JEROME WHEELOCK.

Improvement in Steam Engines.

No. 118,764. Patented Sep. 5, 1871.

Fig. 1.

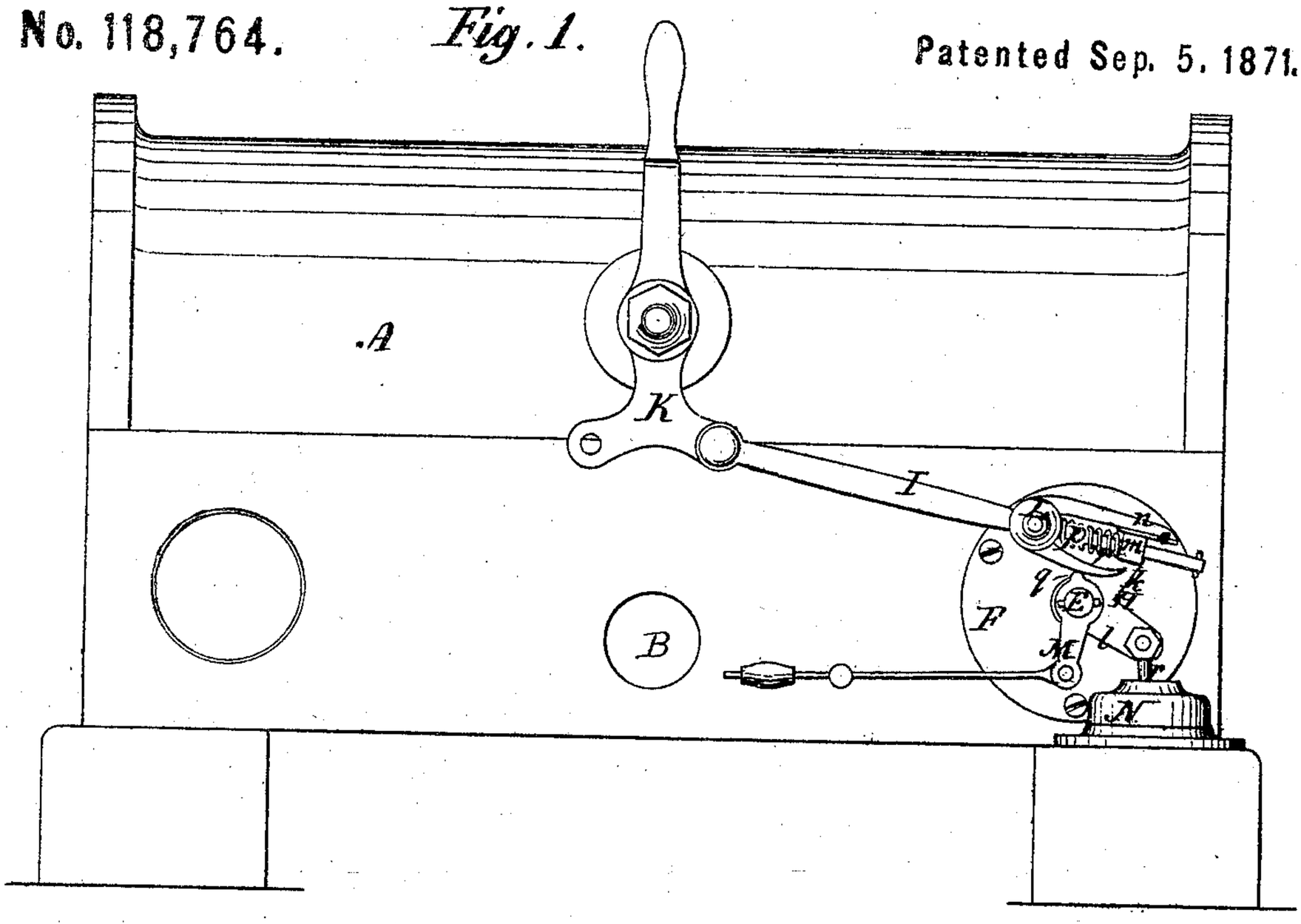
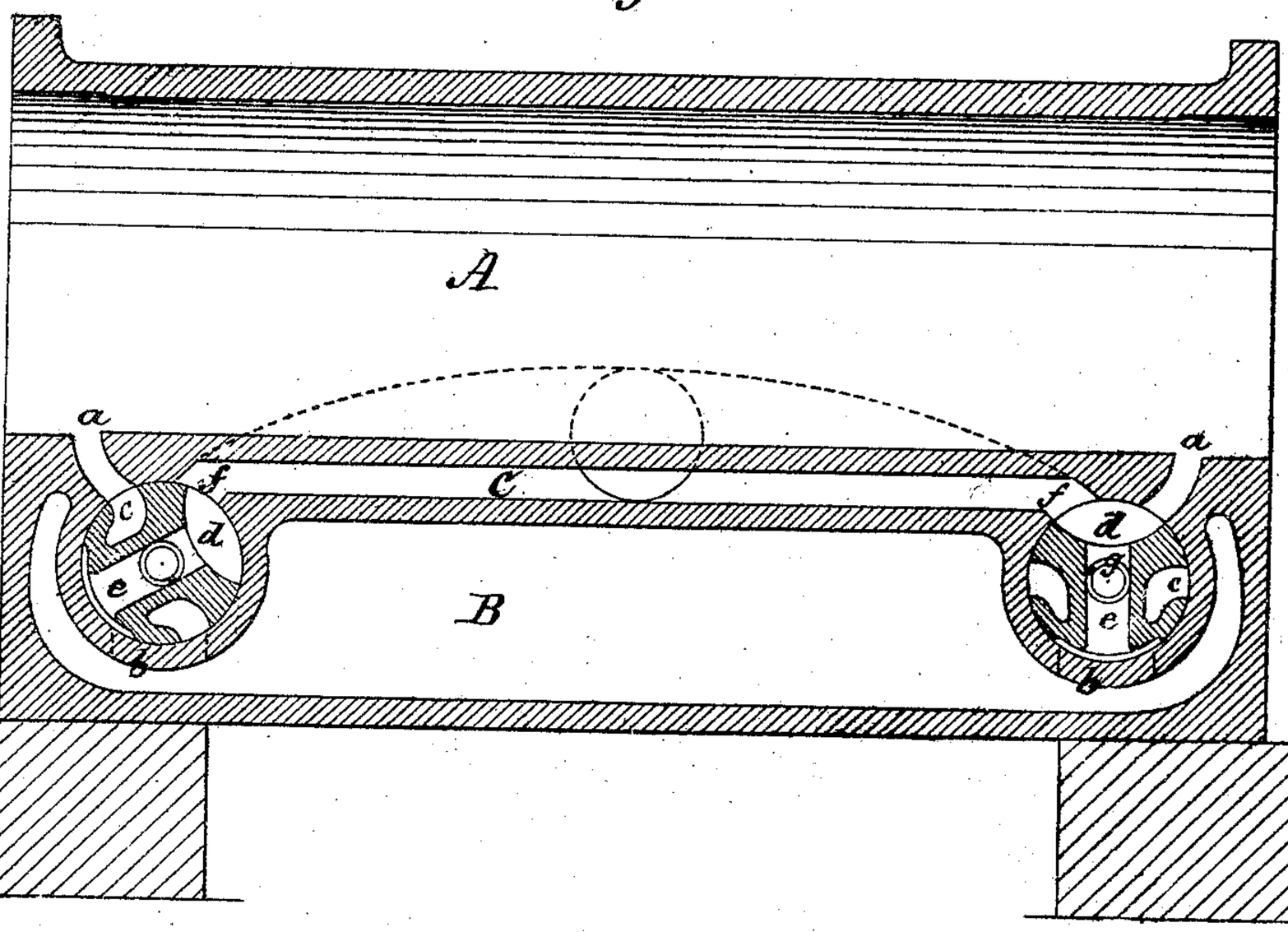


Fig. 2.



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[72.]

2 Sheets.
Sheet 2.

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Fig. 3.

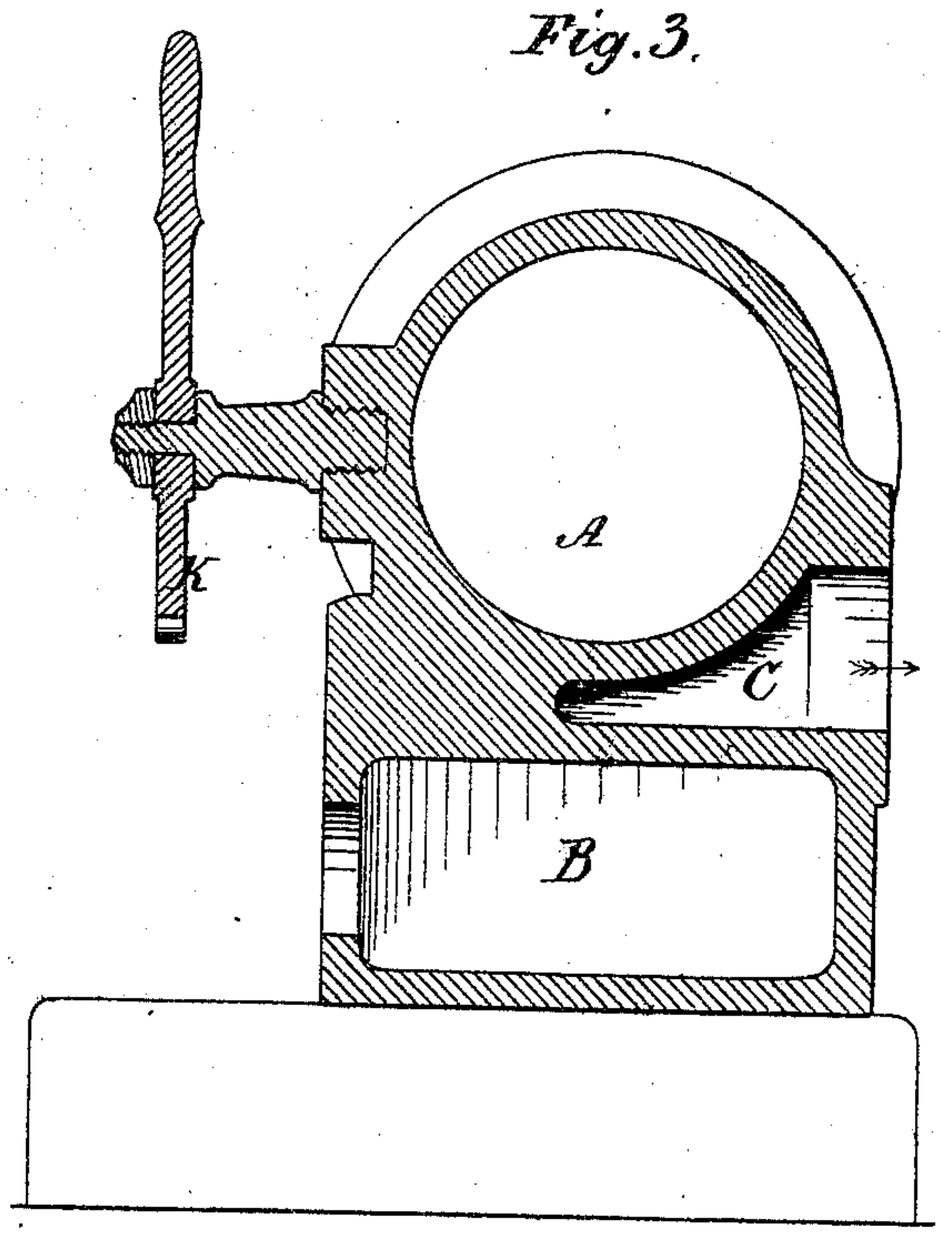


Fig. 4.

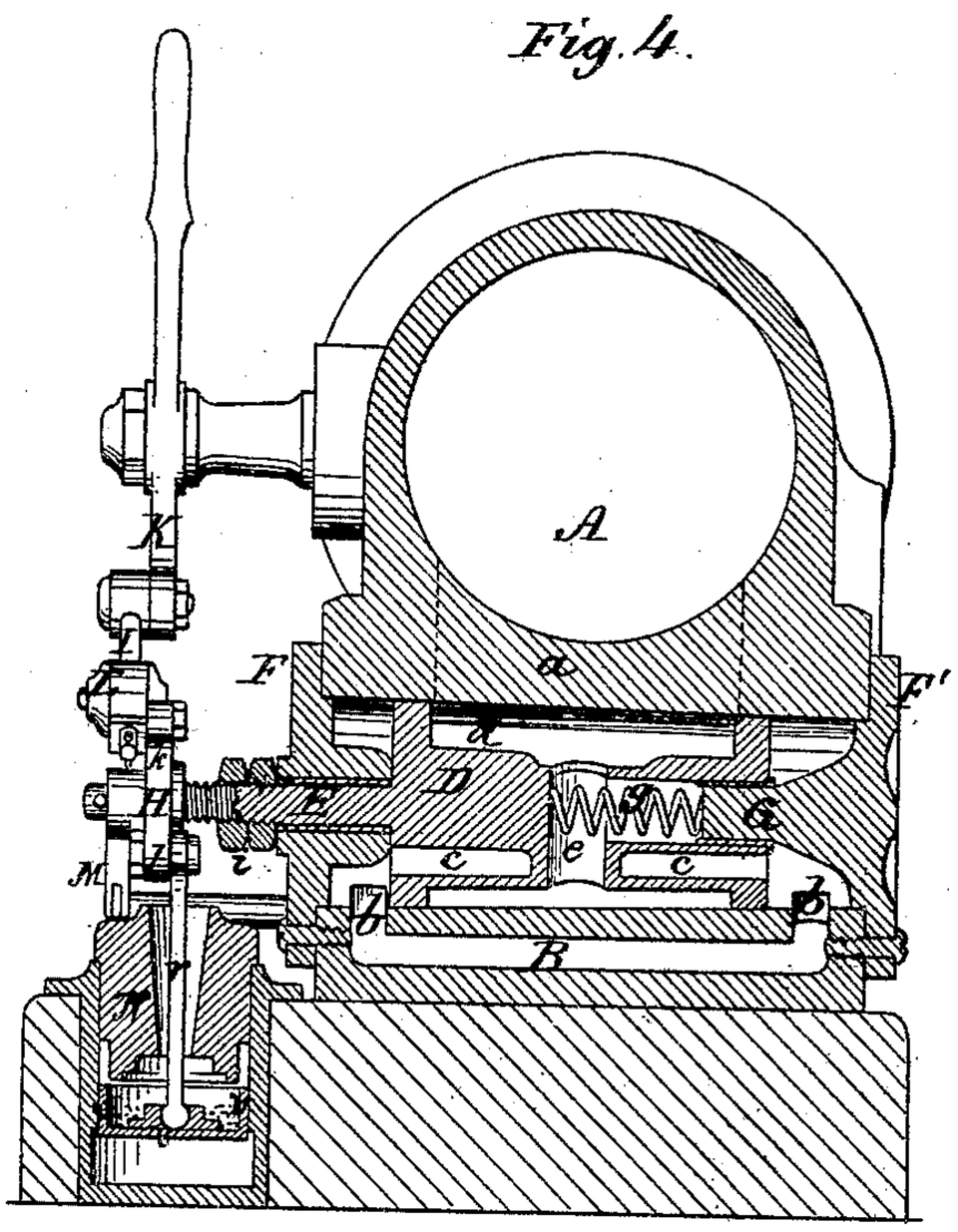
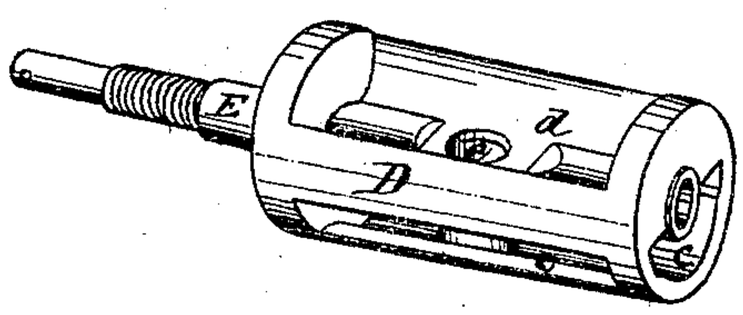


Fig. 5.



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UNITED STATES PATENT OFFICE.

JEROME WHEELOCK, OF WORCESTER, MASSACHUSETTS.

IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. 118,764, dated September 5, 1871.

To all whom it may concern:

Be it known that I, JEROME WHEELOCK, of the city and county of Worcester, in the State of Massachusetts, have invented certain new and useful Improvements in Steam-Engines.

My invention consists, first, in a novel and effective combination of a new automatic cut-off mechanism with two semi-rotary reciprocating valves, by which, practically, the same results are accomplished as have heretofore been effected by the use of four valves; secondly, in certain novel features in the construction and arrangement of the valves; and thirdly, in the novel construction and arrangement of cylinder, steam-chest, and valve-chambers; and I do hereby declare that the following specification, taken in connection with the drawing furnished and forming a part of the same, is a clear, true, and exact description thereof.

Referring to the drawing, Sheet 1, Figure 1 represents, in side elevation, the device illustrating my invention; Fig. 2, a longitudinal vertical section of the same; Sheet 2, Fig. 3, a transverse vertical section through the center of cylinder; Fig. 4, a transverse vertical section through one of the valves and a dash-pot; and Fig. 5, a detached view in perspective of one of the valves.

A is the cylinder, represented in this instance as pertaining to a horizontal engine. At each end on the lower side are the ports *a*, through which the steam is alternately inducted and exhausted. B is the steam-chest. It is located directly beneath the cylinder and slightly below the valves, and communicates with the boilers by a steam-pipe, which enters the chest at a point midway between the ends. By so locating the steam-chest with reference to the valves and cylinder it is practically impossible for any water to pass through the valves into the cylinder. A waste-cock, applied so as to communicate with the lowest portion of the steam-chest, affords a ready means of drawing off at any time such water as may be collected therein. C is the exhaust-chamber. It is located below the cylinder, but between its lower external periphery and the upper wall of the steam-chest B. The exhaust-pipe communicates with this chamber at a point midway between the two ends. D is one of two semi-rotary valves. They are located beneath the cylinder adjacent to each extremity, and are hollow, balanced, slightly tapering, and fitted to well-ground seats. The valve-chambers are located within cylindrical shells, which separate them from the interior of the steam-chest B, with which they communicate by several ports, *b*, cut through the shell into the spaces between the two ends of the valve and the interior ends of the valve-chamber.

Direct steam, after entering the valve-chamber at each end from the steam-chest through the ports *b*, enters the interior of the valve at each end parallel with its axis, and passes out through the peripherical opening *c* and into the cylinder through port *a* when the two are coincident. Exhaust steam, leaving the cylinder-ports *a* when the valve is in proper position, enters a longitudinal recess, *d*, in the outside periphery of the valve, and which is equal in length to the induction-port *a*. This recess *d* is connected with a corresponding recess on the opposite side of the valve by a diametrical opening, *e*. It will be observed that, by this arrangement of steam-passages, a balance of forces is practically accomplished. When the valve is in position for receiving the exhaust steam the recess *d* embraces circumferentially the entire area of the ports *a* and *f*, which connects the interior of the cylinder direct with the exhaust-chamber C, as illustrated in the right-hand valve of Fig. 2. By a reciprocating semi-rotary movement the valve is brought into alternate relations with the cylinder-port *a*, and delivers and receives steam in an obvious manner.

The valve is mounted at its largest end upon a valve-shaft, E, to which it is secured. This shaft extends from a point near the center of the valve, and projects through the valve-chamber plate F. The opposite or smaller end of the valve is mounted upon a fixed stud, G, which projects inward from the inner face of the valve-chamber plate F′. The shaft E at the plate F, and the stud G at the point of contact with the valve, are both incased in hardened-steel bushings or sleeves, in order to protect the frictional surfaces from undue wear. The bushing at the smaller end has a greater outside diameter than that at the larger end, and the valve is cut away more at this small end to receive the bushing than at the other, and, therefore, the steam exerts a greater pressure on the large than on the small end, creating a tendency in the valve to always work toward the small end into its seat. Between the inner end of the stud G and the end of the recess in the valve which receives it is an expan-

sive spring, *g*, which serves to force the valve sufficiently from its seat to prevent undue friction. The projecting end of the valve-shaft E, outside the plate F, is provided with a screw-thread, on which is fitted a check-nut, *i*, and a set-nut. By unscrewing the check-nut *i* the valve will advance into its chamber when sufficiently worn to require it. Practice, however, will demonstrate that the inner face of the check-nut *i*, by frictional contact with the face of the plate, will wear away about fast enough to compensate for the wear of the valve and its seat. By having the set-nut well turned up to the face of the plate a practically steam-tight joint may be formed, and thus obviate the necessity of a packing-box.

H is a valve-crank, in the form of a bell-crank lever, keyed to the outer end of the valve-shaft E. It consists of a hub, a vertical arm, *k*, and a horizontal arm, *l*. I is the valve-stem. It is connected at one end by a pin-joint with the wrist-plate K, to which the eccentric-rod is attached in the usual manner. The opposite end passes horizontally through a square-sided latch-block, *m*, which is swiveled to the front side of the vertical arm *k* of the crank-lever H. L is a latch of peculiar form. It consists of two horizontal arms, one above the other, projecting from a closed end, through which the valve-rod I passes, and to which rod it is pivoted through the closed end. These arms extend toward and beyond the latch-block *m*, and vertically embrace it between them. The vertical space between these arms is slightly greater than the thickness of the latch-block. The upper arm *n* rests with its under surface upon the upper side of the latch-block. The under surface of this arm is provided with a latch-shoulder, *o*. Between the inside of the closed end of the latch L and the latch-block *m* is an expansive spiral spring, *p*, which encircles the valve-stem I. M is a crank-cam provided with a pendent-arm, and mounted so as to turn loosely on a bearing at the outer end of the valve-shaft E. Its pendent-arm is connected to the governor-rod. The upper side of the cam is provided with a projecting thumb, *q*, which, by contact with the under side of the lower arm of the latch L, raises it, and thus controls or limits the extent of its connection with the latch-block *m*. N is a dash-pot weight, connected to the horizontal arm *l* of the valve-crank H in a peculiar and novel manner. A rod, *r*, is connected to the end of the arm *l*, and passes downward through an opening in the center of the weight, and is connected at its lower end with a disk, *v*, as large in diameter as the weight, and provided with an upward-projecting flange. Between the top of this disk *v* and the under side of the weight is a packing of cotton, wool, or other elastic matter. Surrounding the dash-pot weight is a shoulder, on which the weight rests when at its lowest point, and in contact with the edge of the upward-projecting flange of the disk *v*.

Having thus described the several parts in detail, the operation may be described as follows: It is easily understood that the semi-rotary movement of the valves will cause an alternating induction and eduction of steam, and it is, therefore, only necessary to describe the operation of the cut-off. When the engine requires a full head of steam the shoulder *o* on the under side of the arm *n* of latch L holds the latch and latch-block *m* together, and, by a forward movement, causes a full opening of the steam-port and the regular operation of the exhaust. As soon as the steam can be used expansively the governor-rod draws back the pendent-arm of the crank-cam M, which projects forward the thumb *q*, thereby raising the latch L by its contact with the under side of its lower arm, and causing the upper arm to release the latch-block *m* and the valve-crank to which it is attached. To overcome the inertia at the start the expansive spring *p*, acting against the latch-block *m*, accelerates the motion of the valve until the weight N, exercising its deflective force, completes the work. By the time the dash-pot weight has reached its rest on the shoulders inside the dash-pot it has lost its deflective force by compression in the usual manner. At or about that time the spring *p*, in contact with the latch-block *m*, moving with the valve-stem, continues its pressure and concludes the opening movement of the exhaust-valve. After the dash-pot weight has reached its seat the continued movement of the valve-crank is permitted by the free deflection of the disk below the weight. When the movement of the valve is completed the valve-stem continues slightly on its longitudinal course, compressing the spring *p* and causing the latch to engage with the latch-block, and on its return movement to open the valve, and so on. The movement in closing the induction-valves by the cut-off is exceedingly smooth and even, and, practically, without shock, by reason of the usual dash-pot resistance to the weight. The opening of the exhaust-valves is also executed without shock, owing to the elastic cushion between the disk and weight, upon which the first strain or pull of the valve-stem is expended before the movement of the valve commences.

I am aware that steam-chests and steam-valves have, before my invention, been located below the cylinder. I am not, however, aware that an engine has ever before my invention been constructed in which the steam-chest and valves were not only below the cylinder, but in which the steam-chest was on a line with or below the center of the valves. If the steam-chest be so located with relation to the valves that, by any reasonable possibility, water can enter therein, it cannot flow back, but must of necessity be forced direct into the cylinder, regardless of the fact that both the valves and the steam-chest are below the cylinder. By my arrangement and improvement the steam-chest is not only below the cylinder, but below the central line of the semi-rotary valves, and it is, therefore, practically impossible for water to enter the cylinder.

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

1. In combination with a steam-cylinder, two

semi-rotary, reciprocating, double-acting valves, operated by a valve-stem and controlled by the governor in such a manner that, while the exhaust movement of the valves is even and regular, the induction movement is limited to fulfil the immediate requirement as indicated by the governor, substantially as described.

2. The combination of the valve-crank, the latch mechanism, and the valve-stem I, the three being connected substantially as shown, and arranged with relation to a tripping mechanism controlled by the governor, as and for the purposes specified.

3. The improved rotary double-acting balanced valve described, capable of receiving steam through its axis and discharging it into the cylinder through its periphery, and also capable of receiving the pressure of the exhaust steam on two exterior and opposite peripherical surfaces, substantially as described.

4. The combination of the conical rotary double-acting valve, the stud G, the expansion-spring *g*, and the fixed shaft E, as and for the purposes specified.

5. The combination of the dash-pot, dash-weight, disk, and elastic packing with a double-acting rotary valve, a latch, and tripping mechanism, substantially as described.

6. The combination of the crank-lever of a semi-rotary reciprocating valve, the valve-stem I joined to the valve-crank by a sliding connection, the latch mechanism mounted upon the valve-stem, and the spring *p*, arranged to exert a repelling force between the valve-stem and the crank-lever, as and for the purposes specified.

7. The peculiar construction, location, and arrangement of the cylinder, valves, valve-chambers, and steam-chest with reference to each other, substantially as described, by means of which the steam, after entering the steam-chest, is directed upward through the valves and thence upward into the cylinder, substantially as described.

JEROME WHEELOCK.

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