

R. GREENE.  
Valve-Gears for Engines.

No. 146,898.

Patented Jan. 27, 1874.

Fig. 1.

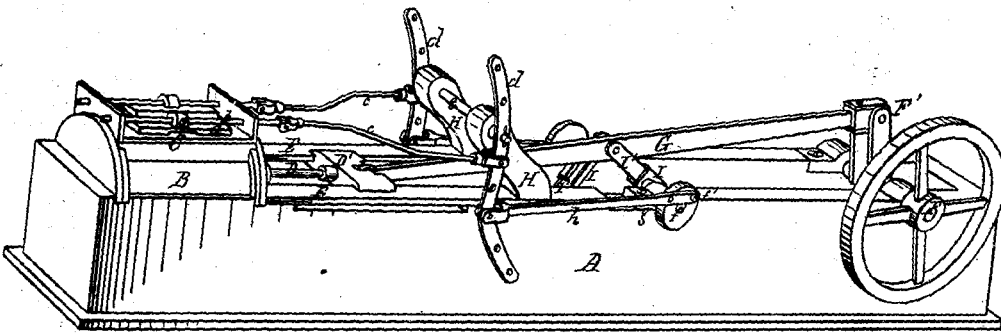
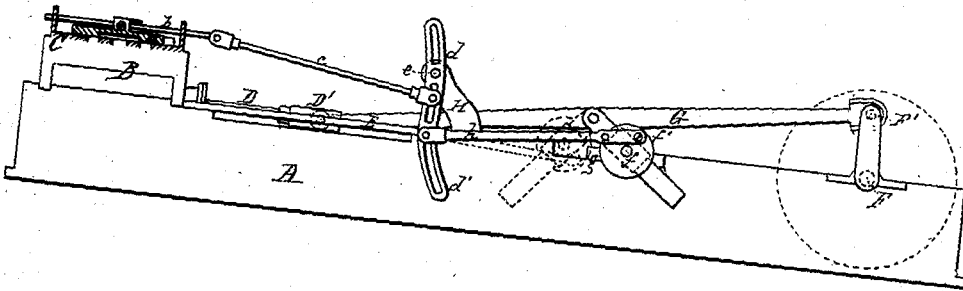


Fig. 2.



Witnesses.  
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## IMPROVEMENT IN VALVE-GEARS FOR ENGINES.

Specification forming part of Letters Patent No. **146,898**, dated January 27, 1874; application filed June 13, 1873.

*To all whom it may concern:*

Be it known that I, ROBERT GREENE, of Greenville, Pitt county, North Carolina, have invented certain new and useful Improvements in Valve-Gear for Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings making part of this specification, in which—

Figure 1 is a perspective view of an engine with my improved valve-gear applied, and Fig. 2 is a side elevation of the same partly in section.

Similar letters of reference denote corresponding parts in both figures.

My invention consists, first, in combining the valve-crank with the pitman through the medium of a slide, in such manner as to compensate for the variation of the throw of the crank relative to the throw of the cross-head or piston; and secondly, in the combination with the ordinary link, of an extension or secondary link for adjusting or regulating the point of cut-off, as hereinafter explained.

In the accompanying drawings, A represents the bed of the engine; B, the cylinder; C, the valve-chest; D, the piston-rod; D', the cross-head, traversing ways E; F, the main shaft provided with the crank F', which is connected by pitman G with the cross-head D'—all of the above parts, with the exception of details hereinafter described, being constructed in any usual or preferred manner.

The steam-chest is left open in the drawing to show the valve-connections complete.

The valve or valves *a*, which may be of any suitable construction, are adjustably connected, by a set-screw or equivalent device, with the rod or stem *b*. *c* is a connecting-rod pivoted at its forward end to rod or stem *b*, and at its opposite end to a curved link, *d*, mounted on a transverse pivot, *e*, which has its bearings in standards H on the bed-plate A. This link *d* in its upper portion is curved in the arc of a circle, of which the pivotal connection between the stem *b* and connecting-rod *c* is the center, and is pivoted midway of the length of said arc, and may be slotted, so that the end of rod *c*, connected therewith by any usual or preferred lever arrangement, may be moved inward toward or outward from the pivot center of said link, or from one side to

the other of said center, for reversing motion in a manner well understood. The lower end of link *d* has an extension or second curved link, *d'*, formed upon or connected with it, the curve of which is in an opposite direction or in the arc of a circle, of which a crank-shaft, *f*, is the center, or approximating thereto, for a purpose which will be explained. The crank-shaft *f* is mounted in boxes *g*, which may be adjusted longitudinally on the bed-plate or frame A, and a wrist or pin, *f'*, on said shaft *f*, is connected by a rod, *h*, with the link *d*, as shown. The inner end of shaft *f* has a plate, I, secured to it, the inner vertical face of which is grooved or made to clasp a slide, I', adapted to slide freely longitudinally in the groove. The outer end of this slide is pivoted to the pitman G, preferably about midway of its length, as shown; but it may be connected therewith at any desired point, either between the crank F' and cross-head D', or upon an extension of the pitman at either end and outside of the crank or slide, as the varying movement of the pitman at such points may be regarded as best adapted to the movement desired.

The curve described by any point of a pitman or connecting-rod G between its extremities approaches a circle or a straight line as that point is taken nearer to the crank or to the slide. If the middle of the rod be the point taken, the curve described is that of an ovated ellipse with its axis major equal to the length of stroke, and its axis minor equal to one-half the stroke, the variation of curvature projecting the center of a true ellipse toward the slide, the degree of variation being governed by the relation between the length of the pitman and crank. The shorter the connecting-rod is in proportion to the crank, the greater the variation, and the farther the center of curvature is removed from the center of a true ellipse.

For determining the position of the valve crank-shaft, I first move the cross-head to the center of its throw, and then place the crank-shaft in the horizontal plane of the slide and crank-shaft, and in the same vertical plane with the point on the pitman to which it is desired to attach the valve-crank. With the crank-shaft thus located with the crank-pin

vertically over it when the slide is at the center of its throw, it will be found that its movements will be timed by the movements of the piston or cross-head instead of by those of the crank, as heretofore, and consequently with the crank-shaft for operating the valve thus located and operated by the pitman, as described, a uniform opening and closing of the ports relative to the movements of the piston will be obtained, adapted to a single valve in which it is essential to open and close the opposite steam-ports in equal times.

For the variable cut-off the double valve-gear arrangement shown and two valves are required. In this arrangement if the two valve-cranks  $f$  are arranged relatively to the point of connection between the slides  $I'$  and pitman, as above described, the same movement of both valves for opening and closing in equal times is, of course, attained; but, if it is desired to open the valve fully at the beginning of the stroke of the piston, by moving the cranks, one,  $f$ , to the rear toward the pitman-crank, and the other,  $f'$ , forward or toward the cross-head, as represented, in such manner that the end movement of the pitman which opens the port is made with the pitman in close proximity to the valve-crank shaft, a rapid movement of the valve is effected for opening the ports, occupying but a small arc in the revolution of the crank, while the balance of the revolution of the crank is required for closing the same. Thus in a piston having a throw of two feet, by the adjustment of the valve-crank relative to the point of pivotal connection between the slide  $I'$  and pitman  $G$ , as explained, the movement of the piston a single inch, more or less, as desired, may be made to open the steam-ports to their full capacity, while the movement of the piston and cross-head through twenty-three inches, or the balance of the stroke, is essential to the gradual closing of said ports. The reverse adjustment of the valve-cranks will, of course, produce the opposite effect—viz., the gradual movement for opening and the quick movement for closing of the valve—thereby giving any required variation in the admission and cut-off of the steam, or time of opening and closing the ports.

The secondary link  $d'$ , or extension of link  $d$ , having the reverse curve to link  $d$ , as explained, may be slotted to permit the vertical adjustment of the end of connecting-rod  $h$ , attached thereto, and a lever arrangement, similar to that in use for adjusting the point

of attachment of the ordinary link and connecting-rod above referred to, may be used for effecting the adjustment while the engine is in motion. By the employment of this extension or second link, a lever, adjustable in length, is provided, varying the throw of the valve and producing a cut-off at any desired point, as follows, viz: The link  $a'$  is curved in the arc of a circle, of which the crank-wrist  $f'$ , when vertically over its shaft,  $f$ , is the center where it is desirable to adjust the point of cut-off; but where such adjustment is not required, the curvature of said link should be the arc of a circle described from the crank-wrist at a point at which the rod connecting said wrist with the link is in a line tangential to the circle described by said crank-wrist.

In this latter construction but one secondary slide,  $I'$ , need be used. By the adjustment of the point of connection between rod  $h$  and link  $d'$ , as above described, the throw of the valve will, of course, be varied as the distance of the point of attachment of the rod  $h$  to link  $d'$  from the center of vibration of said link is increased or diminished. This variation in the throw may, however, be compensated for by a corresponding adjustment of the valve rod or stem  $c$  nearer to or farther from the center of vibration on the upper arm or link  $d$ . By this arrangement variation in the cut-off is effected similar to that produced by the adjustment of the ordinary eccentric upon its shaft, and by the simple lever arrangement, above referred to, for effecting this adjustment of the connecting-rod upon the link, any desired variation in the cut-off may be produced while the engine is in motion.

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

1. The combination, with the pitman or connecting-rod, of the valve-crank and slide, operating substantially as described, and whereby either a uniform or variable cut-off is obtained, as set forth.

2. The adjustable crank-shaft  $f$  and slide  $I$ , in combination with the pitman or connecting-rod  $G$  and link  $d$ , substantially as and for the purpose set forth.

3. The double link  $d d'$ , in combination with the actuating-crank  $f'$ , substantially as and for the purpose set forth.

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Witnesses:

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