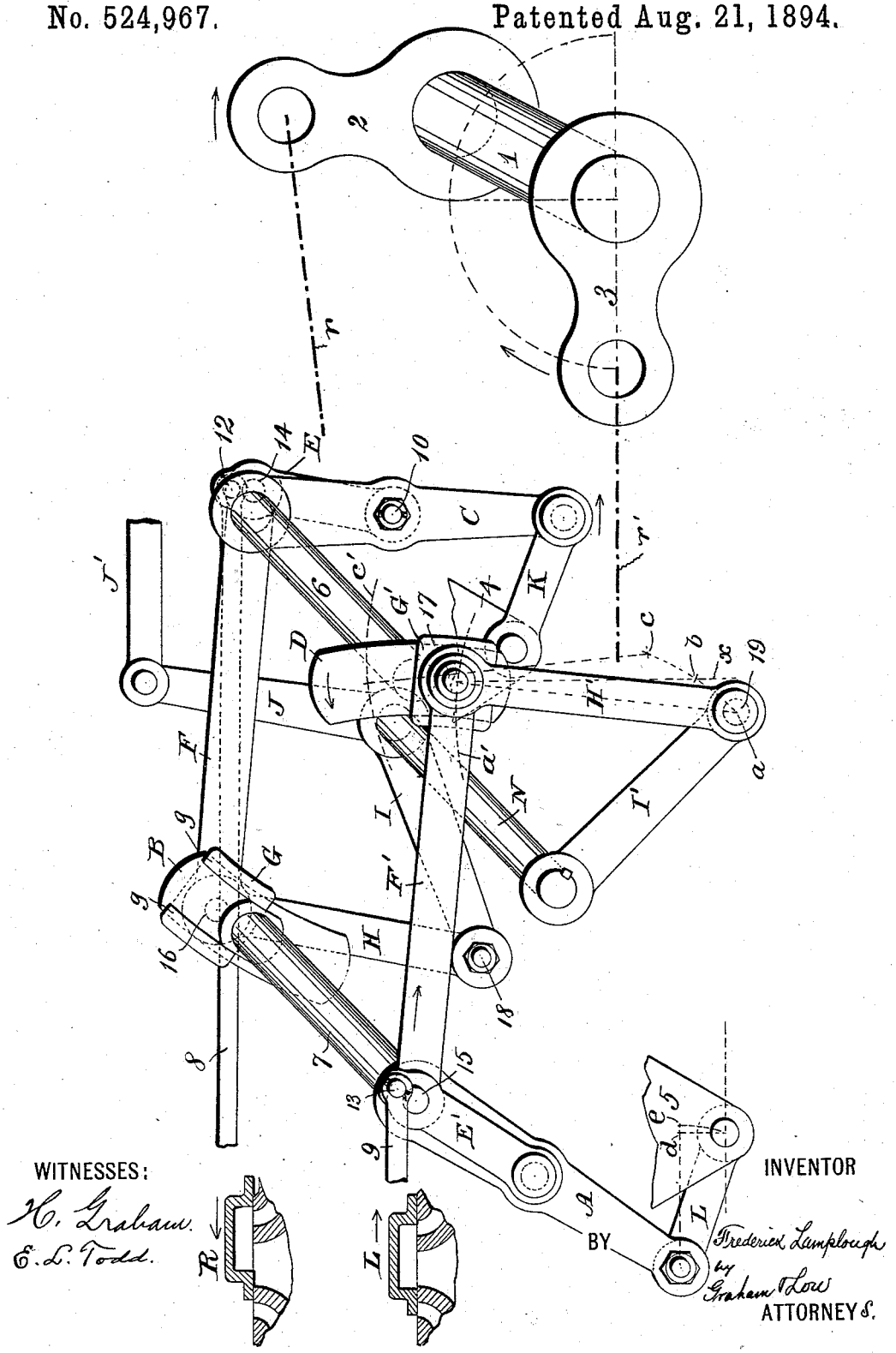
(No Model.)

F. LAMPLOUGH.

VALVE MOTION.

No. 524,967. Patented Aug. 21, 1894.



UNITED STATES PATENT OFFICE.

FREDERICK LAMPLOUGH, OF NEW YORK, N. Y., ASSIGNOR TO THOMAS P. BORDEN, OF ENGLEWOOD, NEW JERSEY.

VALVE-MOTION.

SPECIFICATION forming part of Letters Patent No. 524,967, dated August 21, 1894.

Application filed June 8, 1894. Serial No. 513,950. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK LAMPLOUGH, a subject of the Queen of Great Britain, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Valve-Motions, of which the following is a specification.

My present invention relates to that class of engines in which a plurality thereof are arranged for co-operation, for instance as in a locomotive, each engine operating its own valve but having the latter connected with and modified in position by the piston or cross-head of the other engine. Much difficulty has been experienced in producing an effectual gear of this character, from the complication of parts which have heretofore been thought to be necessary, or from failure to so arrange and proportion them as to cause both engines to work in time at all parts of the stroke.

My invention has for its objects to obtain the advantages of constant lap and lead, with quick action in admitting and cutting off steam, thereby getting the full benefit of the explosive action of the steam; to arrange the ratio of cut-off for expansion at the will of the engineer without altering the lap or lead of the valve; to enable each valve to make the parts of its stroke in proper time with the crank shaft; to cause both engines to operate in proper time with each other at all parts of the stroke; and to make such a gear simple and adapted to the present construction of locomotives.

With such objects in view my invention consists in the parts and combinations thereof hereinafter set forth.

In order to make my invention more clearly understood, I have shown in the accompanying drawing means for carrying the same into practical effect, without limiting my improvements in their useful applications to the particular construction, which, for the sake of illustration, I have delineated.

In said drawing:—the figure is a perspective diagrammatic view illustrating the essential parts of a valve motion or valve gear embodying my invention.

Referring to the drawing, R and L represent the slide valves of the right and left engines of a pair, for instance those of a locomotive, and 1 the main crank shaft having right and left crank arms 2 and 3, with which the pistons, not shown, and connecting rods r, r', are united in the usual manner.

4 and 5 indicate portions of the piston cross-heads of said engines, which are respectively connected by links K and L with oscillating arms C and A. These arms are fixed on transverse rock shafts 6 and 7 which will be mounted in suitable bearings, not shown, and which form the centers of oscillation for the arms. 8 and 9 are valve rods connecting the valve of each engine with its arm, C or A, and through which a reciprocation giving a constant lap and lead is communicated from said arm to the valve. The connections between the said rods and arms are not however direct.

The arms carry movable parts, such as levers E, E′, on pivots 10 and 11 which levers are at points above the axes of the shafts 6 and 7, connected with the valve rods by pivots 12 and 13, and which are also pivotally connected at 14 and 15 with reciprocating links or pitmen F and F′ by which latter the movements of the levers E and E′ are controlled. It is by properly controlling said levers, in conjunction with their movements derived directly from their arms C and A, that the valuable results of my invention, in quickly admitting and cutting off steam and in performing these functions at the most advantageous times, are attained.

B, D, indicate segments, mounted on the shafts 7 and 6 respectively, formed on the arcs of circles from the points 14 and 15 and serving as guides upon which play sliding blocks G, G′. These latter have flanges g, or other equivalent means for obtaining a sliding engagement with the segments, and are pivotally connected by pins 16, 17, with the links F, F′. It will be observed from this construction that when the parts are in the position shown in the figure that the movement of the piston and of the arm C of the right engine will be communicated to the pivot pin 15 and affect the valve of the left engine, and that the movement of the left engine will be communicated to and affect the position of the pivot 14 and valve of the right engine. When the pivots 16 and 17 coincide with the axes

of the shafts 7 and 6, however, the levers E, E′, will be held practically rigid with the arms C and A, and the valves will be given only their desired constant lap and lead by the movement of said arms. If the block G be moved past and below the axis of shaft 7 and the block G′ be moved upward and past the axis of shaft 6, the times of opening the valves and the direction of movement of the engine, will obviously be reversed.

H, H′, are links which are substantially upright (provided the engine is so mounted that the direction of valve motion is horizontal), and which are connected with the slides G, G′, preferably by means of the pivots 16 and 17. The other ends of said links are engaged by pivots 18, 19, on which the links oscillate as the segments B and D are rocked. The links thus serve to control the slides G, G′, and to compel them to move in arcs about the pivots 18 and 19 instead of about the shafts 7 and 6. The paths of the pivots 16 and 17 thus approximate a straight line more nearly than they otherwise would.

It is important that the pivots 16 and 17 move the valves substantially as far during one-half stroke as during another. In order that this may be the result the controlling links H, H′, should be at right angles to the links F, F′, at the middle of the stroke. To this end I provide for actuating the controlling links in such manner that whether either slide be at one or at the other end of its segment its controlling link will, at mid-stroke, be normal to the actuated link F or F′. I accomplish this by causing the controlling links, as they are moved to shift the slides, to be thrown at their lower ends from one side to the other of a line which is horizontal or transverse to the plane of valve movement. One of these lines is indicated by dots at x in the drawing, and a, b, c, show the lower, the neutral and the upper positions of the pivot 19. The paths of the pivot 17 corresponding to the said upper and lower positions are indicated at c', a'.

The pivots 18, 19, of the controlling links are shifted as above described by arms I, I′, connected with said pivots and attached to a rock-shaft N. The latter is operated by an arm J and rod J′ or other convenient means. It will be observed that the reversing rock-shaft N is intermediate between the segments B, D, and has its arms I, I′, inclined the one forward and the other backward, thus enabling it to accurately operate and control, through the links H, H′, the slides G, G′.

The main connecting rod of each engine during its first quarter-stroke is accompanied by a movement of its cylinder cross-head which is greater than a quarter of its complete reciprocation. I have arranged to compensate for this and to cause the valve movement to correspond properly with the rotation of its main crank. Referring to the crank 3, for example, it will be seen that its first quarter-stroke, from the position shown to a vertical position, will be accompanied by a change in the ordinary connecting rod r' from a horizontal to an inclined position. This virtually shortens such rod and would move the bracket 5 and the arm A for more than a quarter stroke. The arm A, and the valve gear of the right engine which is dependent on it, would consequently reach its mid-stroke position too soon. So during the next quarter stroke of the crank 3 the connecting rod r' is made horizontal and virtually lengthened and thus would move the bracket 5 and arm A and mechanism dependent on the latter for too short a distance. This would throw the two engines out of proper time with each other. According to my invention, however, the link L (and correspondingly the link K) is so inclined and proportioned relative to the length and throw of the connecting rod and arm A, which is a matter of measurement, that it approaches a horizontal position as the rod r' becomes inclined, and vice versa, thus lengthening and shortening the connection between the crank 3 and the arm A in the same proportions that the rod r' shortens and lengthens the same connection. Thus, if the distance between the points d, e, represents the shortening and excess of throw of the connecting rod, during the first quarter stroke, it will be observed that the operation of link L will, during said quarter stroke compensate by retarding the arm A a distance equal to d, e, thereby bringing the arm to its median position just as the crank 3 is vertical; so during the next quarter stroke, while the rod r' is approaching the horizontal and retarding the arm A, the link L becomes inclined and accelerates the arm.

Referring now to the positions of the parts as indicated in the figure, it will be observed that the left engine is on the center, while the right engine is one-quarter stroke in advance of the left engine and in full stroke. The arm A and segment B are consequently at rest for the instant, while the arm C, segment D, link F′, and the slide valves are in motion as indicated by the arrows. At this instant the left valve is being moved to the right by the segment D to admit steam in front of the piston and will continue to be so moved for a quarter stroke, this movement being quicker than and overcoming the movement to the left which the arm A will impart to the pivot 13. At the end of this quarter stroke the lower end of the segment B will have attained the limit of its throw to the right and the steam ports to their maximum opening. Thereupon the arm C and lower end of segment D will be moved toward the left, actuating the lever E′ and rod 9 to cut-off steam, which movement will be aided and hastened by the further movement of the arm A to the right and the consequent oscillation of the pivot 13, which is above the axis of the arm, to the left. Both the admission and cut-off are thus rendered quick, while the degree of opening is under full control through the rod

J′ and mechanism already fully explained, without change of the lap and lead of the valve.

The link K might be arranged to pull the arm C backward as does the link L in the case of the arm A. Since, however, the link K is arranged in front of the arm C and pushes it in its backward movement, said link must shorten as the connecting rod *r* shortens in order to obtain the described compensating effect. The link K is, therefore arranged to become inclined as the rod *r* becomes inclined, and to be horizontal when the said rod is on the center.

I claim—

1. In a valve motion a plurality of arms each adapted to be actuated from the piston of an engine, movable parts mounted on and carried by said arms and adapted to be connected with the valves of said engines, and actuating connections between each of said movable parts and an engine other than that with the valve of which the part is adapted to be connected, substantially as set forth.

2. In a valve motion a plurality of arms each adapted to be actuated from the piston of an engine, levers mounted on and carried by said arms and adapted to be connected with the valves of said engines, and actuating connections between each of said movable parts and an engine other than that with the valve of which the lever is adapted to be connected, substantially as set forth.

3. In a valve motion a plurality of arms each adapted to be actuated from the piston of an engine, levers mounted on said arms and adapted to be connected with the valves of said engines, and oscillatory segments or guides connected with said levers and each operated by an engine other than that with the valve-lever of which it is connected, substantially as set forth.

4. In a valve motion a plurality of arms each adapted to be actuated from the piston of an engine, movable parts mounted on and carried by said arms and adapted to be connected with the valves of said engines, oscillatory segments or guides, each operated by an engine other than that with the valve of which it is connected, slides on the guides connected with said movable parts, and links connected with said slides, permitting their oscillation, and limiting their movement in lines parallel with the guides, substantially as set forth.

5. In a valve motion a plurality of arms each adapted to be actuated from the piston of an engine, movable parts mounted on said arms and adapted to be connected with the valves of said engines, oscillatory segments or guides each operated by an engine other than that with the valve of which it is connected, slides on the guides connected with said movable parts, links connected with said slides and situated substantially transverse to the direction of valve motion, and oscillating reversing arms connected with said links and adapted to throw the latter to either side of lines which are transverse to said direction of motion and which pass through the points of connection of said slides and links, substantially as set forth.

6. In a double valve motion a plurality of arms each adapted to actuate the valve of its piston to give a constant lap and lead, and compensating links K, L, connected with said arms and adapted during each quarter-stroke to throw the same equal distances to each side of a line transverse to the direction of valve motion, substantially as set forth.

7. In a valve motion the combination with the segments B, D, of the intermediate shaft N having arms I, I′, oppositely inclined forward and backward, having pivots 18, 19 controlling links H, H′, and slides on said segments said arms operating to shift said pivots from one side to the other of the neutral point *b*, substantially as set forth.

8. The combination with the segments B, B, slides G, G′, links F, F′, and links H, H′, at right angles to the former links when at mid-stroke, of means for reciprocating the latter links and maintaining their said angle, substantially as set forth.

9. In a valve motion or gear the combination with the valves of a plurality of engines, of oscillating arms one for each engine connected with and operated from the piston rod or cross-head thereof, transverse shafts forming the axes for said arms, and carrying upon their other ends segments or guides, slides upon said guides, levers mounted upon said arms, links pivoted to said levers upon centers adapted to coincide with the axes of said transverse shafts and connected at their other ends with said slides, and valve rods connected with said levers, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two witnesses.

FREDERICK LAMPLOUGH.

Witnesses:

GEO. H. GRAHAM,

H. N. LOW.