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ROTARY ENGINE.

APPLICATION FILED JULY 18, 1910. RENEWED MAY 20, 1911.

1,012,616. Patented Dec. 26, 1911.

3 SHEETS—SHEET 1.

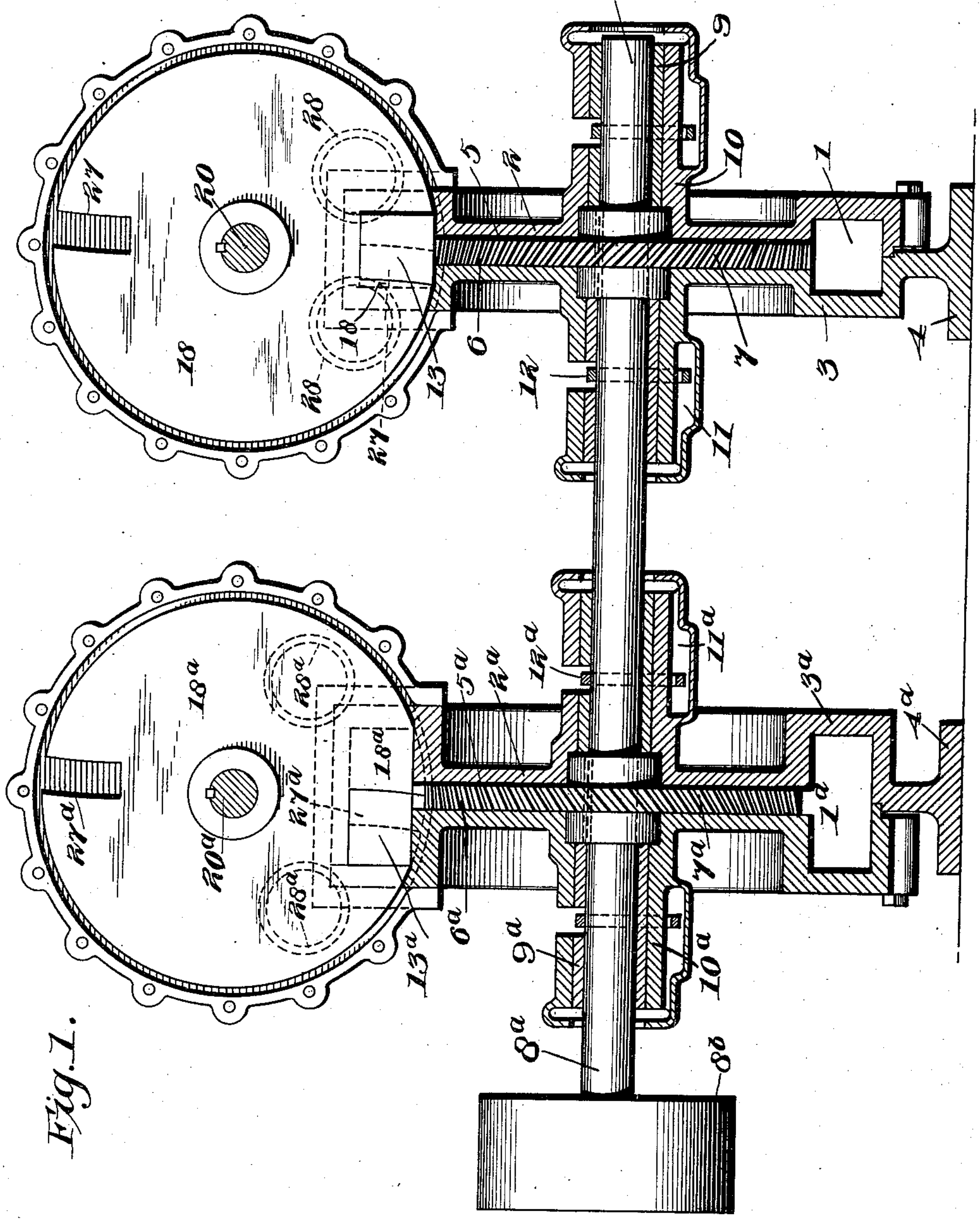

Fig. 1.

Witnesses

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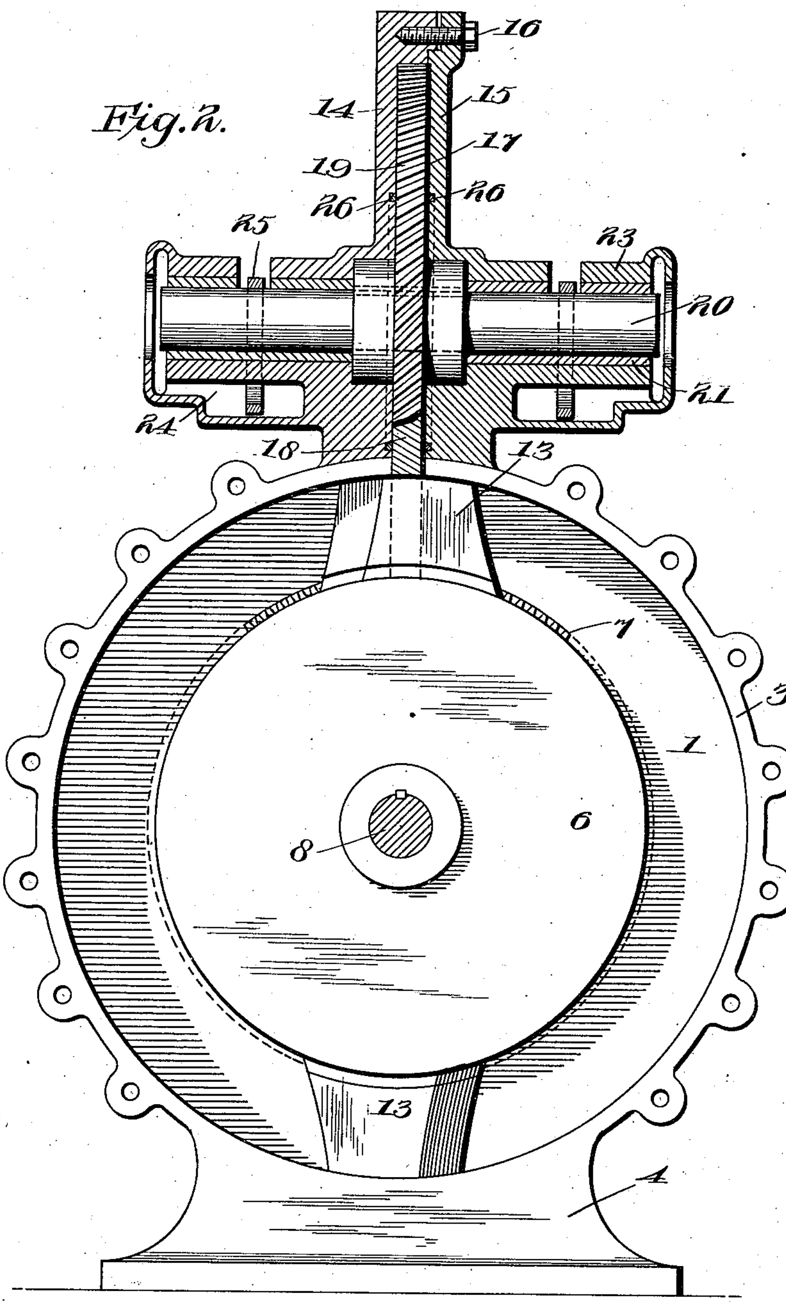
3 SHEETS—SHEET 2.

Fig. 2.



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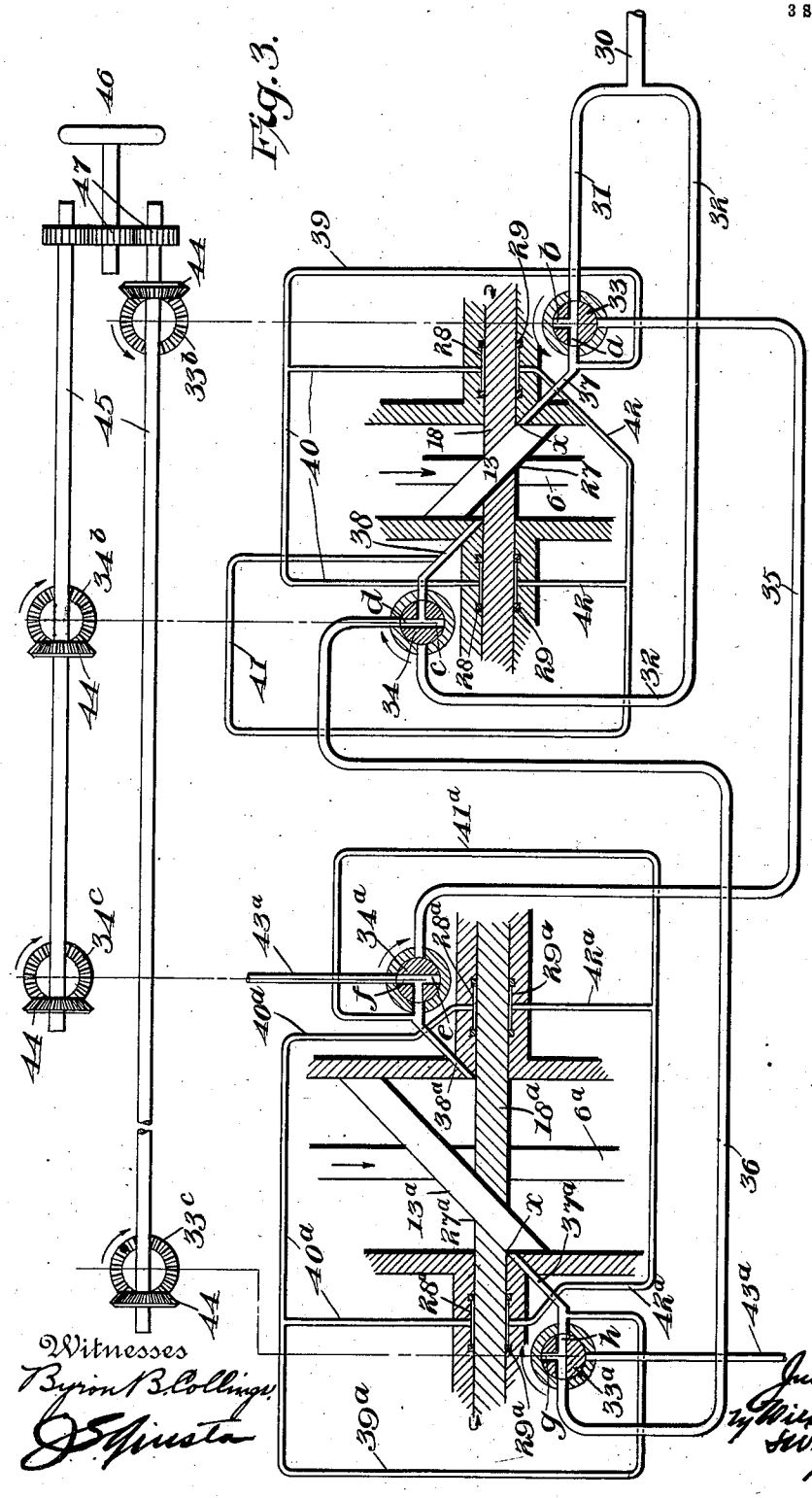
3 SHEETS—SHEET 3.

Fig. 3.



UNITED STATES PATENT OFFICE.

JULES F. DUBUS, OF NEW ORLEANS, LOUISIANA, ASSIGNOR OF ONE-HALF TO GEORGE M. APPELL, OF NEW ORLEANS, LOUISIANA.

ROTARY ENGINE.

1,012,616. Specification of Letters Patent. Patented Dec. 26, 1911.

Application filed July 18, 1910, Serial No. 572,552. Renewed May 20, 1911. Serial No. 628,565.

To all whom it may concern:

Be it known that I, JULES F. DUBUS, a citizen of the United States, residing at New Orleans, in the parish of Orleans and State of Louisiana, 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 invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in rotary engines, and while it is applicable for use to other types of machines than rotary steam engines, still for the purpose of simplicity of description in the following specification I have only referred to the use of steam as the motive power. It is understood, however, that with proper modifications the essential features of the invention might be used in connection with pumping apparatus, internal combustion engines, etc.

One of the primary objects of the invention is to produce a motor that is free from dead centers, which is simple in construction, effective in operation, rigidly supported, well balanced, and practically free from undue vibrations.

Another object is to provide a rotary engine comprising a plurality of coupled engines of the compound type.

A further and primary object is to provide means whereby a rotary abutment for the pistons is geared up with the piston disks.

Another principal object of the invention is to so mount the pistons with relation to the piston disks that they will be disposed on the periphery thereof in planes at acute angles to the plane of the piston disk.

Other objects and advantages will appear from the following description, and the features of novelty will be pointed out more succinctly in the claims.

The invention is not limited to the exact details shown and described, but for the purpose of disclosure reference is had to the accompanying drawings illustrating a practical embodiment of same, in which drawings like characters designate the same parts in the several views, and in which—

Figure 1 is a longitudinal section through a pair of rotary engines of the compound type, the piston disks being shown in end elevation and the rotary abutment being shown in side elevation. Fig. 2 is a central vertical cross section through one of the engines shown in Fig. 1, the piston disks being shown in side elevation and the rotary abutment in end elevation, and Fig. 3 is a diagrammatic sectional plan showing the connection between the high pressure and the low pressure cylinders of a compound type engine with means for controlling the same.

1 designates an annular cylinder formed by the side plates 2 and 3, the side plate 3 being formed integrally or otherwise connected to a base 4, and the side plate 2 suitably bolted or otherwise affixed to the side plate 3, forming the annular cylinder 1, and the restricted chamber 5 adapted to snugly receive a piston disk 6 provided on its periphery with worm teeth 7, and journaled by means of the shaft 8 in bushings 9 set in the journal boxes 10 formed by the respective side plates, oil chambers 11 being formed in said journal boxes, suitable lubricating rings 12 being loosely mounted on said shaft and dipping down in the oil chambers 11. The periphery of the piston disk 6 is also provided with one or more high pressure pistons 13 extending from the periphery of the disk at an angle thereto, as shown more clearly in Figs. 2 and 3.

The object in having the pistons arranged at angles less than right angles to the disks is to avoid clearance space. In the types of engines heretofore constructed, wherein a rotary abutment coöperates with a rotary piston disk, the piston must travel beyond its abutment a distance equal to the width of the piston, before the steam is injected therebetween, but by arranging the pistons at acute angles to the disks I avoid this clearance space as hereinafter referred to.

Surmounting the annular cylinder 1, and formed integrally or otherwise secured to the side plates 2 and 3, are the castings or plates 14 and 15, the plates 15 being suitably secured, as by bolts 16, and spaced apart from the plates 14 to provide an abutment chamber 17, adapted to snugly receive an abutment disk 18 provided with worm teeth 19 gearing with the worm teeth 7 of the piston disk and rotatably mounted on a stud shaft 20 bushed, as at 21, in the bearings 23, provided with an oil chamber 24 and loosely hanging lubricating rings 25.

26 are packing rings contained in suitable recesses in the plates 14 and 15 and bearing against the rotary abutment member.

It will be observed that the shafts 20 and 8 are at right-angles to each other, and the piston disk and abutment rotate in planes at right-angles to each other, the abutment member being provided with openings 27 extending inwardly from their periphery, and of a number, and of proper angle and curvature, to correspond with the pistons on the piston disks, and adapted in their cycle of revolution to allow the passage of the piston disks therethrough with the smallest possible leakage.

On the inside faces of the heads of plates 14 and 15, near the bottom thereof and adjacent the lower end of the rotary abutments, are formed balancing recesses 28 and 29, a pair of such recesses being arranged on opposite sides of the disks and functioning as hereinafter described.

So far the description has been directed to the high pressure engine of the coupled series, and as the low pressure engine is of substantially the same construction the various parts of the low pressure engine are referred to by the same numerals as those of the high pressure one with the exponent *a* added, it being seen that in the particular method of coupling shown in Fig. 1 the shaft 8 and 8^a is an integral one and provided with a suitable pulley 8^b. It will also be understood that the volume of the annular cylinder 1^a and the area of the piston 13^a is greater than that of the cylinder 1 and piston 13, and it will also be understood that the angular disposition of the piston 13^a is opposite to that of the piston 13. 30 is the steam inlet of the steam supply passing through the branch pipes 31 and 32, the valves 33 and 34 respectively, shown as three-way valves, and 35 and 36 are conduits or pipes leading from the valve 33 to the valve 34^a, and from the valve 34 to the valve 33^a of the low pressure cylinder, respectively. 37 is a conduit leading from the valve 33 into the cylinder 1 adjacent the abutment plate 18 on one side, and 38 is a similar conduit leading from the valve 34 into the cylinder 1, adjacent the abutment plate 18 but on the other side thereof from the conduit 37. 39 is a conduit leading from the conduit 37, through the branch pipes 40 to the balancing recesses 28 on one side of the abutment member, and 41 is a similar conduit leading from the pipe 38, through the branches 42 to the balancing recesses 29 on the opposite side of the abutment member. 43^a are pipes leading from the valves 33^a and 34^a either to the valves of another low pressure cylinder, or to a condenser, or to atmosphere, or otherwise.

At the upper corner of Fig. 1 is diagrammatically shown means for rotating the cut-off valves, 33^b, 34^b, 33^c and 34^c being beveled gears mounted on the respective spindles of the valves 33, 34, 33^a and 34^a. These beveled gears coöperate with beveled gears 44 carried by the shafts 45 and are rotated in unison, in the direction indicated by the arrows, by the hand wheel 46 and intermediate gears 47.

In Fig. 1 it will be seen in operation that with the valves in the position shown the steam or other operating fluid will pass through the pipe 31, the straight-way of the valve 33, and the conduit 37 behind the piston 13 and between it and the forward face of the abutment plate, driving the piston 13 in the direction indicated by the arrow, the piston disk and the abutment plate traveling at the same rate of speed, allow for the angular passage of the piston through the opening 27 of the abutment plate. When the piston 13 has passed through the abutment plate the steam or other operating fluid on the opposite side of the abutment plate will pass from that side of the cylinder through the conduit 38, the valve 34, the conduit 36, the valve 33^a, the conduit 37 into the cylinder 1^a behind the piston 13^a and between it and the abutment 18^a, the piston disk in this case rotating in the same direction as the piston disk 6, but the abutment plate 18^a rotating in the opposite direction to the direction of rotation of the abutment 18, the steam expands between the piston 13 and 13^a until the piston 13 has passed through the abutment, when the expanded steam on the opposite side of the abutment plate will exhaust through the conduit 38^a, the valve 34^a and the pipe 43^a to another low pressure cylinder, or otherwise. It will also be observed that with the valve in this position live steam from the conduit 37 will pass through the piping 39 and 40 to the balancing recesses 28 on the opposite faces of the abutment to that against which there is a head pressure of steam, and similarly the same action takes place through the conduits 39^a, piping 40^a introducing the steam to the balancing recesses 28^a of the low pressure engine.

To stop the engine it is obvious that an eighth turn of the wheel 46 will throw all of the ports of the valves out of communication with the steam pipes, while a quarter rotation of the valves in the direction indicated by the arrows, from the position in which they appear in the drawings, will cause the engine to reverse as follows:—The ports *a* and *b* in the valve 33 will register with the pipes 35 and 37, while the ports *c* and *d* of the valve 34 will register with the conduits 32 and 38. So also the ports *e* and *f* will register with the conduits 38^a and 35, and ports *g* and *h* will register with the conduits 37^a and 43^a. The passage of the operating fluid will then be through the con-

duit 32 (the valve 33 being closed to the pipe 31) thence through the ports *c*—*d* and the conduit 38 into the cylinder 1 between the reverse faces of the piston 13 and the abutment 18, as heretofore described, driving the piston in a reverse direction, until the piston has passed through the opening in the abutment, when the exhaust will be through the conduit 37, the ports *b* and *a*, the pipe 35, the ports *f*—*e*, through the conduit 38ª into the cylinder 1ª between the faces of the piston and abutment in the low pressure cylinder, the reverse of that heretofore described, and driving the piston in a reverse direction. When the piston 13ª has passed through its abutment the exhaust from the chamber on the other side is through the conduit 37ª, the ports *g* and *h* and through the pipe 43ª. When the engine is running in this reverse direction it will be observed that the balancing recesses 29 and 29ª are supplied with steam through the conduits 41 and 41ª communicating with the inlet conduits 38 and 38ª. From the foregoing description of the operation it will also be observed that the live steam enters through the conduit 37 into the cylinder at a position *x* immediately adjacent that side of the abutment disk, so that as the pistons pass through the slots in the abutment disk the live steam is injected immediately behind same without any clearance space being formed between the face of the piston and the face of the abutment.

Having thus described my invention, what I claim is:—

1. In a rotary engine, the combination of an annular cylinder having an intermediate restricted circular chamber communicating therewith, a rotatable piston disk snugly fitting within said restricted chamber, a piston mounted on the periphery of said disk and extending within said annular cylinder, a rotatable abutment member mounted in a plane at right angles to said piston disk and extending within said annular cylinder, said abutment being provided with an open slot extending inwardly from its periphery, worm teeth peripherally arranged around said piston disk and rotary abutment, and a fluid inlet and outlet, substantially as described.

2. In a rotary engine, the combination of an annular cylinder, a piston mounted to revolve therearound, said piston having flat working faces diagonally disposed with relation to said cylinder, an abutment member rotatable in a plane at right angles to said cylinder and projecting therein, said abutment being provided with an angular opening corresponding with the diagonal disposition of said piston to permit of the passage of said piston therethrough, and means for operating said piston and abutment synchronously, whereby the angular disposition of the piston with relation to the abutment will avoid clearance space therebetween, substantially as described.

3. In a rotary engine, the combination of an annular cylinder, a rotatable piston support, a piston mounted on said support within said cylinder and rotatable therearound, said piston having flat working faces disposed diagonally of said cylinder, an abutment member rotatable in a plane at right angles to said piston support and projecting within said cylinder, said abutment being provided with an open-ended angular slot corresponding to the angular disposition of said piston, said slot being of a width corresponding to the thickness of said piston and of a depth no greater than the height of said piston, and means for rotating said abutment and piston support in synchronism, whereby the piston will pass through said abutment slot without any leakage and avoiding clearance space, substantially as described.

4. In a rotary engine, the combination with side plates forming a narrow circular central chamber opening into an annular cylinder, a rotatable piston disk snugly fitting within said chamber, a piston carried by the periphery of said disk and disposed within said annular cylinder at an angle, a rotary abutment disposed in a plane at right angles to said piston disk and extending within said annular cylinder, said rotary abutment being provided with an open slot extending inwardly from its periphery, said slot being of a curvature and angle to permit of the passage of said piston therethrough at predetermined times, and said abutment and disk being provided on their periphery with engaging worm teeth to drive said disk and abutment in synchronism, and a fluid inlet and outlet, substantially as described.

5. In a rotary engine, the combination of a high pressure and a low pressure cylinder each comprising an annular cylinder, a rotary piston disk mounted on a common shaft, a plurality of pistons disposed on the periphery of said disk at an angle thereto, a rotary abutment disposed in a plane at right angles to said disk and provided with angular slots permitting of the passage of said pistons therethrough, gearing between the periphery of said disk and abutment for driving the same in synchronism, the pistons of said cylinders being disposed at opposite angles relative to each other, means for introducing fluid to said high pressure cylinder between one of its pistons and its rotary abutment, means for directing the exhaust of said high pressure cylinder to said low pressure cylinder between its piston and abutment, means for exhausting from said low pressure cylinder, and balancing means for said abutment members dis-

posed on the sides thereof opposite to the injected pressure thereon, substantially as described.

6. In a rotary engine, the combination of a high pressure and a low pressure cylinder each comprising an annular cylinder, a rotary piston support provided with a piston projecting in said cylinder, an abutment member rotatably mounted in a plane at right angles to said piston support and projecting in said cylinder, said abutment member being provided with an open ended slot to allow the passage of said piston therethrough, means for conjointly rotating said piston support and abutment in synchronism, a valve 33 with a conduit leading to the front of said high pressure abutment, a valve 34 with a conduit leading to the rear of said high pressure abutment, a valve 34^a with a conduit leading to the rear of said low pressure abutment, a valve 33^a with a conduit leading to the front of said low pressure abutment, a conduit between said valve 33 and said valve 34^a, a conduit between said valve 34 and said valve 33^a, a conduit leading from said valves 33^a and 34^a, and means for rotating said valves in unison to start, stop or reverse the engine, substantially as described.

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

JULES F. DUBUS.

Witnesses:
N. CURTIS LAMMOND,
J. S. GINSTA.