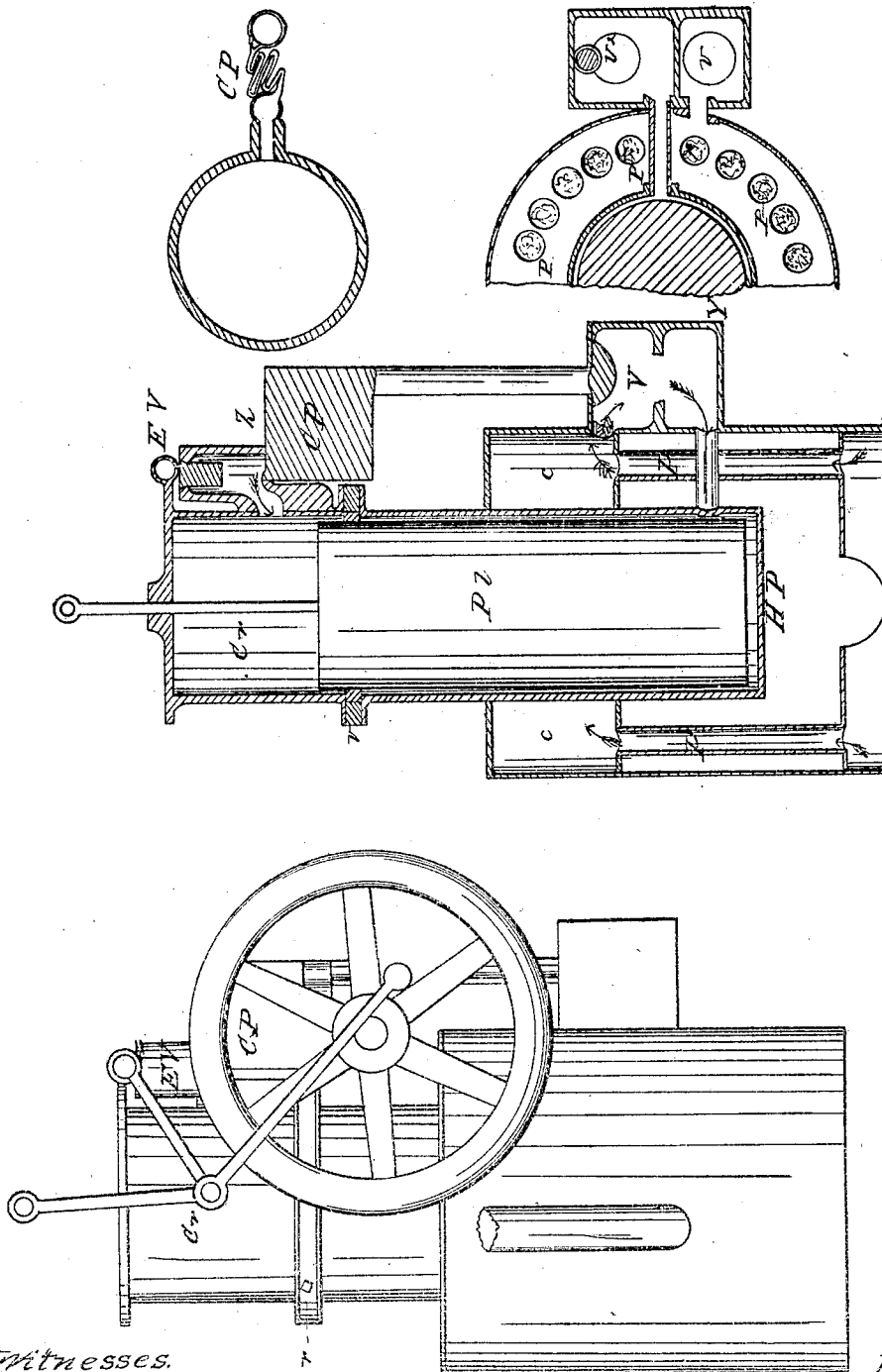


T. McDONOUGH.  
HOT AIR ENGINE.

No. 44,966.

Patented Nov. 8, 1864.



Witnesses.  
Edward C. Galtison  
W. C. Stoughton

Inventor.  
Thomas M<sup>c</sup>Donough

# UNITED STATES PATENT OFFICE.

THOMAS McDONOUGH, OF MIDDLETOWN, CONNECTICUT.

## IMPROVEMENT IN HOT-AIR ENGINES.

Specification forming part of Letters Patent No. 44,966, dated November 8, 1864.

*To all whom it may concern:*

Be it known that I, THOMAS McDONOUGH, of Middletown, in the county of Middlesex, in the State of Connecticut, have invented a new and useful combination of improvements in the calorific-engine; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

Metal pipes P P, filled with wires, are placed around the furnace and exposed to its heat. Their lower ends are open to cold air to enter them. Their upper ends open into a hot chamber, *c c*, above the furnace. These pipes are used to heat the air as it passes among the wires and into the chamber *c c*. A valve-chest containing two valves, *v* and *v*<sup>2</sup>, is connected by one passage with the chamber *c c*, and also by a passage with the lower part of the cylinder of the engine, so that the hot-air may be drawn past the valve *v* into the lower part of the cylinder whenever the plunger *Pl* is raised, and may also be moved past the valve *v*<sup>2</sup> into the passage that leads from the valve chest toward the upper part of the cylinder whenever the plunger *Pl* is lowered. These valves are opened and shut by any usual method of working puppet-valves.

Sheets of metal soldered or braced together at their edges and corrugated, as shown in the section *z*, are connected a tone part to a passage leading from the valve-chest, and at another part to the passage leading to the upper part of the cylinder, so that the air in moving from the lower part of the cylinder past the valve *v*<sup>2</sup> must pass between these sheets *c p*, and thus be cooled before entering the upper part of the cylinder *Cr*.

A valve, *Ev*, opening outward, is attached

to the upper part of the cylinder *Cr* to discharge the air when the plunger is raised. The valve *v*<sup>2</sup> being shut, prevents any other egress for it. The plunger *Pl* is connected to the crank, and by its upward movement hot air is drawn into the lower part of the cylinder and cold air thrown out of the upper part; then by its downward movement the hot air in the lower part is moved past the valve *v*<sup>2</sup> through *CP*—that is, between the sheets—into the upper part, where its tension is less and volume the same as in the lower part, so that on admitting the air from the chamber *c c* now to press on the lower end of the plunger *Pl*, it is forced up until the cold air above it equals in tension the hot air beneath it, and the momentum acquired moves the plunger through the remainder of its upward stroke, during which it discharges the cold air above it. The momentum also gives the plunger the next downward stroke.

I am aware that wires in heated chests have been used as regenerators for air which has first obtained its heat by contact with plates heated directly by the fire, and next imparted it to the wires.

I am aware that thin plates are variously applied for cooling.

I am aware that a single piston is used for the transfer of gases arising from combustion.

I disclaim all these inventions.

I claim—

The combination of the heaters and coolers with the plunger, by means of which the increased power is utilized substantially as described

THOMAS McDONOUGH.

Witnesses:

EDWARD C. PATTISON,  
N. C. STOUGHTON.