(No Model.) 2 Sheets—Sheet 1.

B. B. HOUGH.

VALVE MECHANISM.

No. 346,657. Patented Aug. 3, 1886.

Fig. 1.

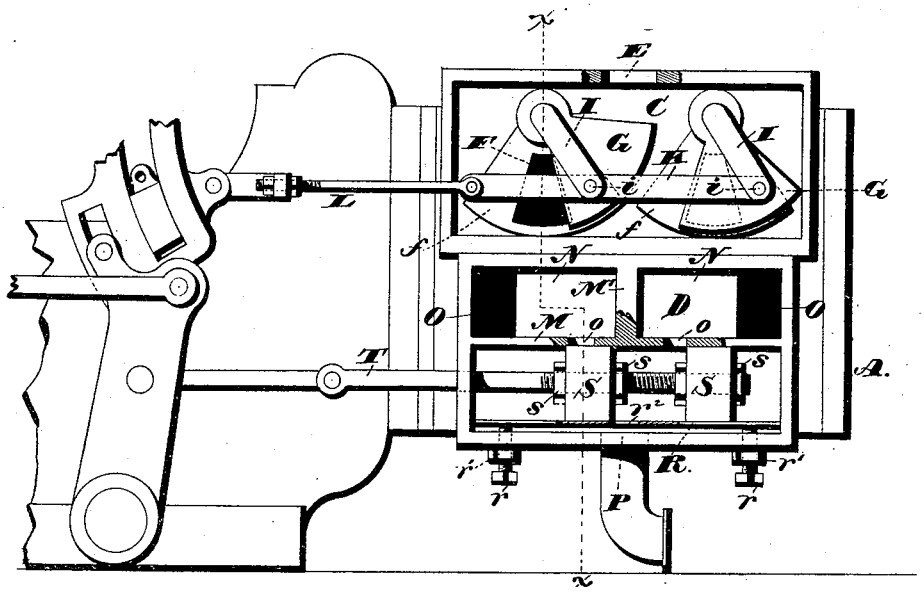
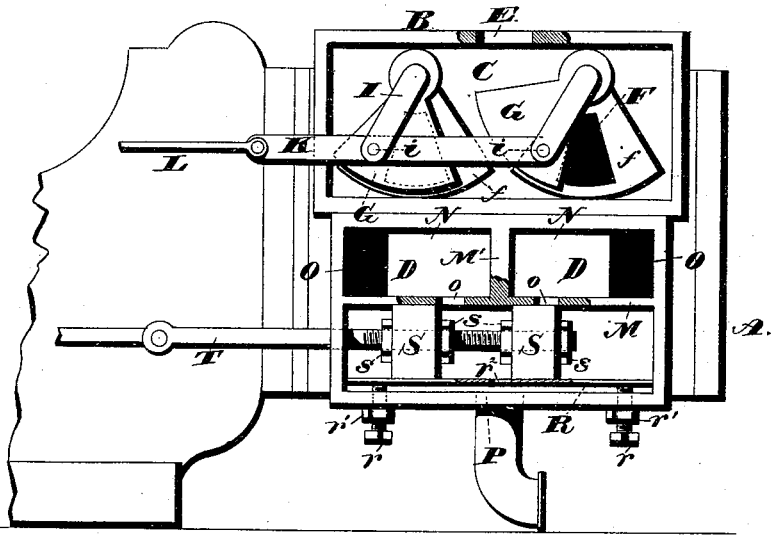


Fig. 2.



Witnesses:
Chas. J. Williamson.
Henry C. Hazard.

Inventor:
Benjamin B. Hough
by Pindle and Russell
his Attorneys.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

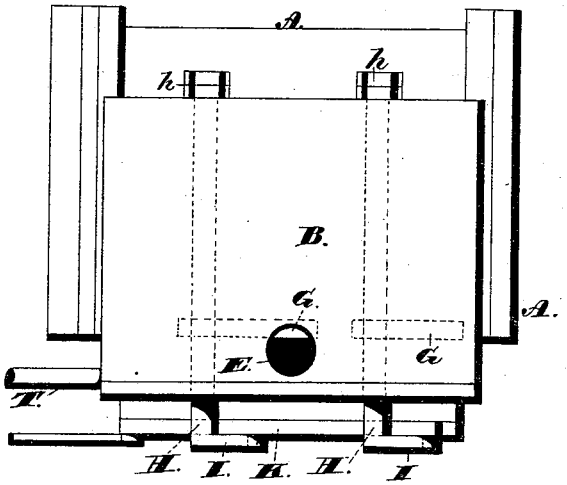
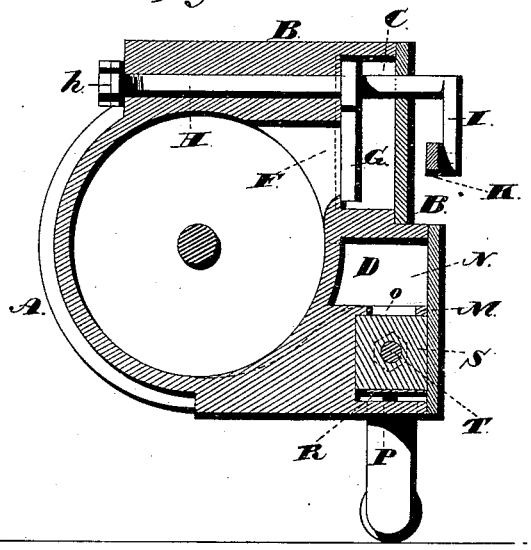


Fig. 4.



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UNITED STATES PATENT OFFICE.

BENJAMIN B. HOUGH, OF WILMINGTON, DELAWARE, ASSIGNOR OF ONE-HALF TO SAMUEL G. WARNER, OF SAME PLACE.

VALVE MECHANISM.

SPECIFICATION forming part of Letters Patent No. 346,657, dated August 3, 1886.

Application filed November 14, 1885. Serial No. 182,859. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN B. HOUGH, of Wilmington, in the county of New Castle, and in the State of Delaware, have invented certain new and useful Improvements in Valve Mechanisms; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 shows a view in elevation of my valve mechanism, the lid or outer side of the valve-box being removed; Fig. 2, a similar view showing the valves in position opposite to that shown in Fig. 1; Fig. 3, a plan view of the valve-box, and Fig. 4 a transverse sectional view on line *x x* of Fig. 1.

Letters of like name and kind refer to like parts in each of the figures.

The object of my invention is to provide an improved valve mechanism for steam-engines; and to this end my invention consists in the construction, arrangement, and combination of parts, as hereinafter specified.

In the drawings, A designates the cylinder, to be suitably supported as desired, and B the valve box or chamber, which, as shown, is preferably divided into two main compartments, C and D. If desired, such compartments can of course be formed as separate boxes or chambers, or by a partition dividing one large chamber into two. Steam from the source of supply is to be discharged into chamber C through opening E, and from such chamber can pass into the cylinder through ports F F, around which are suitable faced valve-seats, *f f*. The valves G G, which close and open these ports, are in the form of segments of disks, fastened upon the rocking pivot shafts or rods H H, journaled in and passing through the valve-chamber casing. As these rock-shafts rock, the valves will then swing over the valve-seats, so as to close and open the ports. Said ports are preferably segmental in shape, like the valves, as shown.

Upon the ends of the rock-shafts H H which project through the top or outer side of the valve-chamber are fixed the crank-arms I I, pivotally connected by pins *i i* with the reciprocating bar K.

To enable the valve rock-shafts H H to be adjusted so as to seat the valves closely against their seats, and to compensate for or take up any wear of the valves and seats, the farther or rear ends of the shafts, where they project through the casing, are threaded and provided with the nuts *h h*. Each shaft is provided with two nuts, one acting as a jam or lock nut. By screwing these up against the casing, as shown in Fig. 3, the valve rock-shafts can obviously be drawn longitudinally, so as to cause the valves to seat with any desired amount of closeness and pressure. The valves are so set on the rock-shafts with reference to the ports that both shall always have an equal amount of lead as the bar K is reciprocated, and as soon as one port is closed by its valve the other port will be opened. For instance, with the valves as shown in Fig. 1, as the bar K moves to the left the port which is opened will be closed by the swinging of its valve over it, while the other valve continues to close its port while swinging over it until the first valve closes its port entirely. Then the second valve is just opening its port. The reverse action of the valves as bar K moves back is similar to that just described. The open port is closed by its swinging valve before the closed one is opened. The amount of swing or partial rotation of the valves can be adjusted by regulating the throw of the connecting valve-rod L in any desired way. Means for doing this I have indicated in the drawings; but as I do not intend to claim the same in this application, but to cover it in another, it is not necessary to describe the means fully herein.

The valve-operating rod L is to be connected, as shown, with the block L′, which is adjustable up and down toward and from the pivotal center of the slotted arm L^2, which is to be swung from above, and is swung by pin-and-slot connection with the arm L^3, which in turn is to be operated by the eccentric-rod L^4 in the usual way. It is preferred to cause the block L′ to be automatically adjusted by suitable connections with a governor, as set forth in my other application filed of even date with this one, and numbered 182,860.

The chamber D is divided longitudinally by the partition M. The upper one of the longitudinal compartments thus formed is divided into the two chambers N N by the partition

M', at right angles to M. Into each of the two chambers N N opens one of the exhaust-ports O O from the cylinder. These ports preferably extend down, as shown in dotted lines in Fig. 4, to the bottom or lower side of the space within the cylinder A, so as to allow of the free passage out and up through them of any water of condensation which may collect in the cylinder, and which, if confined, would cause pounding. In the plate or partition M are the two ports *o o*, each connecting one of the chambers N N with the longitudinal compartment or chamber below the partition. The lower side of the partition, around ports *o o*, can be faced as desired for the proper seating of the valves for opening and closing them, as hereinafter described.

From the lower side of the longitudinal compartment above referred to opens the exhaust-port P, provided with a suitable exhaust-conducting pipe. In the lower side of said compartment is the vertically-movable plate R, parallel with partition M, and adapted to be adjusted toward the partition, as desired, by means of set-screws *r r*, tapped up through the casing-wall below the plate and engaging the lower or outer side of the latter. Each screw is provided with a lock or jam nut, *r'*.

The plate R is provided with openings r^2, preferably in line with port P, to allow free passage of the exhaust-steam from the space above the plate out through such port. Between plate R and the partition-plate M' slide the valve heads S S, preferably square or rectangular in section, as shown in Fig. 4, and reciprocated by rod T, which passes through them and carries nuts *s s*, engaging opposite ends of the heads, as shown in Figs. 1 and 2. As the valve-rod T is reciprocated, these heads alternately open and close the ports *o o*. With the parts in position as shown in Fig. 1, a movement of the rod T to the left causes the heads to close the open port and open the closed one until the parts are in position shown in Fig. 2, with the port *o* at the left entirely open and the other port closed. The reverse movement of the rod will then cause the head at the left to close its port, and then the other head to open the other port. When one of these ports is open, clear passage is obviously left from the cylinder exhaust-port O and the chamber N, into which it opens, to the main or common exhaust-port P. Any water which might tend to collect in the cylinder and cause pounding will be drawn out from the bottom of the cylinder through port O into chamber N, and from there down and out with the exhaust-steam. By means of the plate R and the set-screw, as described, the valve-heads can be held against the partition-plate M' or the faced valve-seats thereon, so as to seat them firmly and squarely, and any wear can be easily taken up. By screwing nuts *s s s s* along the rod T the valve-heads can be adjusted along the rod T with reference to each other or to the respective ports *o o*.

The rod T can be operated or actuated in any desired way, though I prefer the way and means shown in the drawings. As shown, the rod is connected by a link with the swinging arm or lever L^3, which, as already indicated hereinbefore, is to be actuated by the eccentric-rod in the usual way. With this construction the valve-heads S S will always open the exhaust-valve ports *o o* the same amount, and having been once adjusted on the rod to open the ports to their fullest extent, will continue to do so, whatever the adjustment of the inlet-valves or the amount of swing thereof may be. The advantage of thus making the exhaust-valves always open fully, independently of the amount of opening of the inlet-valves, cannot be overestimated.

Where, as heretofore, the inlet and exhaust valves are operated by mechanism such that as the inlet-valves opened less the exhaust-valves opened less also, the free escape of the exhaust-steam, which is especially desirable, was in so much interfered with.

With my valve mechanism, constructed and operating as shown and described, with the cylinder exhaust-ports extending down to the lower side of the cylinder and opening into the intermediate chambers, N N, between the ports O O and the valved ports *o o*, there is found to be no noise or pounding, the valves act easily and without shock or jar, the valves are easily adjusted to take up wear, and I secure the greatest amount of power for the steam used, as the exhaust is most free and unimpeded.

I have shown the valve box or casing as on the side of the cylinder; but it can obviously without departure from my invention be placed in any other position with relation to said cylinder.

The valve-heads need not be square or rectangular in section, as described, but can be made any other shape, the shape of plate R being altered accordingly, if desired.

Having thus described my invention, what I claim is—

1. In combination with the two segmental ports and the valve-seats around the same, the two rock-shafts substantially at right angles to the plane of the valve-seats, the crank-arms on the shafts, the reciprocating bar pivotally connected with these crank-arms, and the segmental valves so fixed on the shafts, and of such extent that they will be swung to open the ports alternately as the bar moves in opposite directions, and each valve will keep its port closed until the other valve has closed its port, substantially as and for the purpose described.

2. In a valve mechanism for steam-engines, in combination with the cylinder provided with suitable exhaust-ports, a valve box or casing provided with chambers into which such exhaust-ports open, and with ports opening out of such chambers, and valves for opening and closing these latter ports, substantially as and for the purpose specified.

3. In a valve mechanism for steam-engines, in combination with the cylinder provided

with exhaust ports or openings, the separate chambers into which such exhaust-ports open, a valve box provided with openings or ports communicating with these chambers, and valves for opening and closing such ports, substantially as and for the purpose shown.

4. In combination with the exhaust-valve mechanism of a steam-engine, intermediate chambers independent of the valve-chamber and between such mechanism and the exhaust ports or passages from the cylinder, substantially as and for the purpose set forth.

5. In combination with chambers N N, for receiving the exhaust-steam from the cylinder, suitable ports leading from such chambers, and valves for opening and closing them operating outside of the chambers, substantially as and for the purpose described.

6. In combination with the cylinder provided with exhaust openings or passages extending down to its lower side, the intermediate chambers, N N, connecting such openings with the exhaust-ports, and valves for closing such ports outside of the chambers, substantially as and for the purpose specified.

7. In combination with the cylinder provided with the exhaust-passages, the two separate chambers connected with such passages, and the outer chamber connected with such other chambers by suitable ports and provided with the main exhaust-opening, exhaust-valves for opening and closing said ports, situated in the outer chamber, and means for operating them, substantially as and for the purpose shown.

8. In combination with the cylinder provided with separate exhaust and inlet passages, the separate chambers connected only with the exhaust-passages and provided with exhaust-ports, and suitable valves to open and close such ports, substantially as and for the purpose described.

9. In combination with the cylinder provided with suitable inlet-valve mechanism, and having suitable exhaust-passages, the separate chambers connected with the exhaust-passages and disconnected from the inlet passages or ports provided with exhaust-ports, and valve mechanism to open and close the latter, substantially as and for the purpose described.

10. In combination with the cylinder provided with suitable exhaust-passages, the exhaust valve chamber, the intermediate chambers, connected with the exhaust-passages and with the exhaust valve-chamber by the exhaust-ports, the valves in the valve-chamber for opening and closing such ports, and means for operating the valves, substantially as and for the purpose described.

In testimony that I claim the foregoing I have hereunto set my hand this 29th day of October, A. D. 1885.

BENJAMIN B. HOUGH.

Witnesses:
EDWIN J. PRINDLE,
HENRY C. HAZARD.