J. HOCK & L. P. MARTIN.

HOT-AIR ENGINE.

No. 190,490. Patented May 8, 1877.

Fig. 1.

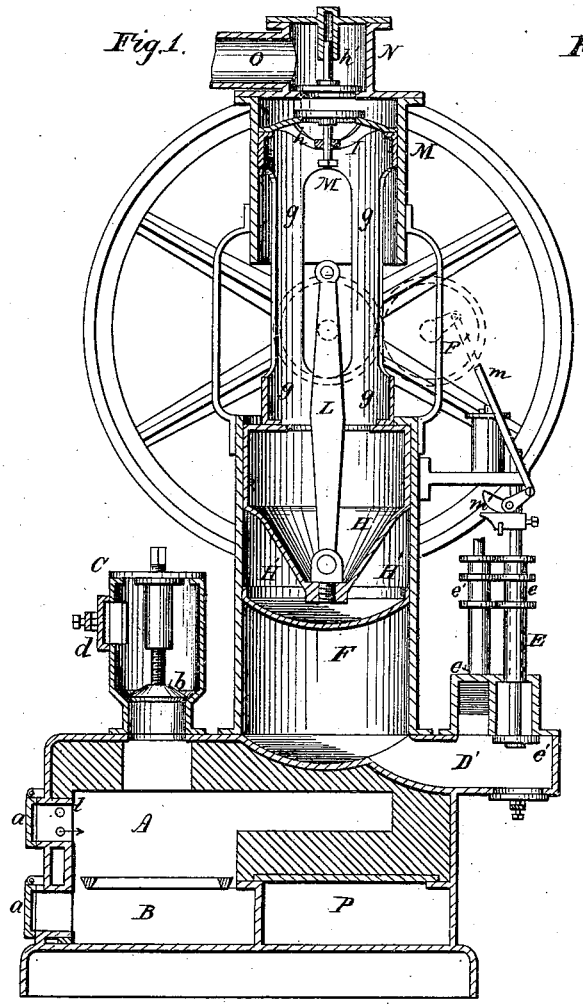


Fig. 2.

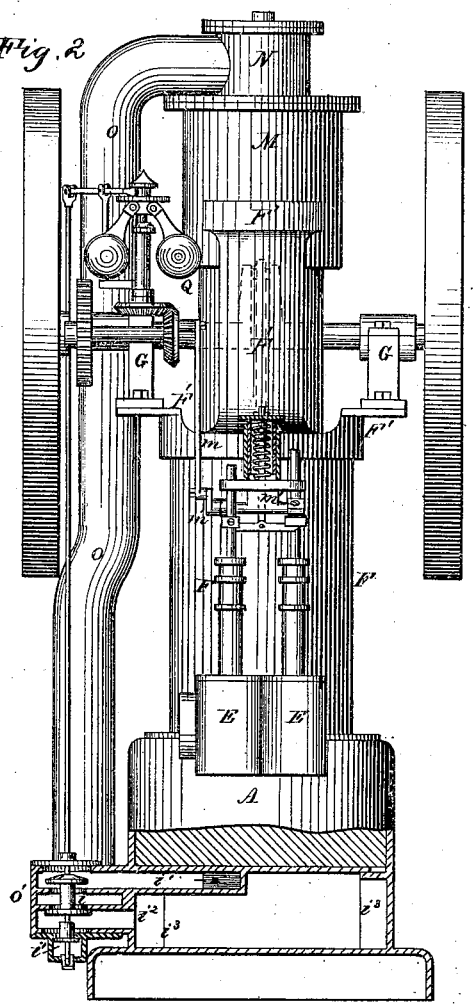


Fig. 3

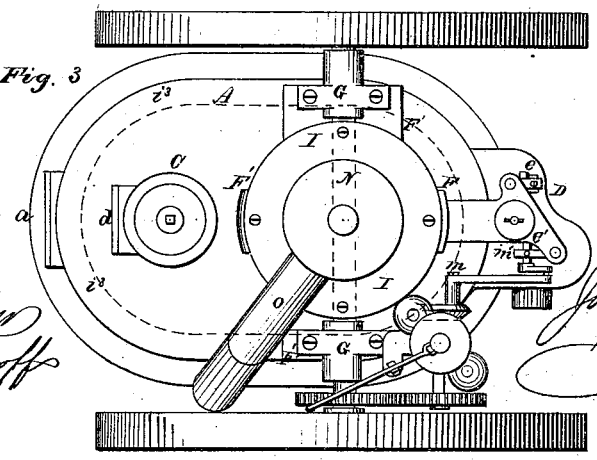
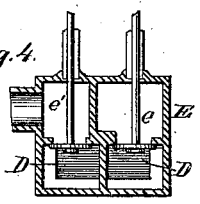


Fig. 4.



Witnesses:

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UNITED STATES PATENT OFFICE.

JULIUS HOCK AND LOUIS P. MARTIN, OF VIENNA, AUSTRIA.

IMPROVEMENT IN HOT-AIR ENGINES.

Specification forming part of Letters Patent No. **190,490**, dated May 8, 1877; application filed September 9, 1876.

To all whom it may concern:

Be it known that we, JULIUS HOCK and LOUIS P. MARTIN, of Vienna, Austria, have invented a new and Improved Hot-Air Engine, of which the following is a specification:

The invention relates to improvements in hot-air engines with closed furnaces or motors, in which the atmospheric air is forced, by means of an air-pump, into a hermetically-closed furnace, where it is heated, and then conducted into the cylinder for use.

The invention consists, mainly, of an improved mechanical distribution of air above and below the grate by means of the governor before the same opens a regulating cold-air-discharge valve, and in the details of construction and arrangement hereinafter fully described, and then pointed out in the claims.

In the drawing illustrating this invention, and to which reference is made, Figure 1 represents a vertical longitudinal section of our improved hot-air motor. Fig. 2 is an end elevation, partly in section; Fig. 3, a plan view of the same, and Fig. 4 a detail section of the hot-air valves.

Similar letters of reference indicate corresponding parts.

A represents the cast-iron furnace, that forms the base-section of our improved hot-air engine. The interior of the furnace A is lined with fire-bricks, and both furnace and ash-box closed by hermetically-sealing doors *a*. Concentrically above the circular grate is arranged a box or casing, C, whose contracted throat or discharge-opening is closed by a valve, *b*, that is raised or lowered to open or close the communication of casing C and furnace A, for supplying the required quantity of fuel to the furnace during the running of the engine. The fuel is filled into the box through a hermetically-sealing door, *d*, which is firmly closed by a fastening-screw, after the casing C has been filled with coal, coke, or other fuel. The fuel box or casing C may, by closing the connecting-valve *b*, be filled, and the fuel then supplied after the door is closed and the valve opened to the grate, without any admission of air through the fuel-box to the furnace.

At the rear end of the furnace-casing, opposite the fire-door, is arranged a chest, E, with the hot-air valves *e* and *e'* of which the air-supply valve *e* connects by a channel, D, with the cylinder F, while the exhaust-valve *e'* forms, by a second channel, D', the communication of the cylinder F to the chimney.

The cylinder F is arranged vertically on the furnace-box, between fuel-box C and valve-chest E, and is provided at its upper end with four horizontal flanges, F', of which two opposite flanges carry the journal-boxes G of the driving-shaft, that is placed diametrically across the cylinder, while the other two are extended in upward direction, to support the air-pump at the upper part of the engine.

The piston H of the hot-air cylinder F, and the piston I of the air-pump M, are concentrically connected by a tubular piece, *g*, that is broken out to give play to the crank of the driving-shaft. The crank-shaft is connected directly by a crank-rod, L, with the cylinder-piston H, which is provided with a suitable leather or other packing, and inclosed by a sheet-metal casing, H'. The piston I of the air-pump M is also tightly packed with leather, and provided with a central suction-valve, *h*, in the upper part of the piston. The suction-valve *h* is opened during the downward motion of the piston I, to draw in the required quantity of air, which is forced by the upward stroke of the piston through a second valve, *h'*, into a casing or dome, N, secured to the top part of the air-pump. The cold air is then conducted from the dome N, and through cold-air tube O to the air-regulator O', which is arranged at the side of the furnace-box, communicating by a valve, *i*, and an upper channel, i^1, directly with the grate, and by a lower opening, i^2, with the heating-chamber P, back of the ash-box, and from the same by side channels i^3 to the front part of the furnace back of the fire-door. The partially-heated air is forced through openings *l* back of the fire-door into the furnace, where it is heated to the required degree and conducted to the cylinder, for working the piston of the same.

The introduction of the atmospheric air back of the fire-door keeps the same cool, while the side channels protect the furnace-walls against too rapid deterioration.

The governor Q is worked by gear-wheel connection with the driving crank-shaft, and

arranged to operate by a fulcrumed lever and rod the valve *i* of the air-regulator O′. The governor-shaft is also connected by a crank pin and rod, *m*, with a cam-shaft, *m′*, that bears alternately the spring-acted top-plates of the spindles of the air supply and exhaust valves *e* and *e′*.

When the engine is at rest the valve *i* is shown in raised position by the weight of the governor-balls, and admits thereby the direct entrance of the cold air from the conducting-tube to the grate, until, by the gradual increase in speed, the governor lowers the valve *i*, so as to close the upper channel and conduct the air into the heating-chamber P and to the furnace, in the manner described.

If the speed of the engine, and consequently the pressure of the air within the engine, exceeds a certain limit, the governor-rod depresses and opens a regulating exit-valve, i^4, below the valve *i*, so as to reduce in this manner, by the escape of cold air, the pressure in the lower part of the engine. This mechanical distribution of air below and above the grate by the governor, and before the opening of the exit-valve, protects the engine against loss of heat, and allows the dispensing with the continuous supervision required in nearly all caloric-engines.

The engine is operated by starting the fire in the furnace and closing then the doors hermetically, also the hot-air valves *e e′*, when, by a few turns of the crank-shaft, a quantity of air is pumped into the heating-chamber and furnace, sufficient to keep the engine in regular motion.

We do not confine ourselves to engines with single cylinders, as they may be also built with several cylinders, and in different positions.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. The combination of the governor Q and cold-air regulator O′, having slide-valve *i*, with the openings i^1 and i^2, grate and heating-chamber P′, and regulating air-discharge valve i^4, substantially as and for the purpose set forth.

2. The combination of the hot-air cylinder F, channels D D′, and alternately-operated hot-air valves *e e′*, arranged outside of furnace and cylinder, with the governor-shaft, substantially in the manner and for the purpose set forth.

3. The combination of the governor Q and cold-air regulator O′, having valve *i* and air-discharge valve i^4, with the heating-chamber P and furnace A, to regulate pressure of air in furnace, substantially as specified.

JULIUS HOCK.
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Witnesses:
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