(No Model.)

E. MIHSBACH & A. GROESCHEL.

HOT AIR ENGINE.

No. 566,785. Patented Sept. 1, 1896.

Fig. 2.

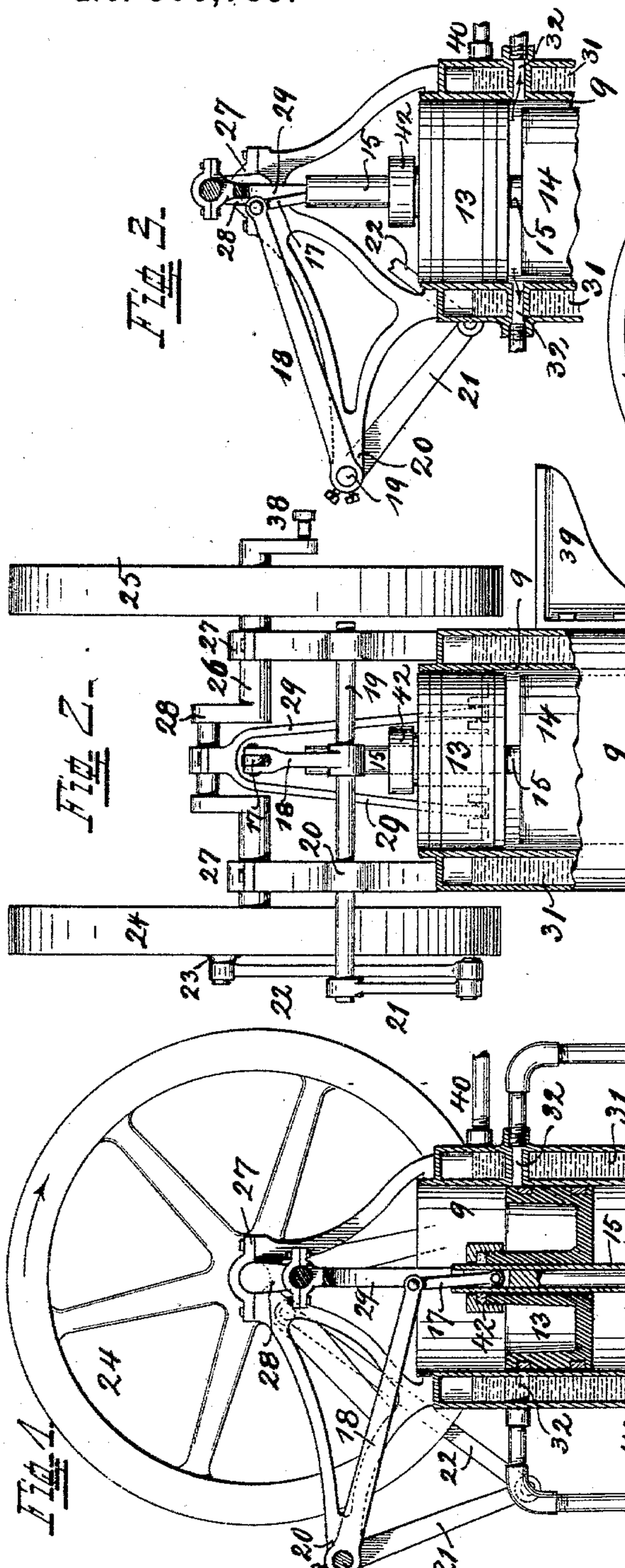

Fig. 4.

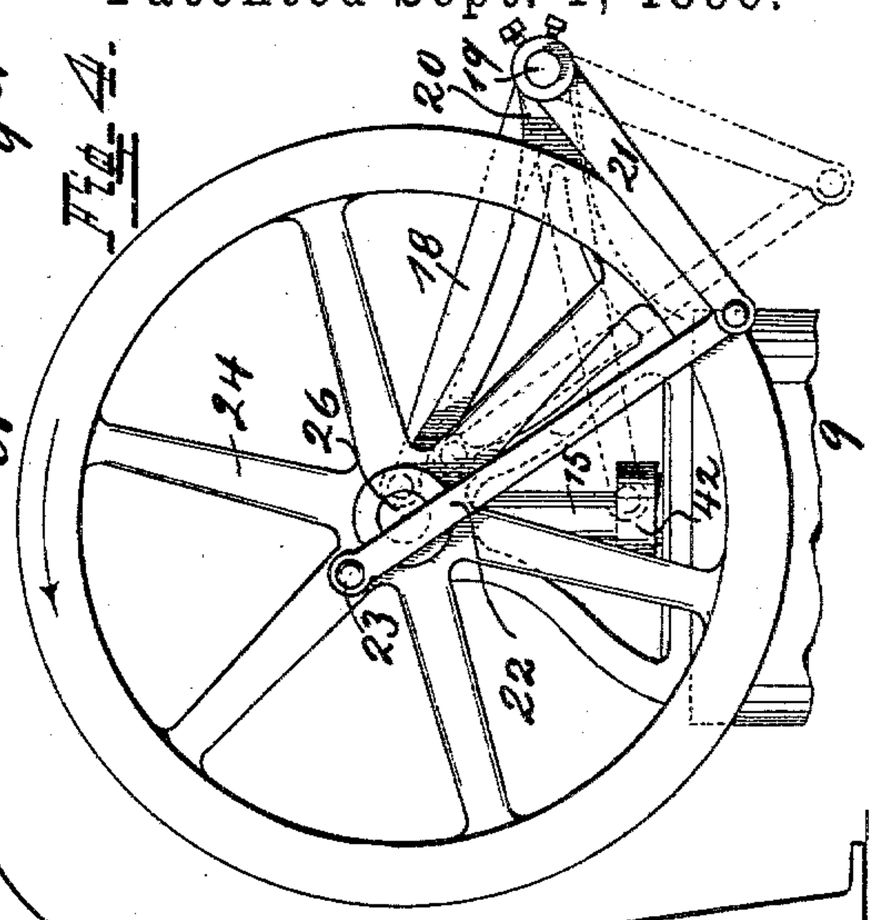

Fig. 3.

Fig. 1.

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UNITED STATES PATENT OFFICE.

EMIL MIHSBACH AND ANTON GROESCHEL, OF CINCINNATI, OHIO, ASSIGNORS TO THE FOUNTAIN MACHINE COMPANY, OF SAME PLACE.

HOT-AIR ENGINE.

SPECIFICATION forming part of Letters Patent No. 566,785, dated September 1, 1896.

Application filed August 28, 1895. Serial No. 560,750. (No model.)

To all whom it may concern:

Be it known that we, EMIL MIHSBACH and ANTON GROESCHEL, citizens of the United States, and residents of Cincinnati, Hamilton county, State of Ohio, have invented new and useful Improvements in Hot-Air Engines; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, attention being called to the accompanying drawings, with the reference-numerals marked thereon, which form a part of this specification.

This invention relates to improvements in hot-air engines, a class of machines or motors in which a piston is reciprocated by the expansive force of hot air, such force acting usually only in one direction, while a fly-wheel, assisted more or less by the outer atmosphere, assists the return of the piston. The same air is used over again, being alternately heated and cooled, as well as compressed within a cylinder wherein it is confined.

The features of our invention consist particularly of means whereby the pressure of the hot air at the end of the working stroke is quickly relieved from in front of the piston to permit and facilitate the latter's immediate return.

Other features pertain to certain details of the construction, which will be explained at the proper time.

In the following specification, and particularly pointed out in the claim at the end, is found a full description of our invention, its operation, parts, and construction, which latter is also illustrated in the accompanying drawings, in which—

Figures 1 and 2 are side elevations, partly in section and taken at right angles to each other, the first showing the power-piston at its lowest, the second at its highest, position. Fig. 3 is a sectional view similar to Fig. 1, but with the piston in its highest position. Fig. 4 shows the construction whereby the lower or displacer piston is operated.

The air-cylinder is, for convenience in manufacture, preferably constructed in two parts, the lower part 8 of which is screwed to the upper part 9 at 10. For the purpose of heating the air quickly, we have found copper to be the best material for the lower part 8, and particularly for the bottom thereof, against which the heat is applied. This latter may come from any source, and for the smaller-sized engines gas is the most convenient. In this case a gasolene-burner 11 is shown within a jacket 12, which surrounds it and the lower part of the cylinder to prevent too rapid radiation of the heat. Within the cylinder is the power-piston 13 and the displacer-piston 14, each of independent stroke. The latter is below the former and does not completely fit the inner bore of the cylinder, but is sufficiently smaller to permit the air to pass from one end to the other. Its piston-rod, consisting of a sleeve 15, surrounding a stem 16, which screws into the upper end of piston 14, connects by a link 17 to an arm 18, fast on a rock-shaft 19, supported in bearings 20. Rigidly secured to the outer end of rock-shaft 19 is another arm 21, which by link 22 connects to a wrist or crank pin 23 of fly-wheel 24. This latter and another fly-wheel 25 sit on the driving-shaft 26, supported in bearings 27 and provided midway with a crank 28, which by a forked link 29 connects it to piston 13. At their highest positions the opposing surfaces of the pistons practically meet, while at their lowest positions at the end of the downstroke they are about farthest apart, from which it follows that the stroke of the lower or piston 14 is longer than the stroke of the upper piston, for which reason it must necessarily travel faster in order to be in time with the other piston of shorter stroke.

The operation, the principle of which is not considered broadly new and does not form the leading feature of this invention, is briefly as follows: The displacer-piston 14 on its downstroke transfers the previously-heated air below it between its upper end and the power-piston 13, after which the two pistons move up together, the lower piston moving faster and closing up rapidly the space between the two. The impetus which the upper piston thus receives forms the live or power stroke of the same. The position of the parts at the beginning of this stroke is

shown in Fig. 1, while Figs. 2 and 3 show their position at the end of the same stroke. At the end of this stroke the temperature of the air has become lower, partly by reason of being more remote from the heat, as well as by reason of a water-jacket 31, which surrounds the upper part 9 of the cylinder, whereby it also contracts in volume and permits the pistons to descend, the same being carried down principally by the force of the fly-wheels. Meanwhile during this upstroke the air displaced between the two pistons has passed down again below piston 14 and into the hottest part of the cylinder to be reheated. As will be seen by the positions of the cranks, the two pistons do not simultaneously arrive at their highest and lowest positions respectively, but the lower or displacer piston 14 is given a proper lead, corresponding as to its object with the lead given a slide-valve in a steam-engine, and it insures a prompt and timely action on the power-piston at the turning-points of the latter. To reduce as much as possible the loss of live power by counteraction of the air on the downstroke of the upper piston, we provide relief-ports 32 32, which are uncovered at the same moment that the power-piston arrives at its highest position, and by permitting the air to escape reduce at once the pressure in front of the descending piston. The air thus escaped passes down in pipes 33, during which time it becomes cooled, and lifting check-valves 34 it enters the lower part of the cylinder to be reheated. By reason of said check-valves no air can pass out the other way. As in practice the loss of air cannot be avoided it is necessary that a vacuum-valve 36 be provided, being substantially a check-valve, which permits the influx of air, but no escape outwardly. The quantity of air supply may be regulated or entirely shut off by means of a cock 37. The power of the motor is transmitted from its main shaft 26, at the outer end of which connection is made by means of a crank 38, or cog-wheel, or otherwise, to meet particular requirements. When driving a pump, the same may rest on a bracket 39, in which case the water pumped may also be used to cool the upper part of the cylinder, entering the jacket 31 at 40 and passing out at 41. Proper provision to prevent the escape of air should be applied wherever necessary, for which purpose piston 13 has packing-rings and a stuffing-box 42 between it and the piston-rod of the lower piston where it passes through the upper piston.

Having described our invention, we claim as new—

In a hot-air engine, the combination of a cylinder, a power and a displacer piston reciprocating therein, the latter piston not completely fitting the cylinder, a main shaft to which the two pistons are operatively connected, pressure-relief ports 32 so located in the cylinder as to be uncovered when the power-piston is at its highest position, air-return pipes connecting with said ports and check-valves 34 therein.

In testimony whereof we hereunto affix our signatures in presence of two witnesses.

EMIL MIHSBACH.
ANTON GROESCHEL.

Witnesses:
C. SPENGEL,
ARTHUR KLINE.