2 Sheets—Sheet 1.

G. E. DOW.

Valve Mechanism for Direct-Acting Engines.

No. 221,220. **Patented Nov. 4, 1879.**

FIG. 1.

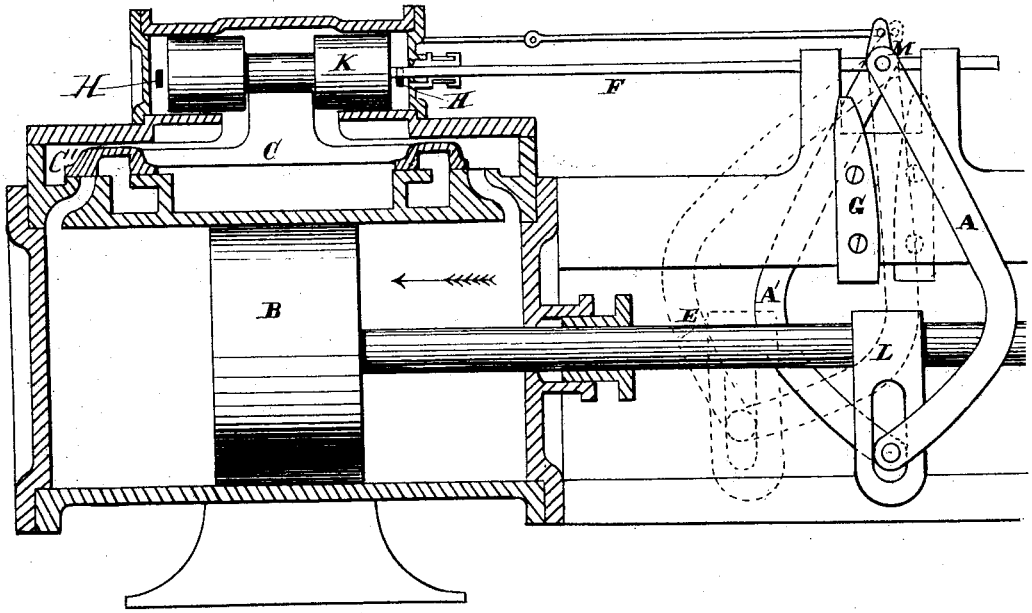


FIG. 2.

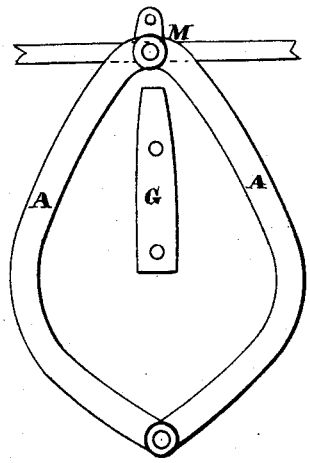


FIG. 3.

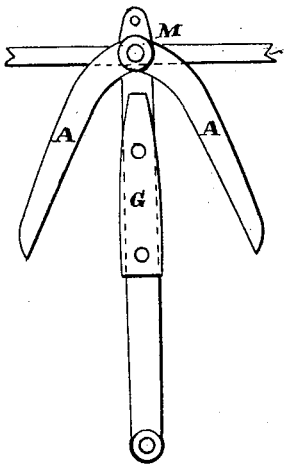
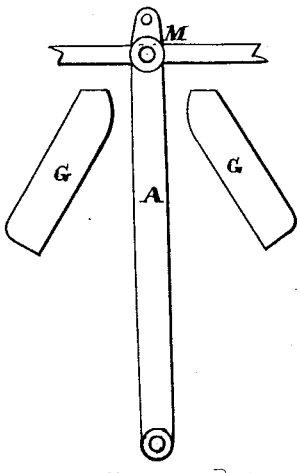


FIG. 4



Witnesses

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FIG. 5

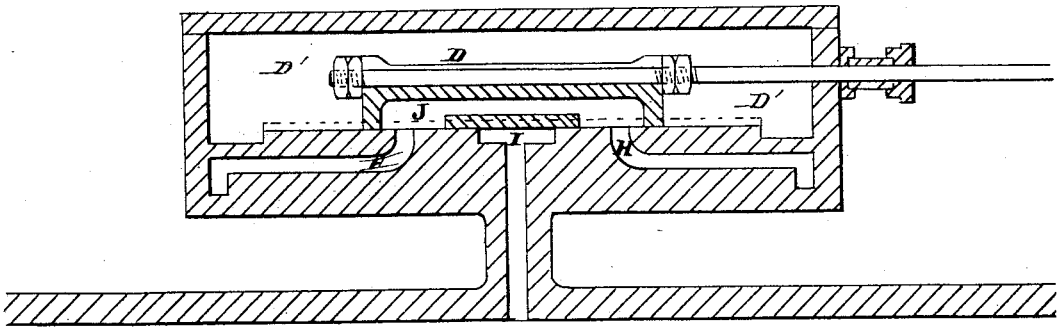
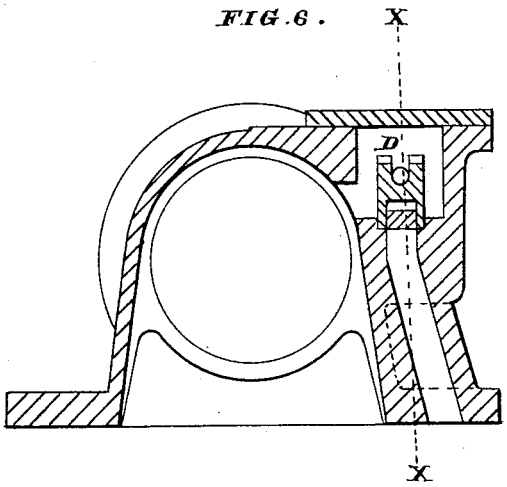


FIG. 6.



Witnesses

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UNITED STATES PATENT OFFICE.

GEORGE E. DOW, OF SAN FRANCISCO, CALIFORNIA.

IMPROVEMENT IN VALVE MECHANISMS FOR DIRECT-ACTING ENGINES.

Specification forming part of Letters Patent No. **221,220**, dated November 4, 1879; application filed July 17, 1879.

To all whom it may concern:

Be it known that I, GEORGE E. DOW, of the city and county of San Francisco, and State of California, have invented a Valve Mechanism for Direct-Acting Engines; and I do hereby declare the following to be a full, clear, and exact description thereof.

The object of my invention is, first, to provide means for a better distribution of steam to the engine, to facilitate the motion of the piston, combined with a more economical use of the steam, and to apply particularly to the better control of engines having heavy reciprocating parts, thus making the change of stroke easier, yet bringing the piston closely to the cylinder-heads under all conditions, while thumping would be impossible.

Second, in order to successfully accomplish the above the main valves of the engine must be moved by and under the immediate control of the main piston from a point somewhat later than the half-stroke. This device must have the elements of first equalizing the pressure by opening a communication between the two ends of the supplementary piston, (the same being required to move the valves the latter part of its stroke,) then to move the main valve by a positive movement at first very slowly; but its motion must accelerate rapidly as the main piston approaches the end of its stroke, to the extent of opening rapidly in advance of the piston at a speed equal to or in excess of that of the main piston.

Third, that an auxiliary valve must be connected to this mechanism to act the part of opening a communication between the two ends of the supplementary piston just before the action of moving to close the main valve; also, to admit steam to that end of the supplementary piston toward which the main piston is moving just before the main valve has reached its lapped position or center of travel, and at the same time open a passage from the opposite end to the exhaust. This determines the length of the stroke and reverses the engine by completing the latter half-stroke of main valve by steam from the steam-chest, though this movement of reversing may be accomplished in part or wholly by the engine itself at any speed in excess of that dependent upon the auxiliary valve for reversing.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1 is a longitudinal section in elevation of my engine. Figs. 2, 3 and 4 are modifications of the device. Fig. 5 is a section through *x x* of Fig. 6, showing the auxiliary valve. Fig. 6 is a transverse section through the valve-chambers C′ D′.

My improvement consists of one or more levers, A A′, employed to impart motion from the main piston B to the main and auxiliary valves C D by connecting the valves at one end of the lever and the main piston at the other by means of the piston-rod E and the supplemental piston-rod F of the auxiliary piston K, to which the valve C is secured, so that they move respectively coincident longitudinally.

The lower ends of the levers A A′ are loosely connected with the main piston-rod E by a pin or rod passing through the slotted block L, mounted on said piston-rod, while the upper ends of said levers are pivoted to a block, M, mounted on the supplemental piston-rod F. The lever A′ projects a short distance above the block M, and has connected thereto the stem of the auxiliary valve D.

In connection I use one or more fixed pieces or cam-faced lug or lugs, G, of suitable shape for the levers to engage with, as desired, though the two bent levers, as shown, with one cam-lug for each, give the best result in practice. One open lever, as shown in Fig. 2, engaging on opposite sides of one cam-lug, is a desirable form of construction. Two more constructions, as shown in Figs. 3 and 4, will operate, but with no additional advantages.

The lever or levers A A′ in all cases engaging or rocking over a cam-lug, G, of suitable form to produce a desired change of fulcrum, its location and connection to the piston and valves may be according to the best and most convenient method of construction. I connect an auxiliary valve, D, working in the chambers D′, to the same end of the levers with the main valve C. The main valve and supplementary piston are connected without lost motion to the end of the lever.

The valve-chamber D′ is arranged in rear of the valve-chamber C′, and communicates therewith through the steam and exhaust ports H H I.

The operation will then be as follows: With

the piston B moving in the direction of the arrow, the main valve C will be open to admit steam to the cylinder. The auxiliary valve D, by its connection to the levers, as shown, above the point of oscillation (although it can be made to operate below by a corresponding change in the ports of the valve and its seat, the object being to obtain the most desirable results) will be found, as well as the main valve, at the end of its stroke toward which the main piston B is moving. Hence the port H, admitting steam to the acting end of supplementary piston, being exposed at this point and from the commencement of the stroke, the main piston moving onward, and by its oscillation at the point connected to the main valve, returns a movement to the auxiliary valve D, which closes the steam and exhaust ports H I to the supplementary piston. Then an independent communication is opened by the port or passage J through the valve D, the same being effected just before the contact of the lever A with the cam-lug G, thereby reducing the strain on the valve-rod to no more than the friction of the parts connected thereto.

Motion is transmitted, as shown by the diagram, only to the auxiliary valve during the stroke of the main piston up to the point of contact with the fixture G. Motion is then transmitted to close the main valve slowly and easily at first; but, owing to the rocking motion of the lever and rapid change of fulcrum, an easy movement, combined with any desired acceleration of the valve, is attained and controlled directly by the motion of the main piston, allowing the same to work closely to the cylinder-head, while being under the most complete control of the main valve.

The auxiliary valve is always in motion with the main piston, and, as may be noticed, laps or covers its ports, the interval of which between admitting and exhausting alternately at the supplementary cylinder represents the period of equalization of pressure upon the supplementary piston K during the first half of its stroke, or such portion thereof as is controlled by the main engine.

At a point just before the main valve *c* reaches its lapped or central position and the communication between the two ends of the supplementary piston is closed admission and release by means of same ports H alternately complete the act of reversing the engine by steam acting upon the supplementary piston K during the latter half of its stroke only.

It will be seen that but one-half the volume of steam is used in this combination as heretofore to actuate the valves, and that the movement of the supplemental piston and main valve is effected by the direct action of the main engine and independent of the steam-pressure upon the supplemental piston.

From my invention I secure the following advantages: the better distribution of steam, as effected by the early action and better control of the valves—that is, by commencing earlier to close, slowly at first, but gradually increasing the speed of the valves as compared with that of the main piston, combining the advantages of gradually closing the admission and exhaust ports, and by the accelerative movement bringing the valves promptly, but without jerking, suddenly upon them to the position determining the length of the stroke, and much closer to the cylinder-head than heretofore. While from excessive momentum consequent upon high speed with a heavy reciprocating weight, or from any other cause, the piston should go closer than that desired to the cylinder-head, the steam and exhaust ports will be opened to their full capacity, reversing the piston promptly; but the harshness commonly due to this latter feature in this class of engines is entirely overcome in this combination. All the moving parts of this engine are mechanically connected, and move with the same reference to the requirements and advantages of working steam expansively when desired as a crank-motion controlled by an eccentric, but having in its favor a more uniform thrust and no dead-point under any condition of working when arranged as in the accompanying drawings, although lap on the valves used in this combination for working the steam expansively, where the work to be performed will admit of a uniformly high or moderate speed, is one of its peculiar advantages.

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

1. The levers A A′, with the cam-faced lugs G, in combination with the main and auxiliary piston-rods and the auxiliary valve of an engine, whereby the movements of the valves are controlled by the main piston, substantially as herein described.

2. The curved levers A A′, loosely connected at one end with the main piston-rod E by means of the slotted block L, and at the other end united to the auxiliary valve-rod, while the supplemental piston-rod serves as a fulcrum about which the lever moves to actuate the auxiliary valve, in combination with the cam-faced lugs G, whereby the fulcrum is changed, substantially as and for the purpose herein described.

3. The levers A A′, having one end loosely connected with the main piston-rod E by means of the slotted block L, and pivoted or hinged to the block M upon the supplemental piston-rod F, one of said levers having an arm, by which the auxiliary valve-rod is actuated directly from and at the same time with the main piston, in combination with the cam-faced lugs G, by which both main and auxiliary valves are moved at a certain point in the stroke, substantially as herein described.

4. The auxiliary valve D, with its port or passage J, whereby opposite ends of the sup-

plemental cylinder are connected and the pressure balanced, in combination with the main and auxiliary pistons and main valve, and the levers A A′, and cam-faced lugs G, substantially as herein described.

5. An auxiliary piston and valve-rod connected to the main piston-rod, the movement of said parts being controlled by cam-faces acting against the connecting-link, substantially as described.

In witness whereof I have hereunto set my hand.

GEORGE E. DOW.

Witnesses:
S. H. NOURSE,
FRANK A. BROOKS.