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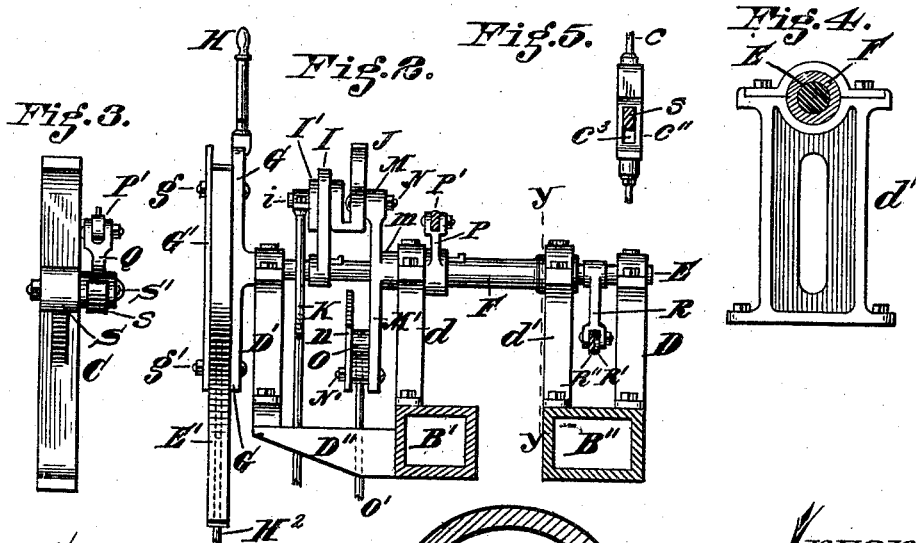
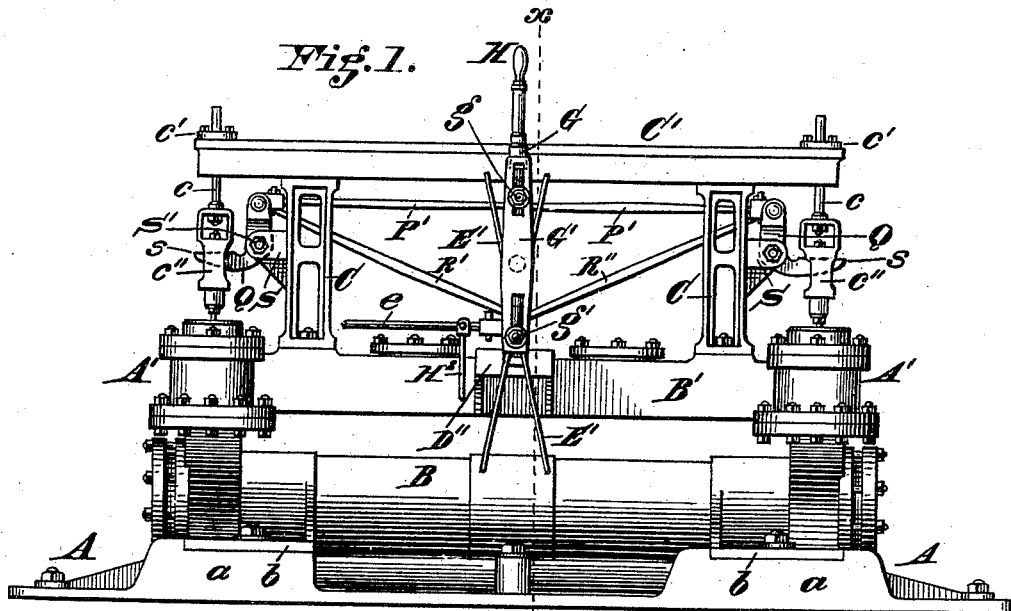
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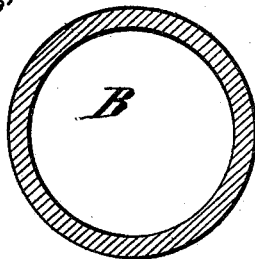
VALVE GEAR FOR PUPPET VALVE ENGINES.

No. 302,835.

Patented July 29, 1884.



*Attest*  
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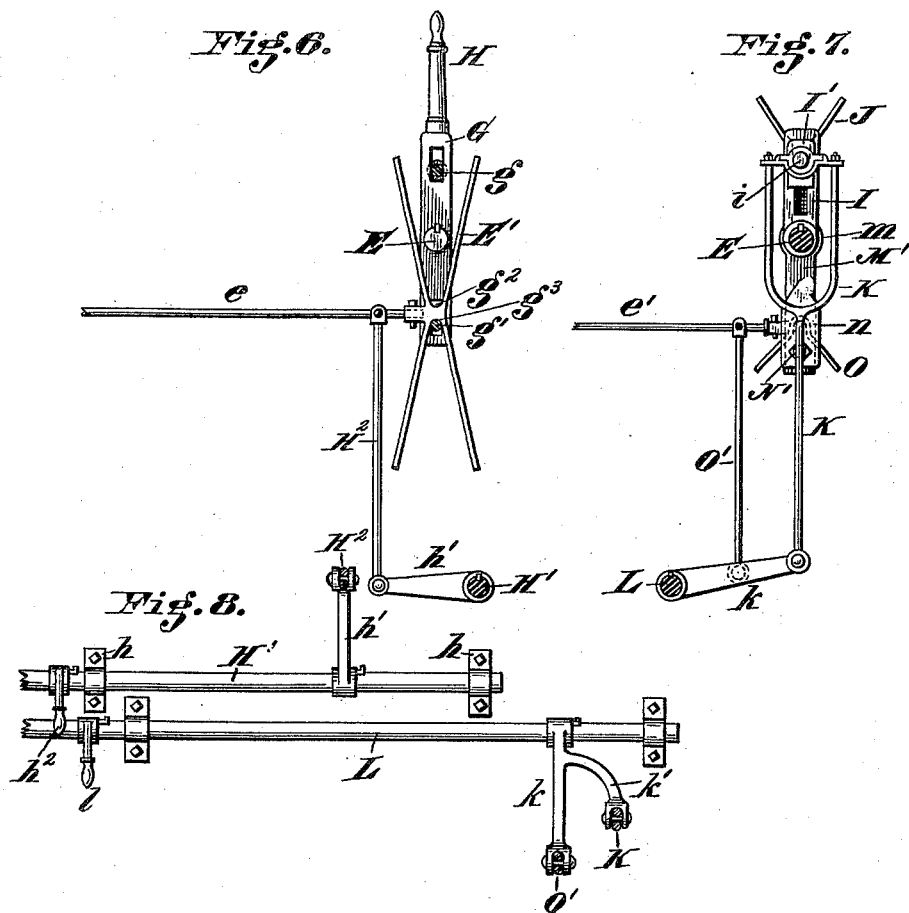
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# UNITED STATES PATENT OFFICE.

HAMLIN F. FRISBIE, OF CINCINNATI, OHIO.

## VALVE-GEAR FOR PUPPET-VALVE ENGINES.

SPECIFICATION forming part of Letters Patent No. 302,835, dated July 29, 1884.

Application filed February 7, 1884. (No model.)

*To all whom it may concern:*

Be it known that I, HAMLIN F. FRISBIE, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Valve-Gear for Puppet-Valve Engines, of which the following is a specification.

My invention relates to an improved engine adapted to operate puppet-valves, all of which will be fully set forth in the description of the accompanying drawings.

Figure 1 is a longitudinal elevation of a puppet-valve engine embodying my invention. Fig. 2 is a transverse sectional elevation on line *x x*, Fig. 1, showing the mechanism for operating the valve-rods. Fig. 3 is an elevation of one of the pillars on which the valve-rod crank-arms are pivoted. Fig. 4 is a sectional elevation on line *y y*, Fig. 2, showing one of the journal-bearings and the two shafts, one inside the other, for supporting and operating the valve-rod mechanism. Fig. 5 is a broken elevation, partly in section, of one of the valve-stem cross-heads and its lifting crank-arm. Fig. 6 is an elevation of a detailed part of the valve-operating mechanism, showing a broken-off portion of one of the eccentric-rods and its forked connection with the vibrating arm on the valve-operating shaft, and also showing a cross-section of the tumbling-shaft and its crank and rod connection with the said eccentric-rod, for bringing the valve-operating mechanism into and out of engagement with said eccentric-rod. Fig. 7 is a view similar to Fig. 6, but showing another eccentric-rod and its forked connections with the valve-mechanism, and another tumbling-shaft and rods for bringing the cut-off and full-stroke devices into and out of engagement. Fig. 8 is a plan view of the two aforesaid tumbling-shafts, showing crank-arms keyed thereto, with the rods (in section) for connecting the said crank-arms with the eccentric-rods.

A represents one of the bed-plates of the engine, being duplicated on the opposite side thereof. *a a* represent shoulders of the bed-plates, to which the cylinder B is secured by ears *b*.

A' A' represent the supply-valve chambers,

secured to the ends of the cylinder in the usual manner.

B' represents the steam-supply pipe, and B'' the exhaust-pipe. The supply and exhaust valves are both of the puppet form, and their construction and mode of operation are fully shown and described in a pending application for Letters Patent filed by me December 18, 1883, Serial No. 114,991. The present application relates more particularly to the mechanism for operating said valves automatically, and is constructed and arranged as follows:

C C represent pillars or posts, which are bolted to the pipes B' B'' in juxtaposition to the supply and exhaust valve chambers.

C' represents a rectangular frame or plate supported by the pillars C and bolted to the tops thereof. These parts, together with the steam pipes or chests B' B'', form the framework upon which the valve-operating mechanism is supported.

*c c* represent the stems of the steam-supply valves. These stems slide in collars or bearings *c'*, which are bolted to the plate C', as shown in Fig. 1.

*c'' c''* represent slotted cross-heads of valve-stems *c*.

*c''* represents the slots of cross-heads *c''*. The stems of the exhaust-valves on the side of the engine opposite to that shown in Fig. 1 are constructed and supported in a manner similar to the supply-valve stems *c'' c''*.

D represents a standard-bearing bolted to exhaust-pipe B'' and supporting one end of a through rock-shaft, E.

D' represents another standard-bearing, for supporting the opposite end of shaft E.

D'' represents a horizontal arm, projecting from the steam-supply chest B'. Bearing-standard D' is bolted to the arm D'', as shown in Fig. 2.

*d d'* represent bearing-standards bolted to chests B' B'' in line with the standards D D', so as to support the through-shaft E on the bearings D D' and a short hollow shaft, F, upon bearings *d d'*. Shaft F loosely surrounds a part of shaft E, as shown in Figs. 2 and 4, and operates the valve cut-off devices presently described.

*e e'* represent the eccentric-rods which connect the valve mechanism with the cams on

the driven wheel-shaft, for operating the said valve mechanism.

E' represents a double-forked or X-shaped arm on the free end of eccentric-rod *e*.

5 G represents a slotted crank lever or arm, keyed to the end of shaft E, adjacent the standard-bearing D'.

G' is a slotted guide-plate, between which and the crank-arm G the fork E' operates.

10 *g g'* represent bolts for securing friction or slide plate G' in position, and act as wrist-pins, upon which the sockets *g<sup>2</sup> g<sup>3</sup>* of the forked arm E' engage to oscillate shaft E.

H represents a handle on the crank-arm G, for raising the valves by hand in starting the engine, if desired. Crank-arm G and guide-plate G' are slotted in the manner shown in Figs. 1 and 6, so that the position of the bolts *g g'*, which pass through them, may be changed to adjust and regulate the stroke of crank-arm G, and therefore to quicken or lengthen the movement of the valve mechanism.

H' represents a horizontal tumbling-shaft, journaling in suitable bearings, *h*, and provided with a crank-arm, *h'*, which connects by a vertical rod, H<sup>2</sup>, with the eccentric-rod *e*.

*h<sup>2</sup>* is a handled lever, keyed to tumbling-shaft H'. When shaft H' is oscillated by the lever *h<sup>2</sup>*, the forked arm E' is raised or lowered for engagement with either of the bolts or wrist-pins *g g'* to run the engine on the forward stroke, or to stop and reverse it, or to stop it altogether, as desired.

I represents a slotted crank-arm, keyed to shaft E intermediate the standard-bearings D' *d*; and I' represents a box sliding therein. On one end of box I' is a wrist-pin or stud *i*, and on the other end an upwardly-forked arm, J.

K is a vertical yoke-rod, pivotally connected at its upper end with pin *i*, and at its lower end with a crank-arm, *k*, keyed to a horizontal tumbling-shaft, L, which is journaled and operated in a similar manner to tumbling-shaft H', and is arranged parallel therewith.

*l* is the operating hand-lever of shaft L.

*k k'* represent a double or forked crank-arm, keyed to shaft L.

M M' represent crank-arms extending above and below shaft E, and united by a hub, *m*, which is keyed to hollow shaft F, adjacent the standard-bearing *d*.

M is a short arm and M' a long one.

N is a bolt or pin, projecting from the upper end of short arm M, so as to engage fork J.

N' is a bolt at the lower end of long arm M', attaching a guide-plate, *n*, and having an intermediate downwardly-projecting forked arm, O.

60 O' is a vertical rod, pivotally attached at its upper end to the eccentric-rod *e'*, which in turn is attached at its free end to the fork O. The lower end of rod O' is pivotally connected with crank-arm *k* on the tumbling-shaft L. In Fig. 2 I have shown the forks J and O in their upward position for the cut-off stroke,

fork J being in engagement with the bolt N on the short crank-arm M, and fork O out of engagement, both forks J and O being connected with the tumbling-shaft L by the rods K and O' and the double-crank arm *k k'*. They are raised or lowered simultaneously to reverse the engine or alter the stroke from a cut-off to a full stroke, or vice versa.

P represents a crank-arm keyed to hollow shaft F, intermediate the standard-bearings *d d'*, being adjacent bearing *d*.

P' represents the connecting-rod pivotally connected at its center to crank-arm P, and at its ends to crank-arms or valve-tumblers Q.

R represents a crank-arm keyed to shaft E, intermediate the standard-bearings *d' D*; and R' R'' are exhaust-valve connecting-rods pivotally connected at their inner ends to crank-arm R and at their outer ends to crank-arms or tumblers similar to tumblers Q, being located on the opposite side of the engine and operated in a similar manner.

S represents bracket-bearings projecting from the pillars or posts C C; and S' are bolts passing through holes in brackets S and valve-tumblers Q, forming pivots for supporting and journaling said tumblers Q.

*s* represents the projecting arms or toes of tumblers Q, which enter the slots *c<sup>3</sup>* of the cross-heads *c''* of the valve-stems *c* and raise the valves in the operation of the engine. This manner of arranging the lifting-toes *s* so that they slide within the slotted cross-heads *c'' c<sup>3</sup>* is of advantage, as it effectually obviates any lateral or circular movement of the valve-stems or the valves, and at all times insures a positive connection of the lifting-tumblers and valve-stems.

The arrangement of the standard-bearings *d d' D D'* in line for supporting and journaling a through-shaft and hollow shaft surrounding it simplifies and reduces the cost of construction of the engine, at the same time making it symmetrical and slightly in appearance.

The use of the valve-rods and their crank-arm connections as I have shown and described them, together with my improved balanced valves, as set forth in my said pending application, is of great advantage over the customary lever devices, as a more powerful engine is produced, which requires less steam to operate it, and the valves are elevated with very little resistance to overcome, and therefore with more freedom. The rock-shaft E is journaled concentrically within the rock-sleeve F upon its own independent bearings, located upon the standards D D', and the sleeve F is independently journaled on standards *d d'*. Each of these shafts operates the connecting-valve mechanism independently of each other, yet from the central point of the engine-frame, and allows any desired latitude of adjustment of one set of valves to the other.

I claim—

1. The combination of the steam-supply pipe B', the exhaust-pipe B'', the pillars C, sup-

ported by said pipes B' B'', and the rectangular frame C', secured upon the tops of pillars C, the said several parts constituting a frame to support the operating parts of the engine, substantially as described.

2. In a steam-engine, the combination of the standard-bearings D D' and bearings d d', arranged in line with each other, the rock-shaft E, journaled in bearings D D' and provided with crank-arms and connecting-rods to operate the exhaust-valve, and the sleeve F, journaled in bearings d d', and encircling a portion of shaft E, and provided with a crank-arm and connecting-rods to operate the supply-valve mechanism, substantially as described.

3. In combination with the rock-shaft E and sleeve-shaft F, the double-crank arm M M', and the adjustable forks J O, adapted to engage with the crank-arm M M' for changing the piston from a full to a partial stroke, substantially as specified.

4. In a steam-engine, the combination of the rock-shaft E, sleeve F, rod P, and rods R' R'', connected, respectively, to sleeve F and shaft E, and the pivoted lifting-tumblers connected to the ends of said rods, substantially as described.

5. In a steam-engine, the combination of the pillars C, frame C' supported thereon, the puppet-valve stem c, sliding through a collar on frame C', the slotted cross-head c'', connected to said valve-stem, and the pivoted tumbler having its lifting-arm passed through the slot in the head, substantially as described.

6. In a steam-engine, the combination of the shaft E, sleeve F, slotted crank-arm G, connected to shaft E, tumblers Q, the valve-stems provided with slotted cross-heads c'', and the rods connecting the valves to the shaft and sleeve, substantially as described.

7. In a steam-engine, the combination of pillars C, bracket-bearings S, secured to the sides thereof, the angular lifting-tumblers Q, the bolts S', for pivoting the tumblers to the brackets, and the rod P', connecting the opposite tumblers, substantially as described.

In testimony whereof I have hereunto set my hand.

HAMLIN F. FRISBIE.

Witnesses:

JOHN E. JONES,  
M. E. MILLIKAN.