No. 668,200. Patented Feb. 19, 1901.

W. M. MYERS.

HOT AIR ENGINE.

(No Model.) (Application filed Mar. 24, 1900.)

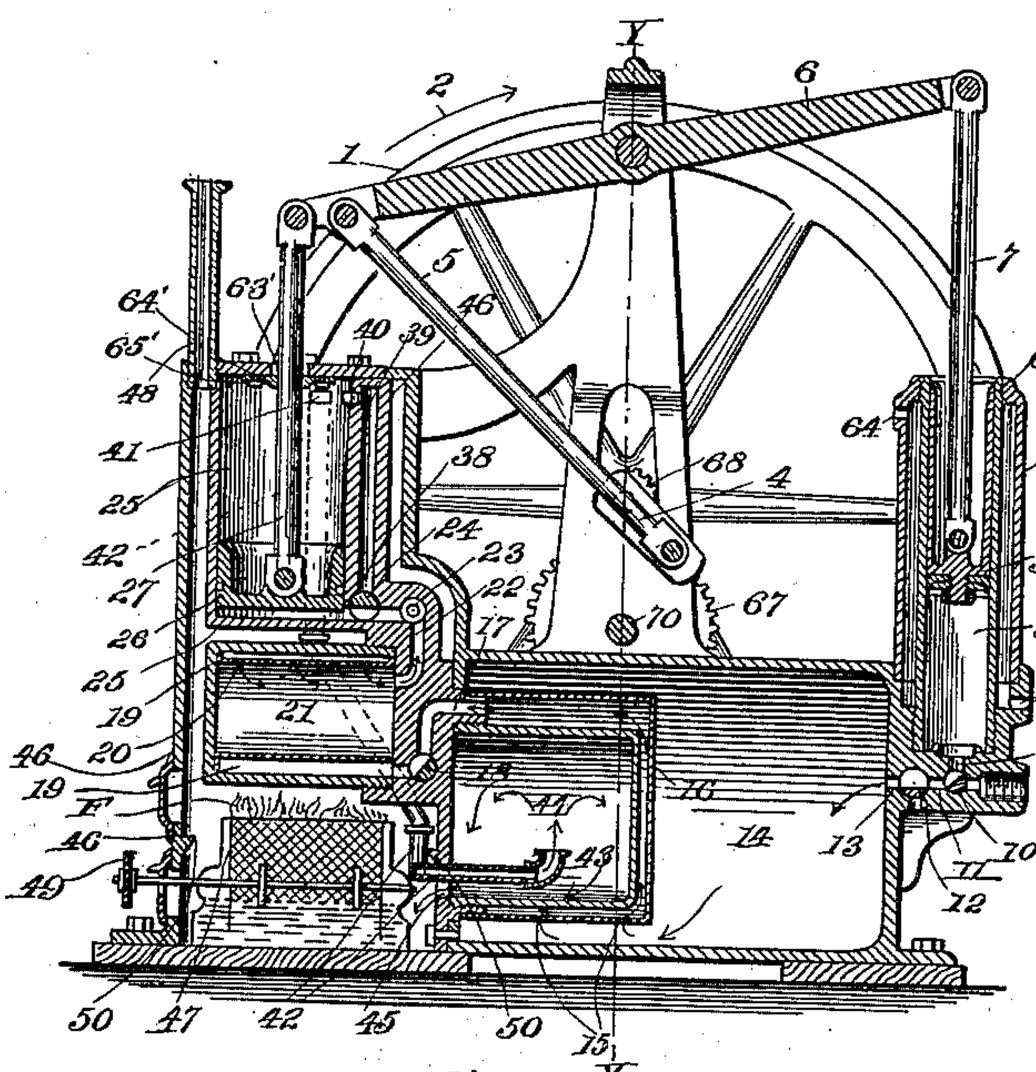

Fig. 1.

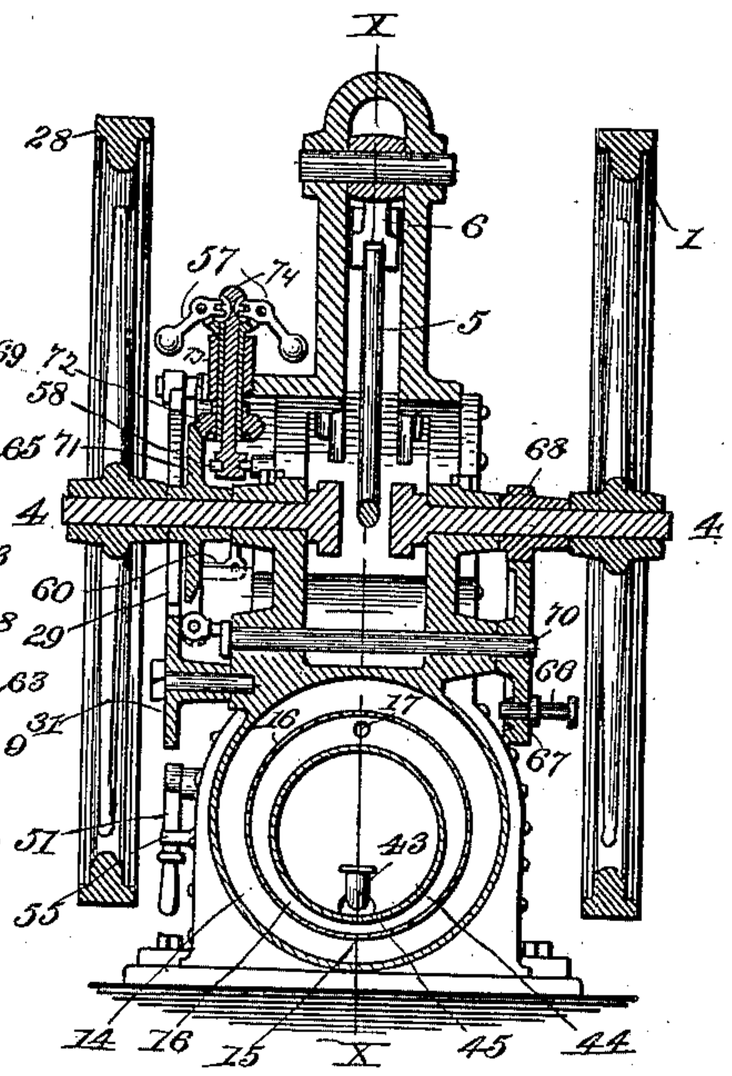

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

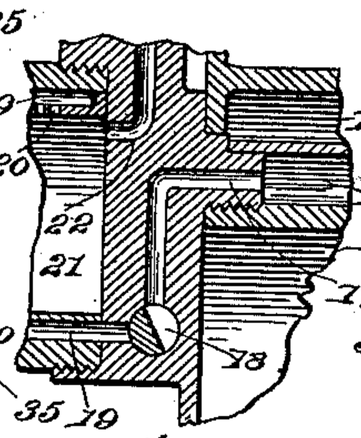

Fig. 6.

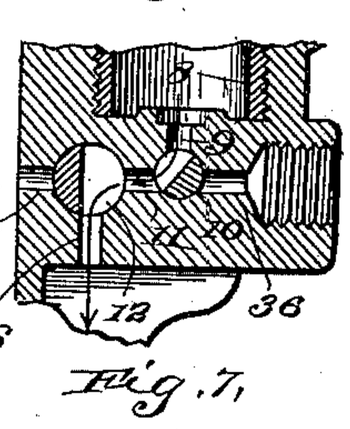

Fig. 7.

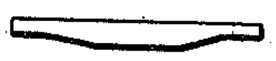

Fig. 8.

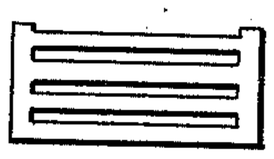

Fig. 9.

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UNITED STATES PATENT OFFICE.

WILLIAM M. MYERS, OF ST. JOSEPH, MISSOURI.

HOT-AIR ENGINE.

SPECIFICATION forming part of Letters Patent No. 668,200, dated February 19, 1901.

Application filed March 24, 1900. Serial No. 10,080. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. MYERS, a citizen of the United States, residing at St. Joseph, in the county of Buchanan and State of Missouri, have invented certain new and useful Improvements in Hot-Air Engines; and I 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, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My improvements relate to hot-air engines, and more especially to that class of engines which derive their energy from superheated air and are used generally for all power purposes, and more particularly for pumping liquids.

The objects of my invention are, first, to provide a hot-air engine which shall be very economical in consumption of fuel; second, to so arrange the parts that they will be neat and compact in appearance, durable, and cheap in cost of manufacture; third, to so construct a hot-air engine that its speed will be automatically regulated to any desired number of revolutions per minute and the combustion of fuel and consequent heat may be normally regulated to any desired degree by very convenient means, after which said engine will require little or no care or attention; fourth, to so construct a hot-air engine that after having been once manually started said engine upon being stopped will possess stored energy sufficient for all future starting purposes; fifth, to so construct the parts of a hot-air engine that all danger of freezing and consequent bursting of certain parts may be positively obviated; sixth, to so construct a hot-air engine that it may readily be conveniently attached to most of the various forms of pumping devices now generally in use, and, seventh, to so construct and arrange the parts of a hot-air engine that inexperienced or careless operators cannot possibly injure said engine through oversight or neglect in starting or stopping the same. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal section cut on the line $x\,x$ seen in Fig. 2. Fig. 2 is a transverse section cut on the line $y\,y$ seen in Fig. 1. Fig. 3 is a side elevation of my invention, one of the fly-wheels being removed to avoid obscurity. Figs. 4, 5, 6, and 7 are enlarged transverse sections of cocks and adjacent parts. Fig. 8 is a side elevation of a grate-bar. Fig. 9 is a top plan of a section of grate-bars.

In practicing my invention I mount a suitable air reservoir or storage-tank 14 upon a base and provide one end of it with an air-pump 8 and the other end with a suitable burner 47. Located in the end of the cylinder, adjacent to the burner, are two smaller chambers or reservoirs 44 and 16, the smaller chamber 44 being located within the larger chamber 16 and communicating with the burner through an aperture 45. The larger chamber 16, which I shall call the "air-warming" chamber, communicates with the reservoir 14 through apertures 15 and with what I shall call the "superheating-chamber" 21 through port 17, outer compartment 19, and apertures 20.

A suitable cock or valve 18 is located within the port 17 for controlling the passage of the air from the chamber 16 to the chamber 21. Located above the chamber 21 and communicating therewith through port 22 is the power-cylinder 25, within which is located the reciprocatory piston 26. The port 22 is controlled by a three-way valve 24 and also by a governor-valve 23. The exhaust from the power-cylinder passes through the three-way valve 24 and port 39, into the upper end of the cylinder, through aperture 40, out through aperture 41, into the exhaust-pipe 42, elbow 43, and into the interior of exhaust-chamber 44. Connected with the piston 26 is a piston-rod 27, which extends up through an opening 63′ in the top of the power-cylinder and is connected with one end of a walking-beam which is pivotally secured at the upper portion of the frame which is secured to the upper part of the device. A rod or pitman 7 is connected with the other end of the walking-beam 6 and operates the piston 3 in the air-pump 8. The air-pump is connected with the reservoir 14 through ports 9, 11, and 13, within which are located the two three-way cocks 10 and 12.

If desired, a suitable water or air jacket 65 may be fitted around the air-pump and be fed or supplied through the ports 63 and 64.

Connected with the end of the walking-beam adjacent to the piston-rod 27 is a connecting-rod 5, which is secured at its opposite end to the crank-shaft 4, by means of which power is transmitted from the operation of the piston 26. Two fly-wheels 1 and 28 are secured upon opposite ends of the shaft 4 in the usual manner, and a gear-pinion 68 is also mounted between the wheel 1 and the side of the frame, through which motion is communicated to the gear-wheel 67, mounted upon the shaft 70, which is arranged transversely across the frame above the cylinder. A wrist-pin 66 is secured to the wheel 67, by means of which reciprocatory motion may be transmitted wherever desired by the ordinary mechanism. (Not shown.) It is evident that power may be transmitted from the shaft 4 by means of the ordinary pulley-and-belt connection, which I have not thought necessary to show.

Secured to the shaft 4 between the wheel 28 and the side of the frame is a bevel-wheel 71, which engages with a bevel-pinion 72, the stem 73 of which is mounted in the frame and is provided with the ordinary centrifugal governor 57 at its upper end. The governor is connected with a rod 74, which projects down through the stem 73 and engages at its lower end with one end of a lever 58, the outer portion of said lever being provided with notches 62 and a regulating device 59. A rod 60 is connected with the outer end of the lever 58 at one end and with one arm of a bell-crank lever 61 at the opposite end. The other arm of the bell-crank lever 61 is connected with and controls the movement of the governor-valve 23 in the port 22, thereby regulating the amount of air that is admitted to the operating-cylinder 25 for operating the machine.

Mounted upon the shaft 4 outside of the bevel-wheel 71 is a substantially fan-shaped cam 29, which fits within a substantially rectangular frame or yoke portion of a lever 31, which is pivotally secured at the side of the engine. As the cam revolves its operating-surfaces alternately engage with the sides 37 and 30 of the frame-like portion 31, and thereby reciprocate the lever upon its pivotal point. The upper end of the lever is connected with a crank-arm 34 by means of a rod 32, and thereby operates the three-way cock 24 in the port 22 to permit of the passage of the heated air to the power-cylinder. The opposite end of said lever is connected with a crank 35 by means of a rod 33. The crank 35 is connected with the valve 10, and thereby permits of the passage of the air from the air-pump into the air-chamber 14.

Valve 18 in the port 17 is controlled by means of a handle 51, which is movable back and forth between the stops 52 and 55 upon the outside of the cylinder. Valve 12 is controlled by means of a handle 53, which is movable between stops 54 and 54′.

As above described, my improved engine is operated by forcing air into the reservoir 14 by means of the air-pump 8 and passing it from there through the chamber 16 into the chamber 21, where it is superheated from flame F of the burner 47, the size of the flame and the amount of heat generated thereby being controlled by means of the wick through the wheel 49. From the chamber 21 the highly-heated air is admitted into the power-cylinder below the piston 26, which drives it upward, and thereby operates the walking-beam. As the walking-beam is thus reciprocated its motion will be communicated to the main shaft through the connecting-rod 5 and at the same time the piston in the force-pump will be driven downward and more air will be forced into the reservoir 14. After the piston 26 has been driven upward to the limit of its stroke the cam 29 will throw the lever 31, and thereby simultaneously close the port 24, so as to prevent the passage of the air from the power-cylinder back into the chamber 21 and will also close the valve 10 to prevent the air from the reservoir 14 being drawn back into the air-pump. The rotation of the valve 10 is sufficient to open communication through the port 9 with the outside air through a suitable opening or port 36, and thereby provide the pump with a sufficient supply of air to be forced into the reservoir with the descent of the piston 3 at the succeeding upstroke of the piston 26. As the heated air is exhausted from the operating-cylinder 25 it passes through the exhaust-pipe 42 into the exhaust-chamber 44, which is surrounded by the chamber 16, and there imparts a part of its heat to the air within the chamber 16. From the chamber 44 the hot air passes into the combustion-chamber 46, and thus utilizes the heat of the air in supporting the combustion. From the chamber 46 the air passes upward through the smoke-stack 48, which is located adjacent of the power-cylinder 25, and thereby utilizes the heat of the escaping products of combustion for keeping the cylinder as hot as possible. On its descent within the cylinder 25 the piston 26 is followed by hot air through the three-way valve 24, the ports 38 and 39, and aperture 40, thereby preventing the cooling of the cylinder by the admission of cold air, as would be the case if the air were admitted to the cylinder 25 from the outside. On the return stroke of the piston 26 air is forced out through the aperture 41 and down into the exhaust-pipe 42 and from there into the exhaust-chamber 44, as above described. The air is prevented from escaping through the large opening 63′ in the top of the cylinder 25, necessary for the movement of the piston-rod 26, by a sliding plate 64′, which is held in position by bolts 65′. When it is desired to stop the engine, the operator rotates the handle 51 until it is against stop 52, when

cock 18 will be thereby rotated to the position seen in Fig. 6, where the port 17 is closed and the admittance of air from the chamber 14 to the cylinder 25 is prevented. The momentum of the fly-wheels will cause the engine to make several more revolutions, during which time the air-pump will be operated and a sufficient amount of air will be stored in the chamber to cause the engine to start as soon as the valve 18 is rotated by the reverse movement of the handle 51. As soon as the engine has stopped the handle 53 is rotated, so as to close the valve 12, and thereby prevent the escape of the air through the air-pump.

Should an inexperienced or careless person close the valve 12 before closing the valve 18 in stopping the engine, any danger to the engine by pumping too much air into it is prevented by causing the air from the air-pump to pass down through port 56 and out into the open air, as shown in Fig. 5.

Instead of using an oil and wick burner 47 it is evident that any other form of burner could be used—as, for instance, the grate, as shown in Figs. 8 and 9—thereby rendering my engine capable of being used for oil or any other fuel. For this purpose I provide the walls of the combustion-chamber with brackets or supports 50 for the reception of the ends of the grate-bars By locating the burner or furnace as shown in the drawings the products of combustion encircle the superheater 21 and then envelop the power-cylinder upon all sides except the top and then pass out of the smoke-stack 48. In this manner the largest amount of the heat is utilized by the engine, and by passing the expanded hot air into the warming-chamber it imparts a portion of its heat to the incoming air, thereby requiring less heat in the superheater, and then by passing the still hot air to the burner the flame is not cooled by the introduction of cold air, as would otherwise be done. It will thus be seen that I am able to economize in the use of fuel without detracting from the efficiency of the engine.

Another advantage is secured by the governor, as the partial closing of the valve 18 in the port 17 not only decreases the amount of air passing to the superheater, which will decrease the speed, but it prevents the air from leaving the reservoir 14, thereby rendering it more difficult to force more air in, and thus taking a portion of the already-decreased power to operate the air-pump. On the other hand, the opening of the governor-valve 23 will increase the charge of air admitted to the superheater; but it will decrease the power required to force air into the reservoir 14, thereby increasing the speed of the engine in a twofold manner.

By adjusting the weight upon the notched lever 58 the speed of the engine can be set or determined, as the weight can be adjusted to counterbalance the action of the governor at any point, thereby affording a desirable means for rendering the action of the engine automatic.

In some countries it may be desirable to remove the water-jacket to prevent freezing or to rely upon the atmosphere to keep the pump cool, which can be done by unscrewing it at 69 from the top of the cylinder.

Having described my invention, I claim—

1. In a hot-air engine, the combination with a reservoir provided with a warming-chamber upon the inside thereof, of a superheater connected with said chamber, a power-cylinder communicating with the superheater, operating mechanism connected therewith, and a furnace for heating the superheater.

2. In a hot-air engine, the combination, with a reservoir provided with a warming-chamber, of a superheater communicating with said chamber, a power-cylinder communicating with the superheater, an exhaust-chamber within the warming-chamber and communicating with the power-cylinder, and operating mechanism connected with the power-cylinder.

3. In a hot-air engine, the combination, with a reservoir provided with a warming-chamber, of a superheater connected with said chamber, a combustion-chamber, a power-cylinder, communicating with the superheater, an exhaust-chamber within the warming-chamber, communicating with the power-cylinder and with the combustion-chamber, and operating mechanism connected with the power-cylinder.

4. In a single-acting hot-air engine, the combination, with a reservoir provided with a warming-chamber, of a superheater communicating with said chamber, a power-cylinder, communicating with the superheater, a valve for admitting air from the superheater to the cylinder, an exhaust-chamber within the warming-chamber, in communication with the cylinder, and with the combustion-chamber of the engine, and operating mechanism connected with the power-cylinder.

5. In a hot-air engine, the combination, with a reservoir, provided with a warming-chamber, of a superheater communicating with said chamber, an operating-cylinder communicating with the superheater, a combustion-chamber below the superheater provided with a smoke-stack, said smoke-stack passing up by the superheater and the power-cylinder, an exhaust-chamber in the warming-chamber communicating with the power-cylinder and with the combustion-chamber and operating mechanism connected with the power-cylinder.

6. In a hot-air engine, the combination, with a reservoir, provided with a warming-chamber, of a superheater communicating with said chamber, a power-cylinder communicating with the superheater, a port communicating with both ends of the cylinder, a three-way valve in the port, an exhaust-chamber within the warming-chamber, an exhaust-pipe lead-

ing from the top of the cylinder to the exhaust-chamber, a combustion-chamber below the superheater, and operating mechanism connected with the piston within the power-cylinder.

7. In a hot-air engine, the combination, with a reservoir provided with a warming-chamber, of a superheater communicating with said chamber, a power-cylinder, a port leading from the superheater and communicating with both ends of the cylinder, a governor-valve and a three-way valve in said port; a combustion-chamber, and operating mechanism connected with the piston of the power-cylinder.

8. In a hot-air engine, the combination, with a reservoir provided with a warming-chamber, of a superheater communicating with said chamber, a power-cylinder communicating with the superheater, an air-pump communicating with the reservoir, means for operating the pump from the power-cylinder, a valve between the superheater and the cylinder, a valve between the pump and the reservoir and means for simultaneously operating said valves.

9. In a hot-air engine, the combination, with a reservoir, of a superheater and an air-pump communicating therewith, of a power-cylinder communicating with the superheater, a valve between the superheater and the cylinder, a valve between the pump and the reservoir, a walking-beam connected with the cylinder and with the pump, an operating-shaft connected with the walking-beam, one end of which is provided with a cam, a lever pivotally secured to the side of the engine, one end of which is provided with a yoke in position to engage with the cam, a rod secured to each end of the lever, each of which is connected with one of the valves.

10. In a hot-air engine, the combination, with a reservoir, of a superheater and an air-pump, communicating therewith, a power-cylinder communicating with the superheater, two valves between the cylinder and the reservoir, and between the reservoir and the pump, respectively, means for operating the pump from the cylinder and for controlling one each of said valves, and handles for operating the other valves independently of each other for stopping and starting the engine.

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

WILLIAM M. MYERS.

Witnesses:

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JOHN F. ARNOLD.