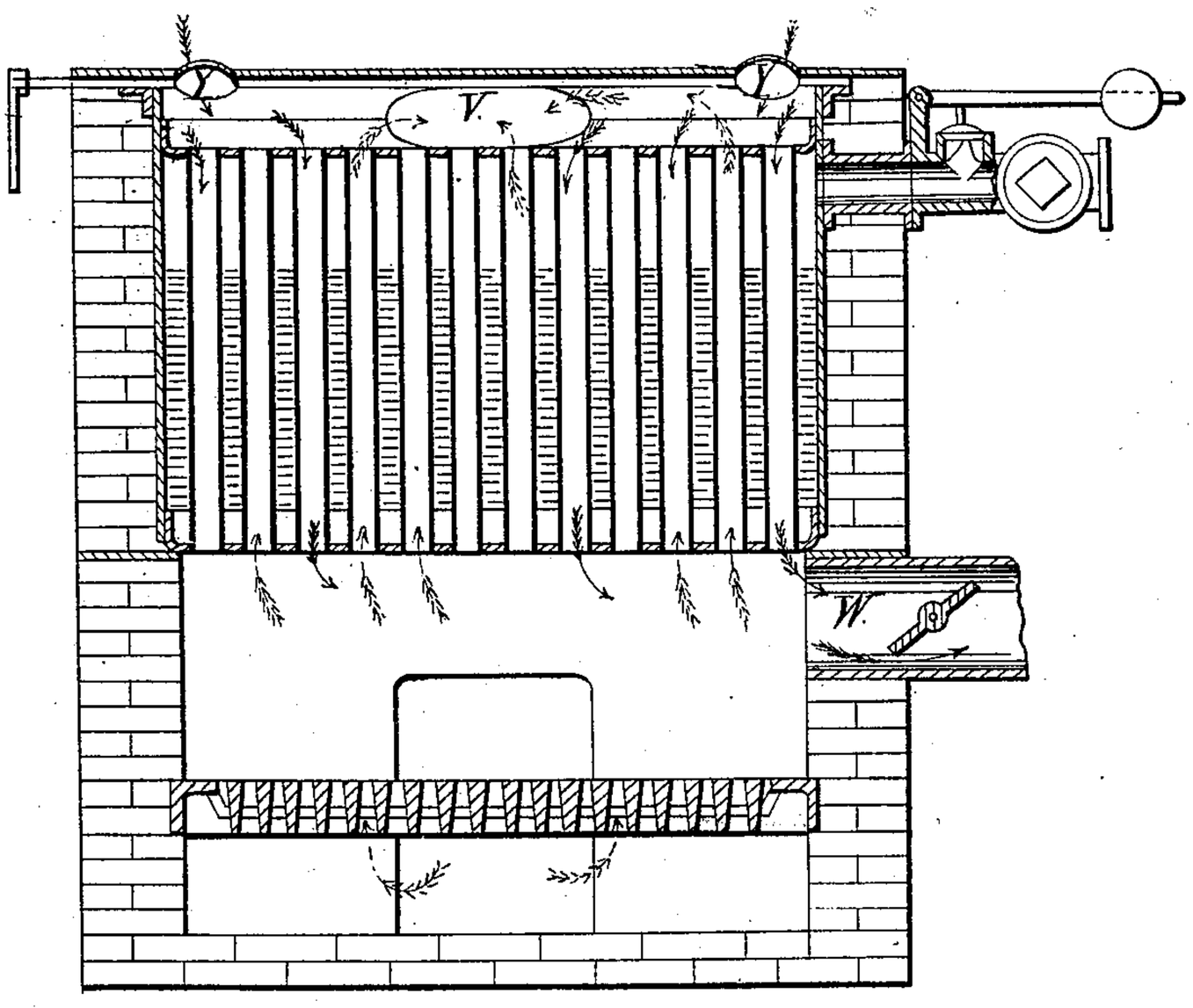
# P. Shaw,

## Air Engine,

No. 33,497. Patented Oct. 15, 1861.




Witnesses.

J. B. Crosby

H. D. Osgood

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# UNITED STATES PATENT OFFICE.

PHILANDER SHAW, OF BOSTON, MASSACHUSETTS.

## IMPROVEMENT IN UTILIZING THE EXHAUST OF CALORIC ENGINES.

Specification forming part of Letters Patent No. **33,497**, dated October 15, 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 made a new and useful invention by which I Utilize the Caloric Escaping in the Exhaust of Hot-Air Engines; and I do hereby declare that the following, taken in connection with the drawing which accompanies and forms part of this specification, is a description of my invention so full and exact as to enable those skilled in the art to practice it.

In hot-air engines the exhaust or current of heated air and gases escaping from such engines, after having imparted motion to the parts thereof, still retains a considerable fraction of the heat generated, and which is commonly lost.

To accomplish the saving of this caloric is the object or my invention, which consists in the employment of the exhaust of a hot-air engine to generate steam in any suitable boiler, and thus by the transfer of the caloric or a portion thereof to another medium to render available the power generated or represented by it.

It further consists in the arrangement of passages for the exhaust of a caloric engine with any suitable boiler and its furnace, so that either the exhaust or fuel consumed in said furnace can be employed to generate steam.

The drawing répresents in section a tubular boiler set in brick-work, with a furnace beneath it and what may be termed a "smoke-box" above it, into which the exhaust of a caloric engine may be discharged through openings Y, which can be closed by valves or dampers therein. The exhaust will pass through the tubes of the boiler (and by a slight modification of the brick-work setting might be made, also, to find a passage around the boiler) in directions indicated by the arrows in solid lines to an outlet W, which is arranged with a valve or damper, by which it can be closed.

When it is intended to generate steam by the employment of the exhaust, all communications with the furnace—such as the furnace and ash-pit doors—should be closed, and also that represented at V. The outlet W may be made to connect with a chimney to establish and maintain a draft to carry off the exhaust after it has passed the boiler. As the temperature of the escaping caloric in the exhaust of hot-air engines is often about 600° Fahrenheit, it is evident that steam may be generated by its passage, as above indicated. This steam may be employed to work an air-pump to furnish cool condensed air to the caloric engine to be heated and expanded, or it may be employed to help to rotate the shaft of the caloric engine by having the engine in which the steam is used connected directly thereto; or the steam may be otherwise used, either in connection with the caloric engine or for any other desired purpose.

In such caloric engines as required or are used with a reservoir of considerable capacity in which compressed air is stored, and in which the pressure is equal to that in the furnace, though the temperature of the air therein may vary in different parts thereof, it is necessary by some means to compress the air in said reservoir and to supply it to the furnace to be heated and increased both in volume and pressure. In small engines this may be done by hand; but in large ones this is too laborious for practice, and it is in such cases that the furnace shown in the arrangement illustrated in the drawing becomes of value. It will be evident that a fire kindled upon the grate shown under the boiler may pass the gaseous products of combustion in the direction indicated by the dotted arrows through the flues of the boiler or around it to a chimney through the opening V, which is provided with a valve to be closed whenever the exhaust of the caloric engine is employed to generate steam.

When steam is being generated from combustion of fuel upon the grates shown in the drawing, the dampers in W and Y should be closed and the ash-pit door and the damper in V should be opened. The steam generated as last described may be used in a suitable steam-engine to drive an air-pump to compress air in the reservoir of a hot-air engine, which when it is started may be made by the requisite and before-described manipulation of valves and dampers, to exhaust in the direction indicated by the dotted arrows, by which the exhaust would be deprived of a portion of its caloric, which would be utilized in the generation of steam.

Having described my invention, what I

claim as new, and desire to secure by Letters Patent of the United States, is—

1. So arranging and applying steam-boilers in connection with the exhaust-passages of hot-air engines that a portion of the caloric contained in the exhaust of such engines shall be utilized in the generation of steam, substantially as specified.

2. The arrangement, operating substantially as set forth, of the exhaust-passages of a hot-air engine with a suitable boiler and its furnace to generate steam either by the exhaust from such engines or by the combustion of fuel in the boiler-furnace.

PHILANDER SHAW.

Witnesses:

J. B. CROSBY,

H. D. OSGOOD.