No. 710,064. Patented Sept. 30, 1902.

# T. J. LITLE, JR.

## LAMP.

(Application filed Jan. 31, 1900. Renewed Feb. 4, 1901.)

(No Model.) 2 Sheets—Sheet 1.

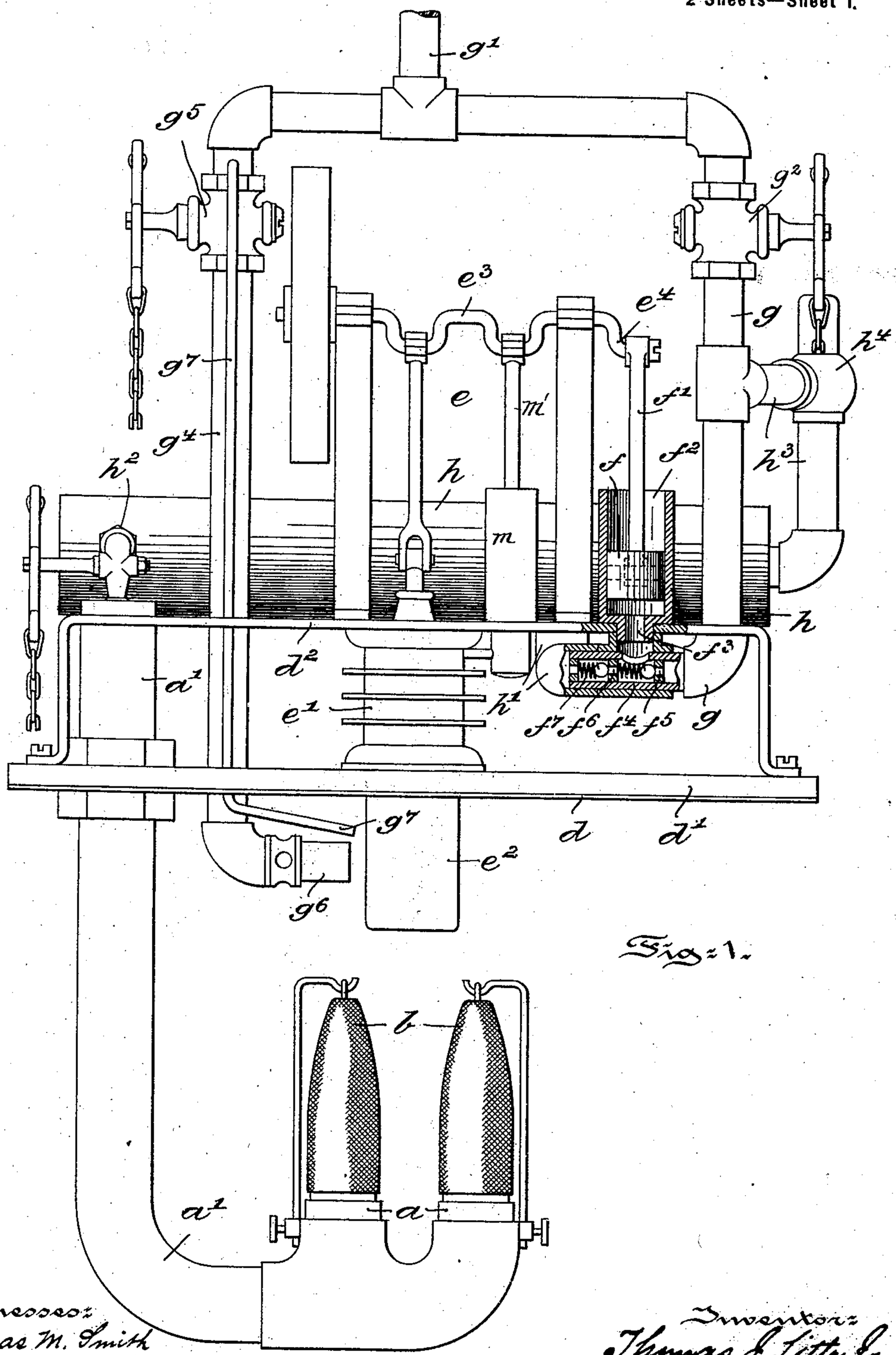


Fig. 1.




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Fig. 2.

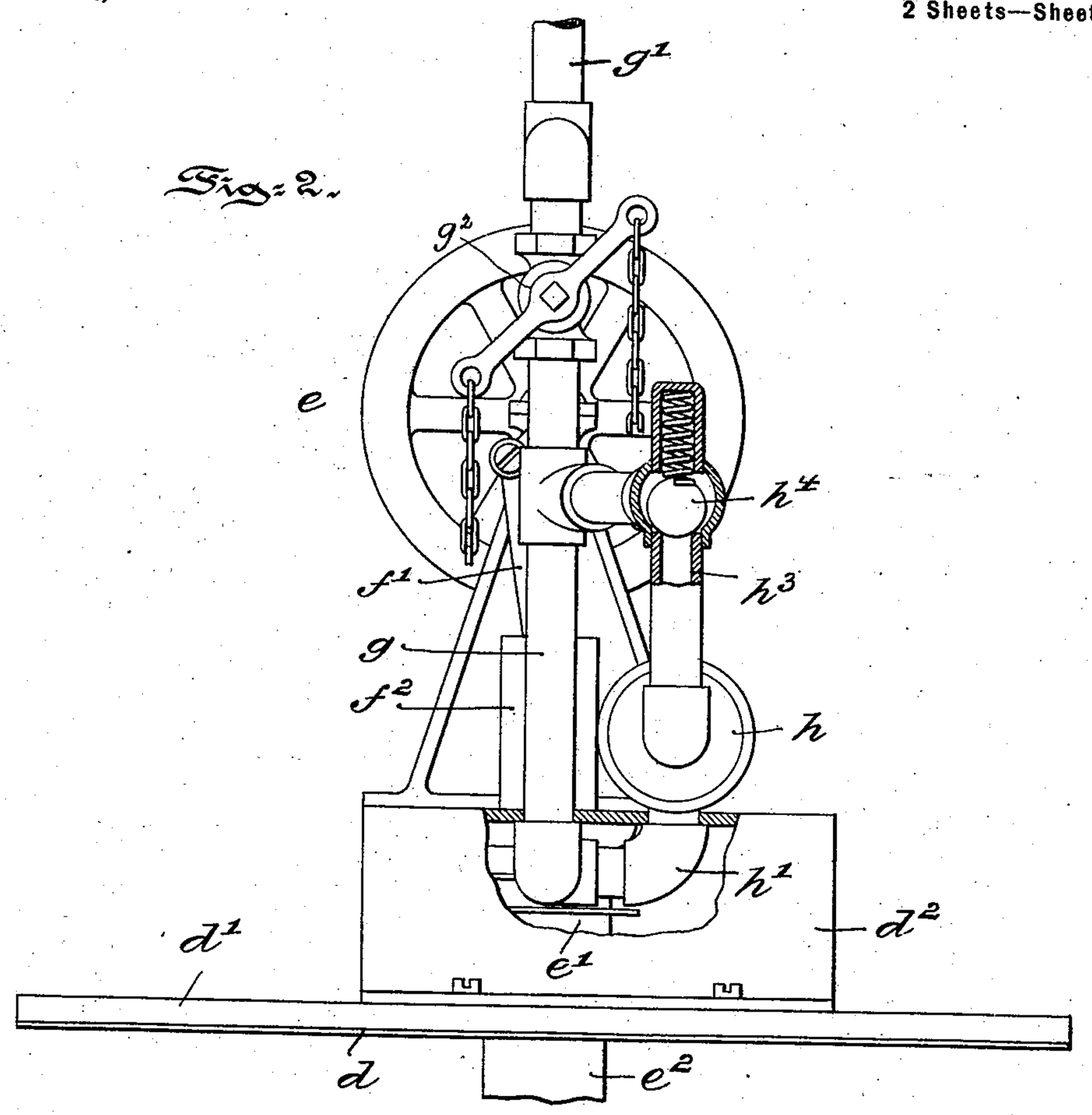
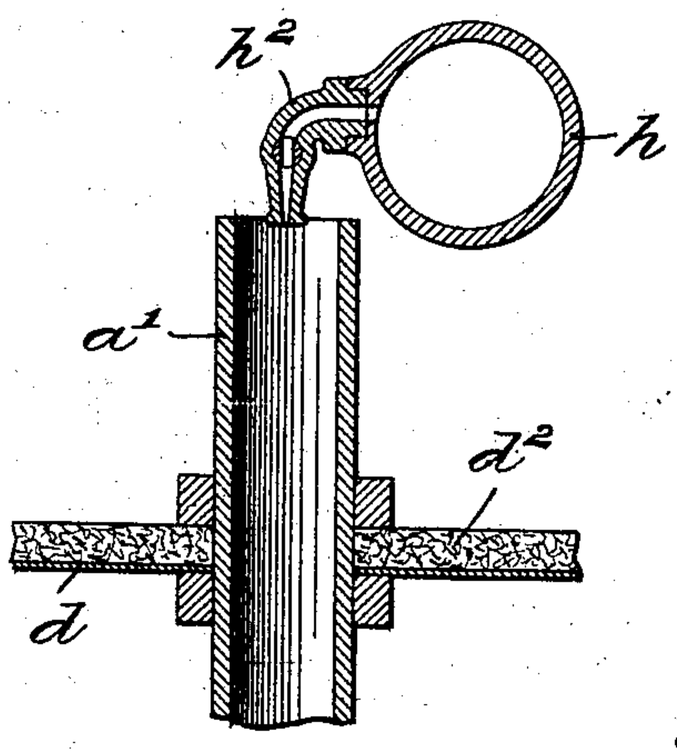



Fig. 3.

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# UNITED STATES PATENT OFFICE.

THOMAS J. LITLE, JR., OF CLEVELAND, OHIO, ASSIGNOR TO THE NEW PROCESS LIGHTING COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

## LAMP.

SPECIFICATION forming part of Letters Patent No. 710,064, dated September 30, 1902.

Application filed January 31, 1900. Renewed February 4, 1901. Serial No. 45,986. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS J. LITLE, Jr., of Cleveland, Cuyahoga county, Ohio, formerly of Philadelphia, Pennsylvania, have invented a certain new and useful Improvement in Lamps, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The object of this invention is to provide a gas-lamp with self-contained and efficient means for increasing the light-giving power of its burner. I accomplish this by providing a caloric-engine driven by the heat from the burner, and I use the mechanical energy of this engine to compress the gas-supply and then let that supply escape in a jet to the burner, taking with it an augmented supply of air. I use the term "caloric-engine" herein in contradistinction to an apparatus driven by the draft generated by the heat of the lamp, for such apparatuses do not possess sufficient power to produce my operation. The caloric-engine is supported so that it is driven by the waste heat from the burner, and it operates to compress the gas into a suitable reservoir, from whence it passes in a jet governed by a suitable cock into a pipe having external openings, whereby it draws air in with it and produces, in effect, a Bunsen burner giving an intense heat to suitably-held incandescible material, preferably a Welsbach mantle or mantles, which thereby furnishes the light.

My invention consists of such an apparatus broadly and more or less specifically, as hereinafter described, and set out in the claims.

My copending application, Serial No. 26,039, filed August 6, 1900, for a lamp covers, broadly, the combination of a heating-burner and incandescible material associated therewith, a caloric-engine operated by the heat of the burner, and means operated by the caloric-engine for augmenting the supply of air or other combustion-supporter to the burner, and that application dominates this case. The present invention relates to a lamp structure wherein the augmenting means consists of an escaping jet of compressed fuel-gas after the manner of a Bunsen burner.

The drawings sufficiently illustrate the invention.

Figure 1 is a front elevation, partly sectional, of my apparatus; Fig. 2, an end elevation, partly broken away; and Fig. 3, a vertical cross-section of the reservoir and its nozzle and the burner-tube.

Referring to the parts by letters, $a$ represents the burner, above which are mounted incandescing mantles $b$. From the burner extends the feed-tube $a'$, which, as shown, is open at its upper end. The gas, as hereinafter explained, discharges in a jet into this open end, and thus carries air with it, increasing the supply to the burner, whereby the burner becomes really a Bunsen burner.

Above the burner is the caloric-engine. As shown in the drawings, there is provided a heat-insulating diaphragm above the burner, consisting of a plate $d$, supporting a layer $d'$ of heat-insulating material, as abestos, and supported by this plate also is a frame or bracket $d^2$, which carries the bed plate or support of the caloric-engine. This engine is of any well-known type. The contraction and expansion cylinder $e'$ thereof extends below the bracket $d^2$ and partly below the diaphragm, so as to expose the lower or expanding portion $e^2$ to the heat from the burner. At the side of the cylinder $e'$ is arranged the cooling-cylinder $m$, which is traversed by a piston, the rod $m'$ of which takes on a crank-shaft $e^3$. The lower end of the cylinder $m$ is connected with the upper end of the cylinder $e'$, and in this latter cylinder is a loose displacer connected by a rod with the crank-shaft $e^3$. Thus a caloric-engine is provided.

As is well understood, the air in the cylinder $e'$ becoming heated and expanding creates a pressure therein, which acting around the loose displacer will force upward the piston in the cylinder $m$. This will bring down the displacer, which will bodily transfer the air in the lower end of the cylinder $e'$ to its upper end and into the cylinder $m$, where it will contract from the coolness of this upper end and of the cylinder $m$, allowing the piston in the latter to descend. The crank-shaft $e^3$ of the engine has a crank-arm $e^4$ connected to the piston $f$, which reciprocates in the pump-cylinder $f^2$. The base of the cylinder $f^2$ is provided with an opening $f^3$, entering a valve-casing $f^4$, wherein are two ports $f^5$ $f^6$, each

controlled by a spring check or ball valve. The port $f^5$ leads into the valve-casing $f^4$ from the pipe $g$, which is a branch from the main gas-pipe. The port $f^6$ leads from the valve-casing of a chamber $f^7$, which discharges into a pipe $h'$, communicating with a reservoir or tank $h$. These two valves and the piston and cylinder operate as a pump, drawing in gas from the main and discharging it under pressure into the tank or reservoir. A valve-controlled discharge-pipe $h^2$ enters the burner-tube $a'$ preferably at its open end. When this valve is opened, the gas issues from the nozzle $h^2$ in the form of a jet, drawing in air through the opening in the burner-tube, thus making a Bunsen burner, as is well understood. From the reservoir $h$ there also leads a pipe $h^3$, which discharges into the gas-pipe $g$, but is provided with a spring-controlled valve $h^4$, normally closing such discharge, but adapted to be open when the pressure in the reservoir is greater than that of the spring. Thus the valve $h^4$ not only provides a safety-valve, but provides a governor for regulating the pressure of the gas in the tank by varying the force of the spring employed.

The operation of the apparatus is as follows: The heat from the burner operates the motor to rotate the crank-shaft which drives the pump to compress gas into the reservoir. The gas under pressure will discharge into the burner-tube in the form of a jet, and thus it draws through such tube the proper quantity of air to cause the gas to burn with the best results. Now it is desirable to cause the motor to operate sufficiently to properly compress the gas before the regular burner is ignited. To accomplish this, a branch pipe $g^4$ leads from the main gas-pipe $g'$ and is provided with a cock, as $g^5$, and a burner $g^6$, located adjacent to the expanding-cylinder of the motor. A continuously-burning pilot-flame through a small tube $g^7$ serves to ignite the gas issuing from the burner $g^6$ when the valve is opened. The gas to the pump being turned on at the main cock $g^2$, and the supply to the heating-burner being also turned on at its cock $g^5$, this burner will speedily heat the cylinder of the motor to cause it to operate to charge up the reservoir, after which the heating-burner $g^6$ is dispensed with, the gas being turned off at the cock $g^5$, and then the cock in the nozzle $h^2$ is turned to admit the compressed gas into the burner-tube $a'$ as desired, and this gas rushing in draws air around it, constituting the burner A a Bunsen burner, which gives an intense heat and a correspondingly intense light to the mantles.

I claim—

1. In a lamp, in combination, an incandescible material, a heating-burner associated therewith, a caloric-engine operated by the heat thereof, means operated by the caloric-engine for compressing a gas, means for causing such compressed gas to escape in a jet, and a passage-way leading from said jet to the burner and adapted to convey the gas and air thereto.

2. In a lamp, the combination of a Bunsen burner, a caloric-engine operated by the heat from said burner, means driven by said engine for compressing the fuel supplied to said burner, and an incandescible material adapted to be rendered luminous by said burner.

3. In a lamp, in combination, an incandescible material, a heating-burner associated therewith, a gas-supply pipe, a caloric-engine operated by the heat of said burner, means operated by said engine for compressing the gas from the supply-pipe, means for causing such compressed gas to escape in a jet and carry air with it to the burner, and a lamp-frame carrying all of said parts.

4. In a lamp, in combination, a gas-supply pipe, a caloric-engine and means driven thereby for compressing the gas from such pipe, said engine being operated by the heat generated by burning gas from such pipe, an incandescible material, and a heating-burner associated therewith, and means for causing the compressed gas to escape in a jet thereto and take combustion-supporter with it.

5. In a lamp, in combination, an incandescing mantle, and a heating-burner associated therewith, a reservoir, a caloric-engine operated by the heat of the burner, and means driven by said engine for compressing gas in the reservoir, and means for conveying such gas to the burner.

6. In a lamp, in combination, an incandescible material, a heating-burner associated therewith, a reservoir, a gas-supply pipe, a caloric-engine operated by the heat of said burner, and means driven by said engine for compressing in the reservoir gas from the supply-pipe, and means for causing the gas to escape from the reservoir in a jet and carry air with it to the burner.

7. In a lamp, in combination, a reservoir, a gas-supply pipe, a caloric-engine operated by the heat of the burner, means driven by said engine for compressing gas from the supply-pipe in the reservoir, an incandescing mantle, a burner, a burner-pipe leading thereto and having an air-opening, and a discharge-pipe from said reservoir into said burner-pipe.

8. In a lamp, in combination, an incandescible material, a heating-burner associated therewith, a conduit leading to said burner and having an opening to the outer air, a reservoir, a gas-supply pipe, a caloric-engine operated by the heat of the burner, means driven by said engine for forcing gas from the supply-pipe into the reservoir under pressure, an exit-pipe leading from said reservoir and discharging into said conduit, and a cock for governing said exit-pipe.

9. In a lamp, in combination, a caloric-engine, a main burner and an initial heating-burner for the same, an incandescible material associated with said main burner, means

operated by said engine for compressing gas, means for feeding compressed gas with air to said main burner, and means for feeding the initial-heating burner with uncompressed gas.

10. In a lamp, in combination, an incandescing mantle, a heating-burner associated therewith, a reservoir, a caloric-engine operated by the heat of the burner, means driven thereby for compressing gas in the reservoir, means for conveying the gas from the reservoir to the burner, and a governor limiting the pressure in the reservoir.

11. In a lamp, in combination, an incandescible material, a heating-burner associated therewith, a reservoir, means operated by the heat of the burner for compressing gas in the reservoir, means for conveying such gas to the burner, and a return-pipe leading from the reservoir to the gas-supply, and a spring-valve for controlling said return-pipe.

12. In a lamp, in combination, a reservoir, a gas-supply pipe, a caloric-engine and means driven thereby for compressing gas from the supply-pipe into the reservoir, an incandescible material, a burner therefor, a burner-pipe leading thereto and having an air-opening, a discharge-pipe from said reservoir into said burner-pipe, and a suspensible frame carrying all of said parts.

13. In a lamp, in combination, an incandescible material, a heating-burner associated therewith, a caloric-engine adapted to be operated by the heat thereof, a pump driven by said engine, a reservoir into which said pump discharges, a supply-pipe adapted to convey gas to said pump, whereby the engine may compress the gas in the reservoir, a discharge-pipe leading from said reservoir, and a pipe having an air-opening for conveying such discharge and air to the burner.

14. In a lamp, in combination, an incandescible material, a heating-burner associated therewith, a caloric-engine operated by the heat thereof, a pump driven by said engine, a reservoir into which said pump discharges, a supply-pipe adapted to convey gas to said pump whereby the engine may compress the gas in the reservoir, a discharge-pipe leading from said reservoir, a pipe for conveying such discharge and air to the burner, a return-pipe leading from the reservoir to the fuel-supply, a spring-valve for governing the same, and cocks in the supply-pipe and discharge-pipe respectively.

15. In a lamp, the combination with an incandescible material, a heating-burner associated therewith, a caloric-engine which converts a portion of the waste heat from said burner into rotary mechanical movement, mechanism operated by such rotary movement for compressing the gas, and means for causing such compressed gas to escape in a jet to said burner whereby it may take air with it.

16. In a lamp, in combination, an incandescible material, a burner therefor, a burner-pipe leading to the burner and having an opening for the reception of air, a caloric-engine above the incandescible material, a heat-diaphragm across the engine for maintaining the upper portion thereof cool, a pump operated by said engine, a gas-supply pipe leading thereto, a reservoir into which said pump is adapted to discharge, and a discharge-pipe from said reservoir to said burner-pipe.

17. In a lamp, in combination, a caloric-engine, a main burner, and an initial-heating burner for the same, an incandescible material associated with said main burner, a reservoir, a pump operated by said engine for compressing gas from the supply into said reservoir, a burner-pipe leading to said main burner, a jet-pipe from the reservoir discharging into said burner-pipe, and two gas-supply pipes branching from a common pipe and one leading to said pump and the other to said initial-heating burner.

In testimony whereof I have hereunto set my signature in the presence of two subscribing witnesses.

THOS. J. LITLE, JR.

Witnesses:
J. WALTER DOUGLASS,
THOMAS M. SMITH.