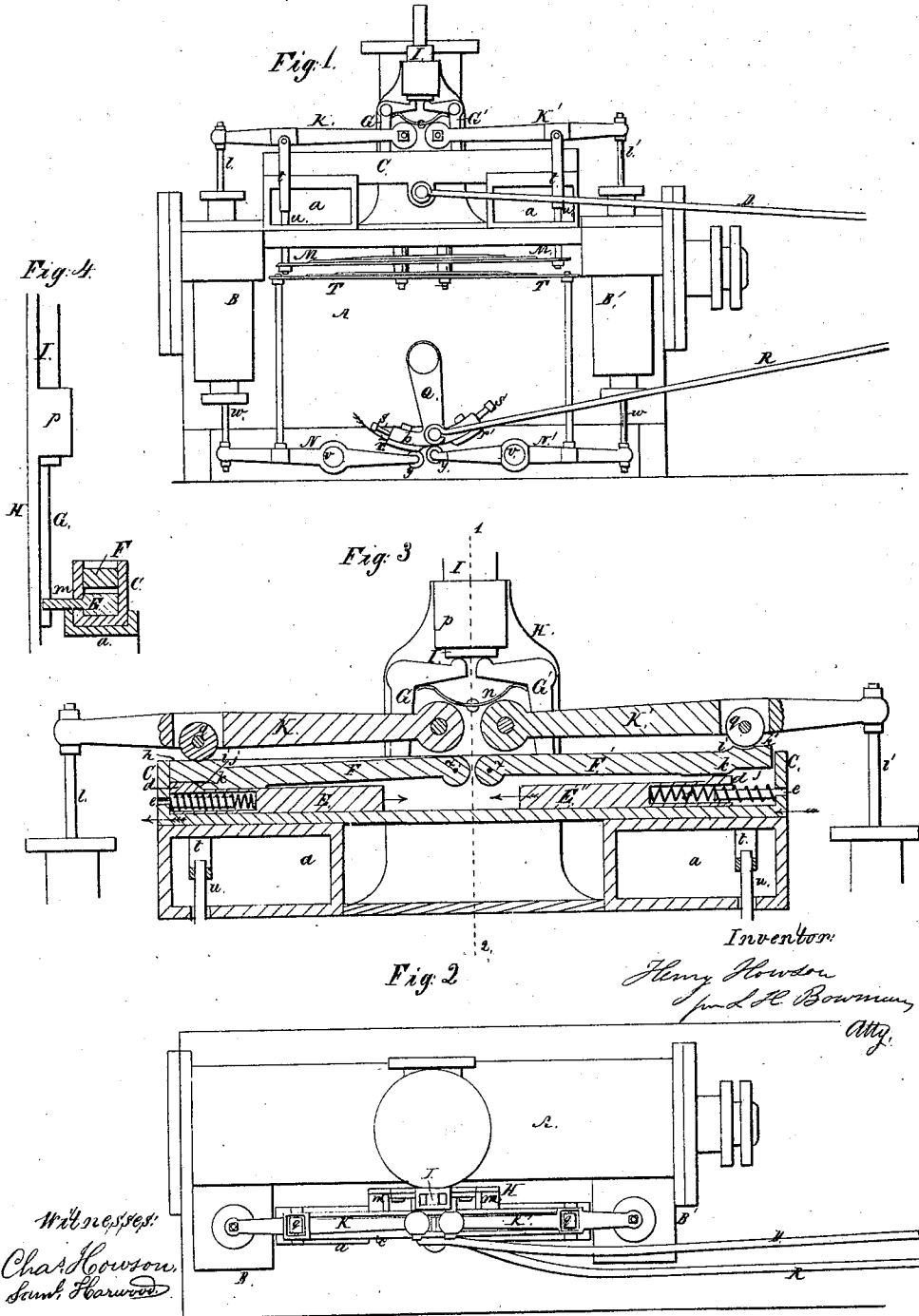


L. H. BOWMAN.
 OPERATING VALVES OF STEAM ENGINES.

No. 30,956.

Patented Dec. 18, 1860.



Inventor:
Henry Howson
per L. H. Bowman
 Atty.

Witnesses:
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UNITED STATES PATENT OFFICE.

LEWIS H. BOWMAN, OF NORRISTOWN, PENNSYLVANIA.

OPERATING THE VALVES OF STEAM-ENGINES.

Specification of Letters Patent No. 30,956, dated December 18, 1860.

To all whom it may concern:

Be it known that I, LEWIS H. BOWMAN, of Norristown, Montgomery county, Pennsylvania, have invented a new and Improved Valve-Motion for 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 drawing and to the letters of reference marked thereon.

My invention relates to devices for so operating the steam valves of engines that the closing of the same and consequent cutting off of the steam is dependent upon the governor, also to certain devices for operating the exhaust valves of steam engines, and my invention consists, firstly, in a reciprocating box having two spring sliding bars with inclined projections and two arms with certain inclinations in combination with two steam valve levers, the whole being arranged and operating substantially as set forth hereafter.

Secondly my invention consists of the above mentioned spring sliding bars each having a certain projection in combination with two bell crank levers and a sliding block operated by the governor, the whole being arranged and operating substantially as described hereafter for the purpose of releasing the steam valves at a point in the movement of the engine, determined by the governor; thirdly, of a device for operating the exhaust valves.

In order to enable others to make and use my invention I will now proceed to describe its construction and operation.

On reference to the accompanying drawing which forms a part of this specification, Figure 1 is a side view of a cylinder and steam chests with my improved valve motion; Fig. 2 a plan view of Fig. 1; Fig. 3 an enlarged sectional view of part of Fig. 2, and Fig. 4 a transverse sectional view of Fig. 3 on the line 1, 2.

Similar letters refer to similar parts throughout the several views.

A is the cylinder of a horizontal steam engine, B the steam chest containing the rear exhaust and steam valves, and B' the chest containing the front exhaust and steam valves.

Between the two steam chests and in suitable guides *a a* is situated the sliding box C, to which a reciprocating motion is imparted by an eccentric on the crank shaft

through the medium of the rod D. Within this box are fitted snugly but so as to move freely in a horizontal direction only, the two bars E and E' one being placed near each end of the box. Each bar has a recess for the reception of a spiral spring *f* which surrounds a spindle *e* secured to the end of the box the springs having a tendency to move their bars in the direction pointed out by their respective arrows Fig. 3. Each bar has a projection *d* the inner end of which is inclined for a purpose which will be rendered apparent hereafter.

Two arms F and F' are also fitted snugly into the box but so as to vibrate freely thereon on their respective pins *w w*, the arm F being situated above the bar E and the arm F' above the bar E'. Each of these arms F and F' has at the outer end a projection *h* on the upper side, and a recess *j* on the under side, the inner end *i* of each projection being inclined and the inner end *k* of the recess having a similar inclination corresponding to the inclination of the projection *d* of one of the arms F or F'. Each of these bars as will be best observed on reference to Figs. 2 and 4 has a pin *m* projecting through an opening at the back of the box C the pin *m* of the bar E being arranged to strike against the vertical arm of the bell crank lever G, and the pin *m* of the bar E' to strike against the vertical arm of the bell crank lever G'. Both levers are hung to a plate H on the cylinder A a spring *n* tending to press their horizontal arms against the underside of the block I, which slides in a box *p* secured to or forming a part of the plate H, the vertical position of this sliding block being under the control of the governor.

Above the arm F and to the plate H is hung the lever K, and above the arm F' the lever K', the outer end of the former lever being connected to the spindle *l* of the rear steam valve, and the outer end of the latter lever to the spindle *l'* of the front steam valve of the engine, and each lever having a roller *q* that of the lever K bearing on the top of the arm F and that of the lever K' on the top of the arm F'. Each lever is connected by a yoke *t* and rod *u* to one end of the spring M which is secured to the cylinder A and which serves to depress the valves after they have been raised in the manner described hereafter.

Two levers N and N' are hung to pins *v*

projecting from the cylinder the outer end of the lever N being secured to the spindle *w* of the rear exhaust valve and the outer end of the lever N to the spindle *w'* of the front exhaust valve, the inner end of each lever being provided with a roller *y*, and a spring T connected to the levers and secured to the cylinder tending to force both rollers against the underside of a segment *b* on the arm Q, which is hung to a pin projecting from the cylinder and to which a vibrating motion is imparted by means of an eccentric on the crank shaft through the medium of the rod R.

The underside of the segment of the arm Q is provided at each end with a curved block *r*, each block admitting of ready adjustment on the segment by the aid of a screw *s*.

When the engine is running at too low a speed the governor will raise the sliding block I and consequently allow the two vertical arms of the bell crank levers G and G' to move toward each other. As the engine increases in speed however the block I will be depressed thereby moving the vertical arms of the bell crank levers away from each other.

Supposing the sliding box C to be moving in the direction of the arrow Fig. 3, the arm F', to be raised and resting on the projection *d* of the bar E' and the roller *g* to be resting on the projection *h* of the lever F' and the front steam valve consequently raised. On the opposite end of the sliding box the lever F will be depressed at its outer end the arm K at its lowest position and the rear steam valve consequently closed. As the sliding box continues to move in the direction pointed out, the pin *m* of the sliding bar E' will strike the vertical arm of the bell crank lever G' which cannot yield owing to the block I, the further movement of the sliding bar E' with the sliding box is consequently retarded the spring *f* being consequently compressed by the continued movement of the box. The arm F' will therefore slide over the retarded bar E' until the inclination *h* of the former will coincide with the inclined end of the projection *d* of the sliding bar E' when the arm F' will instantly drop thereby allowing the outer end of the lever K' to fall and the steam valve to close. In the meantime the sliding bar E which has hitherto been retained in the position shown in Fig. 3 by its pin *m* bearing against the vertical arm of the bell crank lever G, will be released by the continued movement of the sliding box in the direction of the arrow and through the action of its spring *f* will move in the direction of its arrow until the inclined end of its projection catches the inclination *h* of the arm F. Prior to this however the projection *h* of this arm F has been moved away

from the roller *g* of the lever K so that the sliding bar E, propelled by the recoil of its spring, and bearing with its inclination against that of the lever F will raise the latter lever prior to the return movement of the sliding box in a direction contrary to that pointed out by the arrow. At the commencement of this return stroke the inclination *i* on the lever F acting on the roller *g* will raise the arm K and with it the steam valve thus causing the motion of the cylinder's piston to be reversed. As the backward movement of the sliding box continues the rear steam valve will remain open until the pin *m* of the sliding bar E strikes the vertical arm of the bell crank lever G when the movement of the bar E will be retarded and the arm F, will fall, allowing the valve to close and thus cut off further access of steam to the cylinder, the operation of the parts being precisely the same as that described in reference to the devices connected with the front steam valve.

It will be seen without further description that by the reciprocating movement of the sliding box the front and rear steam valves are opened alternately, and that they are allowed to fall at a point in the stroke of the engine determined upon by the position of the sliding block I or in other words by the speed of the engine itself, a slow speed of the engine allowing the steam valves to remain open for a greater length of time than when the speed of the engine is increased.

As the arm Q is vibrated it will impart a vibrating motion to the levers N and N' of the exhaust valves. For instance as the arm vibrates the curved block *r* on the segment *b* will act on the roller *y* of the arm N when the segment moves in the direction of the arrow, and when it moves in a contrary direction the block will leave the roller thereby allowing the valve to be closed by the spring T until the block *r* again acts on the roller and opens the valve. Precisely the same action by the same means is produced on the lever N' of the front exhaust valve and as the blocks *r* can be readily adjusted on the segment *b* it will be evident that the opening and closing of the exhaust valves may be regulated with the greatest exactitude.

I claim as my invention and desire to secure by Letters Patent—

1. The reciprocating box C its spring sliding bars E and E' each having an inclined projection, the arms F and F', with their inclinations, in combination with the valve levers K and K' and their rollers *g* the whole being arranged and operating substantially as set forth.

2. The spring sliding bars E and E' each having a projection *m* in combination with the bell-crank levers G and G' and the sliding block I, the position of the latter being

regulated by the governor and the whole being arranged for joint action substantially as and for the purpose set forth.

5 3. The vibrating arm Q with its segment *b* and adjustable curved blocks *r* and *r'* in combination with the exhaust valve levers N and N', the whole being arranged and operating substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of 10 two subscribing witnesses.

LEWIS H. BOWMAN.

Witnesses:

HENRY HOWSON,
JOHN WHITE.