L. B. LAWRENCE.

Rotary Vacuum Engine.

No. 211,750. Patented Jan. 28, 1879.

Fig. 1

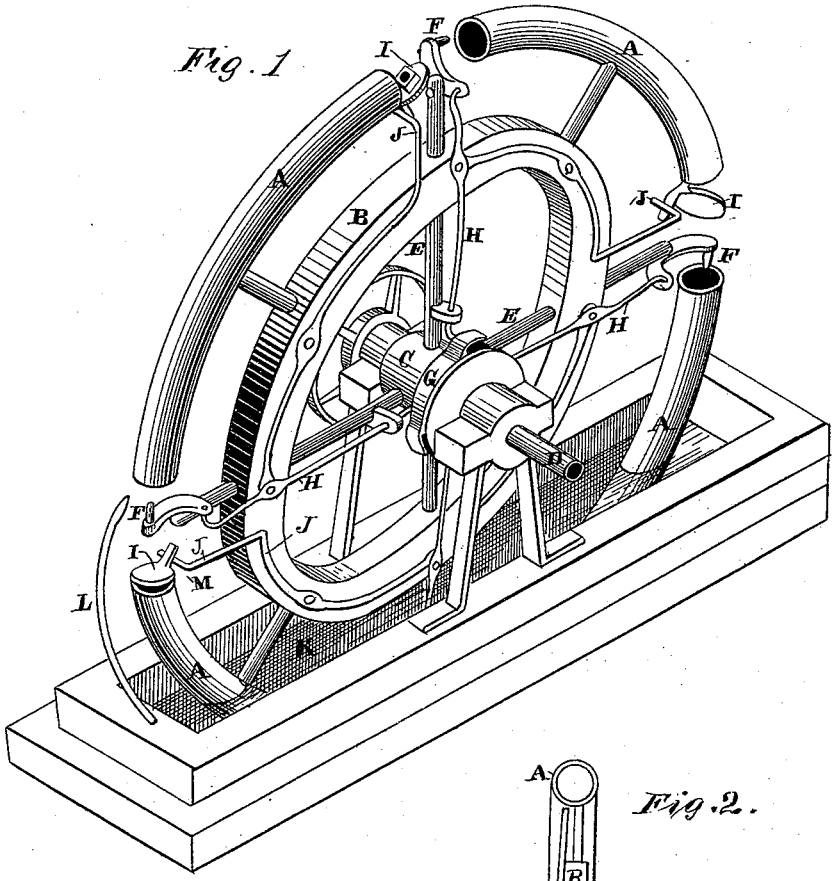
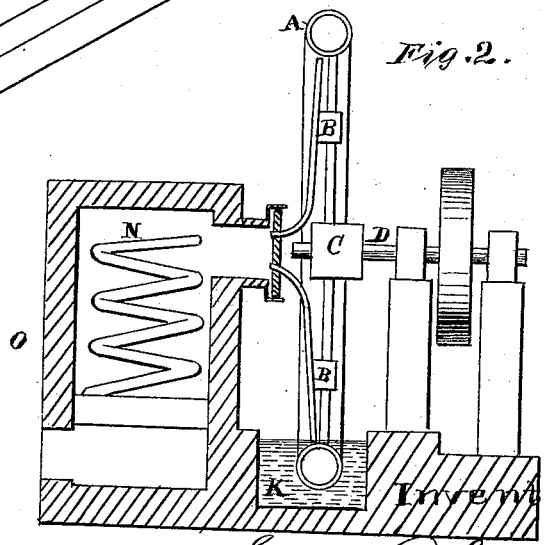


Fig. 2.



Witnesses

Geo. H. Strong.

Frank A. Brooks

Inventor

Lorenzo B. Lawrence

By Dewey & Co

Attys

UNITED STATES PATENT OFFICE.

LORENZO B. LAWRENCE, OF MONTICELLO, CALIFORNIA.

IMPROVEMENT IN ROTARY VACUUM-ENGINES.

Specification forming part of Letters Patent No. **211,750**, dated January 28, 1879; application filed November 22, 1878.

To all whom it may concern:

Be it known that I, LORENZO B. LAWRENCE, of Monticello, county of Napa, and State of California, have invented a Rotary Vacuum-Engine; and I hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings.

My invention relates to a novel apparatus which I call a "rotary vacuum-engine"; and it consists of a circular arrangement of open tubes, which are provided with valves at one end. These tubes are so constructed as to become charged with hot air or vapor during the revolution of the apparatus, which is mounted upon a horizontal shaft. The lower edge of the rim formed of these tubes dips into a tank of mercury, water, or any suitable liquid, and the continuous revolution of this rim brings the sections of the tubular circumference successively below the liquid. The valves at the opposite ends of the sections will be automatically closed, and the atmospheric pressure upon the closed ends of the tubes will force them continuously beneath the surface of the liquid.

The heated air may be supplied from a suitable heater, so arranged as to fill each section of the tube successively just previous to its immersion in the liquid; or it may be provided by a gas-jet, which is alternately ignited and shut off; or, if desired, the tubes may be filled with steam or other vapor to be condensed.

Suitable mechanism is connected with the axle by which the various valves are opened or closed, or the tubes supplied with heated air or vapor.

The apparatus will be more fully described by referring to the accompanying drawings, in which Figure 1 is a view of my apparatus fitted to use gas. Fig. 2 shows the method of using heated air.

In the present case I have shown my apparatus as consisting of a series of curved tubes, A, which are mounted upon a rim, B, or otherwise, to form an interrupted or sectional hollow tube. These sections may either follow each other at slight intervals, or they may overlap, so that the ends of each following tube will extend a short distance past the preceding one, thus making the apparatus continuous in its action.

The central hub, C, is mounted upon a hollow shaft or axle, D, which may be made to convey heated air or gas to the tubes A through the spokes E, which are also hollow.

I will first explain its operation when gas is to be used. At the extremity of each of the spokes, and directly in front of the mouth of the tubes, is a gas-jet, F. This gas-jet is made to turn upon a tubular pin, so that it may be opened or shut off by its own action.

A stationary cam, G, is fixed to the journal-box or other suitable point, and arms H extend from the movable burners to the cam, so that when the wheel revolves the burners are opened at a certain point, so that their heat will rarefy the air within their respective tubes, and at another point they are shut off, as will be more fully described hereinafter. Closing valves I are hinged to the opposite ends of the tubes, and these valves are operated from the cams by arms J, which connect with the arms H, before described, and are hinged or pivoted to the fixed rim B.

Below the wheel is a tank, K, which is filled with a liquid, preferably of considerable density, so that its action upon the tubular rim by atmospheric pressure will be more effective.

The operation will then be as follows: The engine is started by hand, and as the wheel rotates upon its axis the cam G will act to open the gas-jets F at a certain point in the revolution. A stationary jet, L, may be arranged to ignite each jet as it passes, or the lighting may be done by electricity, and the heat from the jet will rarefy the air within the tube. When the forward end of the tube has reached a point near the surface of the liquid in the tank, the gas will be shut off and the valve I will be closed upon the rear end of the tube.

I have shown this valve to be provided with a small cup, M, which brings up a small quantity of liquid from the tank, and when the valve is closed discharges this liquid into the tube, thus partially condensing the air or vapor which may be therein contained. The for-

ward end of the tube has by this time entered the liquid, and the condensation tends to draw the liquid up into the tube, so that its weight will act upon the rim of the wheel to cause it to rotate. As each tube in succession acts in this manner, it will be seen that the rotation will be made continuous.

The tubes will be lined with any suitable non-conducting compound, and the spokes will also be coated or protected upon the outside.

If it be desired to employ steam or other vapor instead of heated air it will be manifest that the jet-tubes could be utilized to throw the vapor into the tubes preparatory to condensation; but I have found that heated air is preferable on many accounts.

The heated air may be supplied to the tubes from a heater, which may consist of a drum or a coil of pipes, N, which is situated in the upper part of a furnace, O.

The tubular shaft or axle D connects with this heater, and conveys the heated air from it out through the hollow spokes E to the tubes.

Valves or cocks may be operated by the cam in a manner similar to the gas-jets, so as to admit the heated air to the tubes successively, and the end valves will be closed in a similar manner to that before described just as the tubes enter the liquid.

By this arrangement a constant current of heated air is flowing from the heater, and is transferred successively to the sections of the tubular rim as they arrive at a certain point; and as the ends of these tubes descend beneath the liquid in the tank the valves at the rear end close, and allow the condensation of the heated air to draw the liquid up into the tubes, so as to cause the rotation of the wheel.

By means of a pipe and a suitable damper (not shown) the heated air may be shut off from the wheel and allowed to pass off when it is desired to stop the machine. When the machine is to be operated by heated air which is furnished from a heater, I prefer to mount the axle upon journals at one side of the wheel, leaving the other side free, and the pipes which convey the air from the heater to the rim-tubes may pass down beside the spokes and turn outward, as shown in Fig. 2, instead of allowing the hot air to pass through the spokes, and a suitable connecting trunnion will make a tight moving joint between these pipes and the heater or its pipe.

It may also be found preferable in some cases to dispense with a heater for pure air, and simply allow all the products of combustion to pass through the tubes, thus converting them into a chimney or stack.

When steam or vapor are used, or in some cases with heated air, it will be preferable to have the front ends of the tubes closed by sliding or other valves when the tubes are filled, said valves to be opened just as the tube enters the liquid; and it will be manifest that the forms of the valves and their method of operation may be changed to suit particular duty or details of construction without essentially altering the character of my invention.

In order to keep the liquid in the tank cool a pipe may be passed through it from the outside. This pipe is of thin material, and may be connected with the heating drum or coil, so that a draft will be established, and the current of air passing through the pipe will obstruct the heat from the liquid and keep it cool.

By this construction, it will be seen that a continuously-rotating engine will be provided, in which the successive vacuums caused by the condensation of the heated air or vapor within the circumferential tubes will cause the liquid to rise into these tubes, and by its weight the wheel will be caused to revolve. Power may, of course, be communicated from its shaft by gearing or otherwise.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The tubular sections A, extending in line with each other and forming an interrupted or sectional rim, said rim-sections being provided with closing valves and adapted to be alternately filled with hot air or vapor and plunged into a tank of liquid by their revolution, so as to condense their contents and produce rotation by atmospheric pressure and the weight of a portion of the liquid, substantially as herein described.

2. The interrupted rim-sections A, having the closing valves I at the rear end, and provided with the gas, hot-air, or vapor-jet tubes F, in combination with the hollow radial converging tubes or spokes E and the gas or hot-air conveying pipe or axle D, whereby the sections may be alternately filled with hot air or vapor, substantially as herein described.

3. The tubular rim-sections A, with their valves I and jet-tubes F, in combination with the cam G and arms H and J, or equivalent devices, to operate the valves and jet, substantially as herein described.

4. The wheel formed with the interrupted hollow rim-sections A, with the valves I and the jets F, in combination with the tank K, containing liquid, into which the rim-sections are plunged and their contents condensed, so as to produce rotation of the wheel by atmospheric pressure and weight of the liquid, substantially as herein described.

5. The wheel composed of the rim-sections A, with their valves I and jet-tubes F, and the tank K, in combination with the cups M upon the valves, said cups being fitted to lift a quantity of the liquid from the tank as the wheel rotates, and discharge it into the tubes

A when the valve closes, substantially as herein described.

6. The wheel composed of the hollow rim-sections A, with their jet-tubes F, valves I, and the condensing-tank K, in combination with the heater N O, and the connecting hollow shaft or axle D, and tubes or spokes E, substantially as herein described.

In witness whereof I have hereunto set my hand.

LORENZO B. LAWRENCE.

Witnesses:
GEO. H. STRONG,
FRANK A. BROOKS.