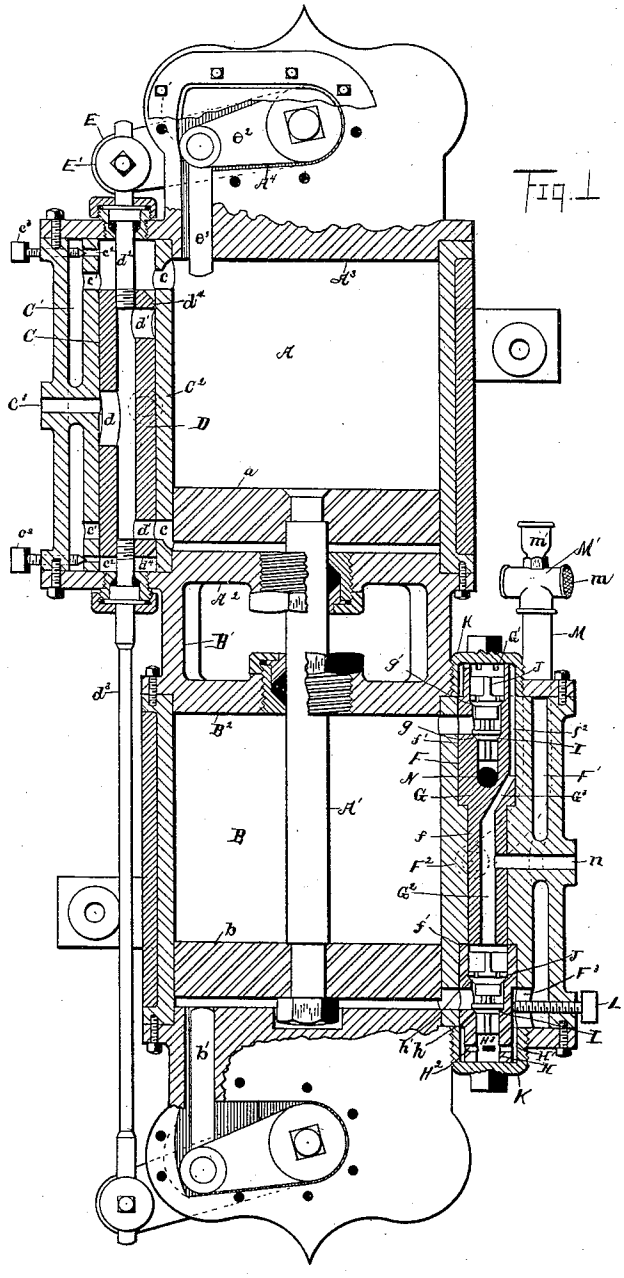
(No Model.) 2 Sheets—Sheet 1.

T. H. HABERKORN.

VALVE FOR STEAM ENGINES.

No. 407,894. Patented July 30, 1889.

FIG. 1



Witnesses
Belle Lowrie
Geo. W. King

T. H. Haberkorn Inventor

By Leggett & Leggett Attorneys

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

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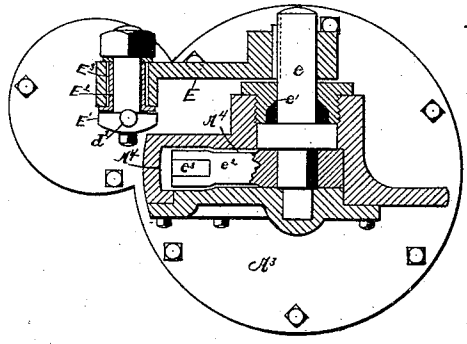


Fig. 2

Witnesses
Bellt Lowrie.
Geo. W. Kline

T. H. Haberkorn Inventor
By Liggett & Liggett
Attorneys

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

THEODORE H. HABERKORN, OF FORT WAYNE, INDIANA.

VALVE FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 407,894, dated July 30, 1889.

Application filed June 21, 1888. Serial No. 277,739. (No model.)

To all whom it may concern:

Be it known that I, THEODORE H. HABERKORN, of Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Valves for Steam-Engines; 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 the same.

My invention relates to a combined steam-engine and air-pump; and it consists in certain features of construction and in combination of parts, hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is an elevation in section, and Fig. 2 is a plan, partly in section, of the upper steam-cylinder head.

The steam-cylinder A and the air-cylinder B are intended to be substantially alike. In fact, they are cast from the same pattern, and are connected by yoke B′, the latter being integral with disks B^2 and A^2, that form the inner cylinder-heads for the two cylinders. The two pistons *a* and *b* are connected by rod A′, the piston-rod operating through suitable stuffing-boxes, substantially as shown.

C is a cylindrical steam-chamber, in which operates a cylindrical or hollow plunger-valve D. The steam-chamber is partially surrounded by exhaust-chamber C′, the latter being provided with eduction or exhaust opening C^2. Induction-opening C^3 leads into chamber C, and is of course connected with the steam-pipe; also, the usual ports *c* connect the steam-chamber with cylinder A. Valve D has ports *d* and *d′*, the former being of such length that opening C^3 is never closed by the valve; also, ports *c′* lead from the steam-chamber into the exhaust-chamber, the different ports being located substantially as shown. Small vent-holes c^2 are provided to prevent back-pressure on the valve at the end of the stroke. Valve-rods d^2 and d^3 screw into the respective ends of valve D. Rods d^2 connect with wrist E′ of rock-arm E. Wrist E′ is journaled in sliding box E^2, the latter operating in slot E^3 of the rock-arm, this box having a slight movement endwise of the rock-arm to accommodate the wrist to the sweep of the rock-arm and to the alignment of the valve-rod. Arm E is mounted on rock-shaft *e*, the latter extending through stuffing-box *e′* into chamber A^4 of the upper cylinder-head A^3.

Mounted on rock-shaft *e* and operating in chamber A^4 is rock-arm e^2, the free end of the latter being connected with rod e^3, the latter extending through a suitable hole of the cylinder-head and the free end of the rod projecting into the steam-cylinder.

Valve-rod d^3, by means of substantially such mechanism as just described, is connected with rod *b′*, the latter projecting into the lower end of the air-cylinder. With such construction valve D is shifted by the engagement of the respective pistons alternately with the rods e^3 and *b′*; but by such means the valve is only moved part way of its throw and just far enough to admit steam from the cylinder past what for the time being is the rear end of the valve, and the pressure of steam behind the valve moves the latter still farther to open the exhaust-port and to admit steam to the other end of the cylinder A, all of which will be readily understood by persons familiar with such mechanism.

It will be observed that the laps d^4 of the valve D are less in width than the ports *c*, and consequently when either lap d^4 is midway of its port *c* the steam can continue to pass from the valve into the cylinder, and can also pass from the cylinder behind the valve, and this end of the cylinder being at the time filled with steam the application of steam-pressure behind the valve is instantaneous, so that from the time that the valve commences its movement in either direction such movement is continuous to the end of its throw; also, the vent-holes c^2 are so diminutive in size that the vapor escaping through these vent-holes is sufficiently retarded to cushion the valve. As the device is intended to run at high speed, spiral springs (not shown) may be coiled around the rods d^2 and d^3 at either end of the valve to prevent the valve from striking the head. If, however, conically-pointed screws c^3, with heads accessible from the outside, are arranged in line with

holes c^2 to partially close these orifices, the openings may be graduated to cushion the valve perfectly without the use of springs.

The air-chamber F of cylinder B is bored, as shown at f, and counterbored from the respective ends, as shown at f', this air-chamber being partially surrounded by chamber F′, corresponding with chamber C′ of the steam-cylinder. Chamber F′ is provided with induction-opening F^2 for receiving air.

A bushing G of considerable length is inserted in air-chamber F, this bushing extending down to the lower counterbore f'. The upper end of this bushing abuts cap K, by means of which the bushing is held in place endwise. The one side of the bushing is cut away at g^2 to form a sub-chamber f^2, and the upper end of the bushing is reduced in external diameter, as shown, so that the chamber f^2 extends around the upper section of the bushing. The bushing G has a series of lateral holes G′ at or near the upper end thereof, connecting chamber f^2 with the central bore or cavity of the bushing. A central hole G^2 leads up from the lower end of this bushing and connects with oblique hole G^3, the latter being in open relation with chamber f^2.

H is a short bushing inserted in the lower counterbore f'. This bushing is cut away on the one side and lower portion thereof, forming sub-chamber H′, the latter, by means of opening F^3, being in open relation with receiving-chamber F′. The extreme lower section of bushing H is reduced in external diameter, so that chamber H′ surrounds this section with lateral holes H^2, leading from chamber H′ into the central bore H^3 of this bushing.

Bushing G is provided with seats g and g', respectively, for the upper induction and eduction air-valves I and J. Bushing H is provided with seats h and h' for the lower induction and eduction air-valves I and J. The upwardly-projecting wings j of valve J fit easily in the enlarged bore of bushings G and H, and the depending wings i of valve I fit easily in the reduced bore of these respective bushings; also, the upwardly-projecting hubs i' of valve I fit easily in the central bore of depending hub j' of valve J, by means of which and of the wings aforesaid the different air-valves being supported at either end are kept accurately in line, so as to fit their respective seats, and consequently the seats are not worn out of shape.

A hole N leads from the receiving-chamber F′ under the upper valve I, and eduction-opening n leads from bore G^2 of bushing G, such opening being connected with suitable pipe leading to the main air-reservoir. (Not shown.) In point of time it is but an instant that valve D in its travels simultaneously admits steam through the same port into and out of the cylinder, as aforesaid, as a slight further movement of the valve shuts off the steam from the cylinder, and the valve continues its movement by the pressure of exhaust-steam behind the valve. The valve is shifted so quickly that the steam-piston no sooner reaches the one end of its stroke than a full port-opening is had to admit steam to drive the piston in the opposite direction. This insures a quick return movement of the piston, the effect of which is to instantly shift the air-valve, so that no wastage of air accrues from a tardy movement of the air-valve.

Pipe M is connected with opening F^2, the upper end of this pipe being provided with cross-fitting M′. The lateral openings of this fitting are covered with wire-gauze m, to exclude dust, cinders, &c., while the upper opening of the fitting has attached an oil-cup m'. As bushing H is comparatively short and has little bearing on the side opposite cylinder B, a set-screw L is provided to press the bushing firmly to its seat on the side next cylinder B.

The operation of the air-pump will be readily understood, to wit: The suction produced by the reciprocations of piston b alternately elevates the respective induction-valves I and admits air to the cylinder through pipe M and chamber F′ and the respective ports of the cylinder. The compressed air forced from the cylinder alternately opens the eduction-valve J, allowing such compressed air to escape through openings n. The valves of an air-pump must necessarily be kept in perfect order.

With the construction shown by removing caps K the air-valves and their seats may be removed without difficulty, so that all of the wearing parts may be repaired or renewed with little trouble or expense.

What I claim is—

1. The combination, with a steam-chest having a cylindrical bore and ports and a hollow plunger-valve fitting snugly within said bore and provided with ports, of valve-rods attached to the ends of the valve, and devices for shifting the valve-rods by the movement of the piston, the ports in the steam-chest being so arranged relatively to the valve whereby a continued movement of the valve to the end of its throw is caused by exhaust-steam admitted behind the valve, substantially as set forth.

2. The combination, with cylindrical steam-chamber, and hollow plunger-valve operating therein, with ports, substantially as indicated, of vent-holes c^2, arranged substantially as described, and for the purpose set forth.

3. The combination, with cylindrical steam-chamber, hollow plunger-valve operating therein, and ports, substantially as indicated, of vent-holes c^2, and means, substantially as shown, for graduating the openings of such vent-holes, substantially as set forth.

4. The combination of cylindrical steam-chamber, hollow plunger provided with steam-ports operating therein, with steam and exhaust ports in valve-chamber, and mechanism, substantially as described, for moving

the valve part way of its throw, substantially as indicated, the arrangement of ports being substantially as described, whereby a continued movement of the valve to the end of its throw is caused by exhaust-steam admitted from the cylinder behind the valve, substantially as set forth.

In testimony whereof I sign this specification, in the presence of two witnesses, this 26th day of March, 1888.

THEODORE H. HABERKORN.

Witnesses:

R. S. ROBERTSON,

N. A. ROBERTSON.