J. A. HUTCHISON & J. W. GOVIER.

Steam-Engine Valve-Gear.

No. 164,456. Patented June 15, 1875.

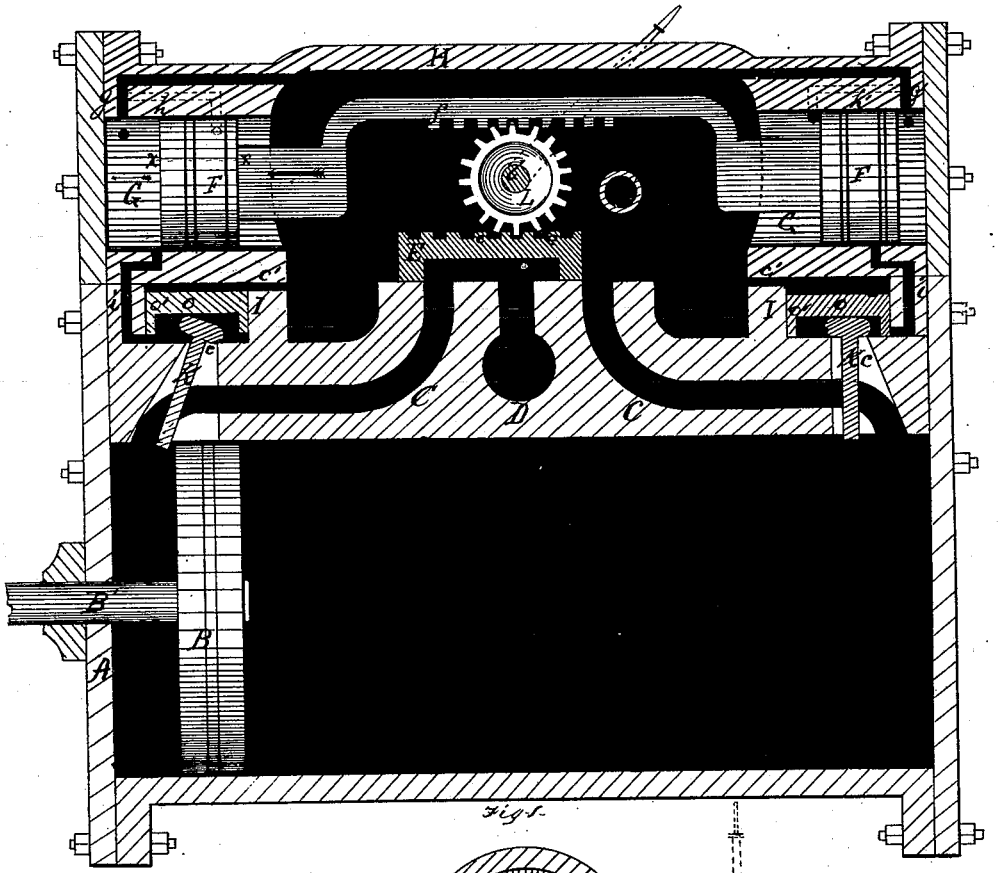

Fig. 1.

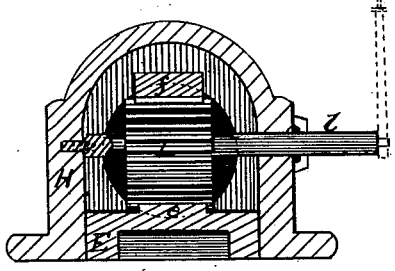

Fig. 2.

WITNESSES.

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JAMES A. HUTCHISON AND JOHN W. GOVIER, OF PITTSBURG, PENNSYLVANIA; SAID GOVIER ASSIGNOR TO SAID HUTCHISON.

IMPROVEMENT IN STEAM-ENGINE VALVE-GEARS.

Specification forming part of Letters Patent No. **164,456**, dated June 15, 1875; application filed May 11, 1875.

To all whom it may concern:

Be it known that we, JAMES A. HUTCHISON and JOHN W. GOVIER, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Steam-Engine Valve-Gears; and we do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing, forming a part of this specification, in which—

Figure 1 is a vertical central section of the steam cylinder and chest. Fig. 2 is a similar section, at right angles to Fig. 1, of a portion of the same.

Like letters refer to like parts wherever they occur.

The first part of our invention relates to the manner of operating the slide-valves of direct-acting engines, and has for its object the reduction of the size of the valve that governs the ingress and egress of the steam to and from the main cylinder. Heretofore, where the entire stroke of the plunger which operated the valve was effected by steam alone, the valve employed has moved in the same direction as the piston or plunger by which it was operated, which necessitated the use of a double D-valve—a form objectionable on account of loss by friction and by wear upon the valve, and by the liability of the valve to stick upon its seat. In carrying out this part of our invention we combine an auxiliary piston, the entire stroke of which is effected by steam alone, and a valve which is operated by said piston by means of intermediate mechanism, so that the valve shall move in a reverse direction from the piston, whereby a single D-valve may be used, reducing the area of the valve necessary to control the ports nearly one-half.

The second part of our invention relates to the manner of balancing the plunger or piston that operates the slide-valve, and to the manner of starting and arresting the throw of the said piston, and has for its object to increase the propelling force at the commencement of the throw, and to retard or check it at the close of the throw. In carrying out this part of our invention we provide the steam-chest or auxiliary cylinder with a set of ports or passages, one of each set being opened and closed alternately by the travel of the auxiliary piston or plunger which operates the valve.

The third part of our invention relates to the manner of operating the valves which open and close the ports *i i*, leading into the auxiliary valve-chamber. In carrying out this part of our invention we cause the exhaust-port of the valve-piston or plunger to open below a valve in the auxiliary valve-chamber, while the valve-chamber above said valve is provided with a port for the admission of live steam.

We will now proceed to describe our invention, so that others skilled in the art to which it appertains may apply the same.

In the drawing, A is the main cylinder, B the piston, and B′ the piston-rod. C C are the steam and D the exhaust ports, said ports controlled by the single D-valve E, operated through intermediate mechanism by a piston or plunger, F, which works in small cylinder G, forming the upper part of steam-chest H. I I are auxiliary valve-chambers, connecting with the small cylinder G by exhaust-ports *i i*, which open into the lower part of the auxiliary valve-chambers below a valve, *o*, said chambers I I being provided with ports *c′ c′*, by means of which live steam is admitted to the chamber above. Within the auxiliary valve-chambers I I are the tappets K K, the stem of each of which passes through ports *c* and C, projecting slightly into the main cylinder A. *o* is a valve, preferably hollowed below, as shown, to accommodate the head of the tappet K, and is arranged within the auxiliary valve-chamber I, so as to divide the same into two compartments, the lower one of which communicates with the small cylinder G through passages *i*, and with the exhaust-port C through ports *c*, and the upper compartment of which communicates with the steam-chest H, or other live-steam space, through ports *c′*. When this piston *o* is formed as shown, one end, *o′*, thereof will act as a valve to open and close the port *i*. E is a single D-valve, upon the upper surface or top of which is a rack, *e*, which gears with a pinion, L, fast

upon a shaft, *l*, passing through a stuffing-box in the side of the steam-chest H. The pinion L also gears into the rack *f* on the lower side of the stem of the double-headed piston F, so that any movement of piston F is transmitted through fixed pinion L, giving a reverse movement to valve E. The projecting end of shaft *l* of the pinion serves as the starting-bar. *g g'* and *h h'* are ports formed in the steam-chest for the purpose of admitting the steam to the rear of the pistons F of the small cylinder. The ports *g g'* admit the live steam in such a manner as to give a uniform pressure to both ends of the piston, by which means the piston F is perfectly balanced, and those marked *h h'* are relatively arranged to *g g'*, to be opened and closed at certain times by piston F, so as to regulate the force exerted in starting and stopping the piston. The ports or passages *g g'* are formed through the steam-chest, so as at all times to permit the passage of live steam from the chest to the rear of piston F, while the ports or passages *h h'* are little longer than the piston-head *x x*, so that the two ports *h* and *g* at one end are open at the time the piston is to commence its throw, and the port *h'* at the opposite end is closed; but the piston in its movement after the first impulse will close the port *h*, so that the continuous force exerted is only what is given by the steam from *g*. Just before the close of its throw the opposite head will unclose the port *h'* at the opposite side of the chest, so that the piston will be arrested or cushioned by the force of the steam entering behind it from *g' h'*. The ports *g' h'* remaining unclosed, the return stroke will take place in the manner before recited.

The drawing shows the piston B near the close of its stroke in the act of tripping the tappet-valve K, which causes K to raise the valve *o*, establishing communication between the space in rear of piston F and the exhaust-port by means of port or passage *i*. At the same instant the opposite end of the piston is acted upon by the live steam passing through *h'* and *g'*, the two ports being open at the commencement of its stroke, and said piston, moving in the direction of the arrow shown in Fig. 1, causes the valve E, by means of pinion L or other suitable means, to move in an opposite direction, changing the exhaust of the main cylinder. When piston F has moved a short distance it closes the passage *h'*, so that for the remainder of its stroke it only takes steam through the single port *g'*, and before it quite finishes its stroke the opposite head uncovers port *h*, so that said head will take steam from two ports, thus increasing the power by which the throw of the piston is checked and cushioned. The instant that the tappet K is released by the piston B the pressure of the steam in chamber I above valve *o* forces it down upon its seat, closing the port *i*.

It is evident that the ports or passages *g g'*, instead of being made as shown, might be made through the heads of F, to operate in connection with the ports *h h'*.

The shaft *l* of pinion L projects through the steam-chest, being provided with a suitable gland or stuffing-box, and is furnished with a lever, which is used as the starting-bar.

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

1. The combination of an auxiliary plunger or piston, the entire stroke of which is effected by steam alone, a single D-valve for opening and closing the steam and exhaust ports, and a pinion or equivalent intermediate mechanism for causing the valve to move in a reverse direction from the piston by which it is operated, substantially as specified.

2. In combination with piston F, two or more ports or passages at each end of the auxiliary cylinder or steam-chest, arranged so that one of each set is alternately opened and closed by the travel of the piston, substantially as and for the purpose specified.

3. In combination with the auxiliary valve-chamber, having port *c'*, which communicates with the live-steam chamber, and ports *i c*, which communicate with the cylinder G and the exhaust-port, a solid valve and independent tappet for operating the valve, substantially as and for the purpose specified.

In testimony whereof we, the said JAMES A. HUTCHISON and JOHN W. GOVIER, have hereunto set our hands.

JAMES A. HUTCHISON.
JOHN W. GOVIER.

Witnesses:
W. S. REESE,
T. B. KERR.