular non-rotatable abutment provided with edges or ends formed by undulating curves composed of an even number of alternating right and left sections of a helix or variations of the same, the curved faces running in opposite directions, that is, a right helical section on one end of the abutment being oppositely disposed to a left helical section on the opposite end; a shaft on which said abutment is longitudinally movable; and wings on either side of said abutment having the edges or faces thereof of a configuration to fit the faces of the abutment, said wings being secured to the shaft in position to permit chambers to be formed on both sides of the abutment and having a plurality of channels therein; and a casing surrounding said abutment and wings provided with channels and ports arranged to alternately throw pressure into the chambers on one side of the abutment and to exhaust from

the chambers on the other side of the abutment, and then to reverse the pressure and exhaust.

2. A rotary engine, comprising a reciprocating annular non-rotatable abutment provided with edges or ends formed by undulating curves composed of an even number of alternating right and left sections of a helix or variations of the same, a right section being opposed by a left section; a shaft on which said abutment is longitudinally movable; wings on either side of said abutment having the edges or faces of a configuration to fit the faces of the abutment, said wings being secured to the shaft in position to form chambers on both sides of the abutment and having a plurality of channels therein; a casing surrounding said abutment and wings provided with channels and ports arranged to alternately throw pressure into the chambers on one side of the abutment and to throw the chambers on the other side of the abutment to exhaust, then to reverse the pressure and exhaust; and means to vary the length of time that said chambers are thrown to pressure or exhaust.

3. A rotary engine, composed of a high-pressure and a low-pressure unit, each unit comprising a reciprocating annular non-rotatable abutment provided with edges or ends formed by undulating curves composed of an even number of alternating right and left sections of a helix or variations of the same, a right section being opposed by a left section; wings on either side of said abutment having the edges or faces thereof of a configuration to fit the faces of the abutment; a shaft running through said wings and abutment, said wings having a plurality of channels therein and being secured to the shaft in position to form chambers on both sides of the abutment; and a casing surrounding said abutments and wings provided with channels and ports arranged to alternately throw pressure into the chambers on one side of the abutment and to exhaust from the chambers on the other side of the abutment and then to reverse the pressure and exhaust, the exhaust from the high-pressure unit being connected to pressure side of the low-pressure unit.

In witness that I claim the foregoing I have hereunto subscribed my name this 21st day of November, 1906.

WILLIAM A. C. PAPE.

Witnesses:
G. E. HARPHAM,
EDMUND A. STRAUSE.