No. 766,053. PATENTED JULY 26, 1904.

P. R. MATTOCKS & J. L. GRAFFLIN.

VALVE.

APPLICATION FILED JULY 23, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1

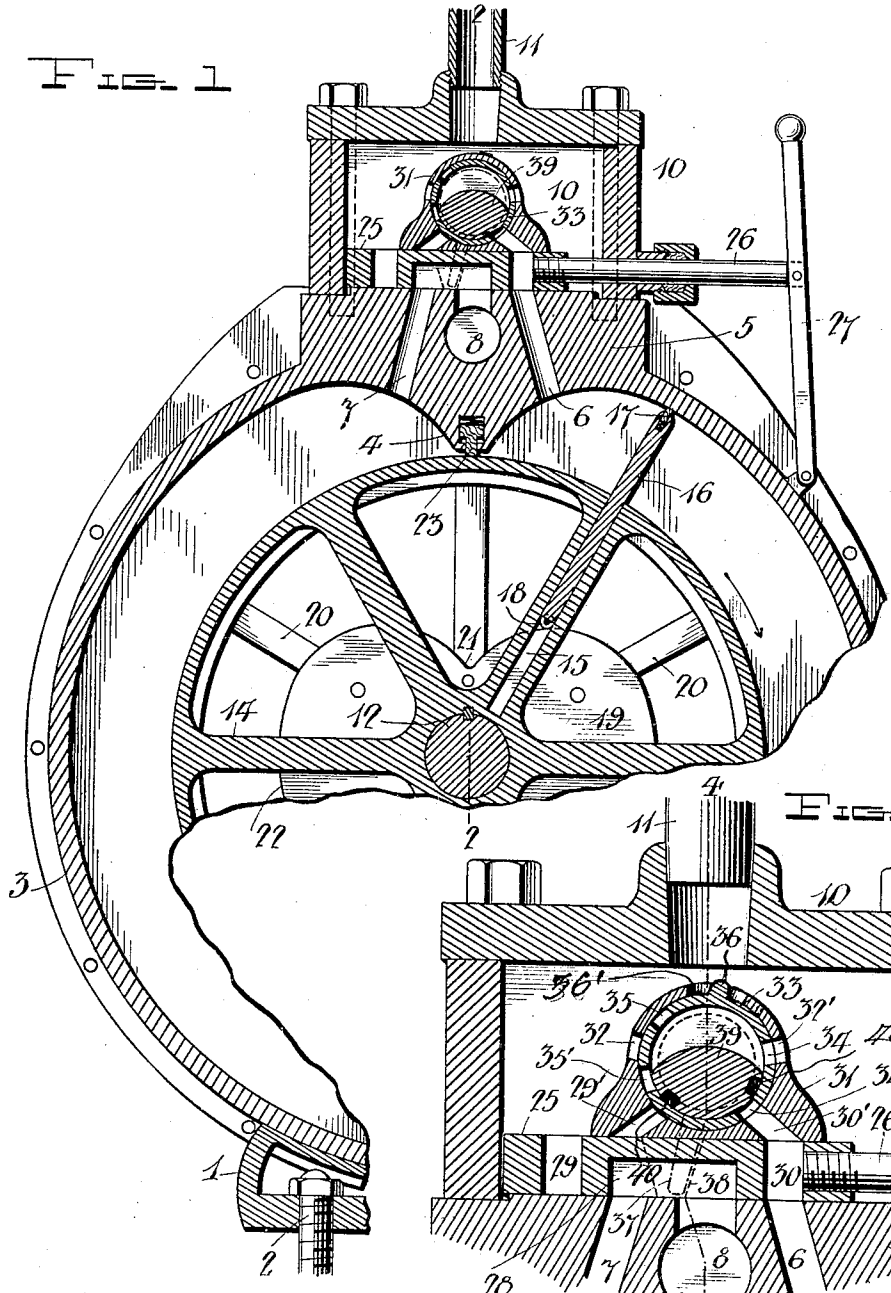

Fig. 3

Witnesses

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2

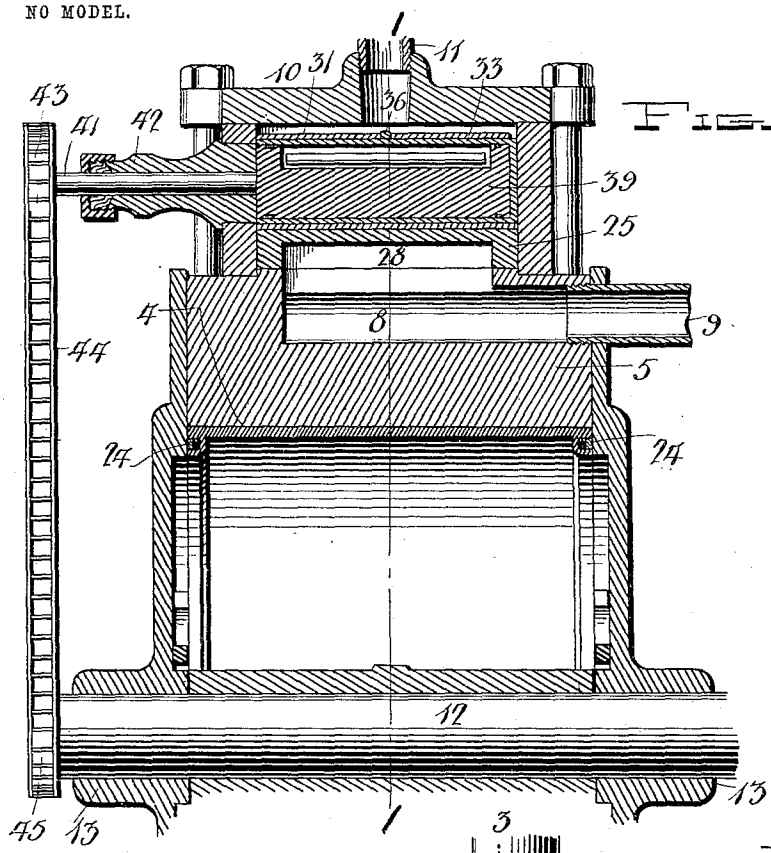
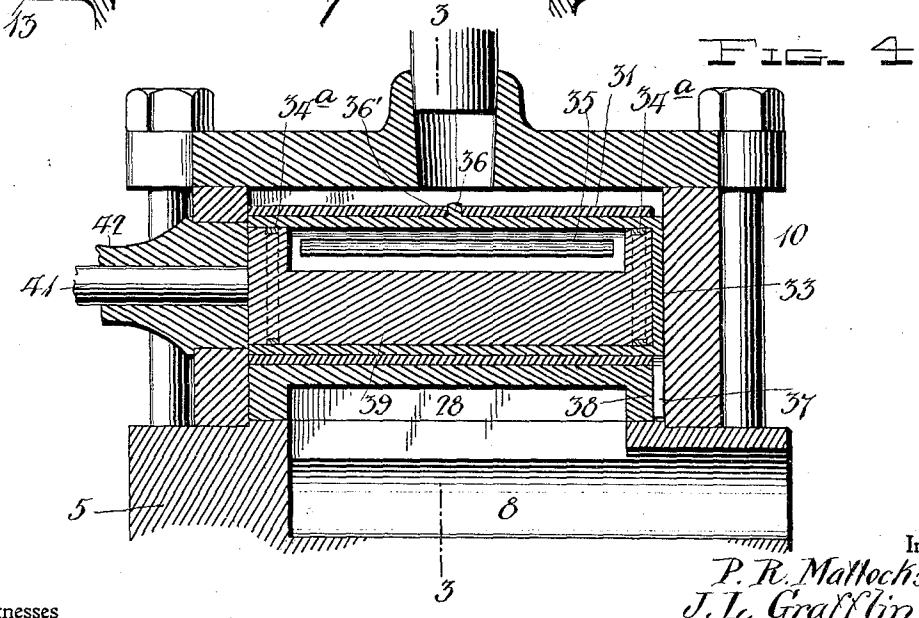


Fig. 4



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UNITED STATES PATENT OFFICE.

PAUL RAYMOND MATTOCKS, OF HIGHPOINT, AND JOHN LEWIS GRAFFLIN, OF WILMINGTON, NORTH CAROLINA.

VALVE.

SPECIFICATION forming part of Letters Patent No. 766,053, dated July 26, 1904.

Application filed July 23, 1903. Serial No. 166,730. (No model.)

To all whom it may concern:

Be it known that we, PAUL RAYMOND MATTOCKS, residing at Highpoint, in the county of Guilford, and JOHN LEWIS GRAFFLIN, residing at Wilmington, in the county of New Hanover, State of North Carolina, citizens of the United States, have invented certain new and useful Improvements in Valves; and we do 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 controlling valve mechanism for rotary or reciprocating steam-engines, and has for its object to provide co-acting valve devices which are simple in construction and efficient in action for reversing the engine and controlling the supply and exhaust of steam through the reversing-valve for either direction of travel of the piston.

In the accompanying drawings, Figure 1 is a fragmentary central section, through the cylinder and steam-chest, of a rotary engine on a line at right angles to the engine-shaft, the plane of section being indicated by the line 1 1 of Fig. 2, showing the valve-gearing set to control the travel of the piston in the direction of the arrow. Fig. 2 is a section on line 2 2 of Fig. 1. Fig. 3 is an enlarged section through the steam-chest and valve mechanism on line 3 3 of Fig. 4, and Fig. 4 is a section on line 4 4 of Fig. 3.

Referring now more particularly to the drawings, the numeral 1 represents the engine-base, which is adapted to be secured to a suitable foundation (not shown) by bolts 2 and which supports the engine-cylinder 3. This cylinder internally is nearly circular in form, the circular formation being broken at one point in the circumference by curving and projecting the central wall of the cylinder inward to form an abutment 4, which constitutes part of an enlargement 5. In this enlargement 5 are formed ports or passages 6 and 7 for the supply and exhaust of steam and an exhaust port or passage 8, which latter communicates with a laterally-projecting exhaust-pipe 9. These ports are in open communication with a steam-chest 10, and the port 8 lies between the said two ports 6 and 7.

A steam-supply pipe 11 communicates with the chest and leads in practice from a suitable source of steam-supply. Arranged within the steam-chest is valve mechanism for controlling the supply and exhaust of steam to and from the cylinder, as will be hereinafter described.

The engine-shaft 12 is journaled to rotate in bearings 13, formed on the sides of the cylinder 3, and has keyed thereto a piston-wheel 14, consisting of a hub connected to the shaft, a series of arms radiating from said hub, and a rim or periphery carried by said arms. One of the arms of the wheel is enlarged and recessed to form a radially-extending chamber 15, which opens through the rim or periphery of the wheel and has slidably fitted therein a piston-wing 16, provided at its outer end with a spring-actuated packing-strip 17 for maintaining a steam-tight connection with the internal periphery of the cylinder and at its inner end with rollers 18, which are engaged by cams 19 to control the sliding movements of said wing. As shown, the cams 19 are bolted or otherwise suitably fastened to arms or bracing-ribs 20, formed on the sides of the cylinder, and are formed immediately below the abutment 4 with recesses 21 to allow the piston-wing 16 to move within its chamber 15 to pass said abutment. That portion of the working edge or surface 22 of each cam between the ends of the recess 21 is of such a shape or curvature as to hold the piston-wing 16 projected and in intimate contact with the wall of the cylinder, except at the point where the abutment breaks the circular continuity thereof, the packing-strip 17 serving to take up any clearance-space and to maintain at all times a steam-tight connection. The abutment-point 4 is also recessed for the reception of a packing-strip 23, pressed outward by a suitable actuating spring or springs to engage the periphery of the piston and prevent the direct passage of steam from one side of the cylinder

to the other between the piston and abutment-point.

In order to further provide for a steam-tight fitting of the piston, the rim or periphery of the same is formed in its opposite side edges with recesses to receive packing-strips 24, which maintain a steam-tight connection between the piston and side walls of the cylinder. These packing-strips are also preferably pressed outward by the action of suitable springs.

In the operation of the engine it will of course be understood that when the steam is admitted through one of the ports 6 or 7 the other becomes the exhaust-port. Assuming that the port 6 is used for the purpose of supply, the piston-wing 16 when passing to the right of the abutment-point 4 will be forced outward gradually by the working edges 22 of the cams 19, forming a pocket between it and the abutment-point, into which the steam from the port 6 enters and which impinges against the piston-wing, thereby propelling the piston-wheel to the right, the impact of the steam being followed by its expansion, whereby both the direct impelling force and expansive action of the steam are utilized to drive the piston, and this action is continuous under the admitted charge until the piston-wing 16 has made one complete revolution and passed the port 7, whereupon the steam exhausts through said port and the port 8 and pipe 9 to the atmosphere, and a new supply of steam is admitted through the port 6 and the operation proceeds as before.

When the piston is revolving in the opposite direction, steam is admitted through the port 7 and impels the piston-wheel to the left, and exhaust takes place through the ports 6 and 8 and pipe 9.

Arranged in the steam-chest 10 is a reversing slide-valve 25, connected to an exteriorly-projecting stem 26, operated by hand-lever 27. This valve is provided with a central cavity 28, formed in its under side and with end ports 29 and 30. These ports are so disposed that when the valve is arranged as shown in Fig. 1, in which the piston-wheel is represented as being adapted to revolve to the right, the port 29 will be blank, while the port 30 will connect the port 6 with the steam-chest, and the cavity 28 will connect the port 7 with the exhaust-port 8. It will thus be seen that steam entering the ports 30 and 6 will act upon the piston-wheel to rotate the same to the right and will finally exhaust through the ports 7 and 8 and the pipe 9. The valve, however, may be adjusted to the right to move the port 30 out of coincidence with the port 6 and to bring the port 29 into register with the port 7 and connect port 8 with the port 6 through the cavity 28, thus allowing steam to enter the cylinder through port 7 and revolve the piston to the left and the exhaust to take place through ports 6 and 8 and pipe 9, as will be readily understood.

The two ports 29 and 30 of the reversing-valve are controlled by a governing-valve device comprising a hollow or chambered casing 31, mounted upon the reversing-valve and provided with admission-ports 32 32′ and exit-ports 29′ and 30′, which are adapted to be brought in register with the ports 29 and 30 in the reversing-valve. A rotary reversing-valve 33 is mounted to oscillate within the casing and consists of a cylinder provided at its ends with packing rings or strips 34ª for maintaining a steam-tight connection with the wall of the casing and having two sets of ports 34 34′ and 35 35′, respectively, which are adapted to coact with the ports 32′ and 30′ and 32 and 29′ to control the supply of steam to either port 6 or 7 to govern the operation of the engine in either direction. The said ports or passages are so arranged that when the ports 34 34′ are in register with the ports 32′ and 30′ the ports 35 and 35′ will be out of register with the ports 32 and 29′, and vice versa, as will be readily understood, such position of the ports being obtained by the oscillation of the valve in one direction or the other. The rotary reversing-valve 33 is limited in its oscillating movement by a stop-lug 36, projecting therefrom and working in a slot 36′ in the casing 31, the length of said slot being such that the end walls thereof serve as stops to hold the valve against movement when one or the other of the sets of ports is in register with one or the other sets of ports in the casing 31. The oscillation of the rotary reversing-valve 33 is effected by means of a connection between the same and the reversing-valve 25, such connection consisting of a lever arm 37, projecting from the rotary reversing-valve and entering the slot 38 in the reversing-valve, the construction being such that when the reversing-valve is adjusted to bring the port 30 into register with the passage 6 the ports 34 and 34′ in the valve 33 will be respectively in register with the ports 32′ and 30′ in the casing 31, while the ports 35 and 35′ of the valve 33 will be out of coincidence or register with the ports 32 and 29′ of the casing 31, as will be readily observed by reference to Figs. 1 and 3. When, however, the reversing-valve 25 is shifted, by means of the lever 27, to move the port 30 out of register with the passage 6 and to bring the port 29 into register with the passage 7, the arm 37 will be acted upon to oscillate the rotary reversing-valve 33 to the left in Fig 3, thereby moving the ports 34 34′ out of register with the ports 32′ and 30′ and bringing the ports 35 and 35′ into respective register with the ports 32 and 29′. Hence it will be seen that this adjustment of the valve will

change the direction of operation of the engine by the supply of live steam to the passage 7 instead of to the passage 6, as before, and that by such reversal the passage 7 will be made to act as the supply-passage, while the passage 6 will serve as an exhaust-passage which is in communication, through the port 28 in the reversing-valve, with the exhaust or outlet passage 8, communicating with the exhaust-pipe 9.

The supply of steam to either passage 6 or 7 is governed by a rotary admission-valve 39, mounted to rotate within said rotary reversing-valve 33. This valve 39 is preferably of elliptical form in order to occupy but a portion of the interior of said regulating-valve and to leave a space for the entrance of steam through the port 34 or 35. The valve 39 is provided with packing-strips 40 to maintain a steam-tight connection between it and the interior of the valve 33 and is connected to a stem 41, journaled in a bearing 42 and provided at its outer end with a sprocket-wheel 43, which is connected by a chain 44 with a sprocket-gear 45 on the engine-shaft 12. These gears are so proportioned that the valve 39 makes one complete revolution on each revolution of the shaft 12.

In the operation of the duplex controlling-valve it will be readily seen that when the parts are in the positions shown in Figs. 1 and 3, in which the ports and passages are so disposed that when the valve 39 uncovers the port 34′ steam will pass from the steam-chest into the regulating-valve through the ports 32′ and 34, thence through ports 34′, 30′, and 30 into the passage 6, steam will be admitted into said passage 6 once upon each revolution of the piston by the valve 39, which in its path of rotation will leave the port 34′ open long enough to admit steam into the cylinder behind the piston-wing for a period equivalent to approximately the time required by the wing to make one-third of its travel, when said valve 39 will close the port 34′ and cut off the supply of steam, allowing that previously admitted to exert an expansive action on the piston-wing for the greater part of the revolution of the piston-wheel to complete the course of travel of said wheel. The steam finally exhausts through the passage 7, valve-cavity 28, port 8, and pipe 9 to the atmosphere. On the other hand, when the valve 25 is reversed to move the port 30 out of register with the passage 6 and to bring the port 29 into register with the passage 7 the latter will act as the steam-supply port, and this reversal of the valve 25 will shift the controlling-valve 33, moving the passages 32′ 34 and 34′ 30′ out of register and bringing the ports 35 32 and 35′ 29′ into register, so that in the operation of the duplex valve steam will be admitted once upon each revolution of the engine through said latter-named ports into the port 29 and thence into passage 7 and will be cut off by the valve 39, governing the port 35′, as will be readily understood, the admitted steam rotating the piston-wheel to the left or in the reverse direction previously described, and the steam finally exhausts through the passage 6 in the valve-cavity 28 and thence through port 8 and pipe 9 to the atmosphere. It will be observed that this operation of setting the duplex valve to supply steam to one side or the other of the cylinder is entirely automatic and performed by the simple adjustment of the reversing-valve 25.

In practice the packing-strips of the duplex valve may be made adjustable, so as to automatically compensate for wear, and the construction and arrangement of parts may be otherwise modified within the scope of the appended claims without departing from the spirit of the invention.

From the foregoing description, taken in connection with the accompanying drawings, the construction and mode of operation of the invention will be readily understood, and it will be seen that it provides valve mechanism which may be employed upon both rotary and reciprocating engines for reversing the travel of the piston and correspondingly controlling the supply and discharge ports to control the inlet and exhaust of steam.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In combination with a reversing-valve provided with supply and discharge ports, a governing-valve comprising a reversing member, a connection between the reversing member and the reversing-valve, whereby said reversing member is adapted to be automatically set to control the ports in the reversing-valve by the adjustment of said reversing-valve, and an admission member controlling the supply of steam through said ports.

2. In combination with a reversing slide-valve provided with supply and exhaust ports, a ported rotary reversing-valve for controlling the supply of steam thereto, a connection between the two valves for adjusting the rotary reversing-valve simultaneously with the reversing slide-valve, and an admission-valve controlling the ports in the rotary reversing-valve.

3. In combination with a reversing slide-valve provided with supply and discharge ports, a valve-casing having two sets of steam-ports, a rotary reversing-valve therein comprising a cylinder having two sets of ports coöperating with those in the casing, one of said sets of ports being out of register with the casing-ports when the other set of ports is in register with the coacting casing-ports, a connection between the reversing slide-valve

and said rotary reversing-valve to effect the adjustment of the latter simultaneously with the slide-valve, a rotary admission-valve within the rotary reversing-valve and controlling the ports therein, and means for operating the said admission-valve from an engine-shaft, substantially as described.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

PAUL RAYMOND MATTOCKS.
JOHN LEWIS GRAFFLIN.

Witnesses:
R. H. BEERY,
EDWARD N. TENNY.