I. W. Bowers,

Steam-Engine Valve-Gear.

No. 43,757. Patented Aug. 9, 1864.

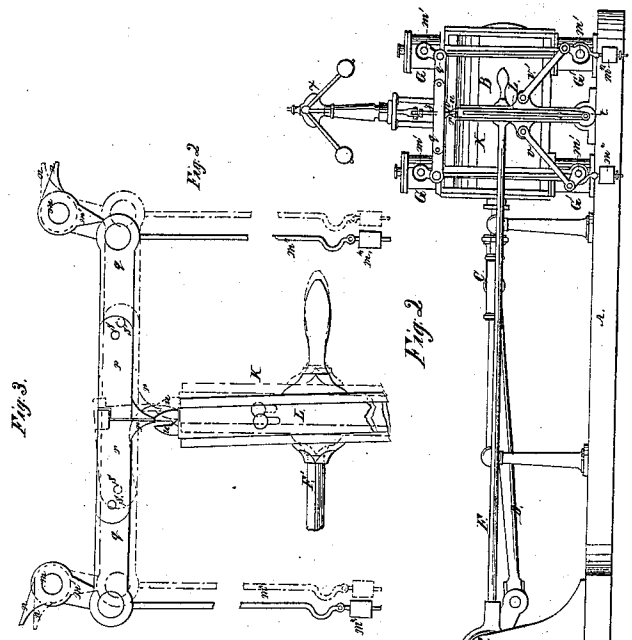

Fig. 2

Fig. 3.

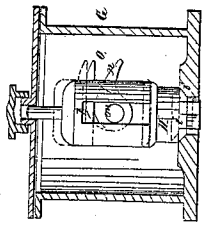

Fig. 5.

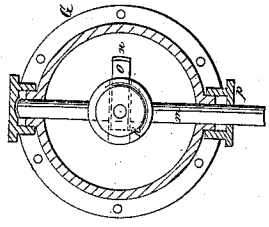

Fig. 4.

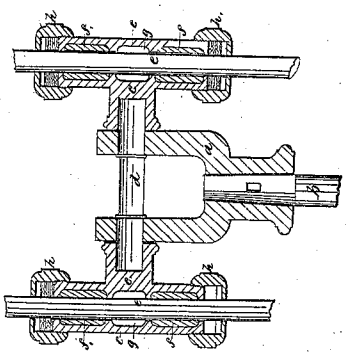

Fig. 6.

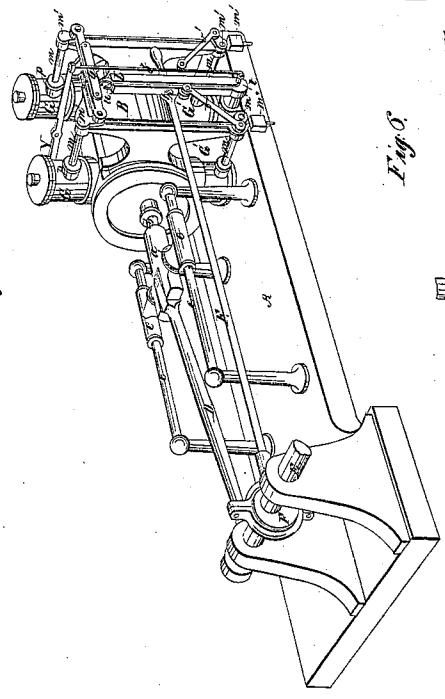

Fig. 1.

Witnesses:

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UNITED STATES PATENT OFFICE.

I. W. BOWERS, OF CINCINNATI, OHIO.

IMPROVED VALVE-GEAR FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **43,757**, dated August 9, 1864; antedated January 27, 1864.

To all whom it may concern:

Be it known that I, I. W. BOWERS, of Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings and letters of reference marked thereon, forming part of this specification.

My invention relates to the valve-chamber and mode of operating the valves, also to a variable or adjustable cut-off.

In the accompanying sheet of drawings, Figure 1 is a perspective view of a horizontal high-pressure engine, in which my improvements are presented. Fig. 2 is a side elevation of the same. Fig. 3 is an enlarged representation of the parts by which the valves are operated. Fig. 4 is a transverse section of the valve-chamber. Fig. 5 is a vertical section of the same. Fig. 6 is a horizontal section of the ⊤ or cross head and slides.

In the following description like letters of reference indicate corresponding parts in the different drawings.

A is the bed-plate of the engine. B is the cylinder. C is the cross-head. D is the pitman; F, the cam or eccentric, and F′ the cam-rod. G G are ingress-valve chambers. G′ G′ are exhaust-valve chambers.

The valve-chambers are made, as represented, of considerable dimensions, and contain the lifting-arm by which the valve is actuated, the valve-stem being also contained entirely in the chamber.

Figs. 4 and 5 are enlarged representations of the valve-chambers. As these are all alike in construction and in the arrangement for operating the valves, the description of one will be understood as applying to all.

i is the valve-seat; H, the valve-stem. Through an enlargement below the stem, which may be termed the "body" of the valve, mortises *l* are made at right angles to each other, of considerable length vertically, in which the rods *m* and the lifters *n* are arranged to operate, the mortises being long enough to allow the valve to raise and fall without interference.

o is a projecting piece secured to the valve at an appropriate point to receive the action of the lifter *n*, by which the valve is raised or opened. The rod *m*, which carries the lifter and operates the valve, enters the valve-chamber through a stuffing-box, *p*, and on its outer end receives a crank, *m′*.

Referring now to the upper or ingress valve chambers, and to the parts appertaining thereto, it will be seen that the cranks *m′ m′* are connected by a bar, *q*, so that when this bar is operated or caused to vibrate, as will presently appear, the cranks and rods to which it is applied are simultaneously vibrated.

Depending from the two cranks *m′ m′* are rods *m″ m″*, which carry weights *m‴ m‴*, and these by their gravity tend to hold or return the cranks to a vertical position, in which position both valves are closed. Now, the arrangement of these parts is such that when the connecting-bar *q* is vibrated from a central position in one direction it operates through the appropriate crank-rod and lifter to open one of the valves and admit steam to one end of the cylinder, and when released it suddenly returns by the gravity of the weights above described to its central position, releasing the valve and allowing it to fall to its seat and cut off the steam, and when vibrated in an opposite direction a corresponding effect takes place with the valve at the other end of the cylinder. If the vibration of the connecting-rod is arrested at a short distance from a central position the valve will be but slightly opened, and remain open but for a comparatively brief time, while if the vibration is greater and prolonged—say during the time the piston is traversing the whole length of the cylinder—the valve will be held open during that time and the engine will be working steam at what is termed "full stroke." Carried by the connecting-bar *q* are two pawls, *r r*, pivoted as shown at *s s*, having abutting faces set in opposite directions and projecting a short distance below the lower face of *q*.

K is a vibrating bar pivoted at *t* and caused to vibrate regularly in a vertical plane through a short arc by the cam F, through the cam-rod F′, the latter being connected with K by a wrist. (N not represented in the drawings.) Upon the outer face of K is an adjustable or sliding bar, L, the upper end of which is armed with two catches, *u*, faced in opposite directions, and adapted to the faces of the pawls *r r*, re-

spectively. Let it be observed that the faces of the catches *u* form surfaces of contact with the faces of pawls *r*, one pair being engaged when the bar K is vibrated in one direction and the other pair being engaged when the bar is vibrated in the opposite direction. Let it also be noticed that the pawls *r* and the catches *u* vibrate in arcs whose curvatures are in opposite directions; hence as the bar *q* is caused to vibrate by the contact of either of said catches *u* with either of said pawls *r*, the surface of contact gradually diminishes as the respective arcs are traversed until the pawl which is at the time engaged becomes released, and the bar *q* is permitted to return, which it does suddenly, to its central position. It will now be apparent that the degree of vibration communicated to the bar *q*, and consequently the degree and comparative duration of the opening of the valves for the admission of steam to the cylinder, will be determined by the position of the catches *u* relatively to the pawls *r*—that is, by raising the adjustable bar L so that the catches have a longer hold upon the pawls, a longer vibration will be communicated to the connecting-bar *q*, even to the extent, as will be readily understood, of working the steam full-stroke, while by lowering the adjustable bar L until the catches have but a slight hold upon the pawls, a shorter vibration will be communicated to the connecting-bar, and a correspondingly less opening will be given to the valves. The bar L may be set and secured in an appropriate manner in any required position relatively to the connecting-bar *q*, so that the former may be acted upon and caused to vibrate through a greater or less arc, causing the valves for the ingress of steam to the cylinder to "cut off" steam at any desired point in the stroke of the engine; and this adjustment of the bar L may, for greater convenience, be effected by a temper-screw, so applied that by rotating it in one direction the bar L will be elevated and a greater opening communicated to the valves, and by rotating it in another direction the opening will be diminished and the admission of steam to the cylinder at each stroke be correspondingly less.

It is apparent that by leaving the sliding bar L free to rise and fall, and then connecting it with an ordinary governor, its position will be accurately controlled thereby, and the motion of the engine governed by this means. An arrangement for this purpose is represented in Fig. 2, where X represents an ordinary governor; Y and Z, rods through which the governor acts upon the sliding bar L.

The exhaust-valves in the valve-chambers G′ G′ are operated by the pitmen *v v*, which are pivoted to vibrating bar K, as represented, and operate through cranks *m′ m′* upon valve-rods *m m*. The internal arrangement of the valve-chambers and the construction and operation of the valves are in all respects similar to the ingress valves and appurtenances which have been described.

In the operation of the engine the exhaust-valves are opened alternately, and remain open during the entire half-stroke to which the respective opening is appropriate.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is the following:

1. Operating the valves H by the lifters or their equivalents, when they are arranged within the valve-chamber, as shown, and for the purpose described.

2. The combination of the valves H, rock-shaft *m*, and cranks *m′* with the weights *m‴*, substantially as described, and for the purpose set forth.

3. The several devices in combination by which the port or steam valves and the exhaust or outlet valves are operated, when combined substantially as described, and for the purpose set forth.

4. The combination of the forked sliding bar L with the vibrating bar K and cam-rod D, when constructed and arranged substantially as described.

5. The combination and arrangement of the connecting-bar *q* and pawls *r r* with the cranks *m′ m′*, when constructed substantially as described, and for the purpose set forth.

I. W. BOWERS,

Witness:
W. K. NIXON,
M. GREENWOOD.