2 Sheets—Sheet 1.

H. W. SHERRILL.

Hot-Air Engine.

No. 213,783. Patented April 1, 1879.

Fig. 1

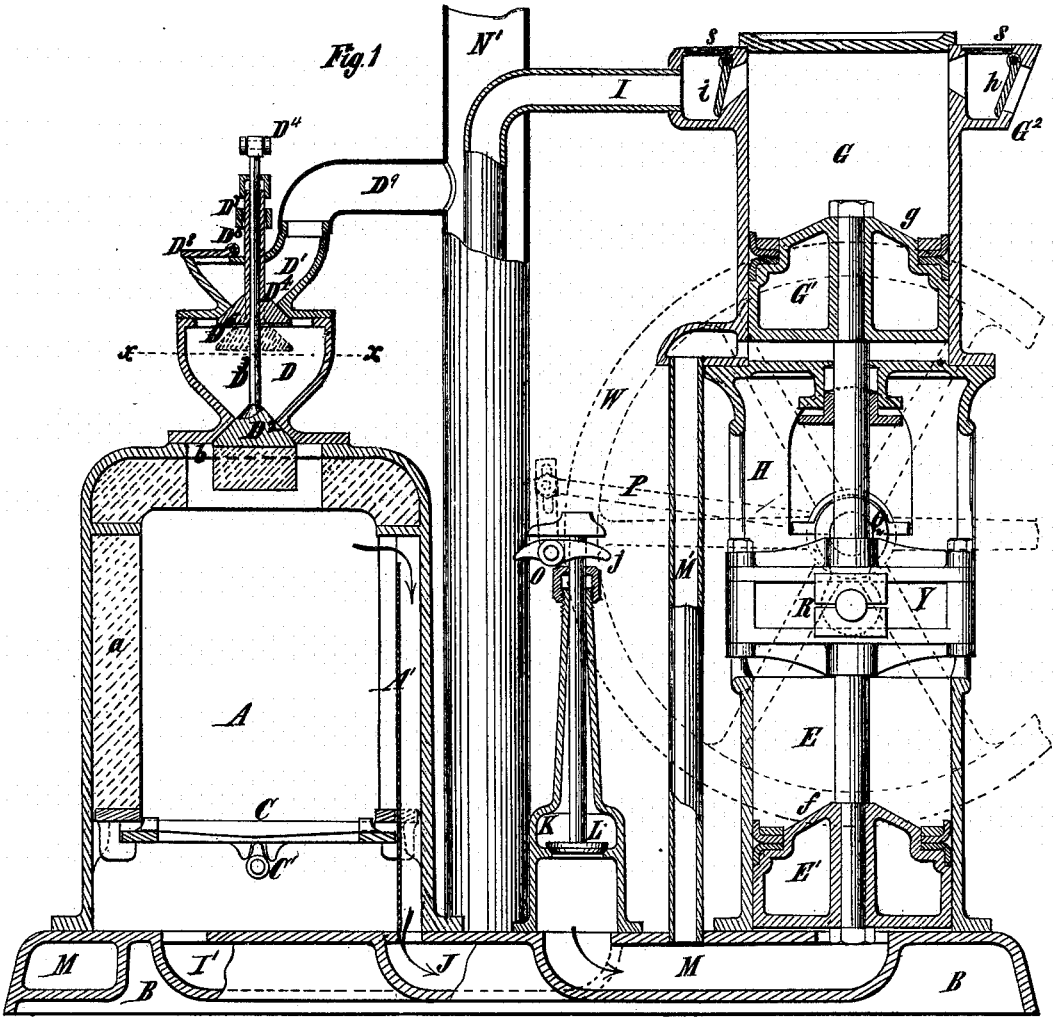
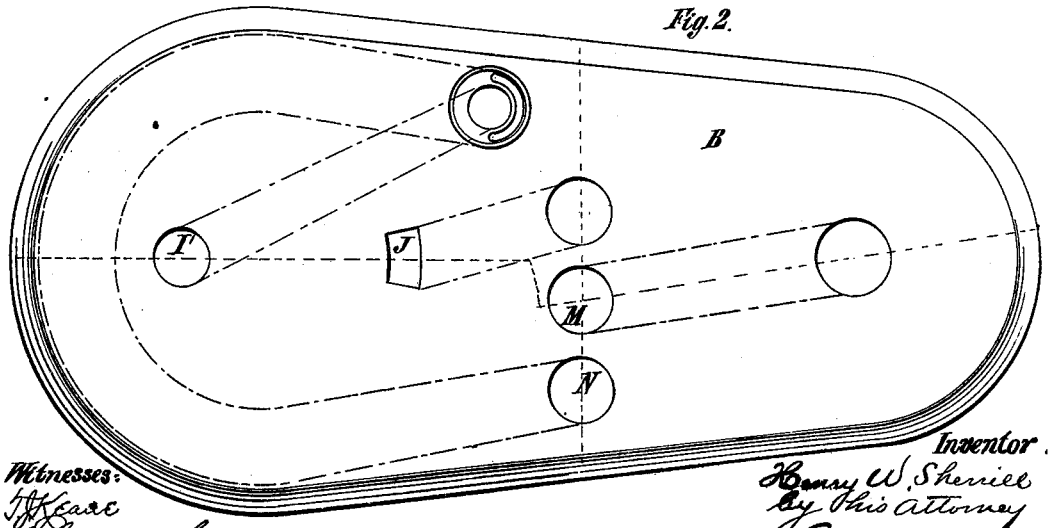


Fig. 2.



Witnesses:
J. H. Keare
Chandler Hale

Inventor.
Henry W. Sherrill
by his attorney
Edwin H. Brown.

2 Sheets—Sheet 2.

H. W. SHERRILL.

Hot-Air Engine.

No. 213,783. Patented April 1, 1879.

Fig. 3.

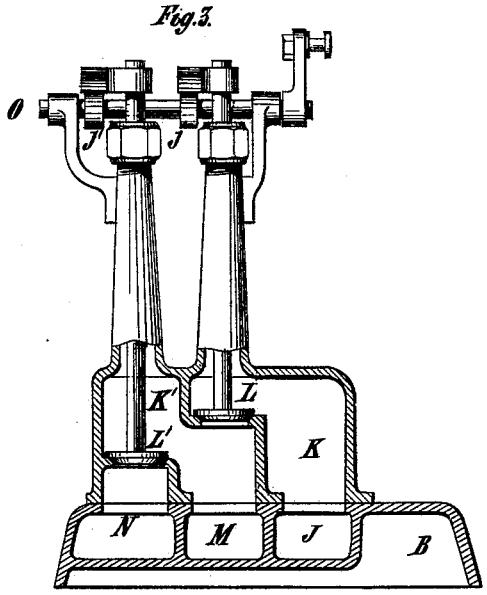


Fig. 4.

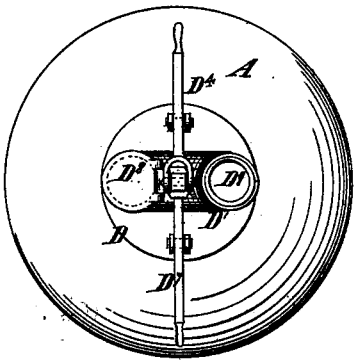
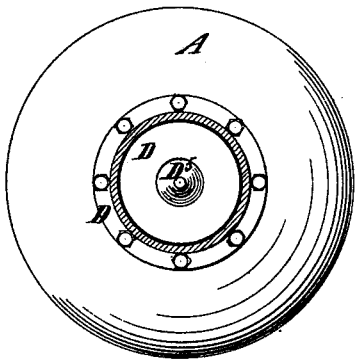


Fig. 5.



Witnesses:
Chandler Hall
T. J. Keane

Inventor.
Henry W. Sherrill
by his Attorney
Edwin H. Brown

UNITED STATES PATENT OFFICE.

HENRY W. SHERRILL, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO SHERRILL ROPER AIR ENGINE COMPANY, OF NEW YORK CITY.

IMPROVEMENT IN HOT-AIR ENGINES.

Specification forming part of Letters Patent No. **213,783**, dated April 1, 1879; application filed February 12, 1878.

To all whom it may concern:

Be it known that I, HENRY W. SHERRILL, of Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Hot-Air Engines, of which the following is a specification:

The object of my improvements is to simplify, cheapen, and increase the effectiveness of hot-air engines, so as to render them more compact, and adapt them for the use of persons of small means requiring motive power, and having a limited space.

One improvement consists in a hot-air engine comprising the combination of an engine-piston and pump-piston and passages, establishing communication between the engine-cylinder and the pump-cylinder and the furnace, and, preferably, under control of a single valve, whereby the pressure is admitted to the pump-cylinder to drive the pump-piston, thus utilizing it as a driving-cylinder as well as a pump-cylinder.

Another improvement consists in a hot-air engine comprising the combination of an engine cylinder and piston, a pump cylinder and piston separate therefrom, and a pipe or passage for conveying heated air from the furnace to the rear or under side of the pump-piston, whereby the engine-cylinder is relieved and assisted in its work.

Another improvement consists in a hot-air engine comprising the combination of an engine-cylinder and a pump-cylinder at least equal in diameter to said engine-cylinder, a pipe or passage for conveying heated air from the furnace to the engine-piston, and a pipe or passage for conveying heated air to the pump-piston, substantially as and for the purpose specified.

Another improvement consists in a hot-air engine comprising the combination of an inlet pipe or passage connecting the pump-cylinder with the furnace, and an exhaust-pipe surrounding or passing over or along the said inlet-pipe, whereby the air is heated in the inlet-pipe before entering the furnace by the exhaust-air, and the furnace is assisted in the work of heating the air preparatory to its entering into the engine and pump cylinders.

Other improvements consist in details of construction to be hereinafter explained.

In the accompanying drawings, Figure 1 is a central vertical section of a hot-air engine embodying my improvements. Fig. 2 is a plan or top view of the base-piece thereof. Fig. 3 is a transverse section of said base-piece, including a partial section and a side view of the valve-box and its appurtenances. Fig. 4 is a plan or top view of the furnace and feeder or charging-vessel; and Fig. 5 is a transverse section of said feeder or charging-vessel, taken on the plane of the dotted line *x x*, Fig. 1, and including a plan or top view of the furnace.

Similar letters of reference designate corresponding parts in all the figures.

A designates a closed furnace, erected on the base-piece B, and made of cast-iron or other suitable material, preferably lined with fire-brick *a* where exposed directly to the fire. C designates a grate comprising a series of bars supported so as to be capable of being rocked or oscillated, for the purpose of shaking the fire supported thereon by means of a tappet or projection, C′, or other suitable device capable of being actuated from outside the furnace. D D^1 designate a feeder or charging-vessel mounted on said furnace and comprising two separate compartments, D and D^1, the lower of which communicates with the furnace through an opening, *b*. Preferably, both compartments of this feeder are contracted downwardly, or, in other words, are funnel-shaped, to facilitate the passage of fuel through them.

The compartment D of the feeder is provided with a cover, D^2, of conical form, affixed to a shaft, D^3, and capable of being lowered or raised by means of a lever, D^4, to open or close the bottom of the said compartment. The compartment D^1 is provided at the bottom with a conical cover, D^5, attached to a tubular shaft, D^7, surrounding the shaft D^3, and connected to a lever, D^4, whereby the cover may be lowered or raised to open or close the bottom of the said compartment D^1.

D^8 designates a cover, which may be opened to admit fuel into the compartment D^1; and D^9 designates a draft-pipe leading from the compartment D^1 into the exhaust-pipe of the engine.

The covers D^2 D^5 may be operated independently of each other or together; but it is intended that the covers D^5 and D^8 shall first

be opened and fuel introduced into the compartments D and D^1, and that after the closing of the cover D^5 the cover D^2 shall be opened to allow the fuel to pass into the furnace A.

By operating the covers in this way fuel may be introduced into the furnace, so that the latter may be replenished without ever opening it to the external atmosphere, and there will be little danger of the fuel clogging.

A furnace provided with such a feeder and shaking grate may be replenished and have its fire shaken without stopping the engine or materially impeding it, as is the case when the furnace has been opened for either of these purposes.

By opening both the covers D^2 D^5 together a draft may be established through the furnace into the draft-pipe, for facilitating the lighting of a fire.

E designates an engine-cylinder, mounted on the base-piece B, in proximity to the furnace A, and fitted with a piston, E′, having a conical or connoidal head or top, *f*, whereby oil or other lubricants introduced into the cylinder and falling upon said piston will be distributed about its circumference where it is needed, and will not accumulate upon the top of said piston, as it otherwise might do.

G designates a pump-cylinder erected upon standards or a frame, H, extending upwardly from the engine-cylinder E, and G^1 designates a piston fitted therein and provided with a conical or conoidal head, *g*, serving the same purpose as that of the engine-piston E′. The rods of the engine-piston E and pump-piston G^1 are connected rigidly together by means of a yoke, Y, wherein a box, R, fitting the wrist of a crank extending from the driving-shaft Q of the engine may slide laterally to and fro during the motion of the said pistons. Motion is communicated through the sliding box R and crank to the driving-shaft, which may be provided with a fly-wheel, W, to carry it over dead-centers. By thus connecting the two pistons together I obviate all the lost motion and noise which is usually entailed through connections consisting of pitman-rods and pins, and I enable the engine-piston to be cushioned by the pump-piston on the air forced into the furnace at the time of changing or reversing the stroke, and hence avoid to a great extent the jar incident to the ordinary single-acting engines.

G^2 designates the inlet of said pump-cylinder, provided with a valve, *h*, pivoted in place and adapted to close by gravity.

I designates a pipe leading to a passage, I′, in the base-piece B, communicating with the furnace, to the furnace A, underneath its grate, and conveying air thereto. Near the pump-cylinder it is provided with a valve, *i*, hinged in place and capable of closing toward the furnace by gravity. Both the chamber containing the valve *h* and that containing the valve *i* may be provided with glass plates *s*, to facilitate the inspection of the valves.

A′ designates a passage in the wall of the furnace A, leading from near the top thereof to a passage, J, in the base-piece, communicating with the induction live-air chamber K of a valve-box, K K′, mounted on the base-piece B. L designates a valve fitted in the live-air chamber K of the valve-box, controlling the communication of said chamber with a passage, M, in the base B, leading to the bottom of the engine-cylinder E, and communicating through a pipe, M′, with the lower part of the pump-cylinder G, so as to convey live air under both the engine-piston E′ and pump-piston G^1.

L′ designates a valve controlling the communication of the chamber K′ of the valve-box with the passage N, leading to an exhaust pipe, N′, which is shown as surrounding the pipe I, whereby air is conveyed from the pump-cylinder to the furnace.

These valves L and L′ may be operated in any suitable manner—as, for instance, by tappets *j j′* on a countershaft, O, worked by a rod, P′, from the driving-shaft Q of the engine. On the opening of the valve L the live air is admitted from the furnace into the engine and pump cylinders, the valve L′ being closed to prevent the passage of said live air into the exhaust-pipe; and on the closing of the valve L the air is exhausted from the engine and pump cylinders into the chamber K′ of the valve-box, and as the valve L′ is then opened it will pass into the exhaust-pipe N′.

By establishing communication between the furnace and the engine and pump cylinders and exhaust-pipe through passages which may be cast in the base of the engine, I obviate the necessity of independent pipes, and therefore simplify and cheapen the engine. I also simplify and cheapen the engine by admitting live air into and exhaust-air from the engine and pump cylinders under control of the same valves. By passing the exhaust-pipe along the pipe conveying air to the furnace I enable the said exhaust-air, which is usually wasted, to assist in heating the air conveyed to the furnace, and thereby lessen the amount of work which the furnace has to perform in heating the air to the requisite extent.

It will be seen that by my invention I provide for replenishing and shaking the fire of the furnace without materially impeding or interfering with the operation of the engine; that I cheapen and simplify the engine by employing passages in the base-plate in lieu of independent pipes; that I utilize the pump-cylinder as a driving-cylinder and control it by the same valves which control the action of the engine-piston and lessen the work of the latter, and that I utilize the exhaust-air for the purpose of heating the air conveyed to the furnace.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A hot-air engine comprising the combination of an engine-cylinder, E, piston E′, pump-cylinder G, piston G^1, with their piston-

rods rigidly connected by the yoke Y, the sliding box R, crank, and driving-shaft Q, substantially as and for the purpose specified.

2. A hot-air engine comprising the combination of an engine cylinder and piston, a pump cylinder and piston separate therefrom, and a pipe or passage for conveying heated air from the furnace to the rear or under side of the pump-piston, substantially as specified, whereby the engine-cylinder is relieved and assisted in its work.

3. A hot-air engine comprising the combination of an engine-cylinder, a pump-cylinder at least equal in diameter to said engine-cylinder, a pipe or passage for conveying heated air from the furnace to the engine-piston, and a pipe or passage for conveying heated air from the furnace to the pump-piston, substantially as specified.

4. In a hot-air engine, the combination of an engine cylinder and piston, a separate pump cylinder and piston, and pipes or passages for conveying air from the furnace to both cylinders, to act on both pistons under control of the same valve and from both cylinders under control of another valve, substantially as specified.

5. A hot-air engine comprising the combination of the furnace A, passage J, valve-box K K′, and valves L L′, passage M, pipe M′, cylinders E G, and passage N, arranged substantially as and for the purpose specified.

6. A hot-air engine comprising the combination, with a pipe or passage for conveying air from the pump to the furnace, of an exhaust-pipe extending along the same, substantially as and for the purpose specified.

7. A hot-air engine comprising the combination, with a pump-cylinder, G, a furnace, A, and engine-cylinder E, of a pipe, I, a base provided with passages I′, J, M, and N, and a valve-box, K K′, mounted thereon, and containing valves L L′, substantially as and for the purpose specified.

8. In a hot-air engine, the combination, with a furnace, of a feeder comprising the chambers D D^1, covers D^2 D^5, and draft-pipe D^9, constructed and arranged substantially as and for the purpose specified.

9. A hot-air engine comprising the combination, with a furnace, of a feeder or charging-vessel provided with covers having independent shafts, one of which passes through the other and fits into a stuffing-box therein, substantially as and for the purpose specified.

HENRY W. SHERRILL.

Witnesses:
H. A. SHERRILL,
C. LAUER.