P. SHAW.

Assignor to himself and E. TOWNSEND.

HOT AIR ENGINE.

No. 32,455. Patented May 28, 1861.

Fig. 1.

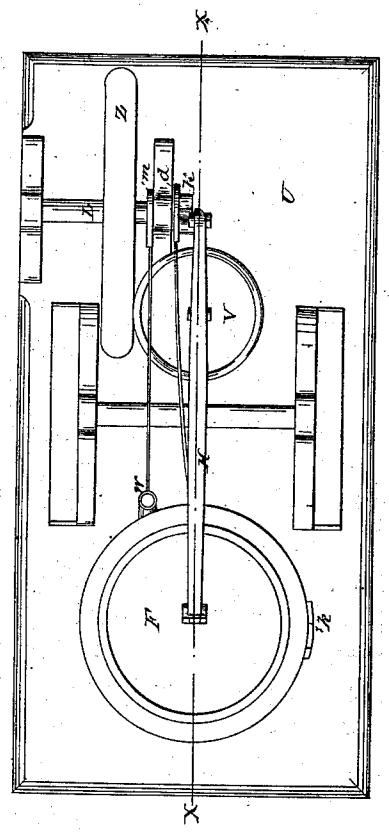
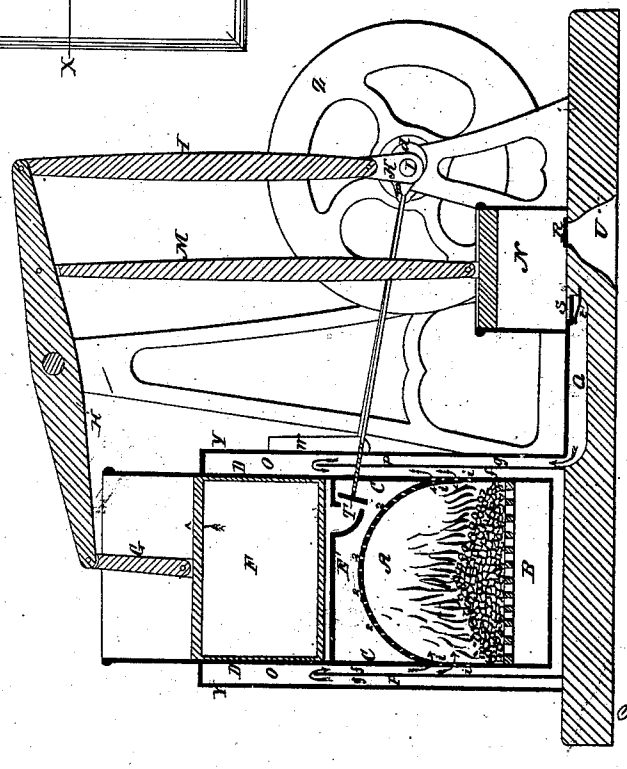


Fig. 2.



Witnesses

Sam Cooper

R. Eschemacher

Inventor.

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UNITED STATES PATENT OFFICE.

PHILANDER SHAW, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO HIMSELF AND E. TOWNSEND, OF BOSTON, MASSACHUSETTS.

HOT-AIR ENGINE.

Specification of Letters Patent No. 32,455, dated May 28, 1861.

To all whom it may concern:

Be it known that I, PHILANDER SHAW, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Hot-Air Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a plan of my engine. Fig. 2 a vertical section through the same, upon the line *x x* of Fig. 1.

In those hot air engines in which the working cylinder was placed over the fire box firstly there has been no means by which the heated air within the cylinder could be worked expansively independent of the air within the fire box. Secondly, every time the exhaust was opened, all the air within the fire box was exhausted, and a great waste of power was the consequence. To remedy this, is the object of the first part of my invention, which consists in a partition or head between the fire box and the cylinder, the communication between the two, being commanded by a valve, operated by an eccentric on the shaft of the engine itself. Another two-fold difficulty has been experienced in the practical operation of the machines, arising from the great radiation from the surface of the furnace and engine, which was not only productive of great loss of power, but also so heated the apartment containing the engine, as to greatly incommode those who were obliged to remain in it.

The second part of my invention has for its object to remove both of these difficulties, and to save both the loss and the inconvenience, resulting from the radiation.

To accomplish these ends I surround the furnace and the cylinder with a tight casing which incloses a chamber or compartment between it and the furnace, the chamber being divided by a vertical partition into two chambers so arranged that the air for the combustion of the fuel and for operating the engine shall first refrigerate the exterior of the vertical partition, next, the exterior of the cylinder and finally the exterior of the furnace before entering the fire pot.

In the accompanying drawings A is the fire box, B the tight ash pit, C the walls of the furnace, which are continued up to form the working cylinder D; the partition or head E separating the cylinder from the furnace.

The piston F may be made in any suitable manner, but I prefer to make it of sheet metal, and fill it with some nonconducting substance.

The piston rod G is connected with the walking beam H, from which descends the connecting rod I to the crank K on the main shaft L, and the piston rod M of the force pump N. Outside of the furnace and cylinder, and surrounding them, is a casing or jacket Y which incloses a chamber O; this chamber communicates by the conduit Q with the force pump N from which it receives the air for the combustion of the fuel and the propulsion of the engine, which passes directly from the chamber, to the furnace by numerous small holes *i* made through the walls of the furnace, a short distance above the surface of the fire. The radiation from the exterior walls of the furnace and cylinder is thus caused to heat the air, immediately before it enters the furnace; by which the radiation into the apartment is prevented, and as this air which is thus heated has passed the force pump, and is on its way to the fire, no loss is experienced, but it is all expended in effecting the expansion of the air immediately in connection with that within the furnace. The heat of radiation which would otherwise be lost, is thus economized and made to assist in driving the engine. It is manifest that this double end would not be gained *i. e.* the economizing of the heat without heating the apartment, were the air from within the casing Y allowed to escape, or were it first passed through the chamber and subsequently pumped into the furnace. The more perfectly to prevent the useless radiation of heat from the exterior of the casing Y, the lower portion of the chamber O is divided into two passages *g* and *f*, so that there is a constant stream of cool air rising through the exterior passage *g* into the chamber O from which it descends partially heated to the interior passage *f*. It will thus be seen that the heat of the surfaces with which the entering air is brought in contact is continually increasing on the way from the air pump to the fire pot, by which great economy of heat is effected and the heating of the apartment is

avoided. R is the induction and S the eduction valve of the force pump, the latter being caused to close by a spring *t*. T is the induction valve between the furnace and the cylinder which is operated by an eccentric or cam *d* upon the main shaft; the exhaust valve is also operated in a similar manner, by an eccentric or cam *m*, the exhaust taking place from the cylinder through the pipe W. The engine is erected upon a suitable bed plate V and is provided with a fly wheel Z upon the main shaft.

To protect the bottom of the cylinder from the direct action of the fire an arch of cast metal or other suitable material is placed between it and the fire, which being pierced throughout with holes 2, 2, permits the heated air to ascend uniformly through it.

Operation: When the fire is started the fire door *k* is opened and the smoke is allowed to pass off through the valve T and cylinder, and by the exhaust pipe W into the chimney. In Fig. 2 the valves S and R are represented as closed, the valve T as just opened, and the piston F starting upon its upward stroke, the cam *d* being arranged to cut off, by closing the valve T at the proper point, when it is required to work the engine expansively. As the piston F rises, the pump piston V descends, and when the pressure within the pump exceeds that within the furnace the valve S opens, and the air enters the furnace as before explained by the passages *g*, O, *f*, and openings *i*.

In the engine represented in the drawings the cylinder of the force pump is of small capacity as compared with the main cylinder, the engine being designed to work expansively. In practice the capacity of the pump should be about one half that of the working cylinder.

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

1. In a hot air engine in which the cylinder is placed directly over the fire box and forms a continuation of the same, separating the cylinder from the fire box by a partition or head and admitting the air to the cylinder through a valve in it operated by the engine for the purpose specified.

2. The chamber O, surrounding the furnace and more or less of the cylinder and placed between the furnace and the air pump and communicating with the two in combination with the partition P, arranged and operating in the manner substantially as set forth.

PHILANDER SHAW.

Witnesses:
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