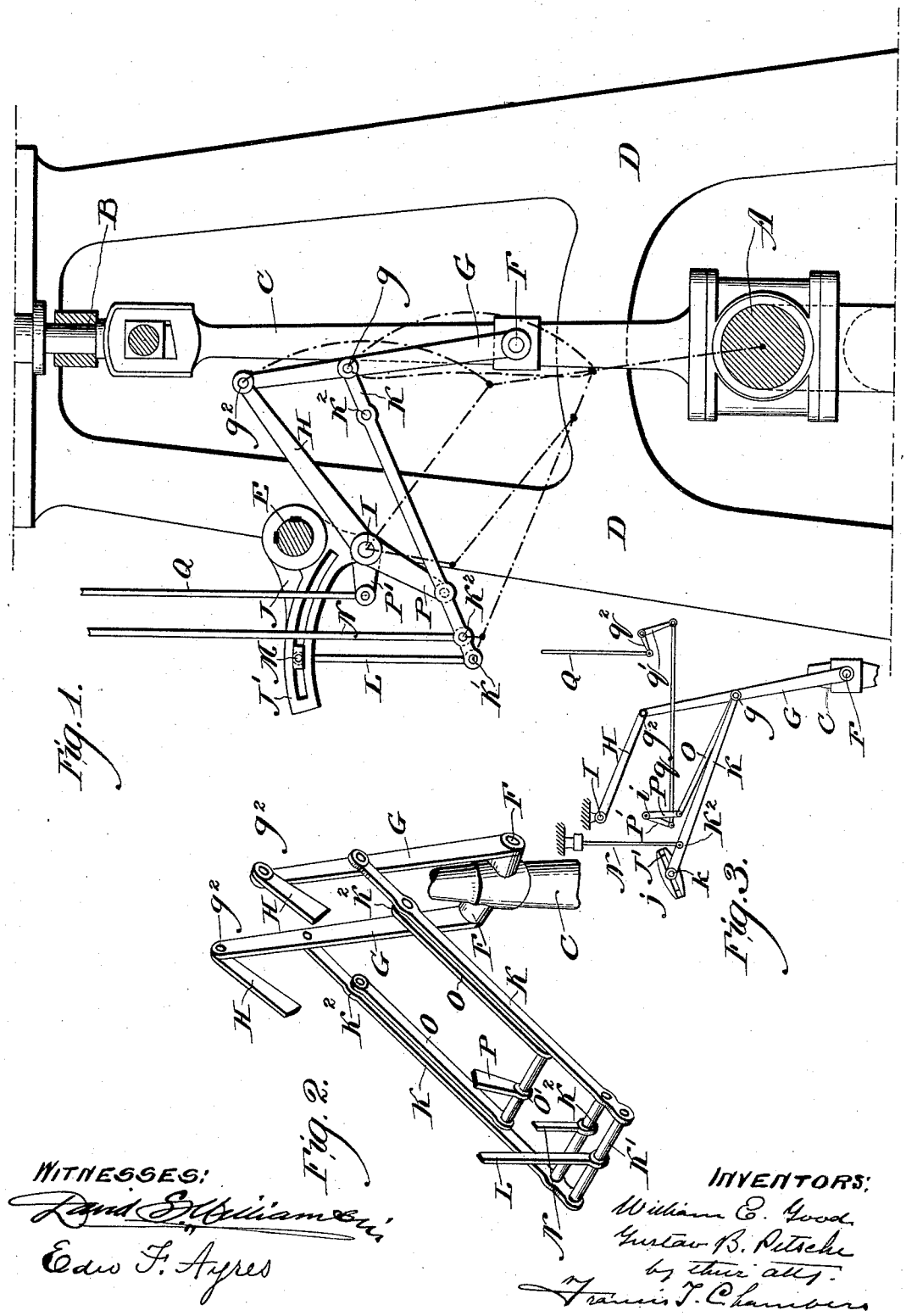
(No Model.)

W. E. GOOD & G. B. PETSCHE.

VALVE GEAR.

No. 498,783. Patented June 6, 1893.



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VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 498,783, dated June 6, 1893.

Application filed February 13, 1893. Serial No. 462,039. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM E. GOOD, a citizen of the United States, and GUSTAV B. PETSCHE, a subject of the German Emperor, residing at Philadelphia, in the county of Philadelphia, State of Pennsylvania, have invented a certain new and useful Improvement in Valve-Gears, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part of this specification.

Our invention relates to valve actuating mechanism and has for its object to provide simple and efficient devices for that purpose, to arrange the valve gear in convenient position, and to so construct the gear that one valve connected therewith will operate to admit the steam through a longer or shorter stroke, or be reversed in its action so as to admit steam for a short time against an advancing piston, while a second valve, for instance an exhaust valve, actuated by the same gear shall be given a substantially constant and uniform motion.

The nature of our improvements will be best understood as described in connection with the drawings in which they are illustrated, and in which—

Figure 1, is an elevation of a portion of a vertical engine showing our valve gear in its preferred form connected therewith. Fig. 2, is a perspective view showing the important parts of the valve gear; and Fig. 3, a diagram illustrating a modified construction.

A, indicates the crank of the engine; B, the piston rod; C, the connecting rod; D, the engine frame.

E, Fig. 1, shows a stud secured to and extending out from the frame B and serving a purpose which will be hereinafter described. To a point F, on the connecting rod C, we pivotally connect a link G, preferably forming it double as indicated in Fig. 2. This link lies along the connecting rod in a direction nearly parallel to the line of the piston rod and its free end g^2 is connected to a link H, which, as shown in the drawings is pivoted to a stud I extending out from the heel of a link J which in turn is supported upon the stud E. This special construction however, is not essential and we may indicate any fixed pivotal point. The position of the pivot I and the length and relative arrangement of the link H with respect to the link G should be substantially as shown in the drawings and so as to cause each of the points on link G intermediate between its ends, for instance, the point g, to describe a crescent shaped curve such as indicated in Fig. 1 of the drawings, the concave side of the curve of course facing the pivot point I.

To a convenient intermediate point on the link G as shown at the point g is pivotally connected a link K, the other end of said link being in turn connected with a guide link which will, together with the link G impart to some point or points on the link K a motion of the kind and preferably of the extent which it is desired to transmit to a valve. This guide link should be made in whole or in part adjustable so as to modify the compound motion given to the link K causing the valve actuated by it to move through a longer or shorter stroke; the adjustment having preferably the capacity of carrying the movement to the negative side so that steam will be admitted for a short time against an advancing piston. The requisite connection between the link K and the guide can be made in various ways. In Fig. 3, we have shown perhaps the simplest method: the upper end of link K being connected to the groove J′ of link indicated at J by a sliding pin k. The necessary adjustments in this construction are made simply by changing the angle of the slotted link j. Preferably however, we use a fixed link as indicated at J in Fig. 1 forming a slot J′ therein and providing an adjustable slide M which can be moved in said slot and to which the end K′ of link K is connected by a link L. The desired variations in the movement of the link K are effected by moving the slide M, which as shown is in a position which will cause the valve to move through simply its lap and lead. A movement of the block M to the right increases the admission, while a movement to the left has the effect of reversing the motion of the valve, causing it to admit steam against the advancing piston. The point indicated in both sets of drawings

as that, the motion of which is transmitted to the valve, is marked K^2, N indicating the valve rod connected therewith.

It will be understood that the motion of point *g* in the direction of the length of its curved path will give to link K the requisite motion for the lap and lead of the valve when its upper end moves substantially in a line perpendicular to the greater diameter of the cresent shaped curve and that the motion of point *g* across the curve of its lesser diameter is what we rely upon in connection with the guide link to regulate the cut off.

To insure that the motion imparted to the valve shall be the same in both directions, that is, symmetrical on each side of the neutral point it is necessary that the length of link K should be such as would describe a curve of the radius of the mean line of the ellipse described by point *g*. Now if the ellipse were symmetrical this would require a link K of infinite length, but by giving the ellipse the crescent form shown we produce a mean line of convenient curvature. In practice the length of the link K is determined by the size and nature of the engine and we develop an ellipse of the proper mean curvature by regulating the length of link K.

Passing next to the devices for transmitting motion to the exhaust valve, it is obviously necessary that the motion of this valve should be substantially uniform and unaffected by changes in the motion of the steam admission valve, and we therefore transmit motion to this valve from a point on the link G which has a simple and uniform motion, or a point on the link K connected therewith which has substantially the plain and unchanging motion of said link; thus, in Figs. 1 and 2 we connect links indicated at O with a point K^2 on the link or links K which is quite close to the pivotal connection of link K to link G, connecting the other end of link O with an arm P of a bell crank lever to the arm P′ to which is attached the valve rod Q which actuates the exhaust valve. In the construction shown the lever P, P′, is pivoted on the same stud I to which the link H is pivoted, but this is a merely convenient and not an essential connection, and in Fig. 3 we have indicated a modified construction in which the link O is attached to the point *g* on link G and to a bell crank lever P, P′, of modified form and pivoted at a point *i* not coinciding with the stud I, and we have shown a rod *q* and bell crank lever *q′*, q^2, through which the motion of the arm P′ is transmitted to the valve rod Q here placed on the opposite side of the engine.

An important feature of our invention is that our construction enables us to place the entire valve gear to one side of the connecting rod which actuates it and substantially forms a part of it.

While we have shown our valve gear as connected with two separate valve rods for admission and exhaust valves and in Fig. 1 have shown the guide link J as adapted for use with a non-reversing engine, it will be obvious to those skilled in the art that our valve gear is well adapted for a reversing engine in which the valve connected with rod N controls both the admission and exhaust.

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

1. In a valve gear, the combination with the connecting rod of the engine of a link G pivotally connected to said rod at one end, a swinging link H pivotally connected to link G at its other end and arranged to give to a point *g* on said link a motion on the line of a crescent shaped ellipse, an adjustable guide, a link K pivoted to the adjustable guide at one end and to point *g* of link G at its other and having substantially the length of the radius a circle of which the medial line of the crescent shaped ellipse forms an arc and a valve connection secured to a point on link K.

2. In a valve gear, the combination with the connecting rod of the engine of a link G pivotally connected to said rod at one end, and extending along said rod forming a small angle therewith, a swinging link H pivotally connected to link G at its other end and arranged to give to a point *g* on said link a motion on the line of a crescent shaped ellipse an adjustable guide, a link K pivoted to the adjustable guide at one end and to point *g* of link G at its other and having substantially the length of the radius a circle of which the medial line of the crescent shaped ellipse forms an arc, and a valve connection secured to a point on link K.

3. In a valve gear the combination with the connecting rod of the engine of a link G pivotally connected to the connecting rod at one end, a link H pivotally connected to a fixed point I at one end and to the free end of link G at the other, said links being arranged as described and so that all points between the pivotal connections of link G will describe crescent shaped curves as the connecting rod completes each movement of revolution with the crank; a guide link J, a link connected with an intermediate point *g* of link G at one end and having its other end controlled by a connection with link J and a valve rod N connected to link K, all said links and guides lying normally at one side of the connecting rod as specified.

4. In a valve gear the combination with the connecting rod of the engine of a link G pivotally connected to the connecting rod at one end, a link H pivotally connected to a fixed point I at one end and to the free end of link G at the other, said links being arranged as described and so that all points between the pivotal connections of link G will describe crescent shaped curves as the connecting rod completes each movement of revolution with the crank; a guide link J, a link K connected with an intermediate point *g* of link G at one end and having its other end controlled by a

connection with link K, a valve rod N connected to link K and a valve rod Q connected to and actuated by a point having substantially the simple motion of a point on link G.

5. In a valve gear the combination with the connecting rod of the engine of a link G pivotally connected to the connecting rod at one end, a link H pivotally connected to a fixed point at one end and to the free end of link G at its other end, said links being arranged as described and so that all points between the pivotal connections of link G will describe crescent shaped curves, a guide link as J, a link K connected to an intermediate point on link G and to said guide link, a valve rod connected to link K, means for adjusting the guide link to reverse the motion of the valve rod connected to link K and a second valve rod connected to a point on the links having substantially the simple motion of a point on link G.

6. In a valve gear the combination with the connecting rod of the engine of a link G pivotally connected to the connecting rod at one end, a link H pivotally connected to a fixed point I at one end and to the free end of link G at its other end, said links being arranged as described and so that all points between the pivotal connections of link G will describe crescent shaped curves, a permanently fixed guide link J, a sliding block as M adjustable along said link J, a link L pivoted to said block at one end, a link K pivoted to link G and to the free end of link L, and a valve rod N, connected to said link K.

7. In a valve gear the combination with the connecting rod of the engine of a link G pivotally connected to the connecting rod at one end, a link H pivotally connected to a fixed point I at one end and to the free end of link G at its other end said links being arranged as described and so that all points between the pivotal connections of link G will describe crescent shaped curves, a permanently fixed guide link J, a sliding block as M adjustable along said link J on each side of a point at which the valve will only throw its lap and lead, a link L pivoted to said block at one end a link K pivoted to link G and to the free end of link L, a valve rod N connected to said link K, a bell crank lever P, P′ a link O connecting one arm thereof to a point on the links having substantially the simple motion of a point on link G and a valve rod Q connected to the other arm of the bell crank.

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