(No Model.)

H. WATKEYS.

VALVE FOR STEAM CYLINDERS.

No. 453,800. Patented June 9, 1891.

Fig. 1

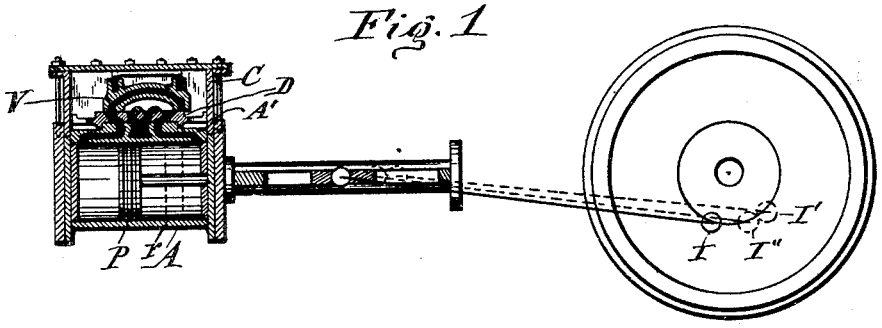


Fig. 2

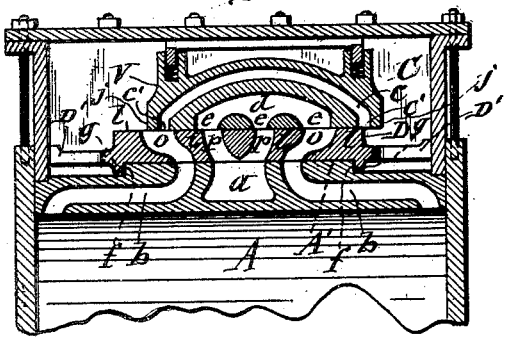


Fig. 3

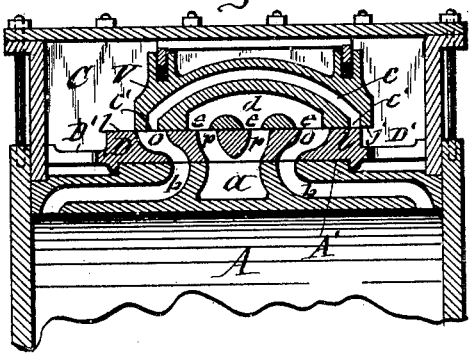


Fig. 4

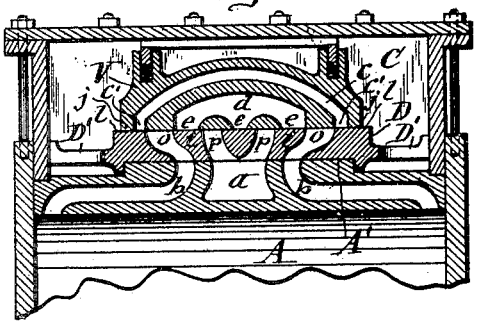


Fig. 5

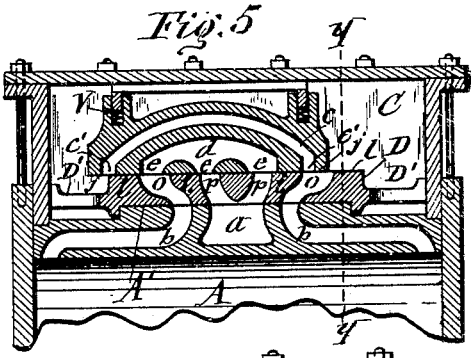


Fig. 6

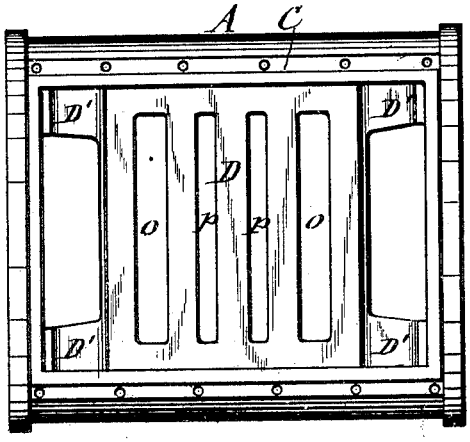
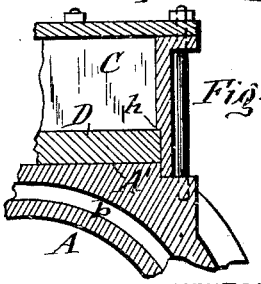


Fig. 7



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UNITED STATES PATENT OFFICE.

HENRY WATKEYS, OF NEW ALBANY, INDIANA.

VALVE FOR STEAM-CYLINDERS.

SPECIFICATION forming part of Letters Patent No. 453,800, dated June 9, 1891.

Application filed July 5, 1890. Serial No. 357,781. (No model.)

To all whom it may concern:

Be it known that I, HENRY WATKEYS, of New Albany, in the county of Floyd, in the State of Indiana, have invented new and useful Improvements in Valves for Steam-Cylinders, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to the valves of steam-engine cylinders, and especially to those which are employed on locomotives.

The object of the invention is to provide a valve which shall admit the steam to the cylinder more quickly at the proper time and retain it therein during the greater portion of the stroke of the piston and during that portion of the stroke in which the piston is most effective on the crank. This, together with the additional expansion allowed to the steam in the cylinder, very materially increases the efficiency of the engine without increasing the consumption of fuel required to produce the requisite steam; and to that end the invention consists in the improved construction and combination of parts hereinafter described, and set forth in the claims.

In the annexed drawings, Figure 1 is a longitudinal sectional view of those portions of a steam-engine to which my invention pertains, said view being designed to illustrate the additional expansion allowed to the steam in the cylinder during the operation of the engine. Figs. 2, 3, 4, and 5 are longitudinal sectional views showing the valve in the different positions into which it moves during the operation of the engine. Fig. 6 is a top plan view of the valve-seat; and Fig. 7 is a transverse section on line 7 7, Fig. 5, of one side of the steam-chest, showing the means for holding the valve-seat down on the cylinder-face.

Similar letters of reference indicate corresponding parts.

A represents the cylinder of a steam-engine; P, the piston; A′, the cylinder-face, in which are the usual steam-ports *b b* and exhaust-port *a* between said steam-ports, and C denotes the steam-chest surrounding the cylinder-face and secured to the cylinder in the usual and well-known manner.

D represents my improved valve-seat, which may be formed directly on new cylinders; but in order to allow my present improvements to be applied to old cylinders having the single exhaust-port *a* between the two steam-ports *b b* I employ a false valve-seat D, formed of a separate plate, which may be either bolted to the cylinder-face A′ or mounted removably thereon and sustained longitudinally in its position by abutments or shoulders *f f* across the ends of said valve-seat, engaging corresponding abutments or shoulders *g g* on the cylinder-face, and preferably, also, by extensions B′ B′, abutting with their ends against the end walls of the steam-chest. The lateral displacement of the loosely-mounted valve-seat D is prevented by the sides thereof abutting against the sides of the steam-chest, and the lifting of the said valve-seat is prevented by shoulders *h h* on the sides of the steam-chest projecting over the top edges of the valve-seat, as represented in Fig. 7 of the drawings.

The valve-seat D, I form with two exhaust-ports *p p*, which are of equal size and converge to the single port *a* in the cylinder-face A′. Said valve-seat is also formed with two steam-ports *o o*, which register at their lower ends with the steam-ports *b b* of the cylinder-face and diverge therefrom toward the adjacent ends of the valve-seat, so as to form a bridge *i* between the upper end of each of the steam-ports *o* and adjacent exhaust-port *p*, and also have a bearing *l* on each end of the valve-seat for the valve V. This valve I form with a steam-channel *c*, extending longitudinally through it, preferably curved in the shape of an arc and terminated with ports *c′ c′* near the ends of the face or under side of the valve, and the central portion of the valve is formed with an exhaust-chamber *d*, which is of a length to extend the entire width of one of the steam-ports *o* and both of the exhaust-ports *p p* and intermediate bridges of the valve-seat. Across that portion of the chamber *d* which is adjacent to the face of the valve are two bridges forming three ports *e e e*, which are respectively of the same or approximately the same width as the aforesaid steam-port and exhaust-ports of the valve-seat. The ports *c′ c′* are spaced so that the distance between their inner edges corresponds to the distance from one end of the

valve-seat to the inner edge of the steam-port *o* near the opposite end of the valve-seat, while the ports *e e e* are spaced corresponding to the spacing of the two exhaust-ports *p p* and one of the steam-ports *o* of the valve-seat. The steam-port *c'* of the valve and the adjacent end portion *j* thereof are each of a width equal to one-third of the width of the steam-port *o* of the valve-seat, and when the valve is at the end of its full stroke the end portion *j* of the valve is in the center of the port *o* and occupies one-third thereof, while one-third of the said port communicates with the port *c'* and the other third of the port *o* is open to the interior of the steam-chest, and at the same time the port *c'* in the opposite end of the valve is carried past the end of the valve-seat D, so as to communicate directly with the interior of the steam-chest. Consequently when the valve is in the aforesaid position steam is allowed to pass from the steam-chest directly into one of the ports *o*, and also through the channel *c* and port *c'* of the valve into the same port *o*. Immediately before the valve has arrived at its aforesaid position the three exhaust-ports *e e e* of the valve have all been opened to their fullest extent to communicate with the steam-port *o* in the opposite end of the valve-seat and with both of the two exhaust-ports *p p*. This free exhaust, together with the double inlet of live steam, greatly increases the efficiency of the engine.

The operation of my improved valve is illustrated in Figs. 2, 3, 4, and 5 of the drawings.

Fig. 2 shows the position of the valve when the piston P is near the end of the cylinder and about the commencement of its stroke. Fig. 3 shows the position of the valve when the piston P has traveled nearly one-half the length of the cylinder and the crank I of the driving-wheel is nearly at the quarter of its movement, as shown by full lines in Fig. 1 of the drawings. It will be observed that at this point the steam is cut off from the end of the cylinder back of the piston, while the exhaust-ports are still open to allow the steam to escape from the opposite end of the cylinder. The steam is retained in the cylinder back of the piston P until the latter has reached the position indicated by dotted lines *r* in Fig. 1 of the drawings, to which position it is carried after the crank has passed beyond the quarter of its movement to the point indicated by I', which is some distance beyond the usual point I'', at which the valve of the ordinary form releases the cylinder from the steam back of the advancing piston, and by this increased retention of the steam in the cylinder a gain of about forty-three per cent. in the expansion of the steam in the cylinder is obtained. When the crank is in the position indicated at I', the valve is in the position shown in Fig. 4 of the drawings.

Fig. 5 shows the valve in position for reversing the movement of the piston.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In combination with the valve-seat or cylinder-face provided with the two exhaust-ports *p p* between the steam-ports *o o*, the valve V, formed with the steam-channel *c*, terminating with ports *c' c'* near the ends of the valve and spaced with the inner edges of said ports corresponding to the distance from one end of the valve-seat to the inner edge of the steam-port *o* near the opposite end of the valve-seat and having the end portion *j* of the valve occupying one-third of the width of said steam-port *o* and having the chamber *d* extending over the entire width of the other steam-port *o* and both of the exhaust-ports *p p* and intermediate bridges of the valve-seat and provided across the portion of the said chamber adjacent to the face of the valve with two bridges, forming three ports *e e e*, respectively, of the same or approximately the same width as the three ports *o p p* of the valve-seat, substantially as described and shown.

2. The combination of the cylinder-face formed with shoulders *f f* across its ends, and the valve-seat D, mounted removably on said cylinder-face and formed with shoulders engaging the aforesaid shoulders of the cylinder-face, substantially as described and shown.

3. In combination with the cylinder-face provided with the steam-ports *b b* and single exhaust-port *a*, the valve-seat D, mounted on said cylinder-face and formed with the steam-ports *o o* and two exhaust-ports *p p*, and the valve V, formed with the steam-channel *c*, terminating with ports *c' c'* at opposite ends of the valve, and the three exhaust-ports *e e e*, communicating with the chamber *d* in said valve, substantially as described and shown.

In testimony whereof I have hereunto signed my name this 30th day of June, 1890.

HENRY WATKEYS. [L. S.]

Witnesses:
MARK W. DEWEY,
H. M. SEAMANS.