J. MARKS.

ROTARY ENGINE.

APPLICATION FILED OCT. 31, 1908.

939,729.

Patented Nov. 9, 1909.

5 SHEETS—SHEET 1.

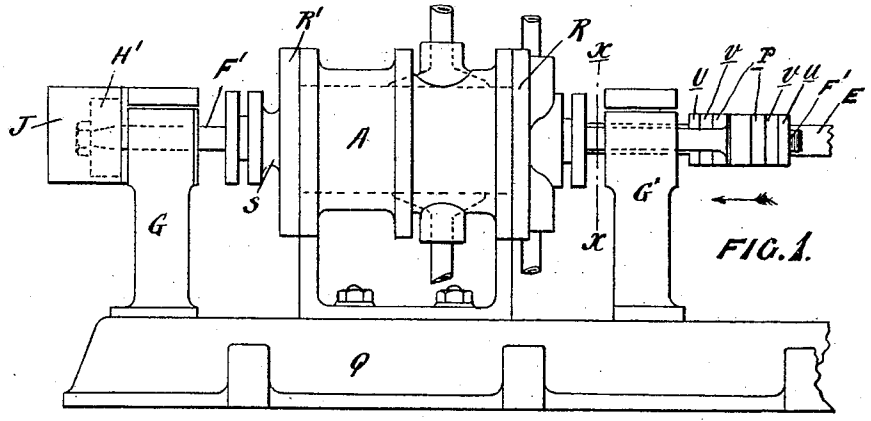

FIG. 1.

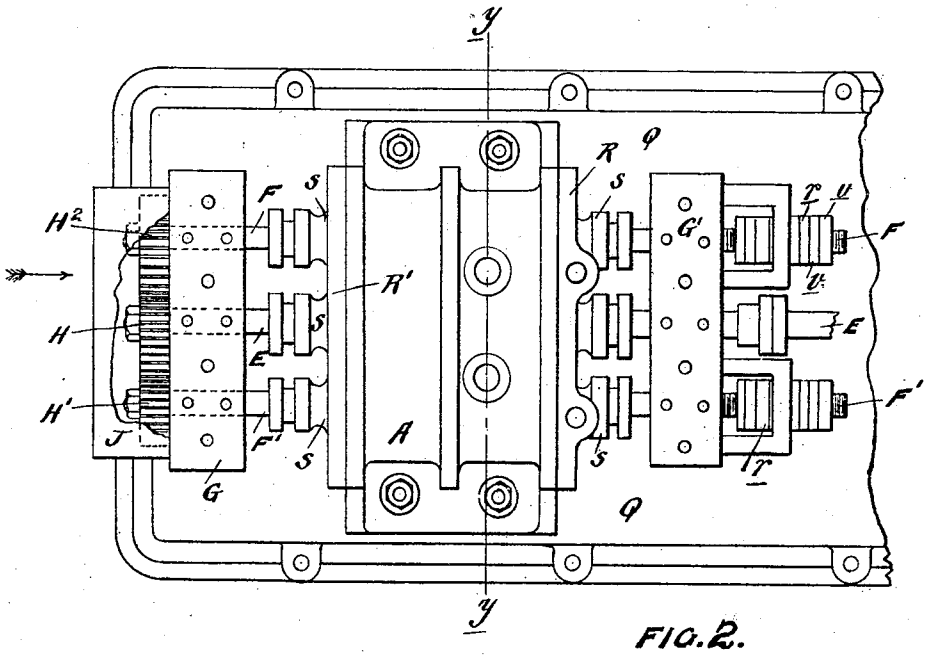

FIG. 2.

Witnesses,

C. D. Kesler

Inventor

John Marks

By

James L. Norris

Atty.

J. MARKS.

ROTARY ENGINE.

APPLICATION FILED OCT. 31, 1908.

939,729.

Patented Nov. 9, 1909.

5 SHEETS—SHEET 2.

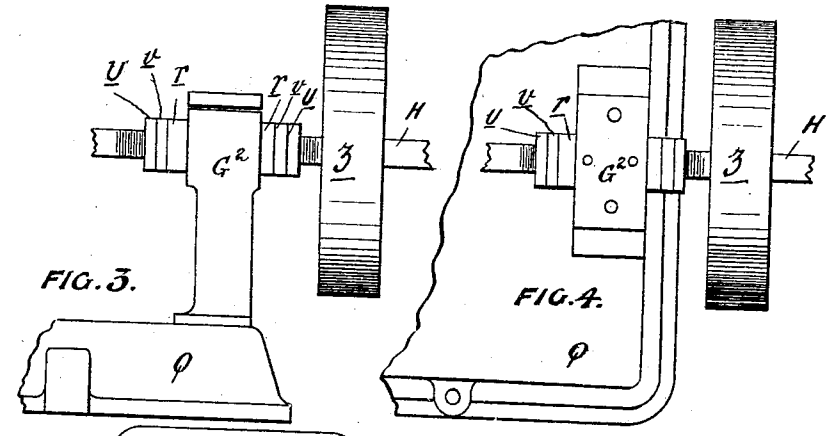

FIG. 3.

FIG. 4.

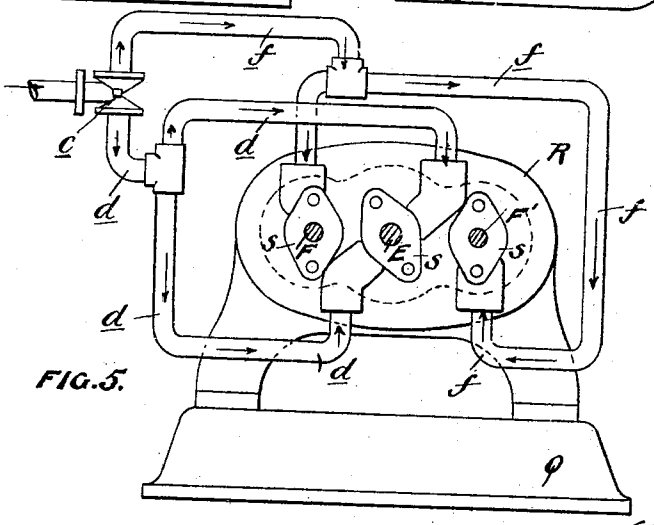

FIG. 5.

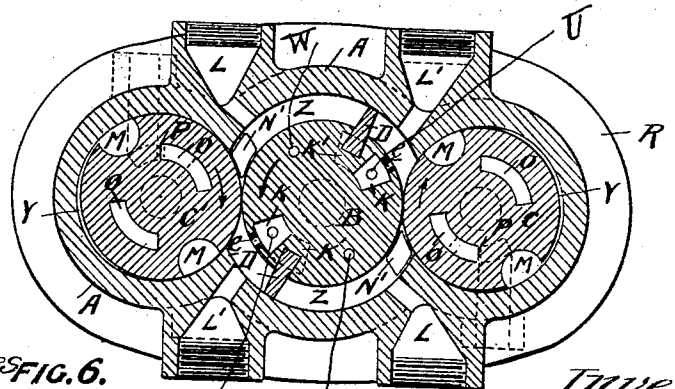

FIG. 6.

Witnesses

W. B. Kesler

Chas. O. Kesler

Inventor

John Marks

By

James L. Norris

Atty.

J. MARKS.

ROTARY ENGINE.

APPLICATION FILED OCT. 31, 1908.

939,729.

Patented Nov. 9, 1909.

5 SHEETS—SHEET 3.

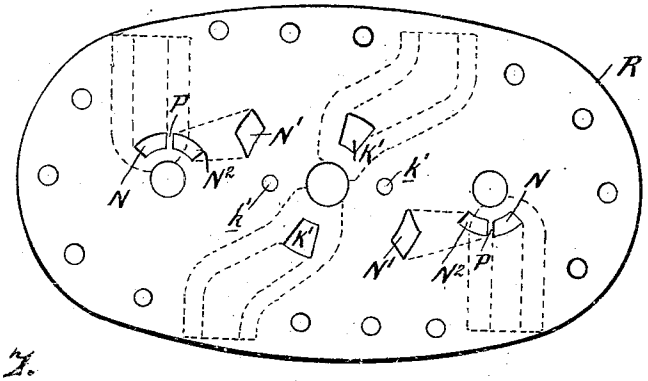

FIG. 7.

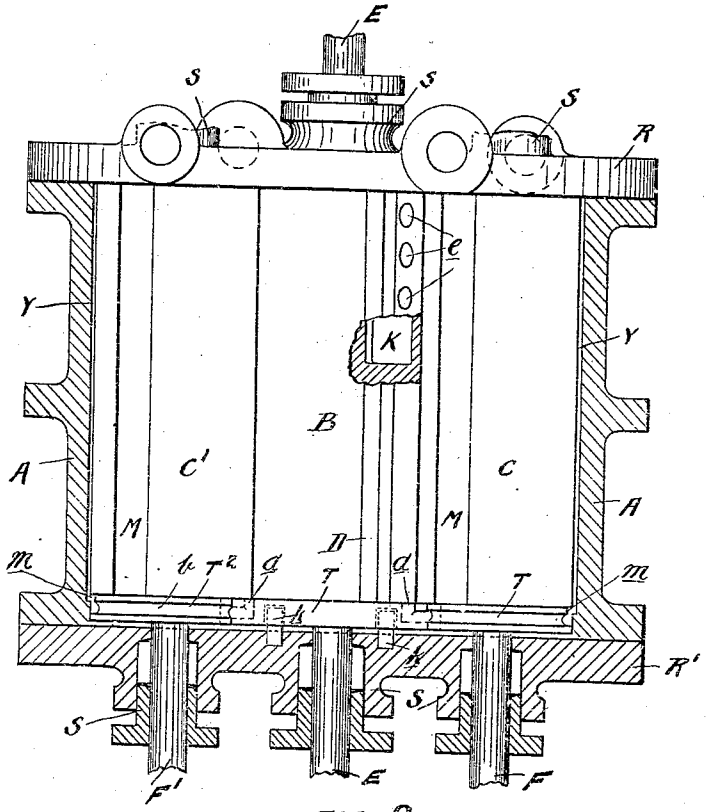

FIG. 8.

Witnesses:

Inventor

John Marks

James L. Norris

Atty

J. MARKS.

ROTARY ENGINE.

APPLICATION FILED OCT. 31, 1908.

939,729.

Patented Nov. 9, 1909.

5 SHEETS—SHEET 4.

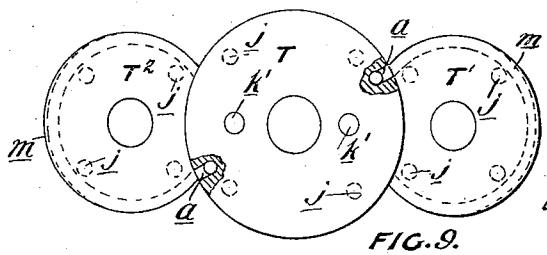

FIG. 9.

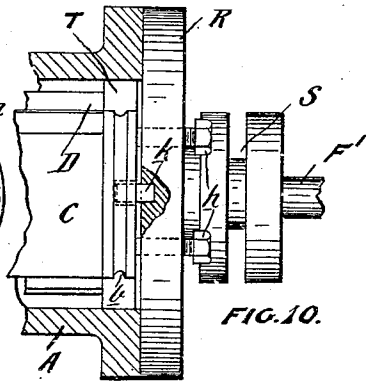

FIG. 10.

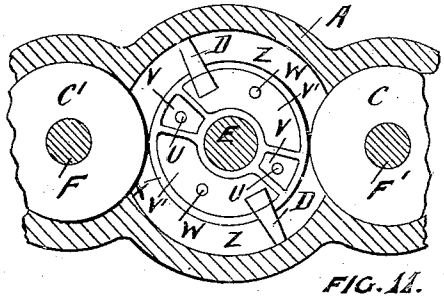

FIG. 11.

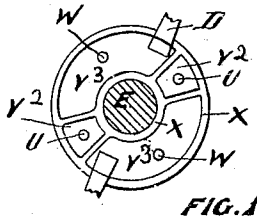

FIG. 12.

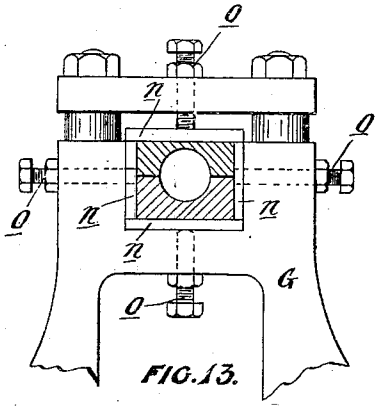

FIG. 13.

Witnesses:

J. B. Kesler

C. E. Kesler

Inventor

John Marks

By

James L. Norris

Atty

J. MARKS.

ROTARY ENGINE.

APPLICATION FILED OCT. 31, 1908.

939,729.

Patented Nov. 9, 1909.

5 SHEETS—SHEET 5.

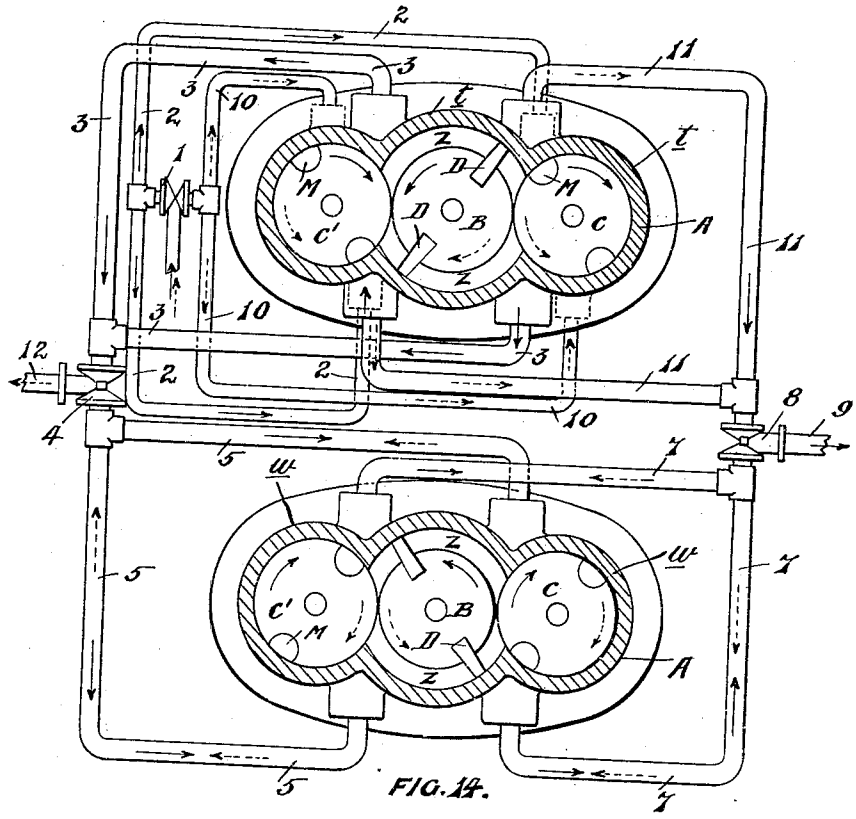

FIG. 14.

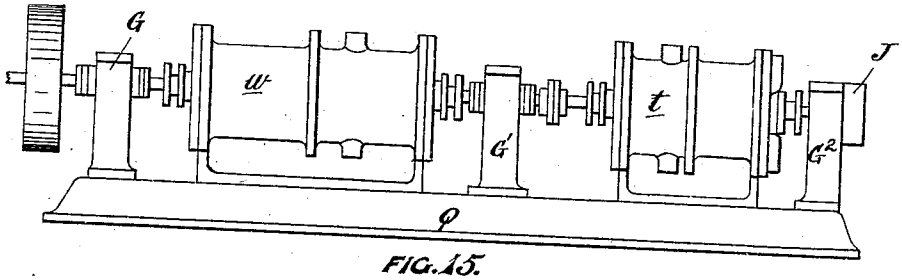

FIG. 15.

Witnesses

E. B. Kelly

E. D. Kesler

Inventor

John Marks

By

James L. Norris

Atty

UNITED STATES PATENT OFFICE.

JOHN MARKS, OF DEVONPORT, NEW ZEALAND.

ROTARY ENGINE.

939,729. Specification of Letters Patent. Patented Nov. 9, 1909.

Application filed October 31, 1908. Serial No. 460,519.

To all whom it may concern:

Be it known that I, JOHN MARKS, a subject of His Majesty the King of the United Kingdom of Great Britain and Ireland, resident of Devonport, in the provincial district of Auckland and Dominion of New Zealand, engineer, have invented a Rotary Engine, of which the following is a specification.

This invention relates to improvements in steam engines whereby a high speed is obtainable combined with a quick and ready means of reversing the engine so that its movement in one direction can be changed immediately, or almost immediately to a movement in the opposite direction, while at the same time with either movement or change from one to the other a prefect and continued economy of steam will be maintained.

The engine is of the rotary type and, as shown in the drawings, it has three rollers which work within a casing body. The center roller or piston has an abutment roller on each side of it and is itself the power receiver and distributer. The three rollers are each mounted on a shaft, which shafts are mounted in adjustable bearings. Cog-wheel connections, inlet and outlet ports, vanes, recesses, grooves and the various other parts forming the engine or fitted as adjuncts thereto are set out in detail hereunder and particularize its construction and action.

The drawing accompanying this specification shows fifteen figures of which—

Figure 1 is an outside elevation of the engine with the end bearing and fly wheel broken away, Fig. 2 is a plan view of the same, Fig. 3 is an elevation of those parts omitted from Figs. 1 and 2, namely, bearing and fly wheel, Fig. 4 is a plan of the same, Fig. 5 is an end elevation of engine taken through x—x looking in direction shown by arrow on Fig. 1 and particularly illustrating the lead of steam pipes to engine, Fig. 6 is a sectional elevation of engine, through y—y, Fig. 2, looking in the direction shown by arrow in said figure and particularly illustrating the relative positions of the steam ports in the rollers and steam ports in the end cover, Fig. 7 is an elevation of the inside of one of the casing heads and particularly showing the positions of the ports through which steam passes to drive the piston in one or the other direction, Fig. 8 is a sectional plan of the casing only showing the rollers and front casing head in full, Fig. 9 is an end elevation of roller adjusting plates and particularly illustrating the method of conveying steam to the outside of the abutment rollers for equalizing or counter-balancing the pressure on such rollers, Fig. 10 is a part sectional elevation of the casing with the plates shown in Fig. 9 and the back casing head shown in full, Fig. 11 is a sectional elevation through the casing at its front end showing the piston roller in full and particularly the recesses formed in its end and the four communicating holes which convey steam through the piston for the purpose of counter-balancing the steam pressure on its opposite ends, Fig. 12 is a view of the opposite end of the piston to that shown in Fig. 11 and illustrates like recesses therein. Fig. 13 is an elevation of an adjustable bearing showing the bearing brasses in section, Fig. 14 is a diagram illustrating the method of compounding the engine, and Fig. 15 is an outside elevation of engine illustrating the positions of cylinders and other parts when the engine is compounded.

The engine has a casing A which incloses the rotary piston B and the two abutment rollers C and C′ placed one on each side of the piston B. Between the casing A and the periphery of the piston B is an annular space Z into which steam enters to act on and rotate the piston. Two longitudinally disposed vanes D are fixed to the piston B on diametrically opposite sides, they being dove-tailed thereinto or otherwise suitably secured to it. These vanes D extend across the annular space Z and bear steam tight against the inner wall of the casing A. The piston B and the abutment rollers C and C′ are respectively mounted on shafts E, F, and F′, rotatable in adjustable bearings G, G′ and G^2 fixed to a bed plate Q. The outer ends of the shafts E, F and F′ are provided with cog-wheels H, H′ and H^2 geared to one another, the two outer cog-wheels H′ and H^2 being rotated by the center cog-wheel H, the three cog-wheels preferably running in an oil box J in which they will be immersed in suitable lubricating oil.

The piston B is provided with two inlet ports K which are adapted to communicate with like shaped inlet ports K′ formed in the casing head R. Outlet ports L and L′ are made through the casing A from the annular space Z for exhaust steam to pass

through. Each of the abutment rollers C and C′ on the opposite sides of the piston B is in contact therewith and remains in such contact throughout its rotation except where the peripheries of the abutment rollers are broken in two grooves or recesses M into which the vanes D project as the piston and rollers rotate.

Inlet ports N and N′ are provided in the casing head R where it abuts against the ends of the rollers C and C′. These inlet ports are each formed in two sections separated on the inside of the casing head by bridges P. The inner sections of the ports have inlets N^2 near the bridges P and outlets N′ into the steam space Z. In the rotation of the abutment rollers C and C′ the ports O and O′ in their ends extend over the bridges P and complete the communication between the two parts of the ports N. The casing ends R and R′ are provided with packing glands S for incasing the shafts E, F and F′, plates T, T′ and T^2 are also provided for adjusting the three rollers B, C and C′.

To produce an equilibrium of pressure on each end of the piston B, holes U are bored from each of the inlet ports K in one end of the piston to its other end and recessed faces V and V^3 are formed on both ends of equal face area, the holes U conveying steam from inlet ports K to the other end of the piston B. Two other holes W are also bored through the piston and open into recesses V′ and V^2 which are sunk into both ends of the piston B to further produce equilibrium while the inlet steam is cut off from the annular space Z. Steam tight margins and ridges X are provided on both ends of the piston B to prevent steam from passing into annular space Z when the steam is not required. To prevent resistances between the casing A and the abutment rollers C and C′ spaces Y are made in the casing adjacent the sides of the abutment rollers opposite the piston B, and these spaces Y are supplied with motor fluid from the annular space Z through ports *a* in the adjustable plate T and around grooves *b* formed on the peripheries of the adjustable plates T′ and T^2.

In Fig. 6, the engine is shown at the point of taking steam to rotate in the direction indicated by the arrow. For this purpose steam will enter from the boiler through the two-way valve *c* along the pipes *d* shown in Fig. 5 to ports K′ shown in Fig. 7, thence into ports K formed in the piston B shown in Fig. 6 and out through holes *e* shown in Fig. 8, into the annular space Z shown in Fig. 6 pressing against the vanes D and rotating the engine in the direction of the arrows shown in Fig. 6. When the ports K have passed the ports K′ the steam is cut off, finally the steam exhausts through the ports L (when vanes D pass such ports) to the atmosphere or to a low pressure engine where compounding engines are used.

For reversing the rotation of the engine the two-way valve *c* is opened so as to allow the steam to pass along pipes *f* shown in Fig. 5 and into ports N shown in Fig. 7 which are formed in the casing head R and when the ports O in the ends of the abutment rollers C and C′ are brought by their movement over the ports N and the inlets N^2 of the inner sections of said ports N, steam will thus be enabled to pass from the outer section of ports N to N^2 over bridges P, thence along the inner sections to outlets N′ into the annular space Z, the steam thereby pressing against the back of the vanes D and so revolving the engine. Steam is cut off when the port O ceases to connect the ports N and N^2. When the steam has done its work it exhausts through the outlets L′.

The arrangement of exhaust pipes is exactly the same as the arrangement of the steam pipes *d* and *f* shown in Fig. 5 with a two-way valve similar to valve *c*. In Fig. 6 the engine is shown at the point of cut off for the rearward movement.

The recesses M are formed in the abutment rollers C and C′ to allow the vanes D to pass such rollers. The shafts E, F and F′ of the three rollers B, C and C′ are connected by the geared cog-wheels H, H′ and H^2 as shown in Figs. 1 and 2.

The end adjusting plates T, T′ and T^2 are fitted to the engine as shown in Fig. 8 and are formed as shown in Fig. 9. Four screws *h* bear on each of the plates T, T′ and T^2 at points *j* indicated by dotted circles, these plates T, T′ and T^2 and screws *h* are used for adjusting the piston B and abutment rollers C and C′ for end play by screwing the screws *h* up when the engine is warmed. Two pins K′ are fitted to the casing end R and fit into holes *k*′ in the center plate T thereby preventing it from revolving with engine.

The two right angle ports *a* shown in Figs. 8 and 9 are formed in the center plate T communicating with the annular space Z. Grooves *b* are formed around the peripheries of the plates T′ and T^2 so that steam from the annular space Z enters through the right angle ports *a* and runs around these grooves *b*. The casing A is bored somewhat eccentric where the abutment rollers are seated leaving a space as shown at Y in Figs. 6 and 8. The inside flanges of the plates T′ and T^2 are slightly reduced at *m* to correspond with the eccentric bore Y of casing A thus allowing the steam which is around the grooves *b* to pass into the bore Y and equalize the pressure on the outside of the abutment rollers C and C′ when the engine is going ahead.

For equalizing end pressure shown in Figs. 11 and 12 four holes U and W are

bored longitudinally through the piston B and recesses V and V′ about one sixteenth of an inch deep are formed as shown in Figs. 11 and 12 at front end of the piston B with corresponding recesses V^2 and V^3 at its back end. The recesses V and V′ get filled with steam as they are in communication with the ports K shown in Fig. 7, such steam passes through holes U and W to the recesses V^2 and V^3 at back end and thus whatever pressure of steam there is on front end of the piston B, a like pressure is produced on its back end.

Four plates *n* are fitted to the adjustable bearing shown in Fig. 13 one at top one at bottom and one each at sides of brasses and adjusting screws *o* bear on these plates as shown and adjust bearing in desired direction.

To set the engine for forward rotation steam is let in through the inlet ports K′ in the casing head R and from them into the inlet ports K in the piston B and therefrom into the annular space Z where, pressing on the vanes D the latter are rotated with the piston B and carried around in the annular space Z until they approach the grooves or recesses M in the rollers C and C′ passing the exhaust or outlet port L just before entering said recesses thereby permitting the steam space Z to empty. In the rotation the inlet port K′ is cut off automatically before the vane D reaches the outlet port L. To obtain the rearward movement steam is projected through the inlet ports N provided for that purpose in the casing head thence to the ports N^2 and finally to port N′ by the communication ports O in the abutment rollers C and C′. The steam let in through the inlet ports N in the casing head R is thereby directed through the ports N′ into the annular space Z and gives the rearward movement.

This engine can be compounded or used with triple expansion. The following description explains the necessary connections for effecting compounding the engine and so on. In the compounded type, the engine has a high pressure cylinder *t* and a low pressure cylinder *w*. Steam is supplied to the high pressure cylinder *t* from any suitable boiler through a two-way valve 1, into the pipes 2 for forward rotation, thence ports K′ of the high pressure cylinder *t*. The arrangement of this cylinder *t* is identical with the ordinary simple form as shown in Fig. 6 the steam on entering the annular space Z between the casing A of the cylinder *t* and the piston B acts on the vanes D causing the piston B to revolve in direction indicated by arrow in Fig. 14. Steam is cut off by the same method as previously explained in relation to the simple form of engine, and exhausts in the same manner to the high pressure exhaust pipes 3 then passes through a two-way valve 4 along the pipes 5 to the steam inlet K′ of the low pressure cylinder *w*. The low pressure cylinder *w* may or may not have ports in the casing head R and piston B′ and abutment rollers C and C′ and may merely have steam inlets and exhausts at the points where the pipes 5 and 7 meet the casing A of this cylinder *w* as is shown in Fig. 14, but if thought desirable ports may be provided as is already described in connection with the simple engine. Steam on entering the low pressure cylinder *w* causes the roller B to revolve as in the other form and exhausts in the usual way to the pipes 7 then through the two-way valve 8, to the final exhaust pipe 9 which may be connected to condenser.

To reverse the engine the two-way valve 1 is opened so as to allow the boiler steam to pass along the pipes 10 to the inlets N which are arranged with the ports bridges and passages as in the simple form of engine already described, steam entering the annular passage Z and forcing the roller B around. The steam exhausting in the usual way to the pipes 11, passing thence through the two-way valve 8 then along the pipes 7 into the annular space Z of the low pressure cylinder *w* forcing the piston B around in the usual way steam exhausting through the pipes 5 and through the two-way valve 4 to the pipe 12 which is connected to condenser.

It will be seen that when the high pressure cylinder *t* is taking steam on the steam side of vanes D, the vanes D in the low pressure cylinder *w* have opened the exhaust to condenser, and thereby allows a vacuum to act through the annular space Z on to the exhaust side of the vanes D in the high pressure cylinder *t* and therefore there is never any back pressure in such high cylinder *t* as with the usual form of engines and turbines.

It will be understood that the engine shown in Fig. 14 is in diagrammatic form the actual arrangement of such engine is shown in Fig. 15 where it will be seen that the high pressure and low pressure engines are made of equal diameters, but the low pressure engine is made proportionately longer than the high pressure, one set of gear wheels H H′ and H^2 only being used for the two engines.

The adjustable bearings G, G′ and G^2 are fitted with adjustable collars *u v* and *r* shown in Figs. 1, 2, 3, and 4, the collars *u* are loosely fitted on the shafts E F and F′ and bear against the adjustable bearings G G′ and G^2, being kept in position by the collars *v* which are threaded internally and screw on to the shafts G G′ and G^2. The collars *r* are likewise screwed internally and act as lock collars to the collars *v*.

The engine is mounted on a bed plate Q and is fitted with a suitable fly-wheel *z* attached to shaft E. It will be understood

that in every case the piston B, with its vanes D, is the motive power of the engine, the abutment rollers C and C′ performing the duty of confining the steam within the annular space Z and the ports in such rollers serving to distribute the steam when the engine is turning rearwardly. The shaft E may be fitted with pulley wheel, or may be connected direct or by gearing to the machinery it is desired to drive.

Having fully described my invention what I desire to claim and secure by Letters Patent is:—

1. A rotary engine comprising a casing having exhaust ports, a rotatable piston therein spaced from the wall of the casing and provided on its periphery with diametrically disposed radial vanes and in one end with longitudinal inlet ports opening laterally into the space between the piston and the casing, a recessed roller abutment on each side of said piston having ports in one end, and a casing head having inlet ports registering with the ports in the piston end and other inlet ports opening directly into said space, the ends of the abutment ports having ports to control the passage of motive fluid through the latter ports.

2. A rotary engine comprising a casing having exhaust ports, a rotatable piston therein spaced from the wall of the casing and provided on its periphery with vanes and in one end with longitudinal inlet ports opening laterally into the space between the piston and casing, a recessed roller abutment on each side of said piston having ports in one end, a casing head having inlet ports registering with the ports in the piston and other inlet ports opening directly into said space, the rollers having ports in their ends to control the passage of motive fluid to the latter ports, and an independent adjustable plate between the piston and each abutment and the casing to hold the ported ends of said parts tight against the casing head.

3. A rotary steam engine comprising a casing, having exhaust ports, a rotatable piston therein spaced from the wall of the casing and provided with peripheral vanes and longitudinal inlet ports in one end opening laterally into the space between the piston and casing, a recessed roller abutment on each side of said piston having ports in one end, and a casing head having inlet ports registering with the ports in the piston through which motive fluid enters to turn the piston in one drection and other inlet ports opening directly into said space for the admission of motive fluid to turn the piston in the opposite direction, the abutment rollers, having ports in their ends to control the latter ports, the ends of the piston having recesses formed therein and connected together to preserve the balance of pressure and means connecting said recesses with a space between the casing and each abutment roller on the side opposite the piston.

4. A rotary steam engine comprising a casing having exhaust ports, a rotatable piston therein provided with inlet ports in one end opening laterally into the space between the piston and casing, a recessed roller abutment on each side of said piston, a casing head having inlet ports registerable with the ports in said piston, an independent adjustable plate between the piston and abutments and the casing for holding the ends of said parts steam tight against the casing head, said piston having its ends recessed and connected by holes for the passage of the motive fluid to balance the pressure, and passages and channels in said adjustable plates to conduct the motive fluid from the recesses in the adjacent piston end to a space between the casing and each abutment roller on the side opposite the piston.

5. A rotary engine comprising a casing having exhaust ports and a casing head provided with two sets of inlet ports, a centrally disposed rotatable piston and an abutment roller on each side thereof geared to said piston, one set of said inlet ports adapted to connect direct with ports in one end of said piston at certan predetermined points in its rotation to permit motive fluid to enter and rotate the piston in one direction, the other set of inlet ports which enable the direction of rotation of the engine to be reversed when motive fluid passes therethrough, to connect with ports in one end of each abutment, which abutment ports, at the proper time also connect with continuations of said other set of ports in the casing head that open into the space surrounding the piston, and independent adjustable means for holding the piston and abutment rollers tight against the casing head.

6. A rotary engine comprising a casing, a centrally disposed rotatable piston therein, an abutment roller on each side of said piston, one end of said piston and each abutment roller having ports therein, a casing head having a set of motive fluid ports registerable with the ports in the piston end and adapted to rotate said piston in one direction, and a separate set of motive fluid inlet ports in said casing head registering with the ports in the ends of the abutment rollers for causing the piston to rotate in the opposite direction when motive fluid is admitted thereto.

JOHN MARKS.

Witnesses:
GEORGE WILLIAM BASLEY,
HILDA MAY FROUDE.