E. A. WULLENWEBER.

HOT AIR MOTOR.

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1,091,904.

Patented Mar. 31, 1914.

Fig. 1

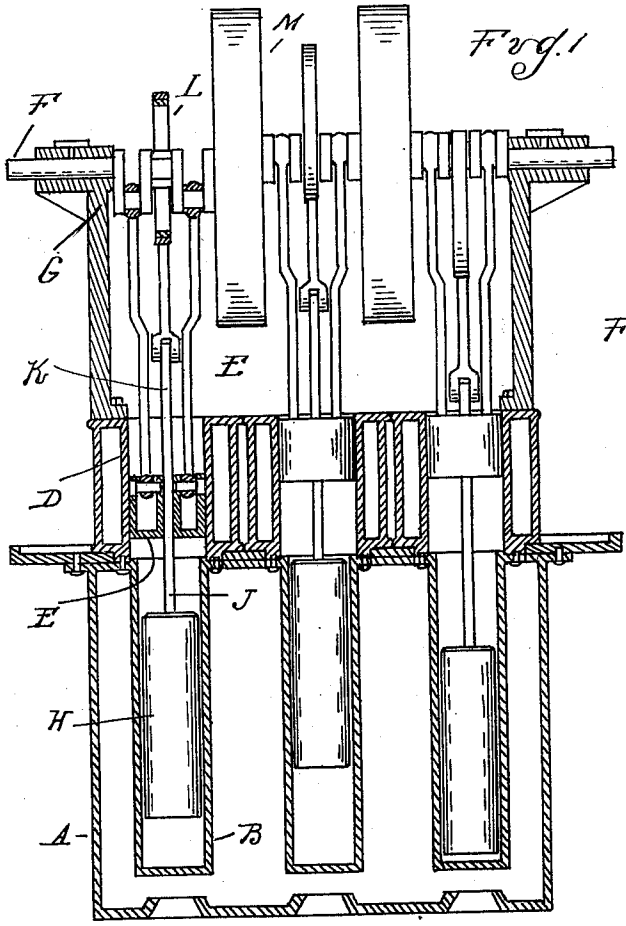
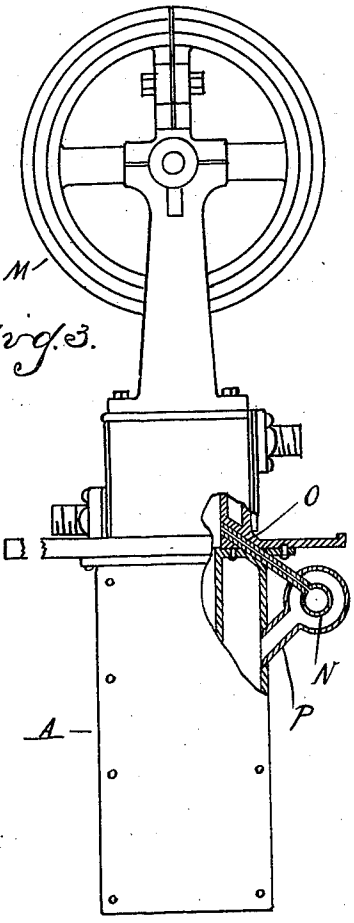


Fig. 3.



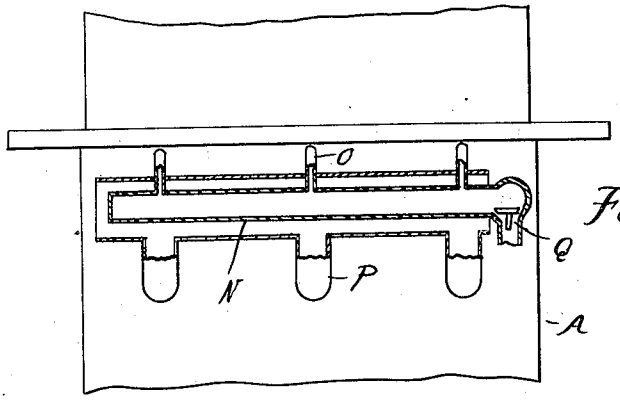


Fig 2.

Witnesses

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HOT-AIR MOTOR.

1,091,904. Specification of Letters Patent. Patented Mar. 31, 1914.

Application filed October 9, 1913. Serial No. 794,205.

To all whom it may concern:

Be it known that I, ERNEST A. WULLENWEBER, a subject of the Emperor of Germany, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Hot-Air Motors, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to hot air motors of that type in which a reciprocatory movement is imparted to a piston within a cylinder, by the alternate expansion and contraction of a volume of air in hot and cold portions of said cylinder.

It is the object of the invention to obtain a simple and inexpensive construction of motor of this type, which is adapted to be built in units having any desired numbers of cylinders; and it is a further object to obtain a self-starting motor, which may be intermittently operated and controlled through adjustment of the heating flame.

In the drawings: Figure 1 is a vertical, central, longitudinal section through a multi-cylinder motor. Fig. 2 is a side elevation, partly in section, showing the arrangement of the auxiliary air-expanding means for starting the motor, and Fig. 3 is a sectional end elevation thereof.

A is a casing forming a heating chamber, within which are arranged the heated air expansion cylinders B. Each of these cylinders is arranged in registration with an opening C in the casing A, through which a gas flame is directed against the cylinder, the products of combustion passing upward adjacent to the sides thereof. Above the casing A are arranged cylinders D, which are water-jacketed or provided with other means of cooling, and each of these cylinders is provided with a piston E therein.

F is a crank shaft journaled in bracket bearings G, extending upward from the cylinders.

H are air-displacers in the cylinders B; I are pitman rods, connecting the pistons E with cranks on the shaft F; J are rods extending upward from the displacers H and passing centrally through the pistons E; and K are connecting rods between the rods J and eccentrics L on the shaft F.

M are fly-wheels arranged intermediate the cylinders and their connecting rods upon the shaft F.

The construction as above described is such that a volume of air within the cylinder B and connected cylinder D will be distributed either in one or the other of said cylinders according to the position of the displacer H. When said displacer is in its elevated position, the air will be forced downward into the lower end of the cylinder B, where the heat of said cylinder will be communicated to the air and will raise the pressure thereof. As the displacer H loosely fits the cylinder B, the increase in air pressure is communicated to the small volume of air above the displacer, where it will act directly upon the piston E, forcing the latter upward, and, through the connecting rods I, rotating the crank shaft F. This, in turn, operating through the eccentric L and rods K and J, will shift the displacer H so as to displace the air in the lower portion of the cylinder B. At the same time, the cooling effect of the water-jacketed cylinder D will reduce the pressure of the air, permitting a downward movement of the piston by external atmospheric pressure. The pistons in the several cylinders are connected to cranks arranged at such angles to each other as to form a self-starting motor, and consequently whenever the flame is of sufficient intensity the motor will operate.

In starting the motor after a period of rest, greater power is required to overcome the inertia of the parts than is necessary to maintain the motor in operation when once started. I have therefore provided auxiliary power-producing means operating only when the heat is first increased, as by the turning up of the gas flame. This consists of a chamber N arranged outside of the casing or jacket A and connected by a conduit O with the interior of the corresponding cylinder D. The chamber N is preferably in the form of a horizontally-extending tube, which is arranged adjacent to the case A; and an outlet P from said case for the heated products of combustion is directed against the walls of said tube N. Thus, when the gas flame is turned down, very little heat will be communicated to the tube N, so that the volume of air contained therein will be contracted or reduced in pressure; but upon the turning up of the flame, this not only expands the air in the cylinder B, but also by heating the tube N expands an additional volume of air contained therein.

The result is that there will be a greater initial rise of pressure within the working cylinders than will occur after the motor is in full operation.

Inasmuch as there are always losses of air due to leakage around the piston and out from the cylinders, I provide an automatic valve for admitting air to the cylinders when cold, that the pressure therein may be equal to the external atmosphere. This valve Q is preferably arranged to control a port in the tube N, which thus performs the additional function of an air-renewing means.

A motor constructed as described is particularly adapted for pumping air in a gas carbureting apparatus, and by reason of the fact that the motor is self-starting and is controlled by the fuel supply to the flame, the operation of the apparatus may be rendered entirely automatic.

What I claim as my invention is:

1. A hot air engine comprising a piston, a cylinder having hot and cold chambers and a displacer for alternately displacing a volume of air from one chamber to the other, an auxiliary chamber external to said cylinder and in communication therewith containing a volume of air, and means for dilating the air in said auxiliary chamber by the waste heat from said hot chamber.

2. The combination with a hot air engine operating by the alternate dilation and contraction of a volume of air, of heating means adjustable to start and stop said engine, and means operating upon the starting of said engine for dilating an auxiliary volume of air to increase the starting force.

3. The combination with a hot air engine operating by the alternate dilation and contraction of a volume of air, of a heater adjustable to increase or diminish the dilation, and a chamber external to said engine but in communication therewith containing an additional volume of air, said chamber being located to be heated by the waste heat from said engine to increase the initial starting force.

4. A hot air engine comprising a cylinder having hot and cold chambers at opposite ends thereof, a piston operating in the cold portion of said cylinder, a displacer operating in the heated portion of said cylinder, a jacket surrounding the heated portion of said cylinder, a gas burner having its flame impinging against the heated portion of said cylinder through an aperture in said jacket, and a chamber external to said cylinder and jacket but in communication with the former arranged in the path of the heated products of combustion escaping from said jacket for the purpose described.

5. A hot air engine comprising a water-jacketed cylinder, a piston in said cylinder, an extension of said cylinder, a displacer therein, a gas burner adjacent to the end of said extension of the cylinder, a jacket surrounding said extension for confining the heated products of combustion and provided with a vent or escape flue at its upper end, and a chamber containing a volume of air in communication with the air within said cylinder arranged in the path of the heated products of combustion from said escape flue for the purpose described.

In testimony whereof I affix my signature in presence of two witnesses.

ERNEST A. WULLENWEBER.

Witnesses:
WM. J. BELKNAP,
JAMES P. BARRY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."