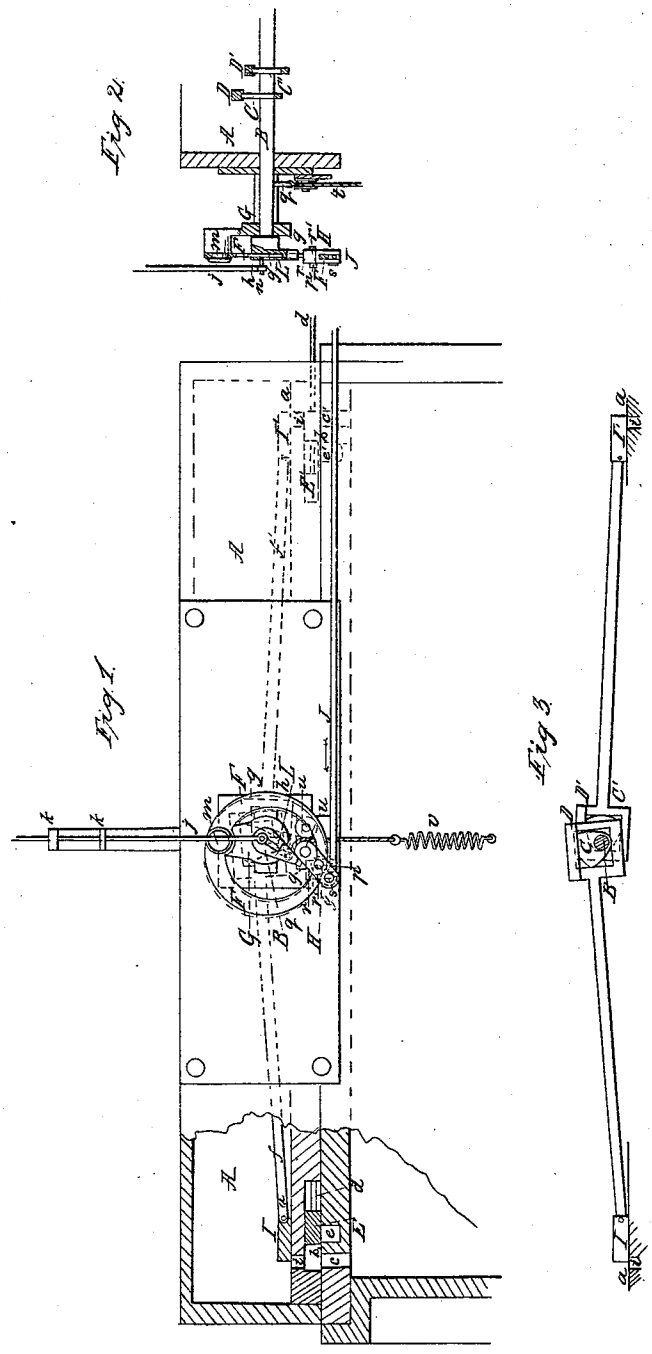
J. F. Allen,

Steam-Engine Valve-Gear.

No. 20,768. Patented June 29, 1858.



UNITED STATES PATENT OFFICE.

JNO. F. ALLEN, OF NEW YORK, N. Y.

VALVE-GEARING FOR STEAM-ENGINES.

Specification of Letters Patent No. 20,768, dated June 29, 1858.

To all whom it may concern:

Be it known that I, JOHN F. ALLEN, of the city, county, and State of New York, have invented a new and Improved Valve-Gear for Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a side view of the steam chest of a horizontal engine with my improved valve gear, the steam chest being represented with part of its exterior broken away to expose to view the valves belonging to one end of the cylinder. Fig. 2 is a transverse vertical section of the valve gear. Fig. 3 is a side view of part of the valve gear which is concealed in Fig. 1.

Similar letters of reference indicate corresponding parts in the several figures.

This invention consists in a certain arrangement of parts for operating the valve rockshaft of a steam engine in such a manner as to effect the induction of the steam at the proper time and cut it off at various points in the stroke.

The invention, though represented in the drawing applied to slide valves, can be used with puppet valves.

A, is the steam chest.

I, I′, are the induction valves, consisting of slide valves of the simplest kind, viz. mere plates, faced to fit and work upon their seat *a*, *a*, to cover and uncover the induction ports *i*, *i*′.

E, E′, are the eduction valves consisting like the induction valves of sliding plates, and being fitted to a seat *b*, *b*, which is under the seat *a*, *a*. In this seat *b*, *b*, are two sets of ports communicating with the cylinder viz. the eduction ports *e*, *e*′, communicating with the eduction pipe, and two ports *c*, *c*′, which coincide with the induction ports *i*, *i*′, and serve as a communication in turn between the induction ports and the cylinder and between the cylinder and the eduction ports. The valve seat *b*, *b*, while its ports *e*, *e*′, and *c*, *c*′, are like the valve seat and ports of steam engines now in use employ two short slide valves for induction and eduction of steam; the ports *e*, *e*′, corresponding with ordinary eduction ports and *c*, *c*′, with ordinary induction ports. The seat *a*, *a*, is placed on the face of that *b*, *b*, either in two short pieces of sufficient lengths for the two valves I, I, to work upon, or in one piece extending the whole length of the steam chest; suitable cavities being left under said seat or seats *a*, *a*, for the valves E, E, to work in. It will be readily understood that as the seat or seats *a*, *a*, is or are put on in this way, my invention may be applied to an old engine constructed for the use of two short slide valves of the ordinary kind. The eduction valves E, E′, are both attached to the same rod *d*, which is intended to be worked by an eccentric or other contrivance independent of the induction valve gear.

B, is a rockshaft by which the induction valves are operated, the said shaft passing through a stuffing box in one side of the steam chest and at the middle of its length, and extending across the chest to a suitable bearing in the opposite side thereof. This shaft carries—within the steam chest A—two cams C, C′, one for operating each valve; the said cams being surrounded by yokes D, D′, which are connected by rods *f*, *f*′, with the induction valves. These cams are what are known as triangular cams, and are arranged at right angles to each other, so that when one is opening or closing its respective valve, the other merely gives a vibrating motion to its respective rod, and thus makes the valves independent of each other. This arrangement is illustrated in Fig. 3, which represents the rockshaft, the cams, cam-yokes, rods and valves. The rock shaft B is furnished outside the steam chest with arm L, which is fitted with a sliding toe *g*, running right through it, and this toe is connected with a rod *j*, by a pin *n*, which passes through a slot *h*, in the outer face of the arm. The rod *j*, is fitted to slide through stationary guides *k*, *k*, and by sliding it down or up, the sliding toe *g*, is caused to project more or less beyond the extremity of the arm. The said rod may be adjusted by hand and secured by a set screw to effect a permanent adjustment of the sliding toe, or connected with a governor to vary the adjustment according to the requirements of the engine, as will be presently described.

q, is an arm attached to the rockshaft B, and occupying a position parallel to the arm L, and having attached to it a cord or chain *t*, which passes down between two pulleys *u*, *u*, and is connected with a spring *v*, which acts upon the cord with a tendency to draw

the arms q, and L, to a position perpendicular to the valve seat. The pulleys u, u, are placed on fixed axles secured to the frame G.

F is an annular plate or open arm, encircling the arm L, and hung to swing upon a stud m, which is secured in a fixed frame G, attached to the side of the steam chest; the axis of the said stud being parallel with the rockshaft B, and in the same plane, perpendicular to the valve seat, as the axis of the rockshaft. At the opposite point in the said plate or arm F, to where it is hung upon the stud m, the said plate or arm has attached to it by a pin p, a small swinging piece H, which has its upper end formed with two corners or points r, r', and which is attached at its lower end by a pin s, to the rod J, which is connected with the contrivance through which the motion of the valves is to be derived from the main shaft of the engine. An eccentric may be used for this purpose. The distance which the piece H is permitted to swing is limited by the form of the slot which is made in it to receive the arm F.

The operation of the valve gear to open and close the valves I, I′, for the induction and cutting-off of the steam is as follows: The rod J, gives a swinging movement to the open arm F; but as the rod moves in either direction, it moves the piece H, on the pin p, before commencing to move the said plate or arm, moving the said piece H to the position relatively to the said plate or arm shown in black outline in Fig. 1, as it commences to move to the left, and to the other position as it commences to move to the right. During the first part of the swinging movement of the open arm F, the arm L, the rockshaft B, and the valves I, I are stationary; and the arm L, is kept by the spring v, in a position perpendicular to the valve seat in which position the induction valves are both closed. As the upper point r, or r', of the piece H, comes in contact with the toe g,—which always occurs at the commencement of the stroke of the piston or just before that if the valves have any lead as they always should have,—the arm L, is caused to move with the plate or arm F, till the said point by reason of the radius of the open arm F, being greater than that of the arm L, works clear of the toe g, and allows the arm L to be drawn back to the perpendicular position before mentioned, by the spring v, thus closing the valve, and cutting off the steam with what is known as a tripping motion. It is obvious that the farther the toe g, is projected beyond the extremity of the arm L, the greater distance will the said arm L be moved before the toe escapes and the valve trips and vice versa; and hence by adjusting the rod j, to project the toe less or more, the steam may be cut off earlier or later in the stroke of the engine, and the cutting-off may be made to govern the engine by connecting the rod j, with a governor. Fig. 1 represents in black outline the rod J, and arm F, moving in the direction of the black arrow and the point r, of the piece H, in operation on the toe g; the movement not having been continued far enough for the toe to escape. In the same Fig. 1, the arm L is shown in red outline as having moved to the perpendicular position after the escape of the toe g, and the arm L returning to operate on the toe g, with the point r', uppermost or in the opposite condition to that shown in black outline. The rocking piece H, is for the purpose of providing for giving a lead to the valve and it can be constructed or adjusted so that each of the points r, r', shall come into contact with the toe g, at the proper time to give the required lead. When the induction valves are worked independently of the eduction valves, as described, the eccentric for working them may be set almost coincident with the cranks or only sufficiently in advance to give a lead to the valve, and then the cutting off of the steam may be caused to take place at any point nearly up to the end of the stroke.

With this valve gear, the education valves may be operated by the same eccentric as the induction valves. This operation may be effected by substituting for the stud m, a rockshaft with a connection therefrom to the exhaust valves and securing the arm F to the said rockshaft, and either driving the whole by the rod J, applied as described or by a rod otherwise applied to move the rockshaft m; but it is obvious that to work the eduction valves by the same eccentric, the eccentric must be set at right angles to the piston or thereabouts. This arrangement of the eccentric it may seem at first would compel the cutting off of the steam within half stroke or else the working under a full head of steam. This however is not necessarily the case, if the motion is given by the rod J, as the friction of the exhaust valves will be sufficient to hold the open arm F, stationary during the first part of the return of the rod J, which commences at half stroke; and the toe g, may be adjusted so that it will not escape from the piece H, till said piece has been turned partly over by the action of the rod; and as the movement of the eccentric rod is at that time very slow (the eccentric having but just passed its center), and the movement of the piston is very rapid (being just past half stroke) as much as two-thirds of the stroke of the piston may be completed before the toe g, escapes and allows the valve to trip and cut off.

This is perhaps the first valve motion which permits of the tripping of the valves to cut off beyond half stroke, when a single

eccentric is used, to work the induction and eduction valves.

To apply the invention to puppet valves, all the same parts may be used, with the exception that different connections are required from the cam-yokes to the valves. The motion of the cams C, C′, will prevent the slamming of puppet valves without using dash-pots.

I do not claim the use of a sliding toe like *g*, applied to the arm of the valve rockshaft but

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

The arrangement of the swinging plate or open arm F, with its two pointed swinging piece H, or equivalent, substantially as described, in combination with the single rockshaft B, its arm L, and movable toe *g*, to operate the two induction valves as described.

JOHN F. ALLEN.

Witnesses:
W. TUSCH,
W. HAUFF.