G. H. CORLISS.

VALVE-GEAR FOR STEAM-ENGINES.

No. 177,059. Patented May 9, 1876.

Fig: 1

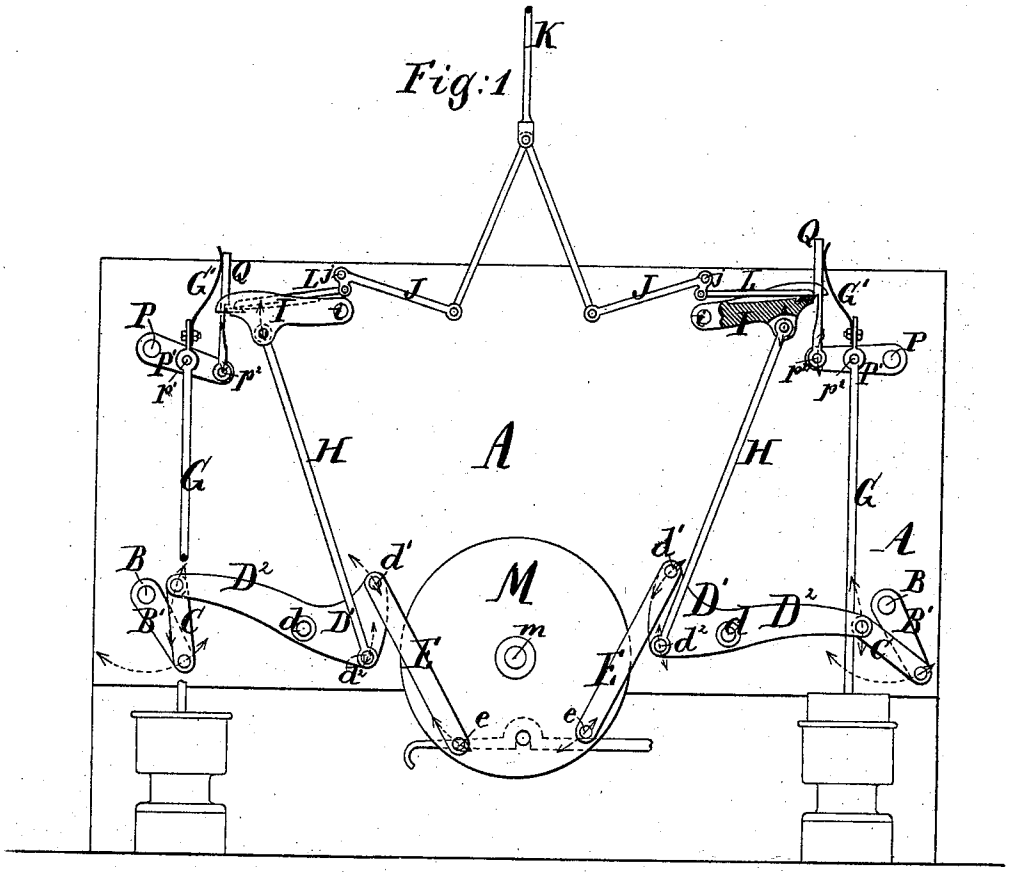


Fig: 2.

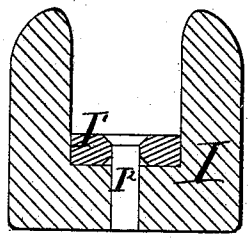
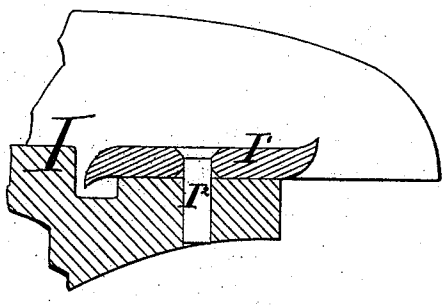


Fig: 3.



Witnesses.

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UNITED STATES PATENT OFFICE.

GEORGE H. CORLISS, OF PROVIDENCE, RHODE ISLAND.

IMPROVEMENT IN VALVE-GEARS FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **177,059**, dated May 9, 1876; application filed January 10, 1876.

To all whom it may concern:

Be it known that I, GEORGE H. CORLISS, of Providence, in the State of Rhode Island, have invented certain new and useful Improvements relating to Steam-Engines, of which the following is a specification:

They may apply to all that class of engines in which separate valves are employed at each end of the cylinder, one for the induction and the other for the eduction of steam. I will show them as applied to the class in which the valves turn in their seats in a manner analogous to a stop-cock. The parts which communicate motion to the exhaust-valve form the subject of a separate application for patent. This specification relates to the operation of the steam-valves.

The accompanying drawings represent what I consider the best means of carrying out the invention.

Figure 1 is a side elevation. Fig. 2 is a cross-section of a portion on a larger scale, and Fig. 3 is a corresponding longitudinal section.

Similar letters of reference indicate like parts in all the figures.

A is the fixed frame-work. B B′ are the exhaust-valve shafts and their arms; and C are links connecting them, respectively, to rocking levers turning on the studs *d*, the two arms of which are each marked, respectively, D^1 D^2. These levers perform an important function, not only in opening the exhaust-valve, but also in opening and liberating the steam-valves. They each receive motion from a common rock-shaft, *m*, through links E, which connect the pins *e* on the wheel M with the pins d^1 on the arm D^1. The shafts of the steam-valves are marked P, and the arms thereof P′. A weight, (not represented,) and which should have proper appliances for arresting it at the end of its descending motion, is connected, by the rod G, to a pin, p^1, which is fixed in the arm P′ in the position shown. p^2 is another pin in the same arm, farther from the shaft P, and to which is connected a hook-rod, Q, subject to the action of a spring, G′, which is mounted on the rod G. There is a corresponding mechanism at each end of the cylinder, which may be all operated from the rock-shaft *m*. I will describe one end only. A pin, d^2, is set in each of the lever-arms D^1, at the point represented, considerably below the line joining *d* and d^1. A rod, H, connects this pin d^2 with a suitable pin or a knuckle-joint in a lever, I, which turns on a fixed center, *i*, favorably mounted for engagement with the hook Q. The lever I is channeled on its upper side, to afford a proper bearing and lateral guide for a push-off rod, L, which lies therein, and is knuckled to the vertical arm of the bell-crank lever J, turning on a center, *j*, and operated by connection to a rod, K, which latter is elevated and depressed by a governor. (Not represented.)

As the shaft *m* rocks in its seat, each depression of a pin, *e*, lowers the corresponding arm D^1, rod H, and lever I. The succeeding ascent of all these parts engages the lever I with the hook Q, and turns the valve-shaft P in the direction to open the valve. This motion continues to open the valve with a rapid and reliable motion at an invariable point in the stroke, continuing to open it farther until the pusher-rod L detaches the hook Q, by pressing it gently out of engagement with the lever I, in opposition to the force of the spring G′. This period arrives sooner or later, according as the lever J is adjusted by the elevation or depression of the governor-rod K.

The point of engagement of the lever I with the hook Q is formed by a piece of steel, I^1, which is secured by a bolt, I^2, and has two acting edges, beveled or bent in opposite directions, and may be reversed when one edge becomes worn.

Instead of a weight on the rod G, it is preferable to employ a piston, subject to a more or less perfect vacuum beneath, as the force thus available might induce a more rapid turning of the valve. The pin p^1 should be near what is termed the center of gyration of the arm P′ and its attached shaft and hook. The pin d^2 should be so low that it is rising rapidly near the middle of the stroke of the main piston. (Not represented.)

Some of the advantages due to certain features of the invention may be separately enumerated as follows: First, by reason of the fact that the force transmitted through the rod G, to induce the instantaneous closing motion, is applied at the point p^2, at or near

the center of gyration of the valve-shaft and its attachments, the inertia of those parts is overcome in the most direct manner, both in giving and arresting motion, with little strain on the bearings of the shaft D, or of any other part. Second, by reason of the fact that the spring G′, actuating the hook Q, is mounted on the closing-rod G, rather than on the valve-arm, I maintain a nearly equal force on the hook in all positions. Third, my intermediate lever I, turning on a separate center, *i*, from the valve-stem, relieves the latter from much of the strain to which it would otherwise be subjected. Fourth, by reason of the double construction of the lever I, it guides the pusher-rod L, and insures the proper lateral position thereof. Fifth, by reason of the pusher-rod L and its operating lever I, and of its connection to the governor-rod K, as shown, I am able to effect the point of cut-off by the elevation and depression of the governor-rod K, in a manner more nearly proportionate to the quantities of steam required than the ordinary arrangement. The fact that the pusher-rod L is centered considerably above the engaging-lever I, and that the center, which is the point of connection of L to J, moves in a practically horizontal line as the speed of the engine increases and diminishes, causes the hook-rod Q to be disconnected with certainty, either near the beginning of the stroke of the piston, or near the middle of its stroke, with just about the proper amount of variation for a given variation in speed in all positions. Sixth, by reason of the connection of the levers I and D^1 by the rod H, as shown, I operate the steam-valve through the medium of the exhaust-valve lever, and thus not only simplify the machinery, but also, by virtue of the wrist-plate motion, due to the low point of the connection d^2 to the lever D^1, obtain a slow motion of the lever I near the commencement, and a rapid movement near the close, of its rising motion.

By mounting the spring G on the rod G′ I obtain highly desirably conditions in regard to its tension at different periods. The lever I, in its descending motion, necessarily acts with its catch against the full part of the hook Q, pushing it away. During this period the parts stand in such position that in consequence of the mounting of the spring G′ on the rod G its force on the hook Q is slight. This condition is indicated on the left side of the drawing, Fig. 1; but during the period while the hook is held engaged with the lever I, and is about being pushed off, the tension of the spring is strong and uniform. No slight force can disengage the hook. It is sure to remain engaged until it is positively pushed off by the actual firm contact of the pusher L, after all lost motion, &c., has been taken up. The slight effect which the spring produces on the position of the governor is also uniform in all changes of the point of cut-off.

It is important to maintain the position of the shaft of a rolling valve very exactly. The ordinary modes for communicating motion to such valve impose a strain on this shaft, which I avoid by my independently-mounted lever I.

By the interposition of the levers J between the pushers L and the links connecting to the governor-rod K, the tendency to disturb the position of the governor by the force required to disengage the hook is reduced to an almost inappreciable amount, and is, by the position of the links and the lever-arm, made practically uniform in all positions of the governor.

By reason of my connection H, communicating between the point d^2 and the knuckle on the lever I, a proper motion is communicated to the latter by simple and reliable mechanism.

I claim as my improvements in steam-engines—

1. The spring G on the rod G′, in combination with a hook, Q, and engaging device I, as herein specified.

2. In combination with the turning arm P′, hook Q, and operating-rod H, the lever I, turning on a stud, *i*, distinct from the valve-stem P, as herein specified.

3. The lever I, channeled or duplex, as shown, with the reversible piece I^1, in combination with the hook Q and valve-arm P′, as specified.

4. The intermediate levers J, between the governor-rod K and pusher-rods L, in combination with the same, and with the vibrating levers I and the engaging-hooks Q, connected with the valve-arms P′, as herein specified.

5. The operating means M E, exhaust-valve lever D^1 B^2, intermediate rod H, and steam-valve-operating lever I and its connections, combined and arranged to serve as and for the purposes herein specified.

In testimony whereof I have hereunto set my hand this 4th day of January, 1876, in the presence of two subscribing witnesses.

GEO. H. CORLISS.

Witnesses:

THOMAS D. STETSON,

ED. W. RAYNSFORD.