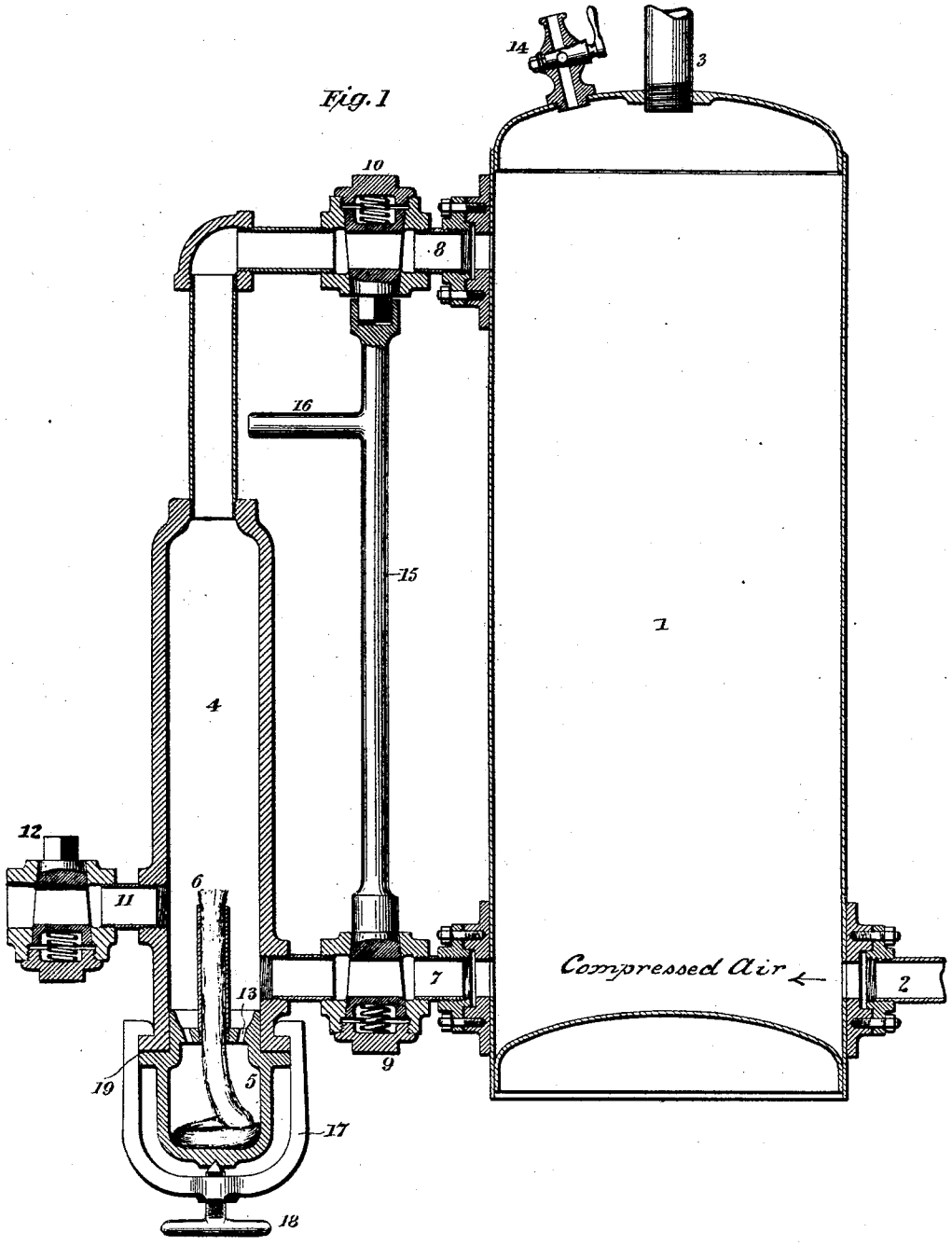
(No Model.) 2 Sheets—Sheet 1.

R. A. PARKE.

APPARATUS FOR HEATING COMPRESSED AIR.

No. 481,623. Patented Aug. 30, 1892.

Fig. 1



Witnesses:
Raphael Netter
G. B. Lewis.

Robert A. Parke Inventor
by Kerr & Curtis
Attorneys.

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

(No Model.) 2 Sheets—Sheet 2.

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Fig. 2

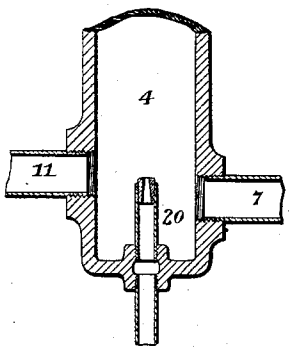


Fig. 3

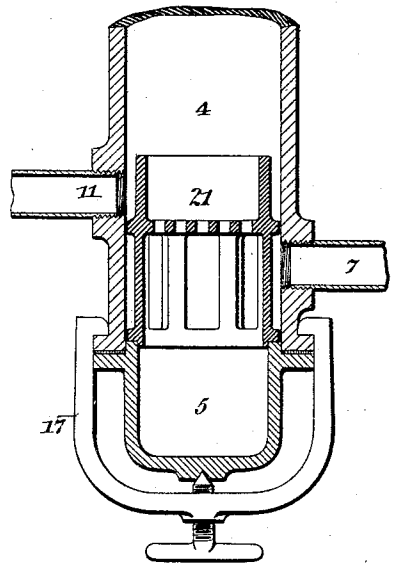
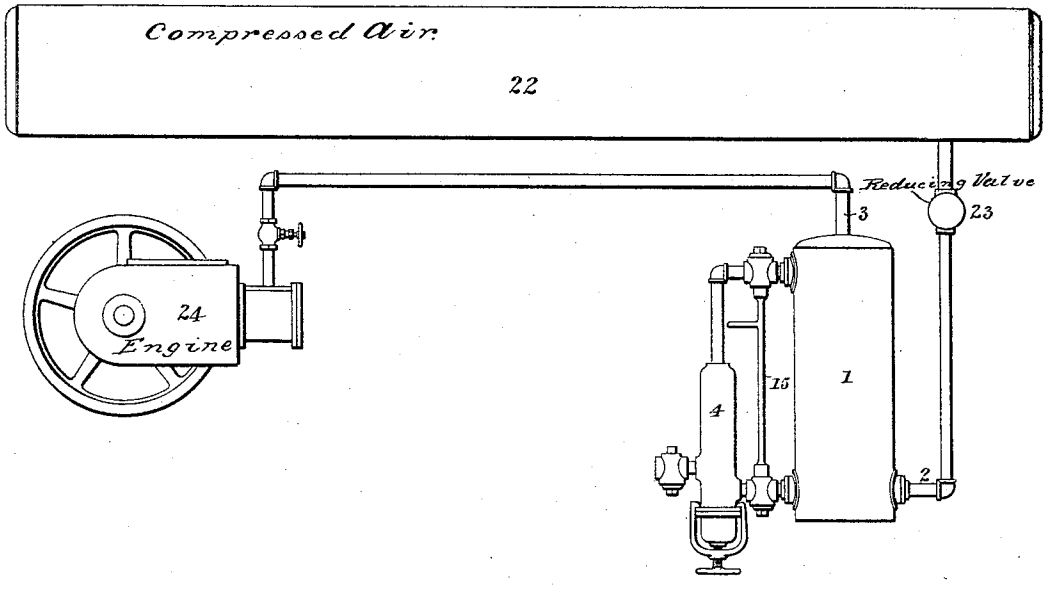


Fig. 4



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UNITED STATES PATENT OFFICE.

ROBERT A. PARKE, OF NEW YORK, N. Y.

APPARATUS FOR HEATING COMPRESSED AIR.

SPECIFICATION forming part of Letters Patent No. 481,623, dated August 30, 1892.

Application filed July 10, 1891. Serial No. 399,052. (No model.)

To all whom it may concern:

Be it known that I, ROBERT A. PARKE, of the city, county, and State of New York, have invented certain new and useful Improvements in Apparatus for Heating Compressed Air for Power Purposes, of which the following is a specification.

My invention is intended to supply heat to the air directly and without the intervention of any conducting medium. I use the oxygen of the compressed air to produce and maintain combustion within the apparatus, thereby increasing the elastic tension of the compressed air both through the introduction of heat and the addition of the products of combustion and also increasing the temperature of the compressed air, so that it may be used expansively to do useful work without producing too great a refrigerating effect upon the motor or other appliance in which the expansion takes place.

It is well known that the expansion of air with an accompanying reduction of pressure causes a considerable reduction of temperature, and that to prevent the final temperature from becoming so low as to cause condensation and freezing of the atmospheric moisture in and upon the apparatus in which the expansion takes place the initial temperature must be sufficiently high to correspond with the degree of expansion permitted. It is also known that to obtain the most economical results in the use of compressed air as a motive power it must be used expansively. It is also known that where heat is applied to compressed air or other fluids by externally heating the receptacle containing the same, so as to communicate the heat indirectly to the air or other fluid, a large proportion of the heat is diverted and lost and only a small proportion can be utilized for the purposes for which it is applied.

My invention, briefly stated, consists of an air reservoir or chamber interposed between the source of compressed-air supply and the point at which the compressed air is utilized, in combination with a separate combustion-chamber connected with said reservoir, in which combustion-chamber the fuel is burned inside the apparatus and the combustion is promoted or sustained by the oxygen contained in the compressed air, which is brought into contact with the burning fuel by a circulation of the air instituted and maintained in the chamber or receptacle by the process of the combustion of the fuel itself.

To enable others skilled in the art to make and use my invention, I will now describe it by reference to the accompanying two sheets of drawings, forming a part of this specification, in which—

Figure 1 is a vertical section of one form of my apparatus provided with a liquid-burning lamp for heating the air. Fig. 2 is a detail view showing the application of a gas-jet to the heating-chamber. Fig. 3 is a similar view showing the applicatian of a grate for burning solid fuel; and Fig. 4 is a diagrammatical representation of a compressed-air reservoir, my improved heating apparatus, and a compressed-air motor, showing the relation of the heating apparatus to the other parts.

In Fig. 1 the air-heating chamber is composed of two vertical cylinders connected together at the upper and lower ends by suitable pipes or air-passages, whereby a circulation may be established between them. Here 1 represents a reservoir or chamber to which the compressed air is conveyed by means of the pipe or tube 2 and from which it passes to the motor or other device, where it is applied to use by means of the pipe or tube 3.

At the side of the chamber 1 is a second chamber 4, which is provided with an oil or other liquid burning lamp 5, having a suitable wick-tube and wick 6. This chamber is connected with the chamber 1 at the lower end by means of a pipe or tube 7 and at the upper end by means of a pipe or tube 8, and these communicating passages are governed by means of suitable cocks 9 and 10, which are operated by a common stem 15, provided with a handle 16. The chamber 4 has an opening 11, by which communication is made to the atmosphere and through which the lamp-wick 6 may be lighted by the insertion of a torch or other means, and this passage is controlled by a suitable cock 12. The top of the lamp is perforated, as at 13, to admit the compressed air to the interior of the lamp, so that the wick 6 is in equilibrium and will not be forced down into the lamp by the pressure upon its exposed upper end. The lamp 5 is

removable, being held in position by the yoke 17 and screw 18, and the joint between it and the end of the chamber 4 is made air-tight by means of a suitable packing 19.

The operation of the device is as follows: The chamber 1 being filled with compressed air, the cocks 9 and 10 are closed and the cock 12 opened. A torch is inserted through the tube 11 and the wick 6 lighted. The cock 12 is then closed and the cocks 9 and 10 opened. The heated air and products of combustion are forced upward in the chamber 4 on account of their reduced density and through the tube 8 into the chamber 1 and are replaced by cooler air, which enters the chamber 4 through the tube 7, so that a circulation of air is established through the chamber 4 and passage 8, chamber 1 and passage 7, which is maintained as long as the lamp continues to burn, bringing the cool air with its free oxygen to the flame and keeping it alive until the oxygen of the air in the apparatus has been consumed.

Ordinarily in the use of the apparatus the heated air is being carried away through the tube 3 to the motor, and the supply is renewed through the tube 2, so that the process is a continuous one. If, however, the motor should be stopped and the continued supply of oxygen be thus prevented, the circulation would continue and the flame be kept alive until the oxygen of the air-supply in the apparatus is consumed. The size of the wick and flame may be proportioned to sufficiently heat the air, according to the rapidity with which it is to be utilized in the motor, and with such definite rate of combustion the length of time the flame may be sustained after the motor has stopped with a given containing capacity of apparatus may be determined. If this stoppage of oxygen-supply should in in any event become longer than the time during which the flame can be kept alive by the oxygen stored in the heating apparatus, the combustion may be still continued by opening the small cock 14, thus permitting the entrance of a sufficient supply of compressed air from the tube 2 to sustain combustion. When the motor begins to work again and the compressed air begins to pass to it from the heating apparatus, the cock 14 should be closed.

Instead of using a liquid fuel I can make use of a combustible gas, in which case the lamp would be replaced by a gas-burner 20, as shown in Fig. 2; or, if preferred, charcoal or other solid fuel may be used, in which case the lamp would be replaced by a suitable grate 21, as illustrated in Fig. 3. In each of these cases an air-circulation will take place, attended with results similar to those obtained by the use of a liquid fuel, as described in connection with Fig. 1.

In Fig. 4 I illustrate the arrangement of the heating apparatus with relation to a compressed-air-storage reservoir and a motor. Here 22 illustrates a large reservoir for containing compressed air. It has a reducing-valve 23, similar in construction and operation to those found in the market at the present time, by which, with varying air-pressure in the reservoir 22, a supply of air at a constant lower pressure is delivered to the heating apparatus hereinbefore described, and through which it passes to the motor 24, which is actuated by it.

I am aware that heat has been applied externally to receptacles to heat and expand compressed air. I am also aware that heat has been applied internally by intermittent combustion or successive explosions for the purpose of utilizing the resulting increased pressure and temperature of the compressed air and products of combustion for producing work.

My invention consists, broadly, of the use of a distinct and separate reservoir or chamber interposed between the source of the compressed-air supply and the motor, having connected therewith a separate combustion-chamber, in which the combustion occurs continuously, being supported by the oxygen contained in the compressed air, which is kept in circulation wholly or in part by the process of combustion.

Whenever the word "motor" is used in this specification or in the claims it means the device or mechanism which is actuated by the compressed air or in which the compressed air is utilized and the source of compressed-air supply may be any form of air-compressing machine or of compressed-air reservoir which is capable of affording a supply of compressed air for power purposes.

The receptacle, reservoir, or chamber interposed between the source of compressed air and the motor in which the combustion hereinbefore described takes place may be of any desired form in which an adequate quantity of compressed air can be inclosed to cause a circulation of air through the combustion-chamber and to maintain combustion without further supply for a definite useful period in the manner hereinbefore described by me. The heated air may be utilized for heating purposes.

I do not herein claim the heating of compressed air by the combustion therein of solid fuel, except in an apparatus provided with an air-reservoir and a separate heating-chamber, as herein described, hereby reserving the right to claim the same, broadly, in my application, Serial No. 424,274, filed March 9, 1892.

What I claim as my invention is—

1. In combination with a source of compressed-air supply and a motor, an interposed reservoir, and a separate combustion-chamber communicating with the reservoir for the purpose of heating the air contained therein, substantially as described.

2. In combination with a source of compressed-air supply and a motor, an interposed reservoir, and a separate combustion-chamber communicating with the reservoir and main-

taining a circulation of air therethrough, substantially as and for the purposes described.

3. A reservoir or chamber having a source of compressed-air supply and an exit leading to a motor, which reservoir communicates at its upper and lower ends with the upper and lower ends, respectively, of a separate combustion-chamber, in combination with a burner producing continuous combustion in compressed air within said combustion-chamber, substantially as and for the purposes set forth.

4. In combination with a reservoir having a source of compressed-air supply and an exit leading to a motor, a separate combustion-chamber, and tubes connecting the reservoir and combustion-chamber at their upper and lower ends, cocks or valves in said tubes, by which communication may be effected or cut off between the reservoir and combustion-chamber, and a cock or valve connected with the combustion-chamber, by means of which the combustion-chamber may communicate with the atmosphere, substantially as and for the purposes described.

5. In combination with a reservoir having a source of compressed-air supply and an exit leading to a motor, a separate combustion-chamber, circulating tubes or passages connecting the reservoir and combustion-chamber, and cocks or valves in said tubes or passages, by which communication may be effected or cut off between the reservoir and combustion-chamber, substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 1st day of July, 1891.

ROBERT A. PARKE.

Witnesses:

ROBT. F. GAYLORD,

THOMAS B. KERR.