3 Sheets—Sheet 1.

S. CURTIS.

STEAM-VALVE.

No. 191,279. Patented May 29, 1877.

Fig. 1.

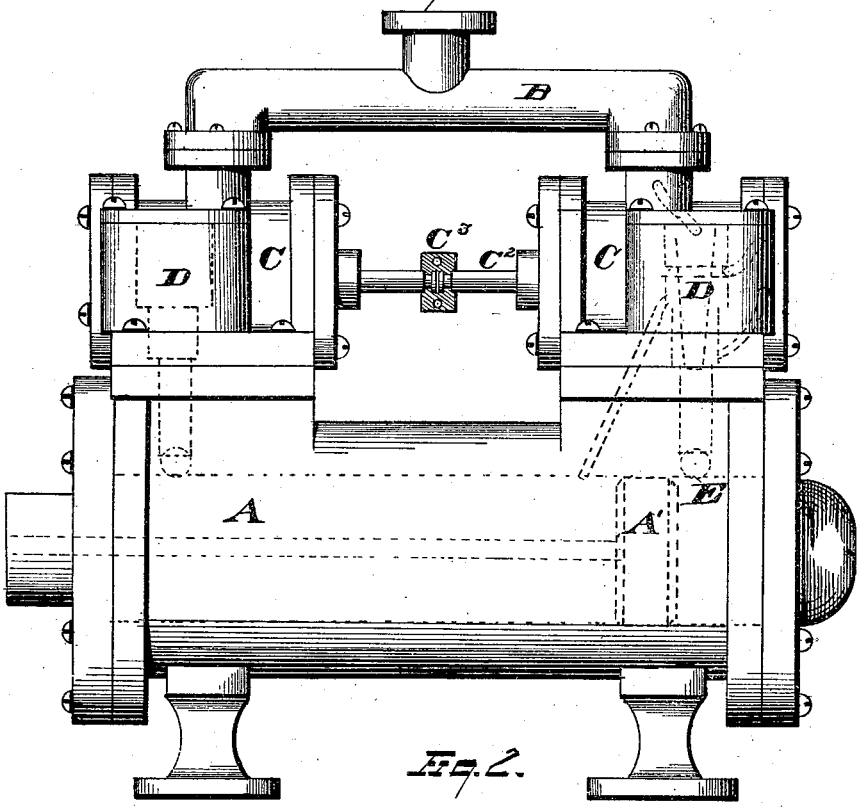
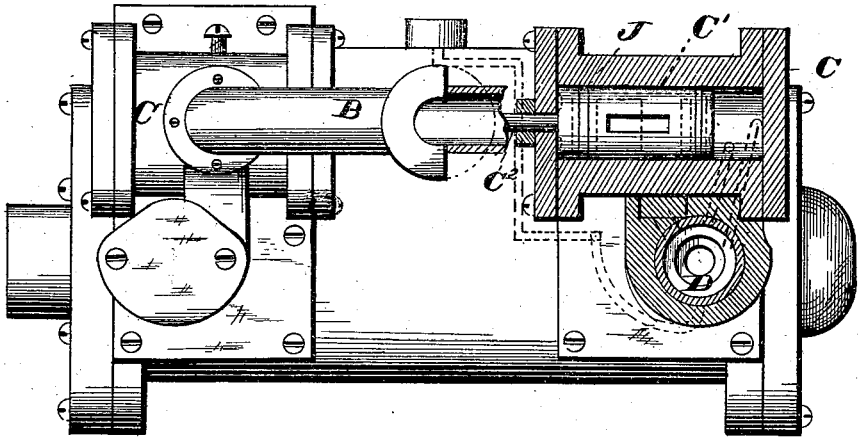


Fig. 2.



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3 Sheets—Sheet 2.

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STEAM-VALVE.

No. 191,279. Patented May 29, 1877.

Fig. 3.

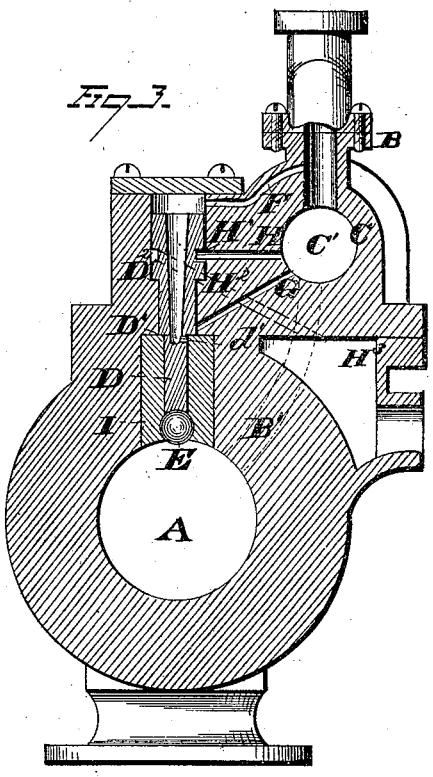
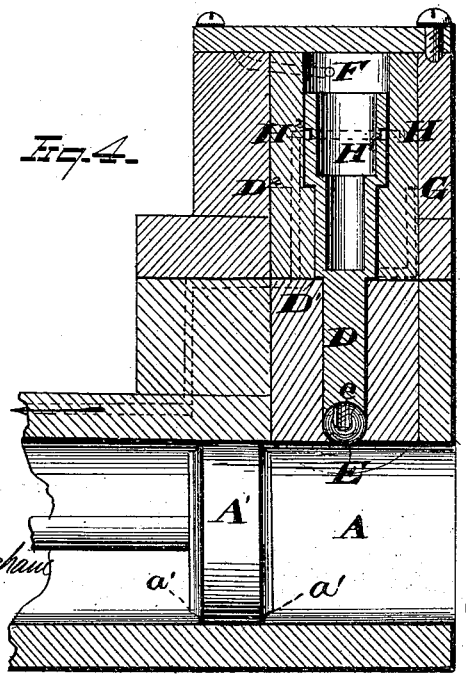


Fig. 4.



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3 Sheets—Sheet 3.

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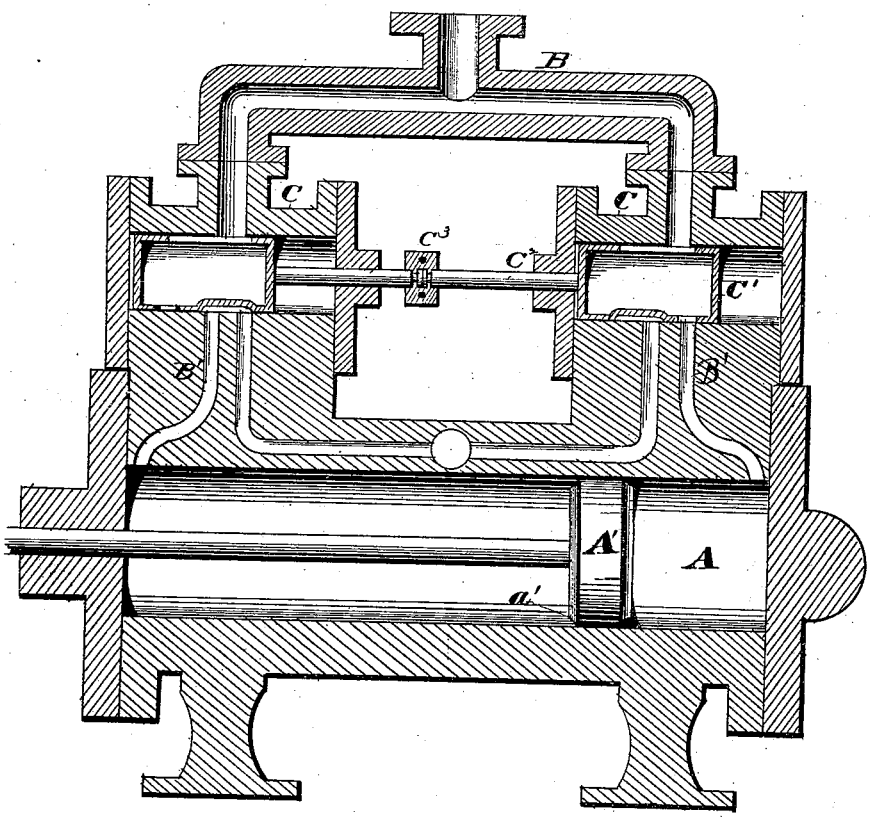
STEAM-VALVE.

No. 191,279. Patented May 29, 1877.

Fig. 5.



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UNITED STATES PATENT OFFICE.

SAMUEL CURTIS, OF CLEVELAND, OHIO.

IMPROVEMENT IN STEAM-VALVES.

Specification forming part of Letters Patent No. **191,279**, dated May 29, 1877; application filed April 19, 1877.

To all whom it may concern:

Be it known that I, SAMUEL CURTIS, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Steam-Pumps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to new and useful improvements in steam-valves; and consists in the combination of devices and appliances, as hereinafter set forth and claimed.

In the drawing, Figure 1 is a view in elevation of an engine embracing my improvements. Fig. 2 is a plan view of the same; Fig. 3, an end view, showing the relative arrangement of the parts in cross-section. Fig. 4 is an enlarged separate view, which more clearly illustrates my invention. Fig. 5 is a vertical section of the main valve-chambers and of the steam-cylinder.

A is a steam-cylinder. B is a steam-pipe, which supplies steam to the said cylinder through the intermediate valve-chambers C and their inclosed cylindrical valves C^1. The valves C^1 are connected by a rod, C^2, and a coupling, C^3, so that the two valves C^1 constitute, in reality, a single valve. D represents two vertical double-seated valves, the office of which is to supply and exhaust steam alternately to the outer ends of the valve or valves C^1, and thereby shift the said valve C^1 at the proper intervals for supplying steam to the steam-cylinder A. The vertical valves D, as stated, have two seats, one at D^1 and the other at D^2. The lower end of the valve-stem projects down nearly to the steam-cylinder, and at this point has a spherical seat, which rests upon the ball E, the ball E in turn resting in a stationary spherical seat, and projecting a short distance down into the steam-cylinder. The piston-head A′ of the steam-cylinder is beveled slightly at *a′* on its front and rear edges, so that in its motion as it comes in contact with either ball E it will lift the ball from its place, and this lifting of the ball lifts the valve D.

The operation of this valve D is as follows: B^1 is the steam-port leading from the valve-chamber C^1 to the steam-cylinder. F is a steam-conduit, leading from the steam-pipe B to the upper portion of the chamber of the valve D. The valve D is hollow. At a point, *d′*, an opening is made through it upon the valve-seat D^1. Just above this valve-seat D^1 a conduit, G, leads directly to the outer end of the valve-chamber C.

H is an exhaust-conduit, leading from the same end of the valve-chamber to a point opposite an annular groove, H^1, in the vertical valve D, and opposite a continuation, H^2, of the said conduit leads to the exhaust-chamber H^3 of the engine.

Now, we will suppose the valve C^1 to be in a position farthest to the right, so as to admit steam through the left-hand portion of the valve into the left end of the steam-cylinder A. The steam-piston will then be driven to the right until its piston strikes the ball E. This will lift the upright valve D. The upright valve D has free steam within it from the steam-pipe F. As it is lifted from the seat D^1 steam passes from within through the opening *d′*, thence through the conduit G to the right hand of the valve C^1. At the same instant, by the raising of the valve D, the exhaust is cut off through the conduit H, so that the free steam passing through the conduit G drives the valve C^1 to the left. This cuts off the supply of steam to the left end of the cylinder A, and opens the exhaust at that point, while, at the same time, it opens the steam-port at the right-hand end of the steam-cylinder A and closes its exhaust-port. The piston then moves to the other end of the cylinder, and the same operation takes place at that point with the other ball E and valve D.

It will thus be seen that I may employ free steam for driving the valve C^1, and that the supply of this live steam to shift the valves is given by a positive motion of the valves D through the medium of the steam-piston and the balls E. The balls are constantly changing their seats, and consequently the spherical seats and the ball itself wear uniform and maintain their spherical form and a tight joint.

The spherical seats, in which the ball E rests, are in the nature of bushings I, that, as they wear away, may be renewed. So, also,

the valves D can be readily lifted from their places and new valves inserted.

The valves C^1 may be of any suitable character; but I prefer to employ such cylindrical valves as were patented to me in Letters Patent No. 183,909, dated October 31, 1876.

In order to compensate for any slight wear on the surface of the valve, and to prevent steam from leaking from the end of the valve as the valve is shifted, I propose to employ packing-rings J in connection therewith.

By a construction of this character the steam can be brought closely to the points where it is required in the same cylinder. The supply-ports and conduits are reduced to the shortest length possible, no steam is wasted, the minimum amount of steam is employed in shifting the valves, and on the whole the construction is such as to utilize the steam to the greatest extent, avoiding condensation, and thereby economizing fuel.

e is a screw-tap hole in the ball E, into which a screw-cut rod may be run to lift the ball from its seat, if desired.

Lift-valves D are kept seated by the pressure of live steam on their upper ends. In order to allow of an annular exhaust-groove of sufficient size around the upper end of the lift-valve to admit of a free exhaust from the end of the valve-chamber to the main exhaust, and also to afford sufficient area of valve to insure the desired steam-pressure on its upper end, the lift-valves are made with their upper ends of considerably greater diameter than the lower end, the latter portion serving simply as a tappet, and the upper portion of the valve cored out, whereby the live steam is carried within the valve and in close proximity to the valve-chamber. Again, the annular passage around the valve is of sufficient size to admit of a free and ready exhaust of steam from the end of the valve-chamber to the main exhaust; and, finally, the valves are reduced to the minimum weight of material, and thereby rendered easy of operation.

It will be observed that the lift-valves, when seated, serve to constitute a free exhaust-passage from the ends of the valve-chamber to the main exhaust, and hence the function performed by the piston in lifting the valve is to cut off the exhaust-passage and establish a continuous passage for the passage of live steam to the end of the valve.

Piston-valve C^1 is formed hollow with an opening on the upper side for the admission of live steam, and an opening on the lower side for the passage of steam to the port leading to the end of the cylinder.

An exhaust-passage is constructed in the lower portion of the valve to connect the steam-port with the exhaust-port.

By this construction the live steam operates to keep the valve in equlibrium, and the same is reciprocated by the alternate action of steam on its outer ends.

What I claim is—

1. The combination, with the steam-cylinder A, independent valve-chambers C, and valves C^1, the latter connected to move in unison with each other, of the hollow double-seated lift-valves D, steam-conduits *d'* G, and exhaust-conduits H, H^1, and H^2, substantially as and for the purpose set forth.

2. The combination, with cylinder A, piston A', independent valve-chambers C, and valves C^1, of the lift-valves D, provided with suitable steam and exhaust ports, as described, and ball E, the latter arranged to project slightly within cylinder A, substantially as and for the purpose set forth.

3. The combination, with valves C^1, of the hollow double-seated lift-valve D, steam-passages *d'* G leading to one end of the valve-chamber C, and exhaust-passages H, H^1, and H^2, connecting with the upper portion of valve D, substantially as and for the purpose set forth.

4. The combination of the valve D, ball E, and piston A', substantially as and for the purposes described.

5. The combination, with a main steam-cylinder, and two valves located in independent valve chambers, each of which govern separate steam and exhaust ports leading to the ends of the main cylinder, of independent lift-valves located outside of the main valve-chambers, and steam and exhaust ports connecting the lift-valves with the outer ends of the main valves, the exhaust-ports being open to the atmosphere while the piston is traveling between the lift-valves, substantially as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SAMUEL CURTIS.

Witnesses:

FRANCES TOUMEY,

W. E. DONNELLY.