2 Sheets—Sheet 1.

A. J. L. LORETZ.

COMBINED STEAM AND CUT-OFF VALVE.

No. 169,911. Patented Nov. 16, 1875.

FIG. 1.

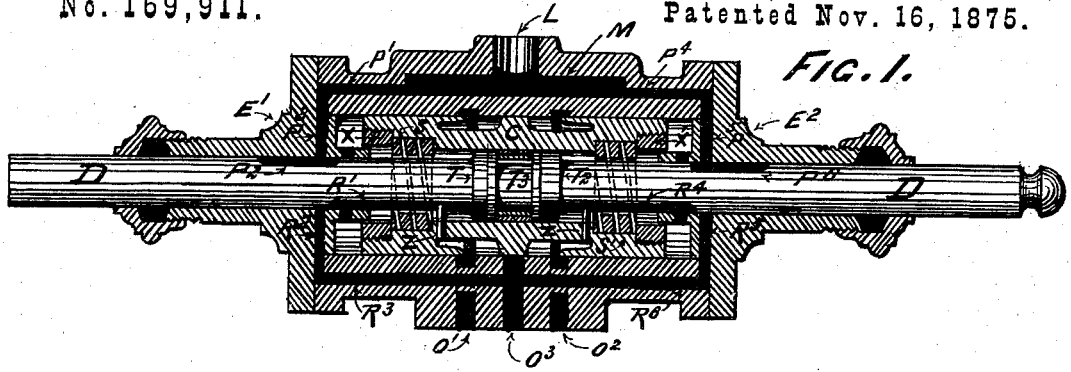


FIG. 2.

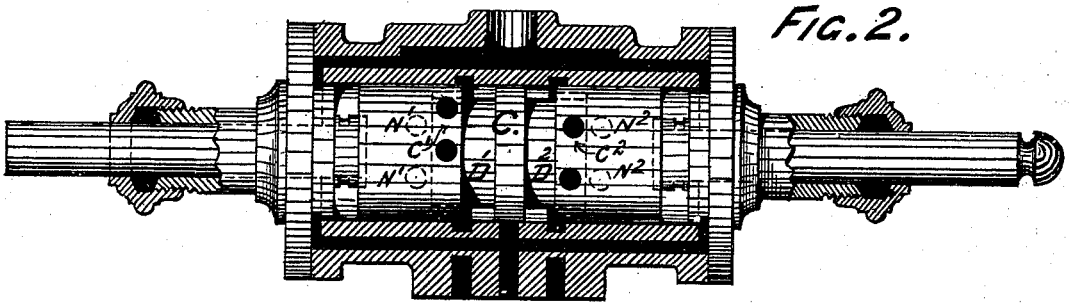


FIG. 3.

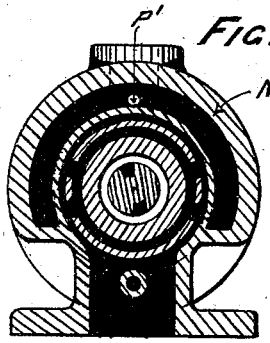


FIG. 4.

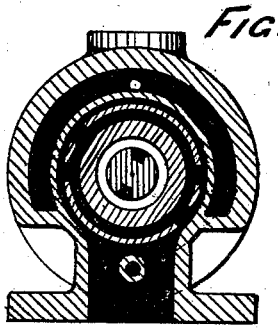


FIG. 5.

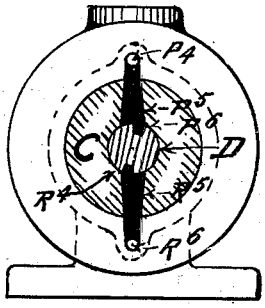
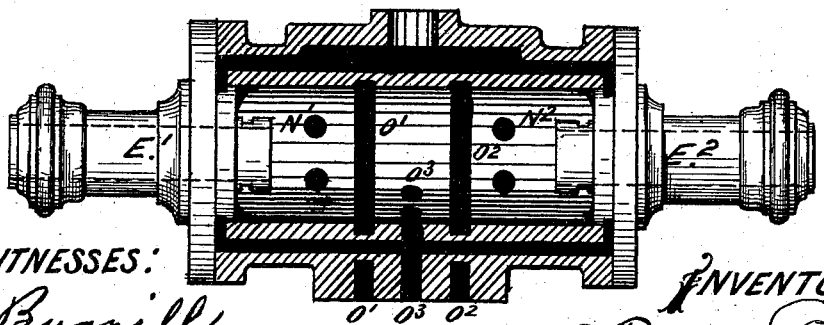


FIG. 6.



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2 Sheets—Sheet 2.

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FIG. 7.

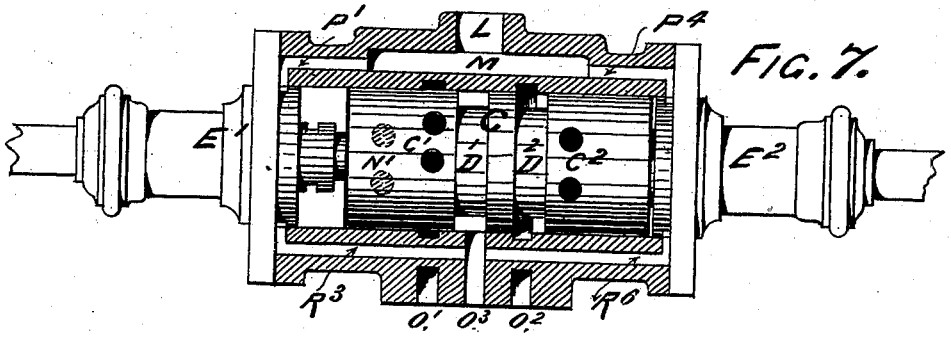


FIG. 8.

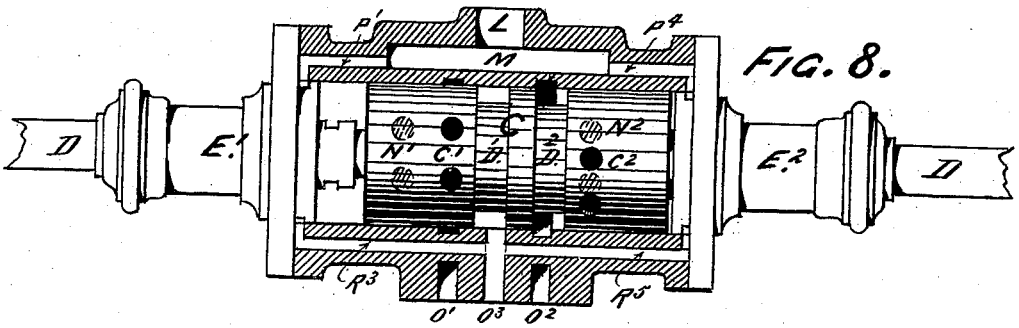


FIG. 9.

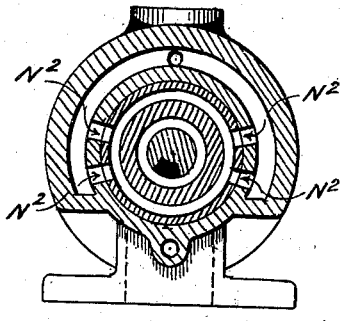


FIG. 10.

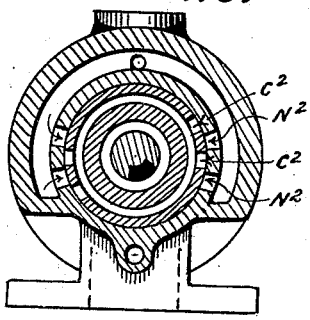


FIG. 11.

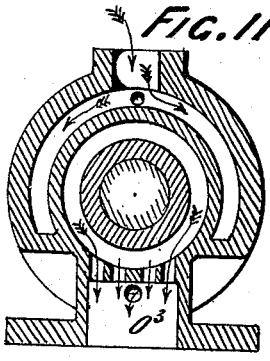


FIG. 12.

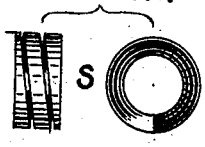


FIG. 13.

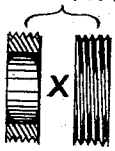
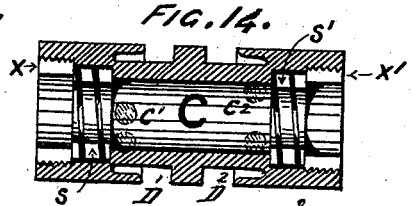


FIG. 14.



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UNITED STATES PATENT OFFICE.

ARTHUR J. L. LORETZ, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN COMBINED STEAM AND CUT-OFF VALVES.

Specification forming part of Letters Patent No. **169,911**, dated November 16, 1875; application filed September 20, 1875.

To all whom it may concern:

Be it known that I, ARTHUR J. L. LORETZ, of Brooklyn, New York, have invented an Improvement in Steam-Valves with Cut-Off Combined for Direct-Acting Engines, of which the following is a specification:

The said invention relates to an improvement in steam-valves actuated by steam, and an expansion-gear combined therewith, for the purpose of cutting off the steam or other elastic fluids at different points during the course of the piston of the engine operated by the above-named valve-gear, and is particularly applicable to engines of the direct-acting kind, where no crank and fly-wheel are used.

The invention consists in the application and improvement of certain mechanical devices for which Letters Patent were granted to me June 2, 1874, No. 151,667, and combined with additional devices, and the use for an additional purpose of certain elements.

In the above-named Letters Patent there were no provisions made for what is termed cushioning the valve or auxiliary piston, when driven to and fro against the heads of the valve-chest by the action of the steam, which causes considerable noise and wear. Neither were there any means provided against a like action of the key in the stem against the slot in the valve when the valve was operated by the momentum of the piston. Both of these defects have been overcome in the present improvement by the use of heavy springs, and other mechanical equivalents or substitutes, which will be hereafter described.

The action of the cut-off is created, first, by a slight change in the ports of the valve-chest connecting with those of the main cylinder; second, an alteration in the shape of the grooves, which are turned in the periphery of the valve and auxiliary piston, into which holes are drilled for the entrance of steam, said holes corresponding with those in the shell or valve-chest; third, an oscillating motion of the valve and stem, by any proper mechanism attached to the tappet on the piston-rod, and acting on the valve-stem, causing the corresponding holes or apertures in the shell through which the steam enters, and those in the valve connecting with the grooves, to overlap each other, by the space between the holes in the valve passing over the apertures in the shell, thereby cutting off the steam, the holes or apertures at each end of the valve-chest through which the steam enters being in a straight line opposite each other, while those on the valve connecting with the grooves in the periphery, with regard to their rectilineal position, are so arranged that the holes on one side are in a line with the spaces between those on the opposite side, the reason for thus locating the holes being that, when the steam is cut off during the course of the piston in one stroke, and the holes in chest and valve consequently lapping when the valve is thrown in its rectilineal position in the opposite direction, the holes in that last position of the valve will correspond with those in the shell, thereby admitting steam into the groove and when again twisted to cut off the steam, the openings will be in proper position for the reception of steam on the other side.

To enable others skilled in the mechanical art to construct and use my invention I will describe the construction and operation, reference being had to the accompanying drawings, which form part of this specification, as also those of the referred-to patent, so far as is necessary to make this present invention operative.

Similar letters of reference indicate similar parts.

Figure 1 is a longitudinal section of the whole arrangement in section, representing all the operative elements on the dead-lap in order to show the proper proportions of the several parts. Fig. 2 is a longitudinal section of the shell, with an exterior view of the valve and heads, representing the relative position of the holes C^1 C^2, connecting with the grooves D^1 D^2 turned in the periphery of the valve C, connecting alternately with apertures N^1 N^2 of the jacket M, and with the main ports O^1 O^2. Fig. 3 is a cross-section through Fig. 1 at a point corresponding with the letters of the latter at M T^2 O^2, representing the holes C^2, connecting with main port O^2 at a time when the exhaust passes through. Fig. 4 is a section through the same, as above, representing the valve twisted, and showing that the oscillation or cut-off motion of the valve does not affect the exit of the exhausting steam from

the main ports O^2 or O^1 into the holes C^2 or C^1, connecting with the grooves D^2 or D^1, and from thence from either of said grooves to main exhaust-port O^3. Fig. 5 is a cross-section through Fig. 1 at a point corresponding with the letters P^4 P^5 P^6 R^4 R^5 R^6, this section representing how the ports P^5 R^5 are widened from ports P^4 R^6 toward the ports P^6 R^4 on the valve-stem D, so that the oscillation of the valve C and stem D do not interfere with the passage of the steam. Fig. 6 is a longitudinal section of the valve-chest, representing more particularly the steam-apertures N^1 N^2, main ports O^1 O^2, and exhaust-port O^3. Fig. 7 represents the valve in proper position for the admission of the steam into the main port O^2, and exhausting from O^1 to O^3. Fig. 8 represents the valve twisted, the steam having been cut off by the oscillation of the valve C, and having caused the communicating apertures N^2 and C^2 to lap. Fig. 9 is a section through Fig. 7 at a point corresponding with the letters, showing the steam passing through N^2 and C^2; and Fig. 10, a cross-section through Fig. 8, corresponding with similar letters, showing the cut-off by the lapping of N^2 and C^2. Fig. 11 is a cross-section through the center of the valve-chest, showing the main exhaust-ports O^3. Fig. 12 represents the cushioning-springs S, which are made of heavy square spring-steel, their office being, as hereinafter stated, to keep the valve C from striking the heads E^1 E^2 when operated by steam or tappets T T^2 on valve-stem D, Fig. 1, which are a substitute for the key T in the referred-to patent, the springs S also acting as cushions for the tappets T^1 T^2 when the latter operate the valve C. Fig. 13 is a section and outside view of the collars X, which keep the springs S in position in the ends of valve C. Fig. 14 is a longitudinal section of the valve C, representing the manner in which the cushioning-springs S S^1 are secured by collars X; also, the shape of the grooves D^1 D^2, and the relative position of the apertures C^1 C^2, connecting with the said grooves.

The construction and operation of the valve are as follows: The steam enters the valve-chest through the nozzle L, to which the steam-supply pipe is attached, enters the chamber N, Fig. 1, filling the auxiliary ports P^1 P^4 in the valve-chest, and P^3 P^5 in the heads E^1 E^2. The valve-stem D now being moved to the right in the direction of the head E^2 (supposing the valve C to have been previously thrown to the left toward head E^1) by a tappet-connection, as described in the referred-to patent—an eccentric or any mechanism deriving its power from the piston which the said valve operates—the slot P^2 in the valve-stem will then allow the steam to enter from port P^3 into the space between head E^1 and the end of valve C, while the slot R^4, on the opposite side of the valve-stem, will open a communication between the space formed by the end of valve C and head E^2 and the main exhaust-port O^3 by connecting with auxiliary ports R^5 R^6, freeing the said end from the vapor used on the previous stroke, allowing the steam which enters through the ports P^1 P^3 P^2 to throw the valve in the direction of the head E^2, Fig. 7. The valve in this position will allow the steam to enter through the apertures N^2, Fig. 9, the opening C^2 communicating with the groove D^2, Fig. 7, and enter port O^2, which connects with the main-cylinder port, the exhaust steam from the opposite port O^1 passing off by way of counter-bore O^1 in the interior of valve-chest, Figs. 6 and 7, through holes C^1 communicating with groove D^1, and from thence to main exhaust-port O^3. Now, when the steam is required to be cut off at the port O^2, Fig. 7, which enters through N^2, Fig. 9, the valve is oscillated by any proper mechanism operating on the valve-stem D, which communicates said motion to the valve C by means of pins Z, Fig. 1, allowing the valve-stem to move independently of the valve in a rectilineal movement by working in grooves R^1 R^4, but latterly oscillating the valve with the stem, in order to lap the ports N^2 and C^2, as represented in Figs. 8 and 10, when the steam will be cut off from port O^2. This oscillating movement does not affect the exhaust, because the holes C^1 on the opposite end of the valve C communicate with a continuous counter-bore O^1, as shown by Figs. 3 and 4. The valve thus twisted, and the ports N^2 and C^2 lapping, Figs. 8 and 10, the holes C^1 on the opposite end of the valve C will be in position to receive the steam through apertures N^1 when thrown over by a rectilineal motion similar to the one as previously stated, viz., by the slot P^6 in valve-stem D admitting the steam between the space formed by the end of valve C and head E^2, and slot R^1 exhausting the steam from the opposite end of valve C.

The office of the key T, which is mentioned in the referred-to patent, for the purpose of giving a positive rectilineal motion to the valve in case the action of the steam should fail, is replaced by the tappets or bumpers T^1 T^2 acting against the inside of springs S S^1, which springs perform a double function, besides that of cushioning the ends of valve C by coming in contact with the interior projection of heads E^1 E^2. The said springs are held in position by being clamped between the shoulder of a counter-bore in each end of the valve C and collars X, Figs. 1 and 14. The steam is prevented from blowing through the center of the bore of the valve C, where the stem D passes by the latter being provided with packing-rings T^3, as shown in Fig. 1. The springs S, besides performing a double function—namely, that of cushioning the valve when acted upon by the steam or tappet, and cushioning the action of the tappet against the valve when the valve is operated by the momentum of the piston—performs a third—viz., that of starting the main valve in the manner hereinafter described. When the valve is driven toward the heads E^1 E^2, either by the action of the steam or

momentum of the piston, the cushioning-springs S are, of course, compressed according to the impulse given to the valve, and are kept so compressed according to the pressure of the steam admitted on the opposite side of the valve by the slots in the stem D. Now, when the reverse action of the valve takes place, the exhaust-slot in the stem D releases the pressure on the aforementioned side by opening communication with the main exhaust. The pressure having been taken off the opposite side of the valve in the manner just described the compressed spring will return to its original length, thereby moving the valve in a forward position, and assisting the action of the steam, or that of the tappet caused by the momentum of the main piston, or both actions at the same time, according to the speed of the main piston.

The valve is operated according to the above description by three different actions, the three actions combined operating the main valve and auxiliary piston when the main piston of the engine is running very fast, and two actions operating—viz., steam and spring—when running slow.

I do not propose to confine myself to an oscillating motion for the purpose of cutting off steam, for the apertures N^1 N^2, with their proper lapping space in the valve-chest, might be carried around the whole interior circumference of the bore; also, the corresponding holes C^1 C^2 connecting with grooves D^1 D^2 around the whole periphery of the valve C; and a rotative motion, with a dwell divided into intervals the length of the distance from the center of a hole to the center of a space, would answer as well, and better, where the valve is attached to a rotative engine, the rotative motion with variable dwell being connected directly to the valve and not to the stem; consequently when I speak of oscillating or segmental motion I wish to be understood to mean as well a rotative motion, one being substituted for the other, according to the class of engines the valve is used to operate.

I claim—

1. The valve C, with grooves D^1 D^2 and connecting-holes C^1 C^2, arranged in the manner described, and having an oscillating or rotative and rectilineal movement, in combination with the valve-chest, provided with apertures N^1 N^2 connecting with jacket M, substantially as and for the purpose herein described.

2. The combination with a valve, C, provided with grooves D^1 D^2 and connecting-holes C^1 C^2, arranged as described, and having an oscillating or rotative and rectilineal movement, the valve-chest, provided with counter-bored ports O^1 O^2, for the purpose herein set forth.

3. The valve C, provided with springs S, arranged and secured as described, in combination with the heads E^1 E^2, provided with an interior projection, as described, and stem D, arranged as specified, for the purpose of cushioning the action of the valve C against the heads E^1 E^2, and also cushioning the action of the stem D against the valve C, each spring performing a double function, as herein, and for the purpose specified.

4. In combination with a valve, C, acting as main valve and auxiliary piston, and valve-stem D, arranged and constructed as specified, and acting as an auxiliary valve, when combined with ports and passages in the valve-chest and heads E^1 E^2, as specified, a spring, S, acting to start the main valve and auxiliary piston C, as specified, in addition to the functions of cushioning the action of the valve C against the heads E^1 E^2, and also cushioning the action of the stem D against the valve C, constructed and operating substantially as and for the purpose herein specified.

ARTHUR J. L. LORETZ.

Witnesses:

J. BURRILL,

JOS. H. BURRILL.