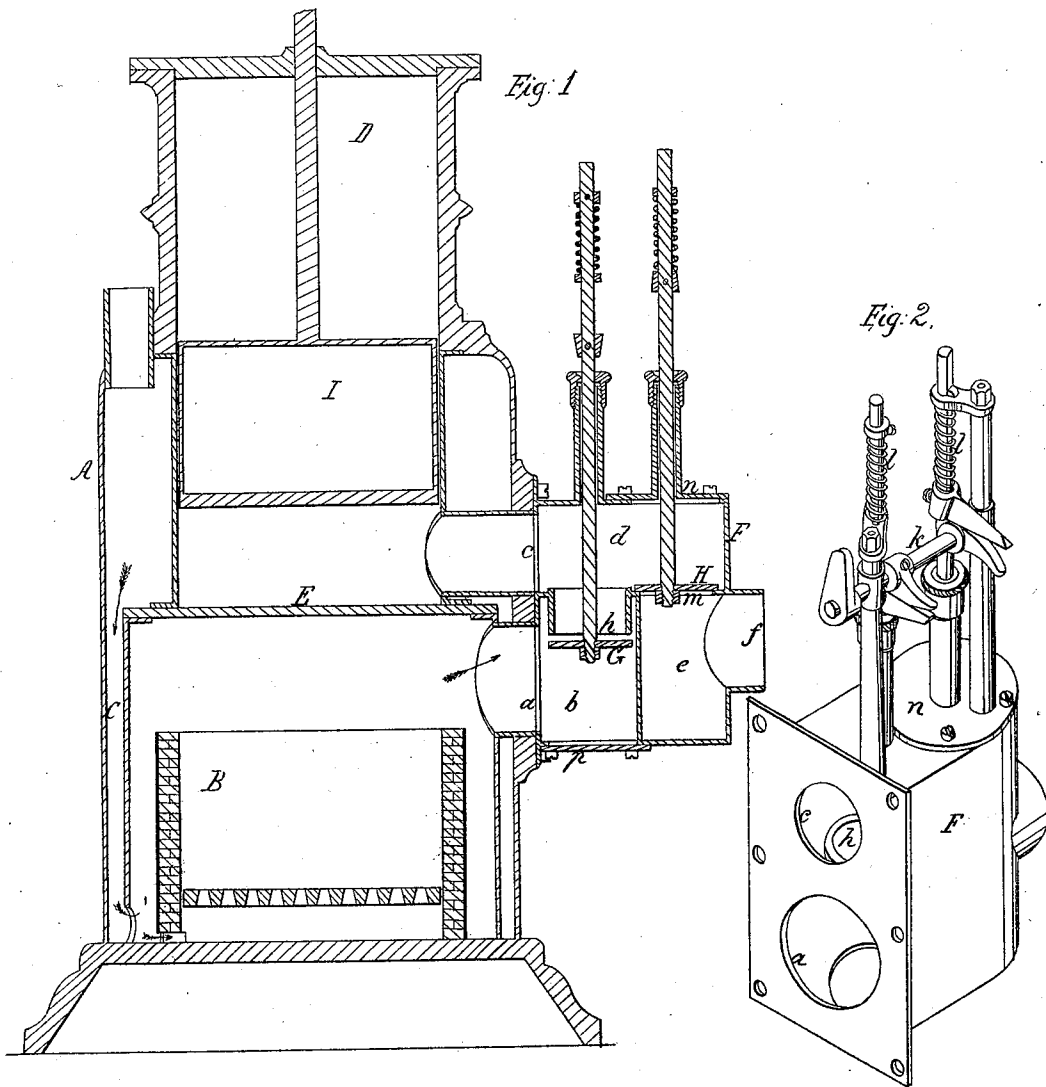


S. H. ROPER.  
AIR ENGINE.

No. 34,723.

Patented Mar. 18, 1862.



Witnesses;  
E. F. Schomacher  
Edmund Haffner.

Inventor  
S. H. Roper  
by his attorney  
Samuel Cooper

# UNITED STATES PATENT OFFICE.

S. H. ROPER, OF ROXBURY, ASSIGNOR TO ELMER TOWNSEND, OF BOSTON,  
MASSACHUSETTS.

## IMPROVEMENT IN HOT-AIR ENGINES.

Specification forming part of Letters Patent No. 34,723, dated March 18, 1862.

*To all whom it may concern:*

Be it known that I, S. H. ROPER, of Roxbury, in the county of Norfolk 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 vertical section through the fire-box, working-cylinder, and my improved arrangement of valves and valve-chest of a hot-air engine. Fig. 2 is a view of the valve-chest.

In the hot-air engines in which the air for operating the piston is forced through the furnace or fire-box and is admitted to the working-cylinder through valves, as in the engine for which I made application for patent June 22, 1861, a difficulty occurs in having the valves placed in such a position that they are exposed to the direct radiation from the fire, which effects their corrosion and destruction much sooner than if the hot air only came into contact with them. To remedy this is the object of my present invention, which consists in attaching to the outside of the shell or case of the hot-air engine a valve-chest in which the valves and their communicating chambers and passages for admitting the hot air to and from the working-cylinder are placed and work, by which the valves are not only protected from the direct radiation of the fire, but are in such a position that they are easily accessible for adjustment or repairs.

That others skilled in the art may understand and use my invention, I will proceed to describe the manner in which I have carried it out.

In the said drawings, A is the shell or casing of the engine; B, the fire-box or furnace to which air is forced by a pump (not shown in these drawings) through the passage C.

D is the working-cylinder; E, a diaphragm

or partition which separates this cylinder from the furnace, and in which the valves have heretofore been placed.

F is a valve-chest, which is attached to the shell A on one side, an opening *a* being made through the side of the shell A into the lower partition *b*, and another opening *c* into the upper partition *d* of the valve-chest. It will be seen by reference to Fig. 1 that this valve-chest is divided into three portions, *b*, *d*, and *e*, by suitable partitions, the latter division *e* opening at *f* to the atmosphere.

A valve G commands an opening *h* from the division *b* to the division *d*, and another valve H commands an opening *m* from the division *d* to the division *e* and the outer atmosphere. These valves are operated by an ordinary rock-shaft *k*, Fig. 2, and are closed by springs *l* on their stems.

The operation is as follows: The air being forced into the furnace and there heated and expanded is admitted by the opening of the valve G to the cylinder D, and the piston I is raised. This valve is now closed and the valve H is opened to permit the cylinder D to exhaust through the opening *f* into the atmosphere. A cap *n* on top of the valve-chest F gives access to the valve H, and another similar cap *p* on the bottom of the chest gives access to the valve G.

What I claim as my invention, and desire to secure by Letters Patent, as an improvement in hot-air engines in which the working-cylinder is separated by a partition or diaphragm from the furnace or fire-box, is—

The arrangement of the valves and their communicating chambers and passages within a valve-chest F on the outside of the shell or casing A, substantially as and for the purpose set forth.

S. H. ROPER.

Witnesses:

THOS. R. ROACH,  
EDMUND MASSON.