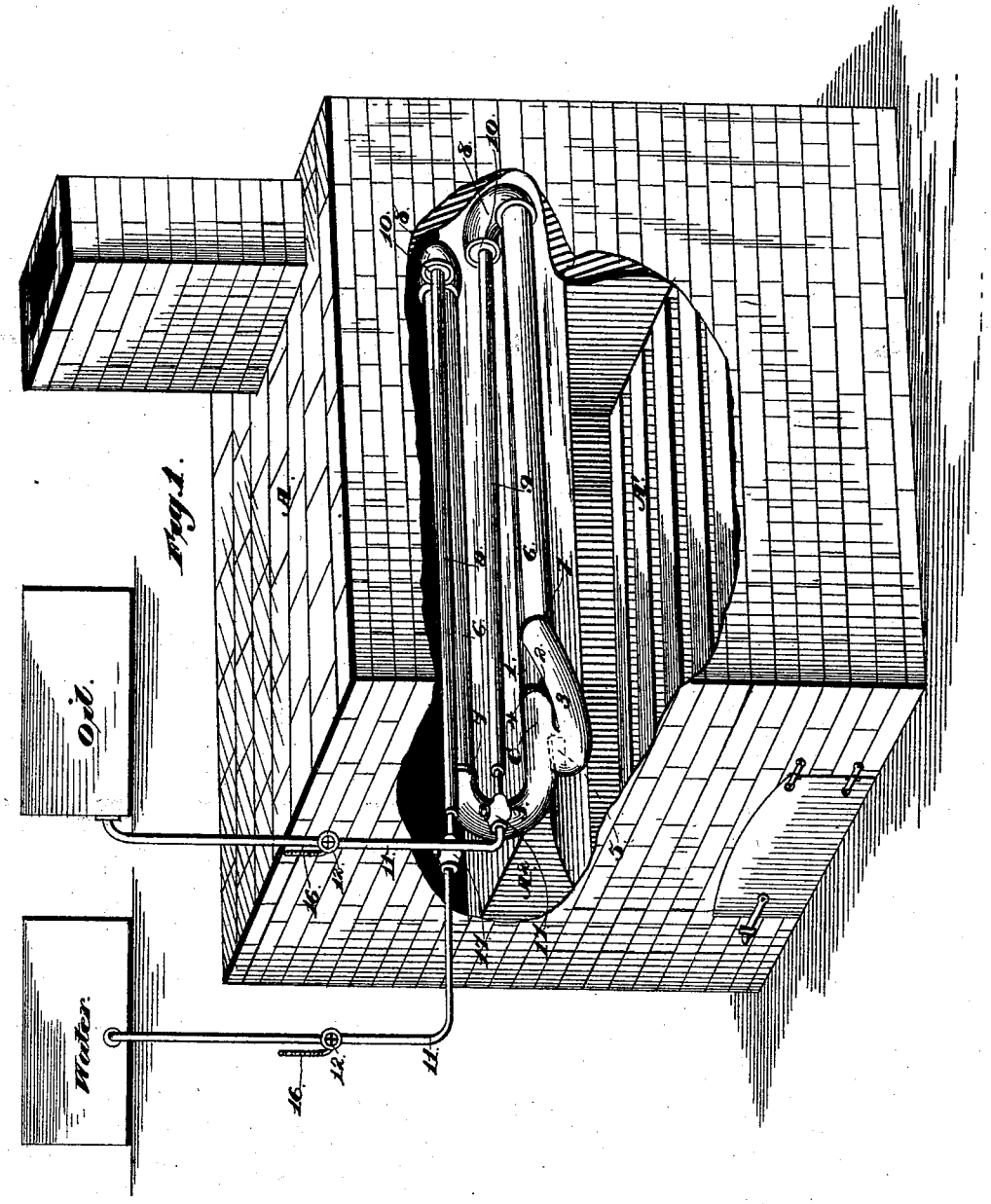
(No Model.)

4 Sheets—Sheet 1.

J. ROBERTS.

PROCESS OF AND APPARATUS FOR MANUFACTURING HEATING AND ILLUMINATING GAS.

No. 345,649. Patented July 13, 1886.



Witnesses:
Charles S. Hoyer.
L. Seward Bacon.

Inventor:
James Roberts.
By Munn & Co
Atty.

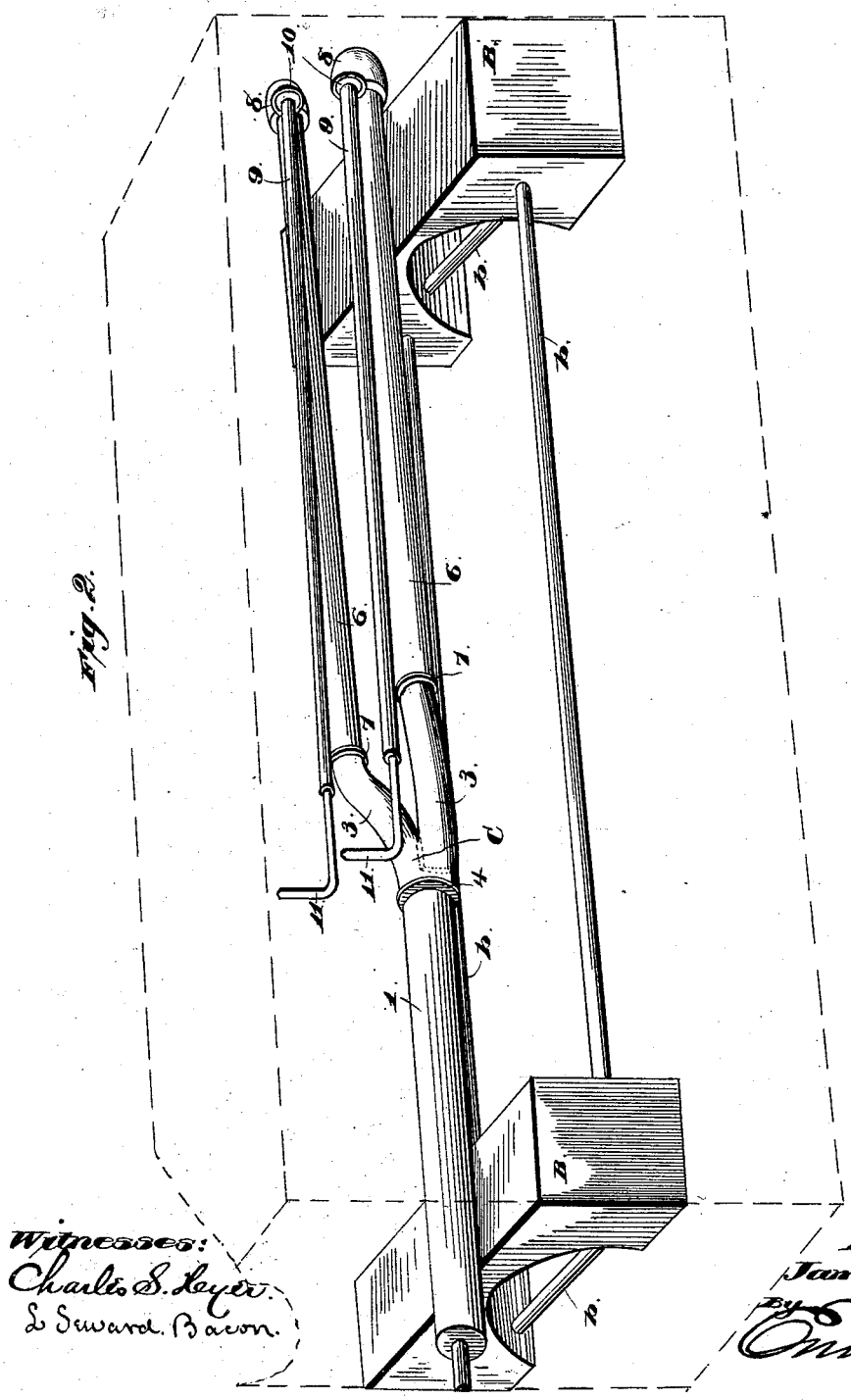
(No Model.) 4 Sheets—Sheet 2.

J. ROBERTS.

PROCESS OF AND APPARATUS FOR MANUFACTURING HEATING AND ILLUMINATING GAS.

No. 345,649. Patented July 13, 1886.

Fig. 2.



Witnesses:
Charles S. Lever.
L. Seward Bacon.

Inventor:
James Roberts
By Munn & Co
Atty.

(No Model.)

4 Sheets—Sheet 3.

J. ROBERTS.

PROCESS OF AND APPARATUS FOR MANUFACTURING HEATING AND ILLUMINATING GAS.

No. 345,649. Patented July 13, 1886.

Fig. 3.

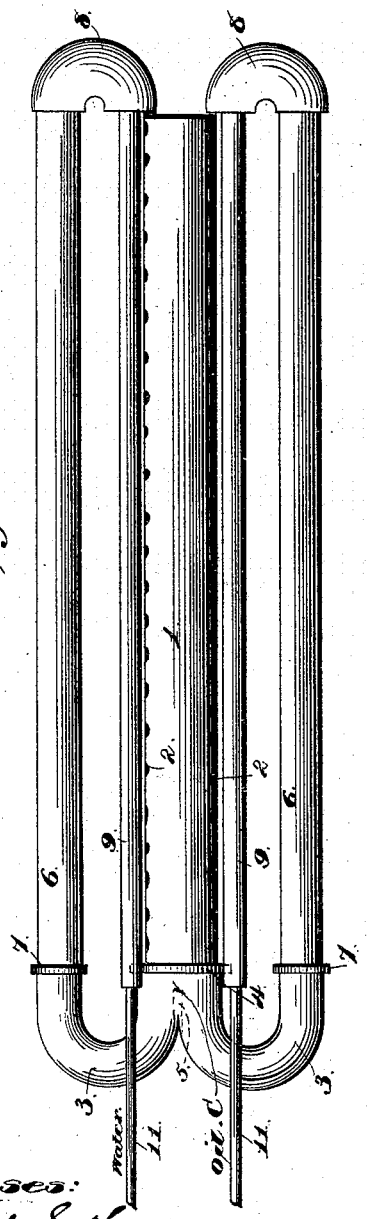
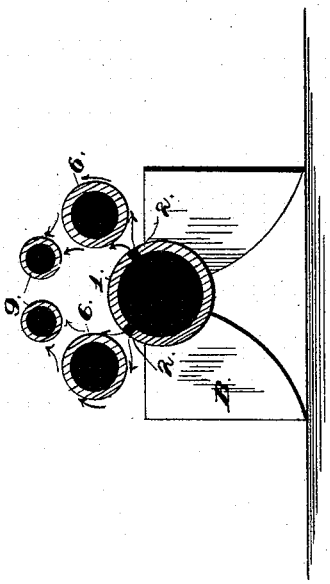


Fig. 4.



Witnesses:
Charles S. Keyser
L Seward Bacon

Inventor:
Jones Roberts.
By
O Munn & Co
Attys.

(No Model.)

4 Sheets—Sheet 4.

J. ROBERTS.

PROCESS OF AND APPARATUS FOR MANUFACTURING HEATING AND ILLUMINATING GAS.

No. 345,649. Patented July 13, 1886.

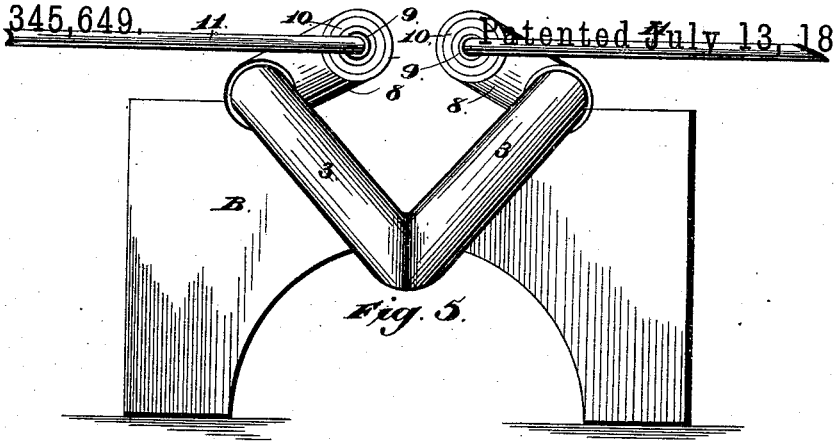


Fig. 5.

Fig. 6.

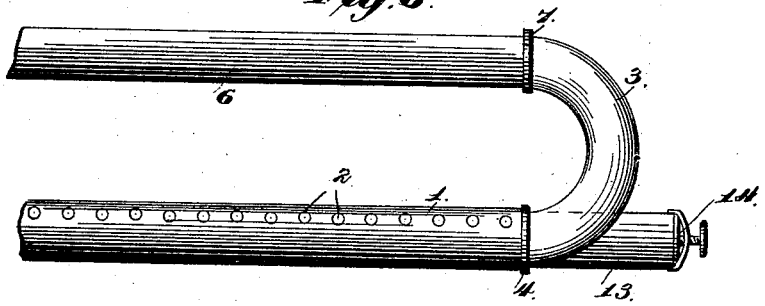
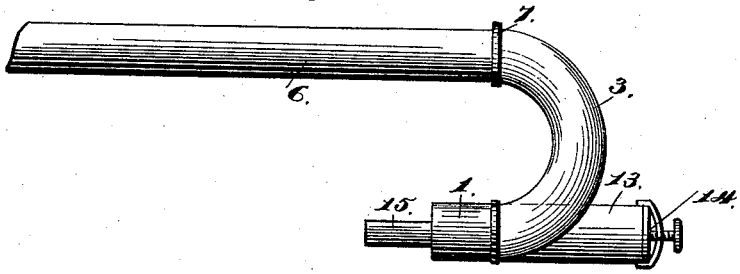


Fig. 7.



Witnesses:
Charles S. Keyes.
L Seward Bacon.

Inventor:
James Roberts.
By
Wm. Marble
Atty.

UNITED STATES PATENT OFFICE.

JAMES ROBERTS, OF NEW YORK, N. Y., ASSIGNOR TO THE ACME LIQUID FUEL COMPANY OF NEW YORK.

PROCESS OF AND APPARATUS FOR MANUFACTURING HEATING AND ILLUMINATING GAS.

SPECIFICATION forming part of Letters Patent No. 345,649, dated July 13, 1886.

Application filed February 23, 1886. Serial No. 192,897. (No model.)

To all whom it may concern:

Be it known that I, JAMES ROBERTS, a citizen of the United States, residing at the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in a Process of and Apparatus for Manufacturing Heating and Illuminating Gas; and I do hereby 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.

My invention relates to a process of and apparatus for the manufacture of heating and illuminating gas from water and hydrocarbons, which process consists of certain steps and in an apparatus of peculiar construction, which will be more fully hereinafter described, and pointed out in the claims.

The object of my invention is to produce a heating and illuminating gas of superior quality by a simple and economical process in an apparatus cheaply manufactured, readily understood and operated, which may be adapted to furnaces of any ordinary construction when desired for heating simply, or be used separately for the generation of illuminating-gas.

I am aware that many attempts have been made to produce such a gas as I manufacture from water and hydrocarbons by various processes and apparatuses, but, so far as I know, with only partial success. The process and apparatus heretofore employed for this purpose have been based upon the theory that by the combination of steam, at a normal temperature or superheated, and hydrocarbons or hydrocarbon vapors in a retort or mixing-chamber heated to a high degree, a fixed gas is produced possessing the desired heating and illuminating qualities. My invention differs from those above mentioned in this, that by my apparatus, as I contemplate using it, the water is separately converted into a gas, and at the same time the hydrocarbon is converted into a fixed gas, and these several gases are then brought together in a common chamber, and there united, forming a resultant gas possessing the necessary qualities for heating or illumination, as may be desired. When this gas is to be used for illumination, water and hydrocarbons are used in about equal quantities; but where it is to be used for heating the quantity of water is increased, as may be desired, thereby producing a greater proportion of hydrogen. The degree of heat may be increased or diminished by increasing or diminishing the relative quantity of water.

In the accompanying drawings I have illustrated the apparatus I prefer to use in the manufacture of this gas, although it is evident that changes and modifications therein may be made without departing from the principle of my invention or the steps necessary to be taken in carrying out my process.

In the drawings, wherein like letters and figures refer to similar parts in the several views, Figure 1 is a perspective view of my apparatus for manufacturing gas, illustrated as applied to a furnace, and showing the said furnace partially broken away. Fig. 2 is a perspective view of the apparatus with the burner running in the reverse direction. Fig. 3 is a plan view of the apparatus shown in Fig. 1. Fig. 4 is a cross-sectional diagrammatic view showing the manner of arranging the several pipes. Fig. 5 is a front elevation of the apparatus shown in Fig. 1. Fig. 6 is a detail view of a modified form of burner. Fig. 7 is a detail view of a further modification of the burner.

As shown in Fig. 1, A indicates a bench of a furnace having a suitable grate, A′, mounted therein, and an extended support, A^2, which acts to keep the apparatus in position.

In Figs. 2, 4, and 5 the apparatus is shown as supported upon suitable end trestles, B B, which may be connected and braced by tie-rods *b b*.

The apparatus consists, essentially, of a burner, 1, provided with a row of apertures, 2 2, on each of its sides, situated radially at right angles to the center of said burner 1, as shown in the diagrammatical sectional view, Fig. 4. To the front portion of this burner 1 two elbows, 3 3, extend downward on an incline in the form of a V, and unite in chamber C, just ahead of the coupling 4, which joins the burner 1 to these united elbows. Where these elbows 3 3 join, a short partition,

5, is constructed, as shown in dotted lines in Fig. 3, and adapted for a purpose which will be more fully hereinafter described.

To the elbows 3 3 are secured pipes 6 6 by couplings 7 7, said pipes 6 6 extending rearwardly in a longitudinal direction, and are secured to the elbows 8 8 at the rear end of the burner 1. To the other side of these rear elbows, 8 8, pipes 9 9, of smaller diameter, are secured, being held in the said couplings 8 8 by bushings 10 10. These pipes 9 9 extend forward to the front of the burner 1 and directly over the same, and have connected to their front ends the small feed-pipes 11 11, which are provided with valves 12 12, said pipes connecting with reservoirs of water and hydrocarbon oil. It will be observed that the diameters of the series of pipes increase from the feed-pipes 11 to the elbows 3 3, where the chamber is formed by the uniting of said elbows, and the burner 1 made somewhat smaller than the said chamber; also, as illustrated in Figs. 1 and 2, the pipes 9 9 are slightly inclined downward toward the couplings 8 8, and the pipes 6 6 have a like incline toward the front portion of the apparatus, where they are connected to the elbows 3 3. The pipes 6 6 and 9 9 are so arranged in relation to the burner 1 that the greatest heat may be brought to bear upon the same, at whatever angles they may be placed. The purpose of these details of construction will be more fully hereinafter described.

In Fig. 6 a modified form of the burner is illustrated. In this modification the said burner has an extension-pipe, 13, which has a suitable valve-opening, 14. This extended pipe 13 is adapted to supply the burner 1 with atmospheric air when it is desired.

In Fig. 7 a further modification of the burner is illustrated. In this modification the said pipe 1 is shortened, and has a small pipe, 15, secured thereto, and the gas as manufactured burns immediately at this point, and the flame is thus forced under the pipes with a greater flame and concentrated heat. This form of burner is especially adapted to be used in connection with blast-furnaces, throwing a steady and intense flame into said furnaces. With this form of pipe 1, having the burner 15 connected therewith, is used the extension 13, as shown. By this means of feeding the burner 15 with atmospheric air a considerable amount of force or pressure is given to the flame, at the same time extending the same. 16 16 are suitable gages on the feed-pipes 11, and 17 17 are suitable automatic cut-off valves.

The construction and arrangement of the apparatus having been fully carried out, as hereinbefore described, my improved process of manufacturing gas will be as follows: The fire having been started on the grate A', as shown in Fig. 1, or by a suitable source of heat placed under and between the end trestles, as shown in Fig. 2, the pipes are heated. When the pipes 6 6 and 9 9 attain a cherry-red heat, the valves 12 are slightly opened, one or both, as may be desired, and the water or oil allowed to gradually drop into the smaller pipes, 9 9, and be decomposed or converted into a gas. If either the water or the oil is first introduced—say, for illustration, the oil—a small quantity is allowed to drop into its pipe 9, and there be converted into a fixed gas. This pipe 9 being small causes the gas to have a considerable amount of pressure, due to the expansive effort of the same confined in a small space. In this state it then flows into the pipe 6, of greater diameter, through the elbow 8, and in this pipe it is again subjected to heat, and consequently its expansion and pressure increase. In this re-enforced condition it passes through one of the elbows 3 into the chamber formed by the uniting of said elbows, and thence passes into the burner 1 and through apertures 2 2, and becomes ignited by the source of heat, and it immediately becomes a source of heat in itself, producing a flame in the chamber about it, which greatly intensifies and aids the source of heat in keeping the pipes up to the proper degree of temperature. This step of the process may be pursued, though not necessary, in order to quicken and aid in keeping the pipes in a highly-heated state when the process will become continuous, using both oil and water. In ordinary practice, the pipes 6 6 and 9 9 being at the desired degree of temperature, the valves 12 are both slightly opened and oil and water allowed to drop gradually and intermittently into the pipes 9 9. As hereinbefore described, the oil will immediately be converted into a fixed gas and flow through the series of pipes of increasing diameters, with a resultant increase of pressure of the said gas until the partition 5 is reached at the point where the two elbows 3 3 unite and form the chamber C. As the water drops into its pipe 9, it is decomposed into gas. This gas expands and flows out of the small pipe 9 with considerable pressure into the pipe 6, through the elbow 8, and is heated to a still greater degree in this pipe, and its expansive force and pressure also increased, and from thence it flows through the elbow 3 down to the partition 5. The fixed gas produced from the hydrocarbon oil and the gas resulting from the decomposed water flow down through the oppositely-situated elbows 3, and strike against the partition 5 and flow into the enlarged chamber C, formed by the junction of the two elbows 3 3, and unite. The affinity which oxygen has for carbon and dydrocarbon gas causes the said oxygen and dydrocarbon gas to unite first, forming carbonic-oxide gas. The hydrogen then unites or is absorbed by this carbonic-oxide gas. The resulting compound gas passes into the burner 1, and may pass through the apertures 2 2 on each side of said burner, and be ignited and form a source of heat, or be carried through suitable pipes into a receiver and used for illuminating purposes.

In using the gas which flows into the burner

1 as a source of heat by ignition, no other source of heat is necessary to keep the pipes up to the required degree of temperature, as the heat resulting from said ignited gas is so intense as to keep said pipes at the required temperature.

By having the pipes 9 and 6 formed with a downward incline to the rear and front, respectively, any tendency to a backing of the fluid will be prevented. A further advantage of this inclined construction of the pipes is, that the oil or water will spread out more quickly, and thereby be more readily converted from the fluid into the gaseous forms, if any of the said oil or water should have a tendency to remain in liquid form.

As seen in Figs. 6 and 7, after the gas has been formed and passed into the burner 1, atmospheric air may be introduced into said gas through the extension 13. In this instance, as the gas and the atmospheric air commingle, the oxygen of the said atmospheric air passes into the center of the flame of the ignited gas passing through the apertures 2 2, and produces a more intense heat and a greater amount of pressure. This pressure may be increased or decreased, as may be desired, by providing the front end of the extended pipe 13 with a suitable valve or other regulating device, as 14.

The quantity of oil or water admitted to the pipes 9 9 through the pipes 11 11 may be ascertained by the gages 16 16, suitably situated on said pipes 11 or in connection with the valves 12.

It is obvious that the number of pipes 9 and 6 may be increased, if desired.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The herein-described process of manufacturing heating or illuminating gas from water and hydrocarbon oils, which consists in passing said water and oil separately through heated pipes of increasing diameters, and thus subjecting the vapors therein formed to continuous and increasing expansion until said fluids are separately converted into gases, then combining said gases in a common heated mixing-chamber, thereby forming a fixed gas.

2. In an apparatus for manufacturing heating or illuminating gas from water and hydrocarbon oils, the combination of a heating-chamber, water and oil supply pipes, two or more series of longitudinal pipes of differing diameters, for converting the water and hydrocarbon oil into gases, and a mixing chamber or receptacle, substantially as described.

3. In an apparatus for manufacturing heating or illuminating gas from water and hydrocarbon oils, the combination of a heating-chamber, water and oil supply pipes having suitable cocks to regulate the flow of the fluids therethrough, two or more series of longitudinal pipes of differing diameters, for converting the water and oils into gases, a mixing-chamber, and a burner for supplying the necessary heat, substantially as described.

4. In an apparatus for manufacturing heating or illuminating gas from water and hydrocarbon oils, the combination of a heating-chamber, water and oil supply pipes, two or more series of longitudinal pipes of differing diameters, and having a rearward and forward downward incline, for converting the water and hydrocarbon oil into gases, a mixing chamber or receptacle, and a burner having an air-ingress in its front portion, substantially as described.

5. In an apparatus for manufacturing heating and illuminating gases from water and hydrocarbon oils, the combination of a heating-chamber, water and oil supply pipes having suitable cocks and gages to regulate and indicate the flow of the liquids therethrough, two or more series of longitudinal pipes of differing diameters, for converting the water and oils into gases, and uniting in a mixing-chamber, said series of pipes being arranged above a burner at suitable angles, substantially as described.

6. In an apparatus for manufacturing heating and illuminating gases from water and hydrocarbon oils, the combination of a heating-chamber, water and oil supply pipes 11 11, having valves 12 and gages 16, for regulating and indicating the flow therethrough, two or more series of pipes, 9 and 6, of differing diameters, for converting the water and oils into gases, a common mixing-chamber, and a burner, 1, having apertures 2 2, substantially as described.

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

JAMES ROBERTS.

Witnesses:

EDWARD L. MILLS,
L. SEWARD BACON.