2 Sheets—Sheet 1.

(No Model.)

A. J. VENTZKI.

CLOSED HIGH PRESSURE HOT AIR MOTOR.

No. 459,501. Patented Sept. 15, 1891.

Fig. 1.

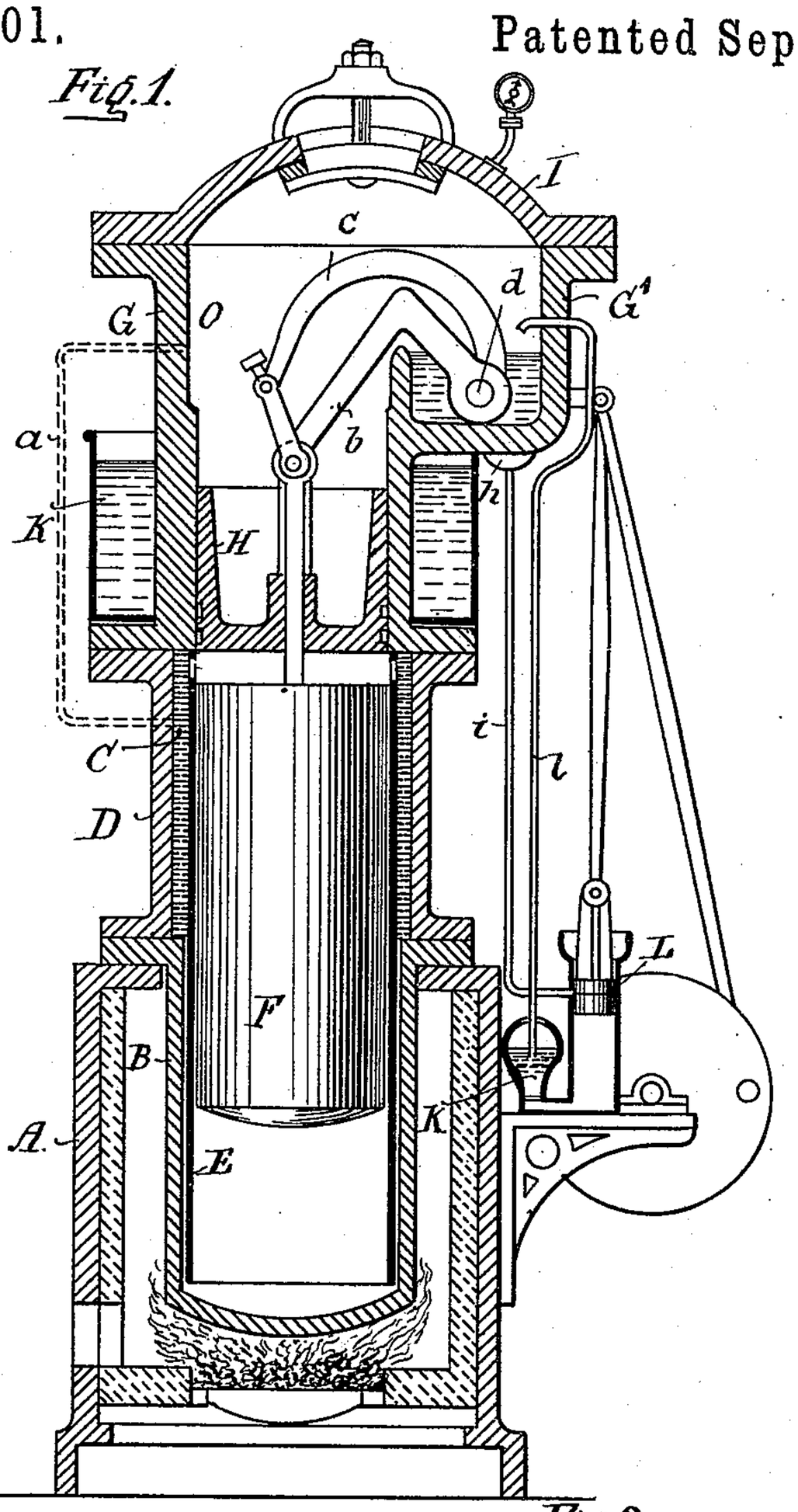
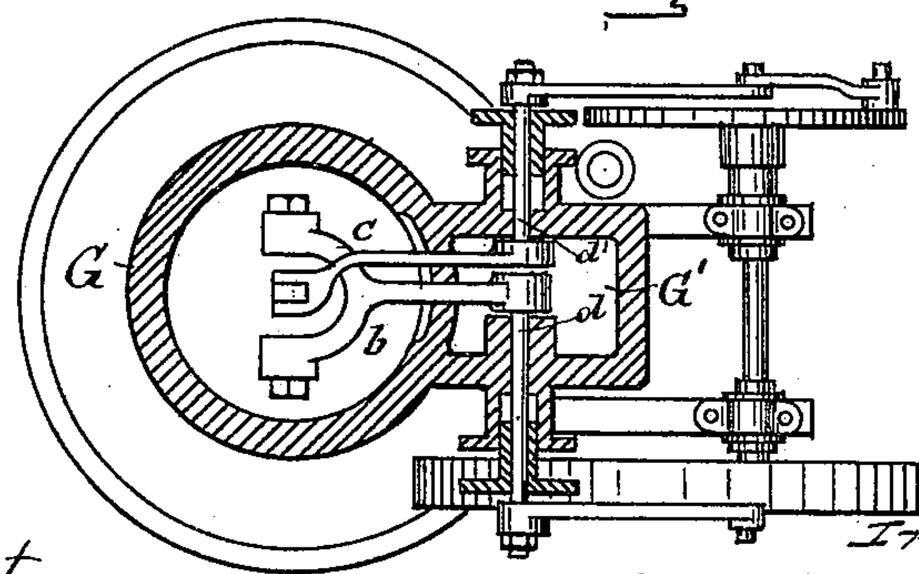


Fig. 2.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

A. J. VENTZKI.

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Fig. 3.

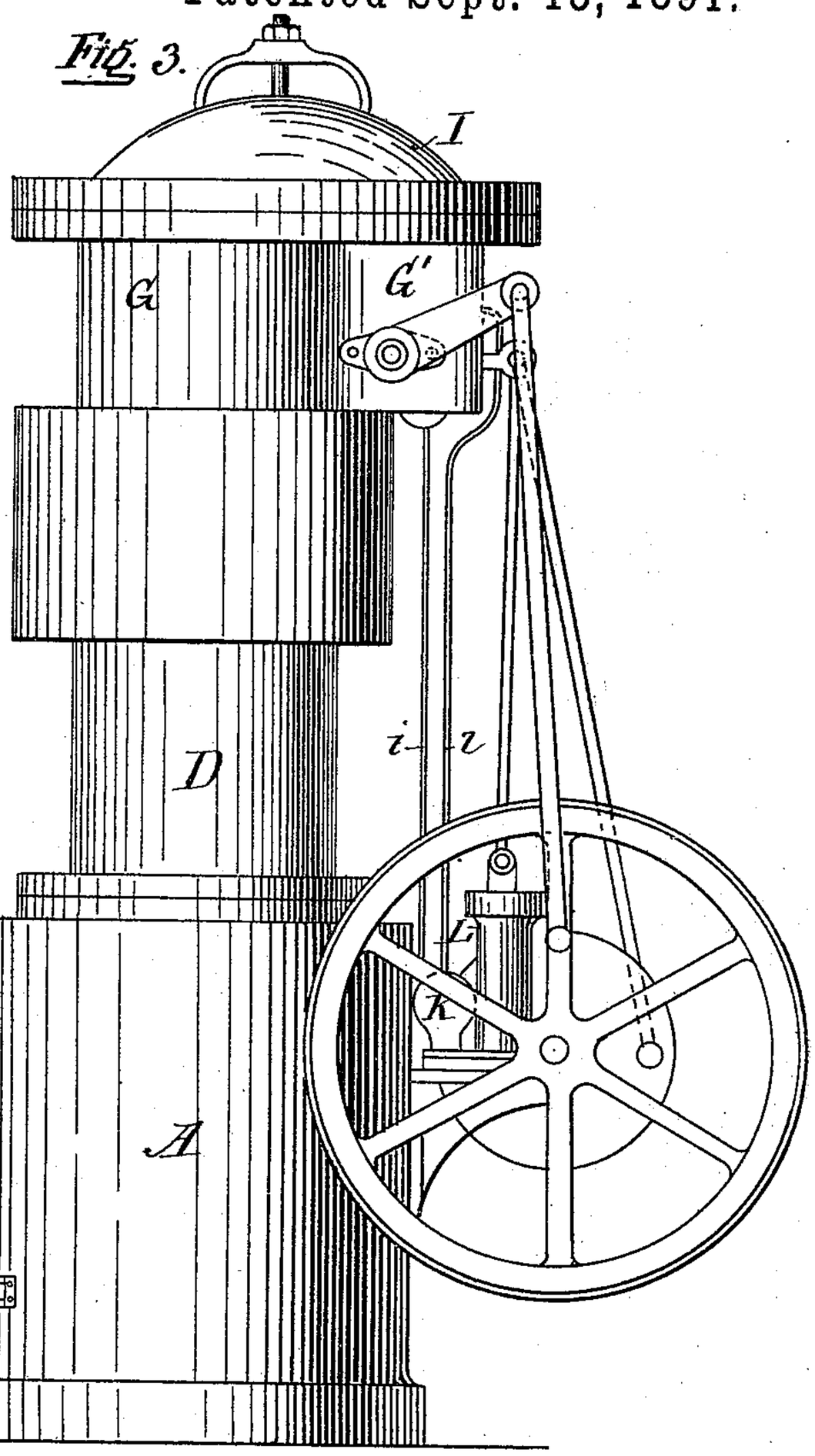
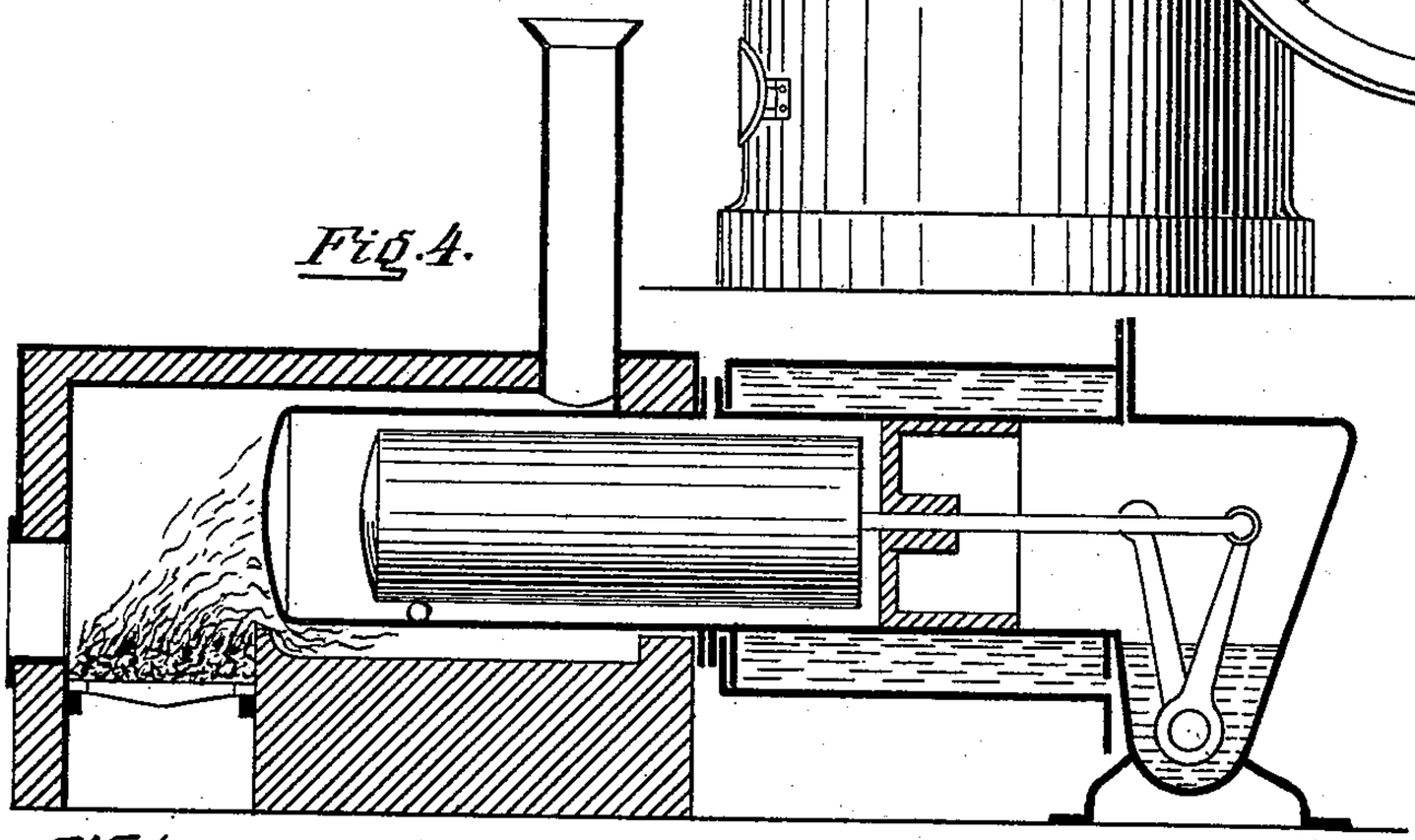


Fig. 4.



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UNITED STATES PATENT OFFICE.

AUGUST JACOB VENTZKI, OF GRAUDENZ, GERMANY.

CLOSED HIGH-PRESSURE HOT-AIR MOTOR.

SPECIFICATION forming part of Letters Patent No. 459,501, dated September 15, 1891.

Application filed January 12, 1891. Serial No. 377,514. (No model.)

To all whom it may concern:

Be it known that I, AUGUST JACOB VENTZKI, a subject of the King of Prussia, and residing at the city of Graudenz, in the Kingdom of Prussia, have invented certain new and useful Improvements in Closed High-Pressure Hot-Air Motors, of which the following is a specification.

The object of the present invention is a hot-air machine which is distinguished by the working piston working in a space closed off from the outer air and filled with high-tension air, so that not only the air under the working piston is compressed, but also the air above the piston is of high tension and the piston works in an atmosphere of high pressure. The proportion of expansion of air is the same under all tension conditions. Therefore compressed air needs only to be heated a little to reach a comparatively high tension. Thereby we are placed in a position to have a large difference between the fire-space and the interior of the fire-pot. As the transition coefficient is in a direct ratio to the difference of temperature in the fire-box and the interior of the fire-pot, and as, further, the conducting capacity of highly-compressed air augments with its density, it is possible, in spite of the increase of the specific heat of highly-compressed air with an unequal higher working capacity of the same, to use only such large heating-surfaces, as by the use of ordinary atmospheric air.

In the following drawings, Figure 1 shows the hot-air machine in a vertical section; Fig. 2, a horizontal section through the working cylinder; Fig. 3, an elevation. Fig. 4 shows another form of construction, in which the machine is arranged horizontally.

In the fire-box A the usual fire-pot B is suspended, on which cylinder D is mounted, which latter surrounds the regenerator C. As an inner coating for the regenerator C, there is provided a downwardly-extending cylinder E, made of copper sieves, in which the plunger F is moved up and down. On cylinder D rests cylinder G, inclosing the working piston H and closed perfectly air-tight by cover I, so that the same air-pressure exists above as below the working piston when the machine rests, as the packing is never so complete that the desired equalization of air should not take place. If necessary, the balancing of the air can be facilitated by arranging a circulation-pipe *a*, which can be shut off, and is shown in Fig. 1 in dotted lines. When the space O above the working piston is filled with compressed air, there exists also under the working piston and in the fire-pot B after an eventual balancing by circulation-pipe *a* the same tension of air. After the firing the air in the fire-pot drives by means of its force of expansion the piston H, and when the same has arrived near its highest point the plunger F goes down and forces the hot air through regenerator C into the working cylinder G, which is surrounded by a water-cooler K. In passing through the regenerator C the air gives off by far the greatest part of its heat and is cooled off still more by the cool casing of the working cylinders G, and its force of tension is thereby diminished. By the momentum of the fly-wheel and by the periodically more expanded air in the upper space O, the tension of which is gradually increased by a pump hereinafter described, the piston H is forced down. The air which is forced out by the descent of the piston H and by the ascent of the plunger F from between those parts goes contrary to its former direction from the top to the regenerator C to the lower part of the fire-pot, and hereby takes up the heat given previously to the copper sieves, so that only that amount of heat is to be replaced by the firing as has been lost through the work done or through radiation or conduction. If the working cylinder G is closed air-tight, the machine works constantly in and with the same compressed air requires a small amount of firing, and needs no new power to conduct fresh compressed air. To keep the same tension of air in the working cylinder, the shaft *d*, bearing the movement-rods *b c*, is laid in an oil bath contained in the extension G′ of cylinder G, which perfectly closes the shaft-bearings. The compressed air closed up in the space O of the cylinder G can therefore not escape by the stuffing-boxes of the shaft *d*, but, at the most, force through some of the oil. Since oil, however, offers a much greater resistance to escaping than air, the escaping of oil takes place in only small quantities, which are caught up by the drop-dish

h and led to air-pump L by pipe i. The pump L then works the quantity of oil forced out of space O back again by pipe l into the oil bath to keep shaft d covered, so that this bath remains practically unchanged in quantity. This work of the pump is only of a secondary nature, as its principal object consists in establishing at the starting of the machine and in keeping up the desired tension of the air in space O of the working cylinder G. For this purpose the back and forward or rocking motion of the shaft d is changed in a well-known manner into an up-and-down motion for the pump-piston, and the pump L is supplied with an air-chamber k, from which the pipe l leads into the space O of the cylinder G. Since the pipe l penetrates to the middle of the air-chamber k, and this is filled with oil to the mouth of the pipe, it results that the pressure-valve of the air-pump is constantly under oil-pressure of the oil, which prevents, in case of loosening of the stuffing, the escape of the air. At starting, the machine works with common atmospheric air, and its power is then small. The air-pump gradually works air into the closed upper space O and compresses the air therein to a certain tension. The maximum tension in the machine corresponds with the relation of the dead-space in the air-pump to the contents of the air-pump cylinder—namely, of its working space. This tension in the space O must be, for example, ten atmospheres if the dead-space in the air-pump amounts to one-tenth of its capacity. If this pressure in the machine is arrived at, the pump L only works as an air-buffer without bringing any more air into space O. The tension of air in space O is balanced, as already observed, with that under the working piston, so that the machine works with double effect in this way. That the heated air forces the piston up until it is so far expanded that it has in its heated expanded condition about the same tension as the air, periodically further compressed by the ascent of the piston H in the upper space O—that is to say, on both sides of the working-piston—the equilibrium is established, (dead-point position.) Then the plunger F forces the warm air through the regenerator C to the working cylinder G, and as it is cooled off here a relative vacuum is formed under the working piston H, compared with the pressure upon it, so that this latter is now forced down.

The advantages of the above-described machine consist then, principally, in that the compressed air—a highly advantageous working-power medium—is entirely shut in and is preserved at a great density by the packing or sealing means.

I claim—

1. A high-pressure hot-air machine provided with rotating shaft d d', air-pump L and its valve, and a bath of a thick fluid into which these parts are laid, so that this liquid can escape only by the interstices or bearings, substantially as set forth.

2. A hot-air motor having a fire-pot or air-heating chamber, a cylinder and piston therein communicating with the chamber, power devices connected with the piston and leading through the wall or casing of the chamber, and a packing or sealing bath of liquid covering and closing the openings through which the power devices pass, all combined substantially as shown.

3. A hot-air motor having a heating-chamber, a cylinder communicating therewith, a piston in the cylinder, power devices extending through the walls of the motor, a sealing bath of liquid closing the openings through which the power devices pass, a pump adapted to renew the liquid-supply and to force air into the interior of the motor, and operating mechanism for the pump connected with the power devices of the motor, substantially as shown.

In witness whereof I have hereunto set my hand in presence of two witnesses.

AUGUST JACOB VENTZKI.

Witnesses:
ALFRED MUSCATE,
EMIL KAPPEL.