W. Reinlein,

Air Engine,

No. 55,971. Patented June 26, 1866.

Fig: 1

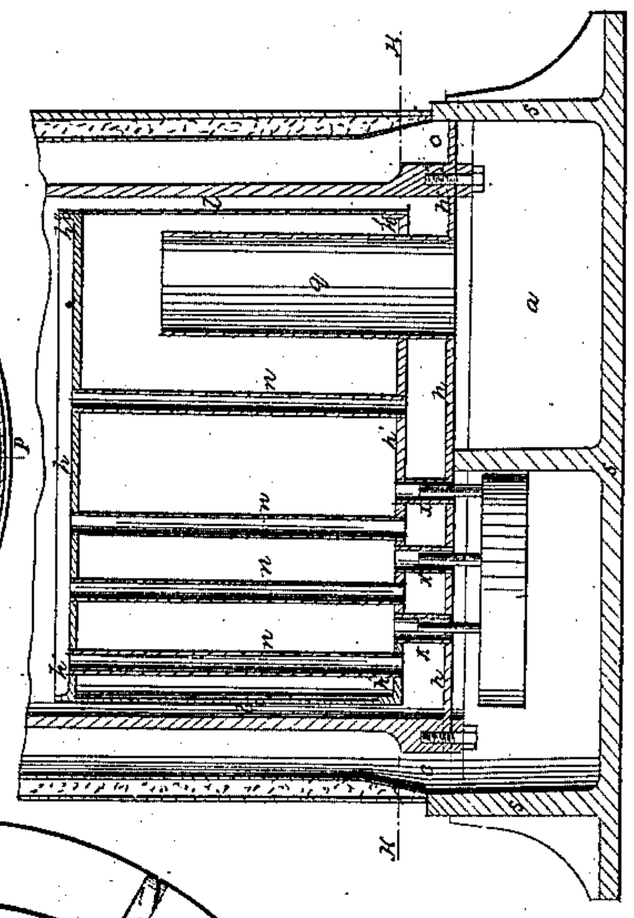


Fig: 5

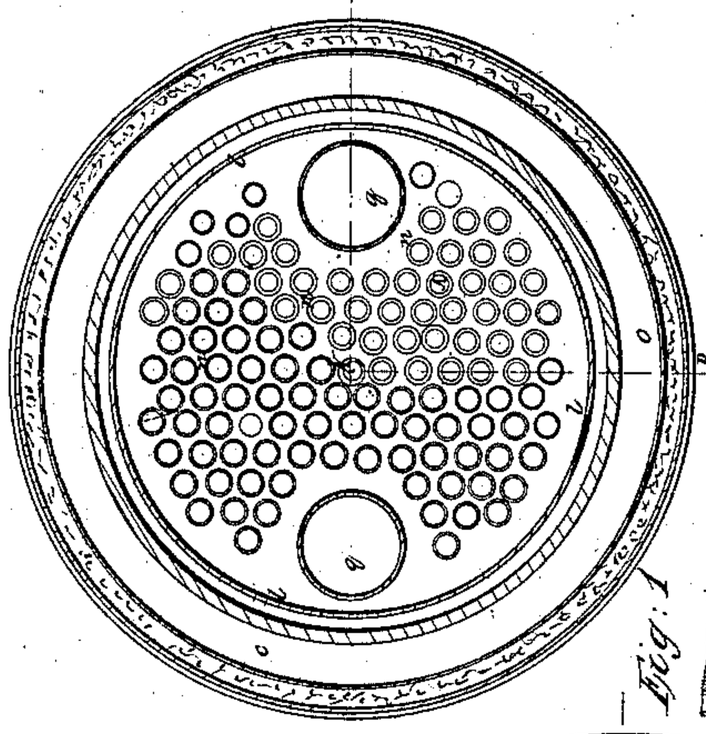


Fig: 2.

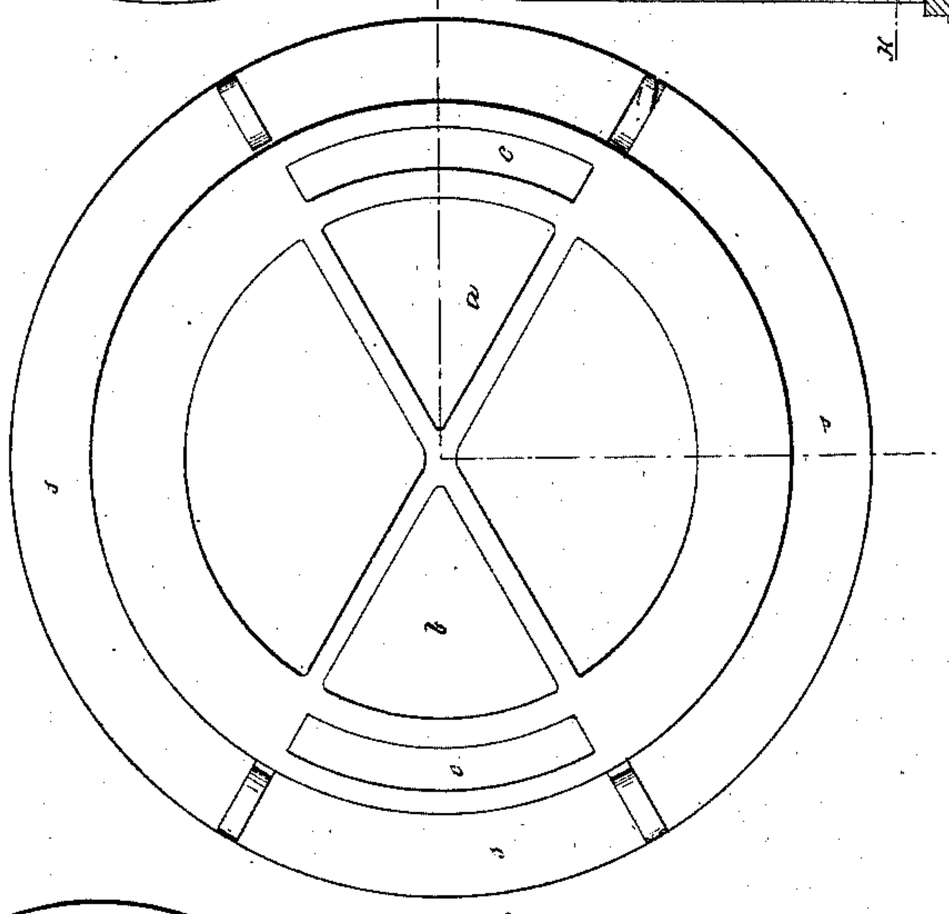


Fig: 4.

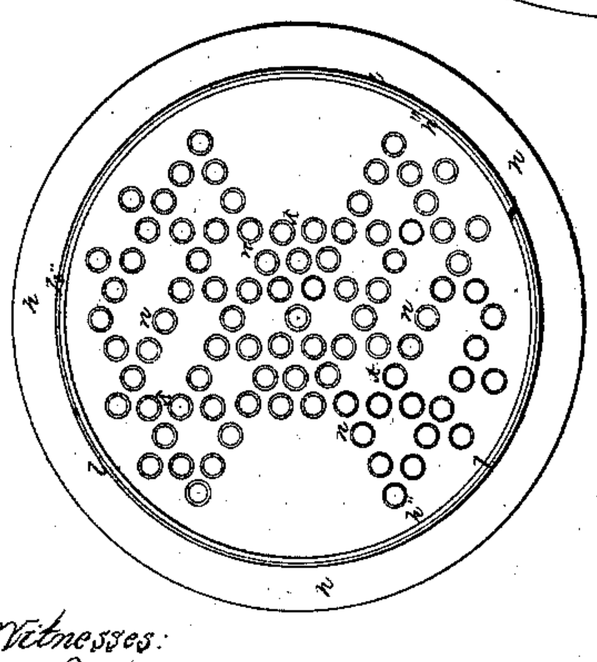
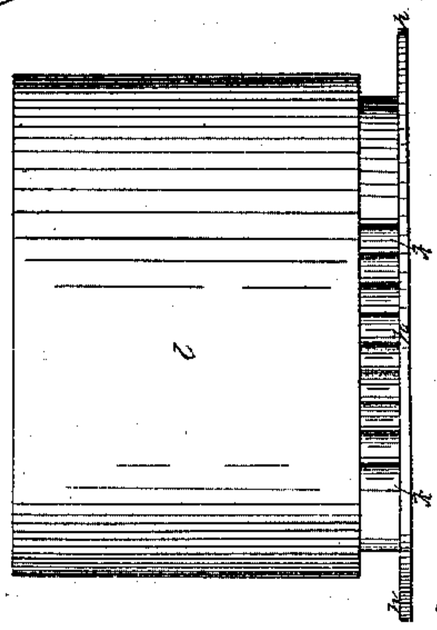


Fig: 3.



Witnesses:
M. Bailey
Peter Coombs

Inventor:
Wm. Reinlein
by A. Pollok
his atty

UNITED STATES PATENT OFFICE.

WILLIAM REINLEIN, OF BARCELONA, SPAIN.

IMPROVEMENT IN HOT-AIR ENGINES.

Specification forming part of Letters Patent No. **55,971**, dated June 26, 1866.

To all whom it may concern:

Be it known that I, WILLIAM REINLEIN, of Barcelona, in the Kingdom of Spain, have invented certain new and useful Improvements in Caloric or Heated-Air Machinery; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings.

My invention consists of certain improvements in hot-air engines, and particularly the Ericsson engine.

To enable those skilled in the art to understand and use my improvements, I will proceed to describe them, referring to the drawings, in which such parts of a hot-air engine are shown which may be necessary for the elucidation of my said invention.

The first improvement consists in so arranging the support of an air-engine that the axis of its motor-cylinder shall be vertical instead of horizontal.

I obtain this result by placing the motor-cylinder so that its base shall rest on the annular support *s s*, a cross-section of which is shown in Figure 1, and in securing it thereto by means of screws. Fig. 2 is a plan view of the support. The two cross-ribs with which it is provided form the boxes *a* and *b*, through which the smoke passes in leaving the boiler before surrounding the cylinder. This improved arrangement of the cylinder does away with the resisting power developed by the friction occasioned by the weight of the pistons.

On examining a steam-engine with reference to the power absorbed by the friction of its piston, it is seen that it is almost immaterial whether the cylinder be in a vertical or horizontal position; but in a hot-air engine the conditions are not the same, and it is not possible to consider as immaterial the position in which the cylinder is placed.

In a steam-engine there is but one piston, while in a hot-air engine there are two. The steam-engine is of double action, while the hot-air engine is of single action, and in the latter the feed-piston has a stroke double that of the motor-piston. In consequence of the perceptible difference between the two engines it follows that in horizontal steam-engines the friction due to the weight of the piston is felt along the path or course of the motor-power, while in the hot-air engine the friction arising from the weight of the feed-piston takes place naturally along a course four times greater than that traversed by the motor-power, and the friction arising from the weight of the motor-piston continues during a course double that of the motor-power. Consequently, supposing the last two pistons to be of equal weight, and each of them to weigh as much as the piston of a steam-engine of the same power, it follows that in the latter kind of engine the relation between the motor-power and that absorbed by the friction produced by the weight of the piston may be represented by the fraction $\frac{fh}{rh}$ in which h is the space traversed by the motor-power, f is that power, and r the friction arising from the weight of the piston, while in the hot-air engine this relation must be expressed by the fraction $\frac{fh}{r6h}$. Hence it will be understood that a variation which in a steam-engine may be of slight importance can exercise a very appreciable influence upon a hot-air engine.

A second advantage which arises from this improvement is that the weight of the pistons in the engine, modified as just related, serves to regulate its motion, acting during the time in which it moves as a retarding power, which resists the motion, and during the neutral period as an accelerating power, returning all the power which it had before taken away from the engine. Besides, with this new arrangement there will be no longer any difficulty in making the pistons of any desired or fitting weight. The engine will thus be of as uniform motion as can be desired, without recourse being had to eccentric fly-wheels, which are prejudicial to the efficiency of the motor.

My second improvement consists in substituting for the cast-iron dome which acts as a furnace to the Ericsson engine a tubular boiler. (Represented in Fig. 1, in vertical section on the broken line M N P, Fig. 5.) Fig. 3 is a side view of the same, and Fig. 4 a plan view. Fig. 5 is a section of the machine on the line H H, Fig. 1. This tubular boiler is composed of three horizontal plates of boiler-iron secured and held together, two by two, by the tubes *k*, *n*, and *q*. The space between the plates *h' h''* is further shut in and inclosed by the cylindrical casing *l l*, made of thin boiler-iron. From this arrangement it follows that the flame and other products of combustion, which commence

their course in the interior of the tubes K, (indicated in Fig. 1,) then heat the exterior of the tubes *n*, and descending through the tubes *q*) they pass into the smoke-compartments *a* and *b* and the channels *c* which surround the cylinder, and thence they escape through the smoke-stack.

The cold air drawn in by the machine in its ascending course and deposited between the two pistons should pass under the feed-piston during the period of its motion, and it is easy to see, by reference to Fig. 1, that in order to arrive at that point it must pass around all the boiler-tubes by the face precisely opposite to that around which the products of combustion pass.

The first advantage derived from this second improved arrangement is that under the arrangement of the tubular boiler, as described, in the same machine a heating-surface can be produced four times greater than that of the Ericsson machine, and, if need be, it can be used to extend and enlarge all the tubes of which the boiler is composed. If in the tubes *n* a piece of boiler-iron be placed of the same length and of a width equal to the interior diameter of the tube, the heating-surface will be still further augmented.

In making it appear that in two like machines constructed on the Ericsson system the heating-surfaces are in proportion to the squares of their diameters and the quantities of air put in action in the two machines are in proportion to the cubes of the same diameters, and that the ratio between the quantity of air put in action in a machine and its heating-surface increases with the dimensions of the machine, it follows that the conditions for working the machine economically will be found to be less favorable in proportion as the dimensions are increased; but in using the tubular boiler I have described the heating-surface increases with the machine and in proportion to the quantity af air required to be heated; and it may be asserted that in employing this boiler hot-air machines can be applied to all degrees of power, whatever may be the dimensions of the machinery or apparatus.

Lastly, a third improvement consists in using in hot-air machines combustibles heretofore almost exclusively used for purposes of illumination, such as gas, mineral-oils, portable gas, &c.

In order to apply to my improved boiler the heat generated by these combustibles, it will be sufficient to place under each of the tubes *n* one of these ignited gases or liquids, and the intensity of the flame may be regulated by cocks suitably arranged for that purpose; but to this I lay no claim.

From the above it will be seen that my improvements effect the following objects: first, economy of fuel; second, ability to regulate the temperature of the machine to any desired point; third, certainty that the so acquired temperature may be maintained; fourth, the suppression of smoke which allows the machine to be located in the interior of residences or dwelling-houses.

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

1. The arrangement of the support of an air-engine so that the axis of the motor-cylinder shall be vertical, in the manner and for the purposes set forth.

2. The combination and arrangement of a tubular boiler in the place of the dome which serves as a furnace in the Ericsson machine, as and for the purposes described.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

GUILL. REINLEIN. [L. S.]

Witnesses:

MARIANO DE PEDRO,

XAVIER DE SALAS.