

(No Model.)

U. G. LEE.
CALORIC OR HOT AIR PUMPING ENGINE.

No. 534,271.

Patented Feb. 19, 1895.

Fig.1.

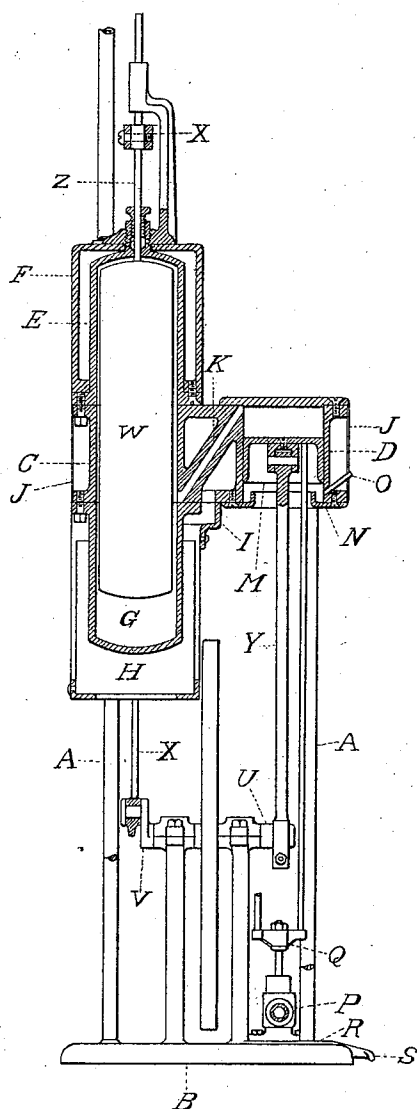
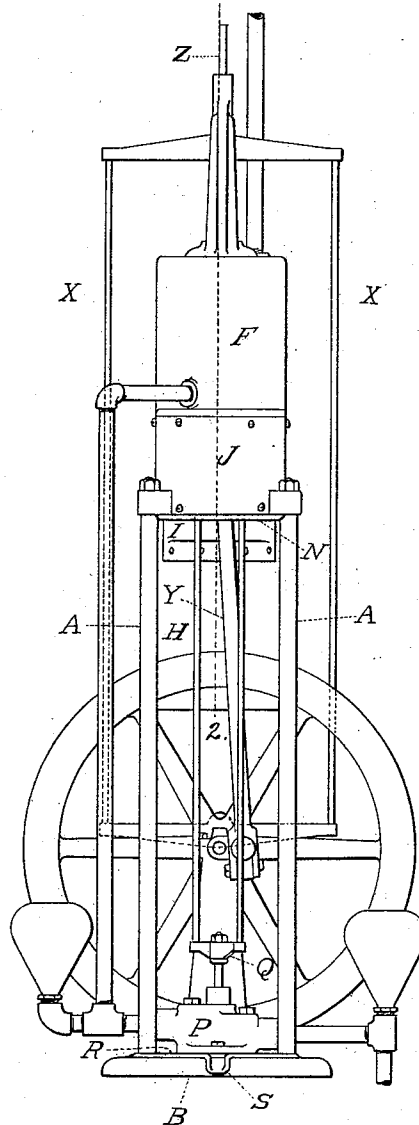


Fig. 2.



WITNESSES

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ULYSSES G. LEE, OF MADISON, OHIO.

CALORIC OR HOT-AIR PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 534,271, dated February 19, 1895.

Application filed June 28, 1894. Serial No. 516,032. (No model.)

To all whom it may concern:

Be it known that I, ULYSSES G. LEE, a citizen of the United States, residing at Madison, in the county of Lake and State of Ohio, have
5 invented certain new and useful Improvements in Air-Engines; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it ap-
10 pertains to make and use the same.

My invention relates to improvements in air engines, and the invention consists in a hot air engine in which the air is transferred by a displacement piston from the hot to the cold
15 end of the cylinder, the resulting expansion and contraction causing a reciprocating motion of the power piston, all substantially as shown and described and particularly pointed out in the claims.

20 In the accompanying drawings, Figure 1 is a vertical central sectional elevation of the cylinders and pistons and a full view of the associated mechanism. Fig. 2 is a plain side elevation of the engine complete and at right
25 angles to the parts in Fig. 1.

To afford free access to the working parts of this engine and to give the requisite support for an engine of this character wherein a comparatively small power is generated and
30 employed, I prefer to mount the cylinders C D on a frame composed of steel rods A and a bed plate B supporting said rods. The displacement cylinder C is supported on the rods A and is fixed to the upper ends thereof and
35 about the upper portion of said cylinder is the water jacket F. The water from the pump, passes through this jacket and keeps the upper end of cylinder C cool. The cylinder C is made up of three sections and about
40 its middle and lower portions is a sheet iron jacket J which confines the heat about the cylinder. A suitable burner or furnace, or the like, is designed to be used at the bottom of the cylinder C to do the necessary heating.
45 As here shown, the lower portion G of the cylinder also has an inside jacket H which with the outer jacket J makes a double jacket.

The waste heat from the burner or furnace is carried, by means of a suitable casting I,
50 between and around the cylinders C D, around both of which a sheet iron jacket J extends. The waste heat or gases are finally carried

away by perforations in the sheet iron jacket J, or when burning coal, by a suitable pipe connection with the chamber within said
55 jacket J.

Midway of the cylinder C and at one side thereof is the power cylinder D. This cylinder and the middle portion of the cylinder C are cast in one piece and in the webbing be-
60 tween said cylinders there is a diagonal channel or port K extending from about the lower portion of the middle part of cylinder C to the top of the cylinder D. This port or passage is for the purpose of transferring the air
65 from cylinder C to cylinder D in both directions; that is, the hot air passes out into cylinder D to exert its expansive power upon the piston therein and then it returns through
said passage to the cylinder C whence it moves
70 to the cool end thereof as hereinafter described.

Within the cylinder C is a displacement piston W which is somewhat smaller in cross section than the inside of the cylinder so as
75 to permit the passage of air freely about its sides from one end to the other of the cylinder, and of course back and forth through the port or passage K. This plunger piston W has about one-fourth less length than the
80 cylinder C and has a free movement up and down therein. Connected with the upper end of the piston W is a rod which works in a stuffing box at the upper end of said cylinder and extends thence through to the outside
85 and has a supporting arm in which it is guided. Connected with this rod is a cross bar or yoke fixed thereto between the said stuffing box and the arm support, and connected with the ends of this yoke are the
90 connecting rods X which extend down and are attached to the bottom cross bar or yoke which has a bearing at its center working on the crank V on the axle of the fly wheel. In this way the piston W is given a positive
95 movement up and down on its cylinder, and it will be noticed that the crank V is at right angles to the power crank U on the same shaft, and which has a piston rod Y connecting it with the power piston M. At the bot-
100 tom of the power cylinder, which is open to the outside atmosphere so as to expose the bottom of the piston M to the atmosphere, there is a circular oil cup N in which the edge

of the piston M dips to receive suitable lubrication, and this cup is furnished with oil through a short tube O at one side of the power cylinder.

5 The engine thus described is designed, among other things, to operate pumps to pump water into buildings, such as residences, barns and the like, and is shown here as connected with a pump P which is in line with
10 the power cylinder and beneath the same and is supported upon the bed plate A. This bed plate has a rib R which extends around the pump P and causes all the drip from the pump to run off at the depression S therein.
15 This bed plate likewise is provided with suitable standards which carry the boxes or bearings of the fly wheel shaft and between which the fly wheel is supported.

By using the connecting rods X X with the
20 crank V and the cross bars to which said rods are connected at their ends, I am enabled to avoid all intervening parts and obtain a very simple and direct construction and arrangement of parts for operating the displacement
25 cylinder.

The pump P is not only in vertical alignment with the power piston but is connected therewith by means of a pair of rods which are attached to a yoke or cross bar Q at their
30 lower ends. These rods are set to avoid conflict with the crank U of the fly wheel shaft.

It will be understood that the engine above described is intended for comparatively light work, such as operating domestic pumps and
35 light machinery of different kinds in small shops or on the farm or other places where applied power is not available.

As seen in Fig. 1 the power piston M is at the half stroke downward and the displacing
40 piston has started downward, but before it reaches the bottom of its cylinder the piston M will be at the end of its stroke and part way back. Meantime an enlarging space above piston W makes room for the cooled air
45 in chamber D which now flows back into transfer cylinder C and rushes into the top thereof. Then as the air heats at the bottom of cylinder C it finds its exit through passage K into the power cylinder just in time to meet
50 piston M at the top and turn of its stroke and act thereon to drive it down under its expanding pressure.

The construction and arrangement of parts

as described furnishes a very cheap and efficient engine, and by reason of the port K
55 reaching the hot air directly and conveying it to the power chamber by a short and protected chamber, I am sure to preserve all the advantage which a direct communication of the air has over any and all indirect channels
60 in which heat is radiated and lost and the power of the engine correspondingly reduced. The passage K is protected all around from the outside atmosphere by jacket J and the two chambers it connects, and is so far re-
65 moved from the water jacket as not to be influenced thereby.

It will be seen that I have my water pump supported in the base B and that I operate the pump directly from the power piston itself. Then in order that all the parts shall
70 work in harmony with this plan I have to elevate the transfer cylinder to a corresponding position and this is effected by means of the frame posts A and the enlarged base B.

Having thus described my invention, what I claim is—

1. In a hot air engine, a transferring cylinder having a middle section to which the end sections are secured, a power cylinder opposite said middle section and closed at its top and open at its bottom, a gas duct from the bottom of the said middle section to the top of the power cylinder, an operating shaft having cranks, a piston in each of said cylinders
80 and connecting rods between said pistons respectively and the corresponding crank on the operating shaft, substantially as set forth.

2. The engine described having a transferring cylinder with a water jacket about its upper portion, a power cylinder open at its bottom and an inclined air duct from the top of the power cylinder down to the transferring cylinder below its middle portion, a displacing piston confined its entire length in the transferring cylinder and a power piston
95 in the power cylinder and a shaft with which said pistons are connected, substantially as set forth.

Witness my hand to the foregoing specification this 26th day of October, 1894.

ULYSSES G. LEE.

Witnesses:

H. T. FISHER,
M. G. NORTON.