

(No Model.)

5 Sheets—Sheet 1.

E. D. LEAVITT, Jr.

VALVE GEAR.

No. 380,328.

Patented Apr. 3, 1888.

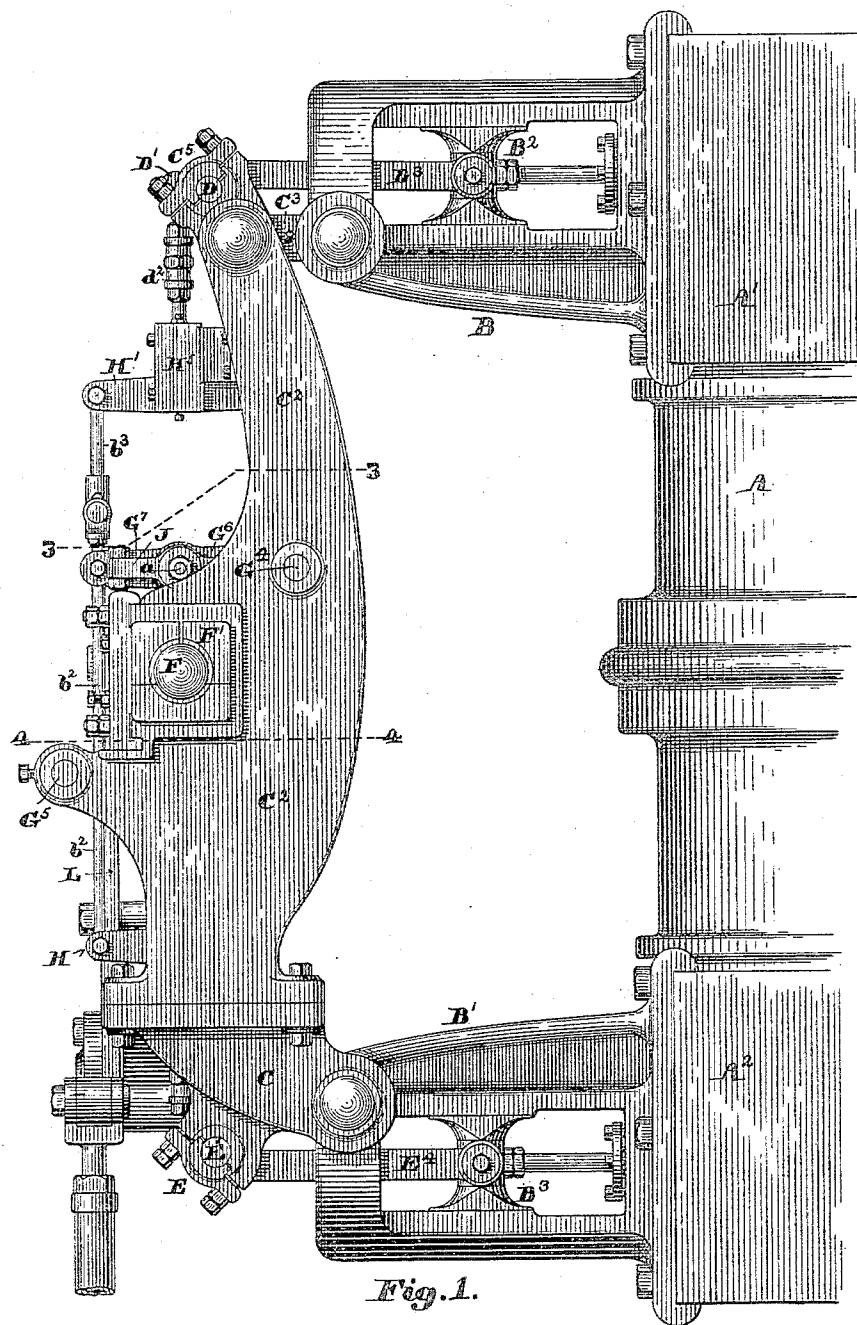


Fig. 1.

Witnesses:
Walter E. Lombard.
Jackson Hilte.

Inventor:
Erasmus D. Leavitt, Jr.,
by N. C. Lombard
Attorney.

(No Model.)

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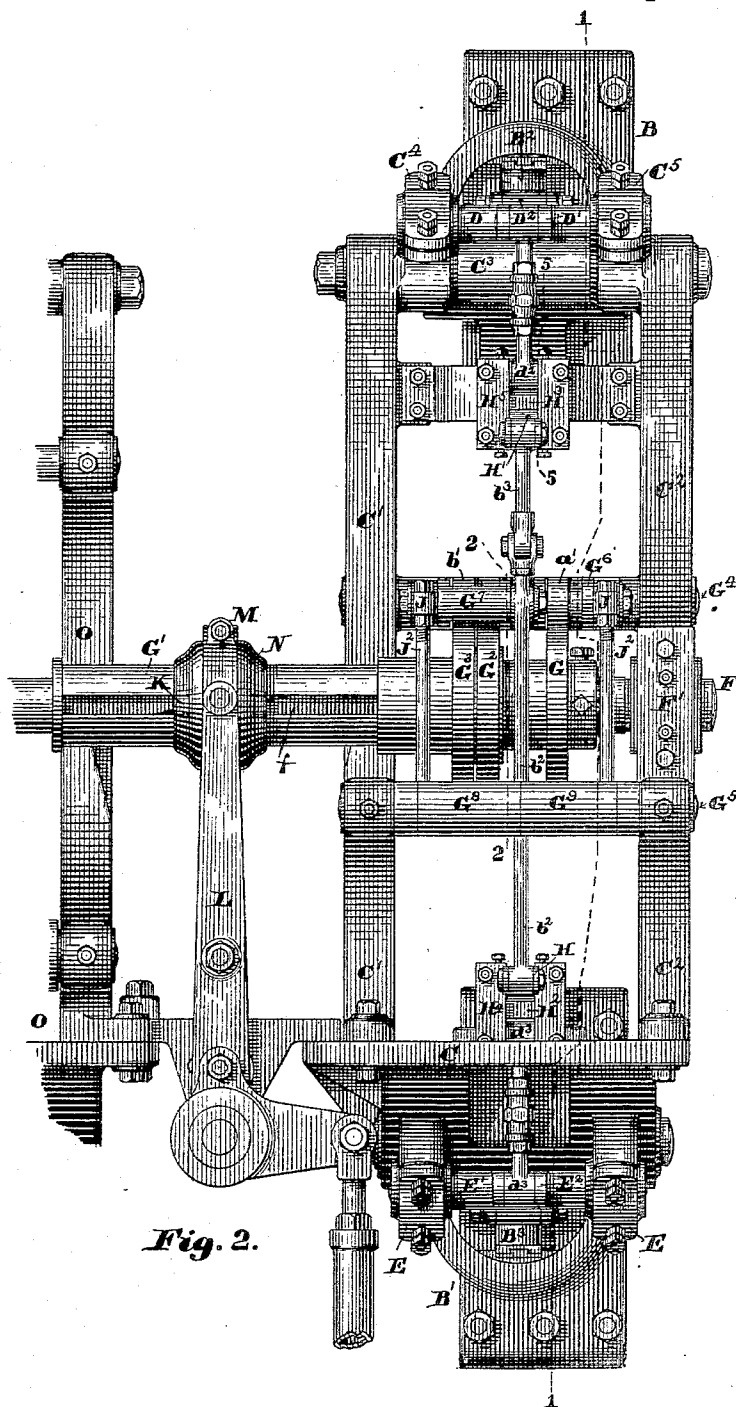


Fig. 2.

Witnesses:
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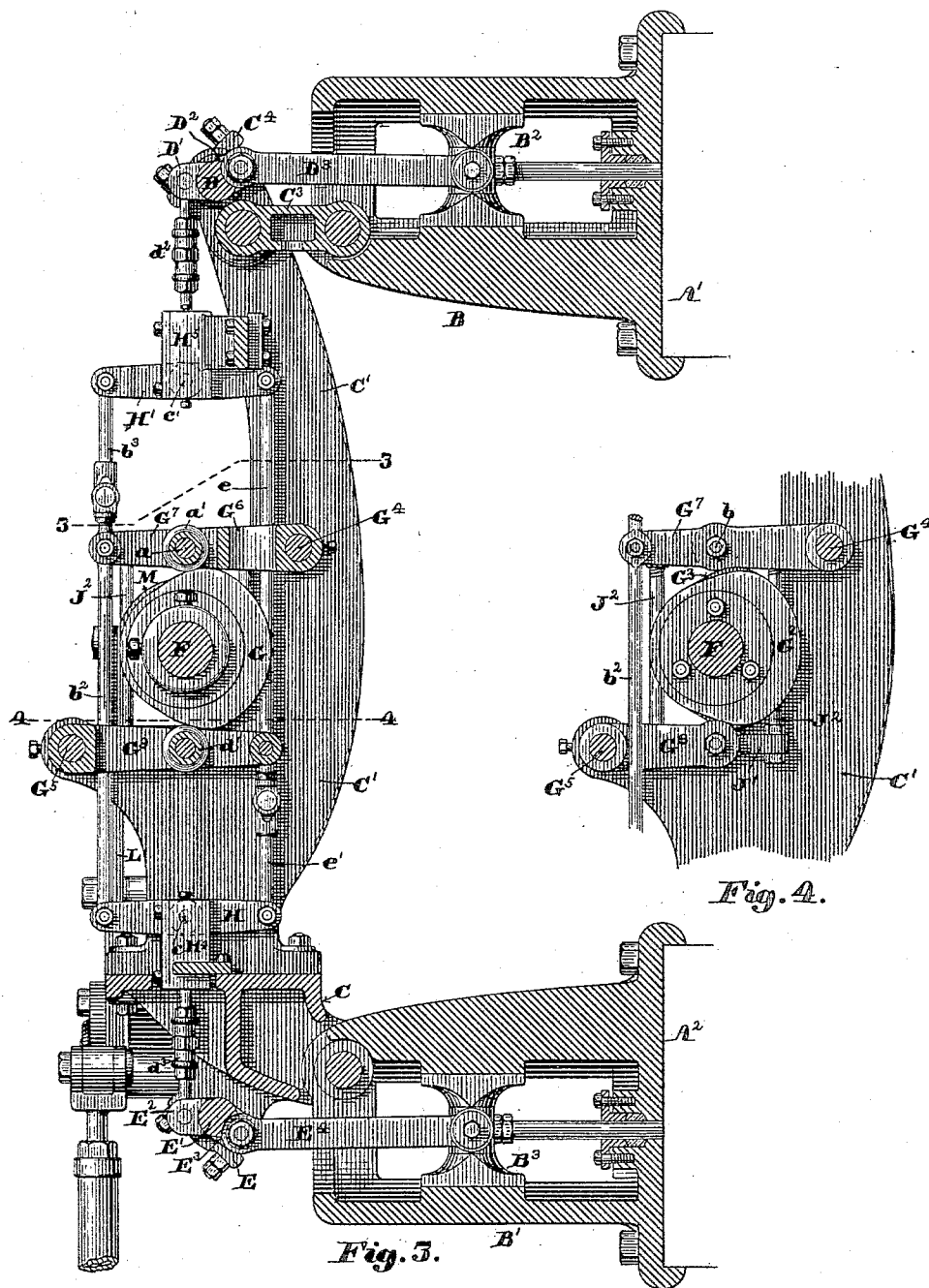
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Witnesses:
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5 Sheets—Sheet 4.

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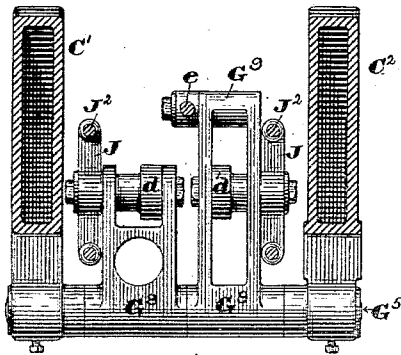


Fig. 6.

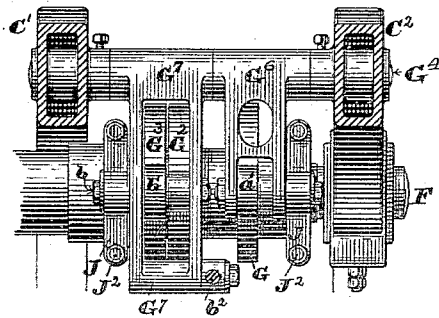


Fig. 5.

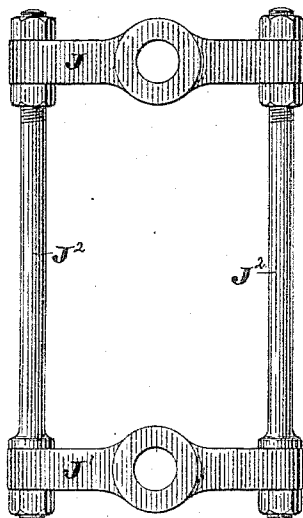


Fig. 10.

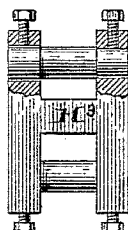


Fig. 9.

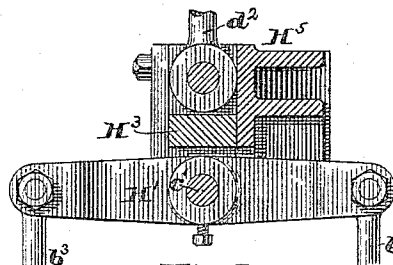


Fig. 7.

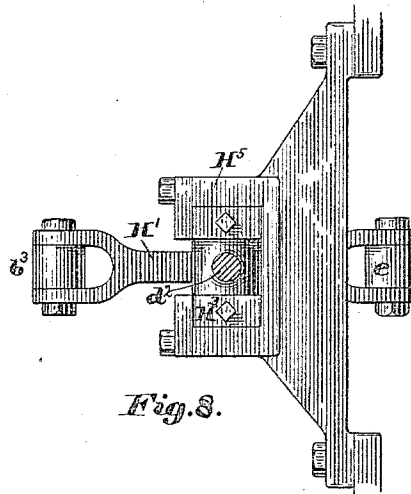


Fig. 8.

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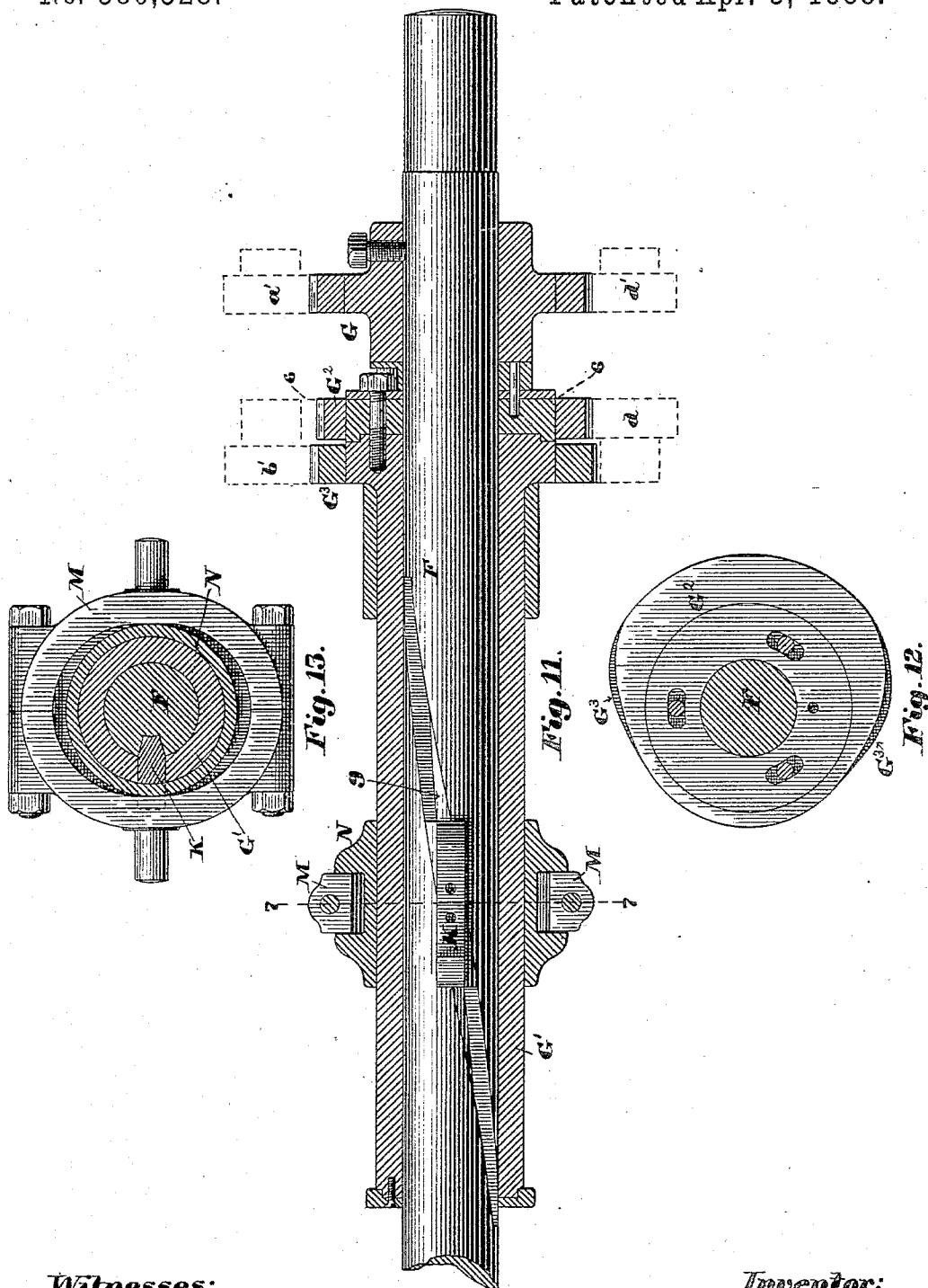
5 Sheets—Sheet 5.

E. D. LEAVITT, Jr.

VALVE GEAR.

No. 380,328.

Patented Apr. 3, 1888.



Witnesses:

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Gudson Hill.

Inventor:

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UNITED STATES PATENT OFFICE.

ERASMUS D. LEAVITT, JR., OF CAMBRIDGEPORT, MASSACHUSETTS.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 380,328, dated April 3, 1888.

Application filed October 10, 1887. Serial No. 251,894. (No model.)

To all whom it may concern:

Be it known that I, ERASMUS D. LEAVITT, Jr., of Cambridgeport, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Valve-Gears for Steam-Engines, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to valve-gears for operating the steam-valves for admitting steam to and cutting it off from the cylinders of that class of vertical steam-engines which have two independent steam-valves and two independent exhaust-valves; and it consists in certain novel features of construction, arrangement, and combination of parts, which will be readily understood by reference to the description of the drawings and to the claims to be hereinafter given.

Figure 1 of the drawings is a side elevation of so much of a steam-engine with my improved inlet and cut-off valve gear applied thereto as is necessary to illustrate my invention. Fig. 2 is a front elevation of the inlet and cut-off valve gear with a portion of the frame for supporting the exhaust-valve gear, the cylinder being omitted. Fig. 3 is a vertical section on line 1 1 on Fig. 2. Fig. 4 is a partial vertical section on line 2 2 on Fig. 2. Fig. 5 is a horizontal section on line 3 3 on Figs. 1 and 3, and showing the inlet and cut-off cams, a portion of their shaft, and the upper levers and trucks acted upon by said cams in plan. Fig. 6 is a horizontal section on line 4 4 on Figs. 1 and 3, and showing the lower levers and trucks acted upon by the inlet and cut-off cams in plan. Fig. 7 is a vertical section on line 5 5 on Fig. 2, and showing the rocker-lever carried by the upper intermediate cross-head and portions of the connecting-links in elevation. Fig. 8 is a plan of the upper intermediate cross-head, its bearing, and the rocker-lever carried thereby, the upper link connected to said cross-head being cut in section. Fig. 9 is a sectional elevation of the intermediate cross-head. Fig. 10 is an elevation of one of the yoke-frames connecting the truck-journals of the upper and lower cam-operated levers. Fig. 11 is a longitudinal section of the cut-off cams, the sleeve connected therewith, and the inlet-cam, and show-

ing the cam-shaft and the key to work in its spiral groove in elevation. Fig. 12 is a transverse section through the cam-shaft on line 6 6 on Fig. 11, and showing the cut-off cams in elevation; and Fig. 13 is a transverse section on line 7 7 on Fig. 11, and showing the cut-off shipper-collar ring in elevation. Figs. 7 to 13, both inclusive, are drawn to an enlarged scale.

In the drawings, A is the steam-cylinder, and A' and A² are respectively the upper and lower inlet-valve chests.

B and B' are stands or brackets bolted firmly to the upper and lower valve-chests, A' and A², and serve the double purpose of guides for the cross-heads B² and B³ and covers for said valve-chests. The outer ends of the valve-stems C and C' are firmly secured in said cross-heads B² and B³, respectively.

C is a bracket pivoted to the outer end of the stand B', and having firmly bolted thereto the two standards C' and C², the upper ends of which are in turn connected to the outer end of the stand B by the link C³, connected to each of said parts by a pivotal connection, for the purpose of providing for unequal expansion between the standards C' and C² and the cylinder A. The standards C' and C² have formed at their upper ends the bearings C' and C⁵, respectively, in which is mounted the rocker-shaft D, provided with the lever-arms D' and D², formed in one piece therewith, said arm D² having pivoted thereto one end of the link D³, the opposite end of which is pivoted to the cross-head B². The bracket C has formed thereon two bearings, E, which have mounted therein the rocker-shaft E', also provided with two short arms, E² and E³, to the latter of which is pivoted the link E⁴, the opposite end of which is pivoted to the cross-head B³.

F is a cam-shaft mounted in a bearing, F', on the standard C² and a similar bearing on one of the standards of the exhaust-valve-gear frame, and has a rotary motion imparted thereto in any suitable and well-known manner. The shaft F has firmly secured thereon the inlet-cam G, and also has adjustably fitted thereon the sleeve G', carrying the two cut-off cams G² and G³, as shown in Figs. 4, 11, and 12. The standards C' and C² are connected to-

gether by the shafts G^4 and G^5 , secured therein in fixed positions by set-screws, as shown, or otherwise.

Upon the shaft G^4 is mounted so as to be movable about the axis thereof the lever G^6 , having mounted upon a fixed pin, a , set in its free end, the anti-friction roll a' , which rests upon and is acted upon by the inlet cam G . (See Fig. 5.) The shaft G^4 also has mounted in like manner thereon the lever G^7 , of greater length than the lever G , and having mounted upon the fixed pin b the anti-friction roll b' , which rests upon the cam G^2 , and said lever has pivoted to its free or movable end the rod b^2 , which extends both above and below said pivotal connection, and is pivoted at its lower end to the rocker-lever H and at its upper end to the shorter rod, b^3 , the upper end of which is in turn pivoted to one end of the rocker-lever H' , said levers H and H' being mounted at the centers of their lengths upon the fulcrum-pins c and c' , set in the cross-heads H^2 and H^3 , respectively, which cross-heads are fitted to slide vertically in guideways H^4 and H^5 , respectively, and are connected, respectively, by the rods d^2 and d^3 to the arms E^2 and D' of the rocker-shafts E' and D .

The shaft G^5 has mounted thereon so as to be movable about the same the short lever G^8 and the longer lever, G^9 , the former carrying the anti-friction roll d , which bears against the under side of the cam G^2 , and the latter carrying the anti-friction roll d' , which bears against the under side of the cam G , as shown in Figs. 3, 4, and 6 and in dotted lines in Fig. 11. The free end of the long lever G^9 has pivoted thereto the rod e , which extends above and below said pivotal connection, and is pivoted at its upper end to the rocker-lever H' and at its lower end to the shorter rod, e' , the lower end of which is pivoted to the rocker-lever H , as shown in Fig. 3. The pins upon which the anti-friction rolls a' and d' revolve project through their levers, and are connected by a yoke composed of the bars J and J' and the rods J^2 . (See Figs. 2, 5, 6, and 10.) The pins upon which the anti-friction rolls b' and d revolve are in like manner connected together by a yoke such as just above described.

G^2 and G^3 are the cut-off cams, and they are rendered automatically adjustable about their axes of motion by the traverse of the key K in the longitudinal slot f in the sleeve G' and the spiral groove g , formed in the shaft F , which traverse is effected by the governor (not shown) acting through the medium of the elbow-lever L , yoke M , and grooved collar or hub N , all constructed and operating substantially as described in the Letters Patent No. 229,240, granted to me July 16, 1872.

O is one of the standards of the frame for supporting the exhaust-valve gear, which is not shown, as it forms no part of my present invention.

By the use of the system of levers, rods, yokes, and cams shown and described I am enabled to regulate the engine to cut off steam

at any point in the stroke from zero to the end of the stroke, which is a great advantage in many cases. The valves to which this valve-gear is applied, and which are not shown in the drawings, are substantially the same as those described in the above-mentioned prior patent, and need not be further described here.

It will be seen that the rod e and e' , which connects the rear ends of the rocker-levers H and H' , is also connected to the lever G^9 , which is acted upon by the inlet-cam G , and the rod b^2 and b^3 , which connects the front or outer ends of said rocker-levers H and H' , is also connected to the lever G^7 , which is acted upon by the cut-off cam G^3 , and that if the cams are set as shown in the drawings the fulcrums of the rocker-levers H and H' will be moved vertically a distance equal to the throw of the cam, thereby causing the rocker-shafts D and E' to be moved about their axes in the direction indicated by the arrows shown in Fig. 1 a given and equal distance; but as the arm of the rocker-shaft E' to which the link or connecting-rod E^4 is pivoted moves toward the dead-point in its vibration at the same time that the arm of the rocker-shaft D to which the link or connecting-rod D^2 is pivoted is moving away from the dead-point in its vibration, it follows that when the lower valve is being moved the slowest the upper valve is being moved the fastest, and vice versa, both valves moving with a constantly-varying speed during the time of opening and closing. If the cut-off cam is set by the shipper-collar to close the valve at its earliest point, no steam will be admitted to the cylinder, because the motion of the cut-off cam will precede that of the inlet-cam. As the shipper-collar is drawn back by the governor, the motion of the inlet-cam will take precedence and admit steam to the cylinder, which will be cut off sooner or later, according to the position of the cut-off cam on the shaft, as determined by the shipper-collar.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a steam-engine provided with an independent inlet-valve at each end of the cylinder, the combination, with the valve-stems and guiding cross-heads, of a cam-shaft having mounted thereon an inlet-cam and two cut-off cams, means, substantially as set forth, for adjusting said cut-off cams about the axis of said shaft, a pair of levers mounted upon fixed fulcrums upon opposite sides of said cam-shaft, one above and to the rear of and the other below and in front of said shaft, and each carrying an anti-friction roll, which bears against and is acted upon by the inlet-cam, a rod connecting the free end of one of said levers with the rear ends of two rocking levers mounted upon movable fulcrums, one above and one below said cam-shaft, a second and similar pair of levers, each provided with an anti-friction roll, one arranged above and to be acted upon by one of the cut-off cams and the other arranged below and to be acted

upon by the other cut-off cam, a rod connecting the free end of one of said levers with the front ends of the above-mentioned rocker-levers, a yoke connecting each pair of roll-carrying levers together, and mechanism, substantially as set forth, for connecting the movable fulcrums of said rocker-levers with the valve-stem cross-head.

2. The combination, with the valve-stems of the two inlet-valves, of two rocker-levers mounted upon movable cross-heads, connected one to each of said valve-stems, rods connecting each end of one of said rocking levers with the corresponding end of the other rocker-lever, a cam-shaft, an inlet-cam fixed upon said shaft, a pair of roll-carrying levers, arranged one above and one below said inlet-cam, the movable end of one of said levers being pivoted to the rod which connects the rear ends of the rocker-levers, a yoke connecting the roll-carrying pins of said levers together, a pair of cut-off cams mounted on said shaft, means, substantially as described, for adjusting said cut-off cams circumferentially of said shaft, and a pair of roll-carrying levers, arranged one above and one below said cut-off cams, the roll carried by one lever being arranged to be acted upon by one of said cams and the roll carried by the other lever being arranged to be acted upon by the other cam, and the movable end of one of said levers being pivoted to the rod connecting the front ends of the rocker-levers, and a yoke connect-

ing the roll-carrying pins of said last-mentioned levers, substantially as described. 35

3. The combination of the shaft F, the cams G, G², and G³, the roll-carrying levers G⁵, G⁷, G⁸, and G⁹, the rocker-levers H and H', the jointed rods b² b³ and e e', connecting the levers G⁷ and G⁹ with the rocker-levers H and H', the cross-heads H² and H³, mounted in guideways H⁴ and H⁵, and mechanism, substantially as described, for automatically moving the cams G² and G³ about the axis of the shaft F, whereby said cross-heads may have imparted thereto a variable reciprocation as a means of imparting a similar variable motion to the valve-stem connected therewith. 45

4. In combination with the cylinder of a steam-engine having independent valves at each end thereof, the stands B and B', firmly secured to the valve-chests of said cylinder, the valve-gear-supporting frame C C' C², pivoted at one end to one of the stands B B', and the link C³, connecting the other end of said frame to the other stand B B', whereby provision is made for unequal expansions, substantially as described. 55

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 24th day of September, A. D. 1887. 60

ERASMUS D. LEAVITT, JR.

Witnesses:

N. C. LOMBARD,

WALTER E. LOMBARD.