

No. 617,785.

Patented Jan. 17, 1899.

W. L. TETER.

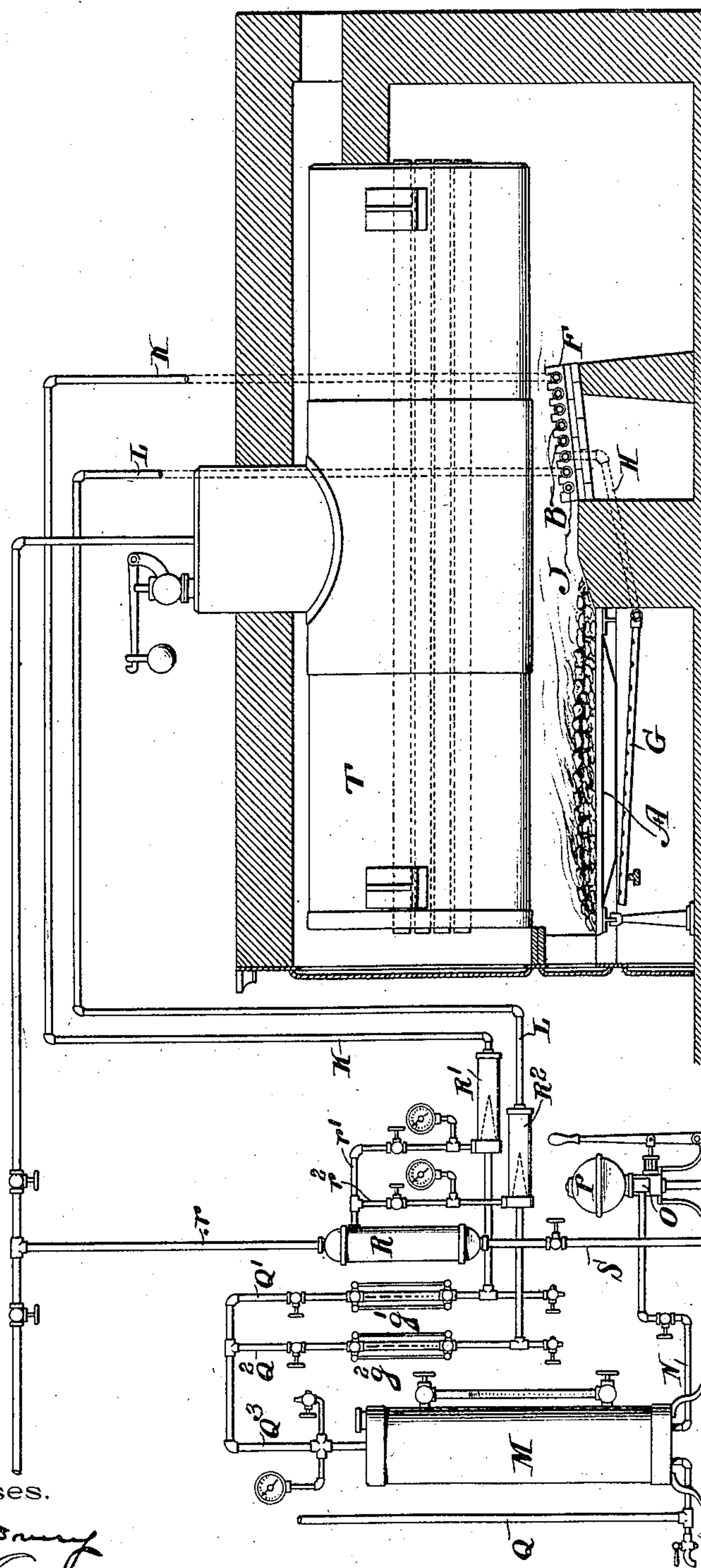
APPARATUS FOR GENERATING AND UTILIZING GASEOUS FUEL.

(Application filed Oct. 30, 1897.)

(No Model.)

4 Sheets—Sheet 1.

Fig. 1.



Witnesses.

Samuel D. Dwyer
Thos. H. Dwyer

Inventor.

Wm. L. Teter

By *Wm. L. Teter*
Attorney.

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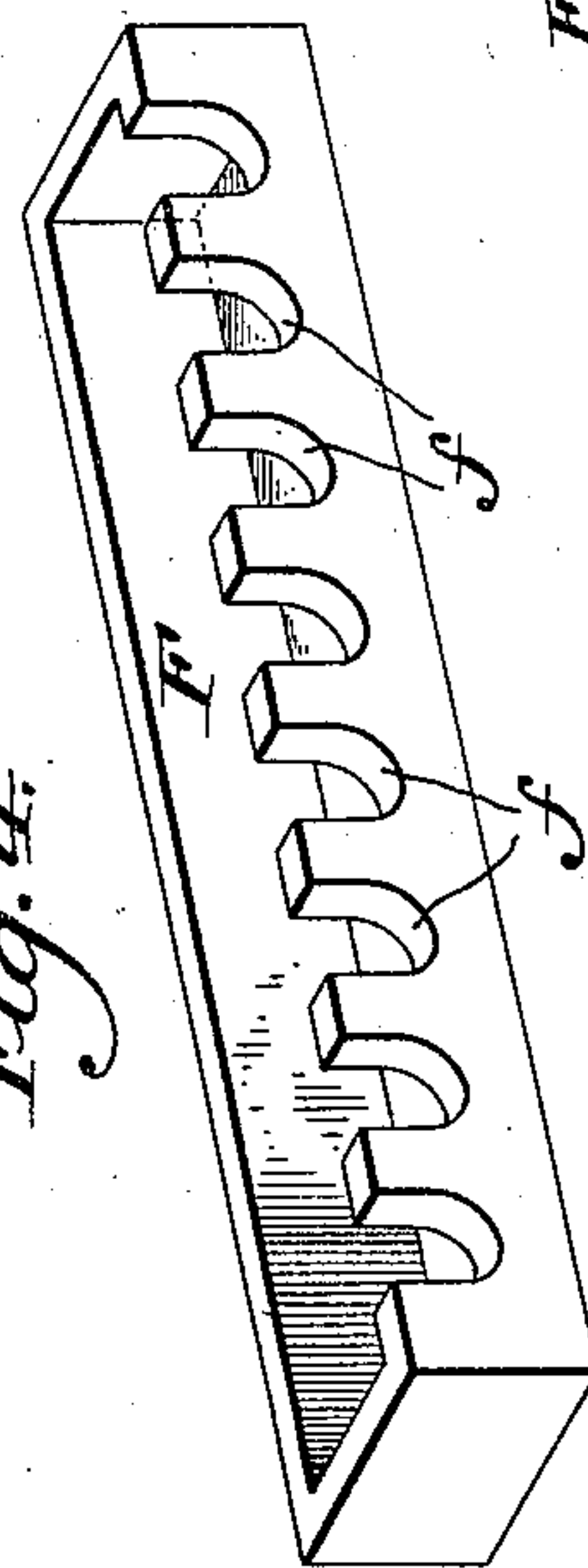
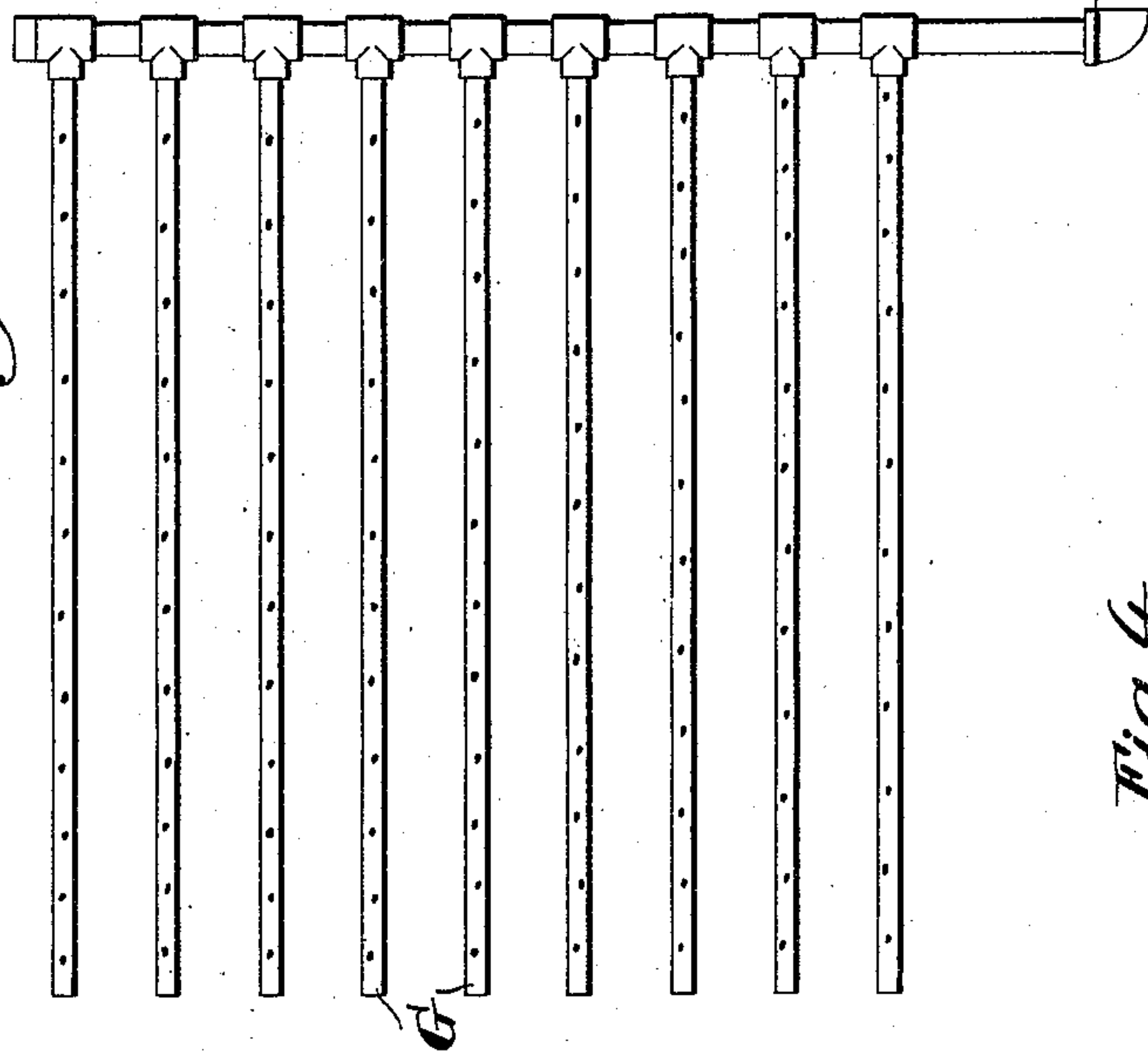
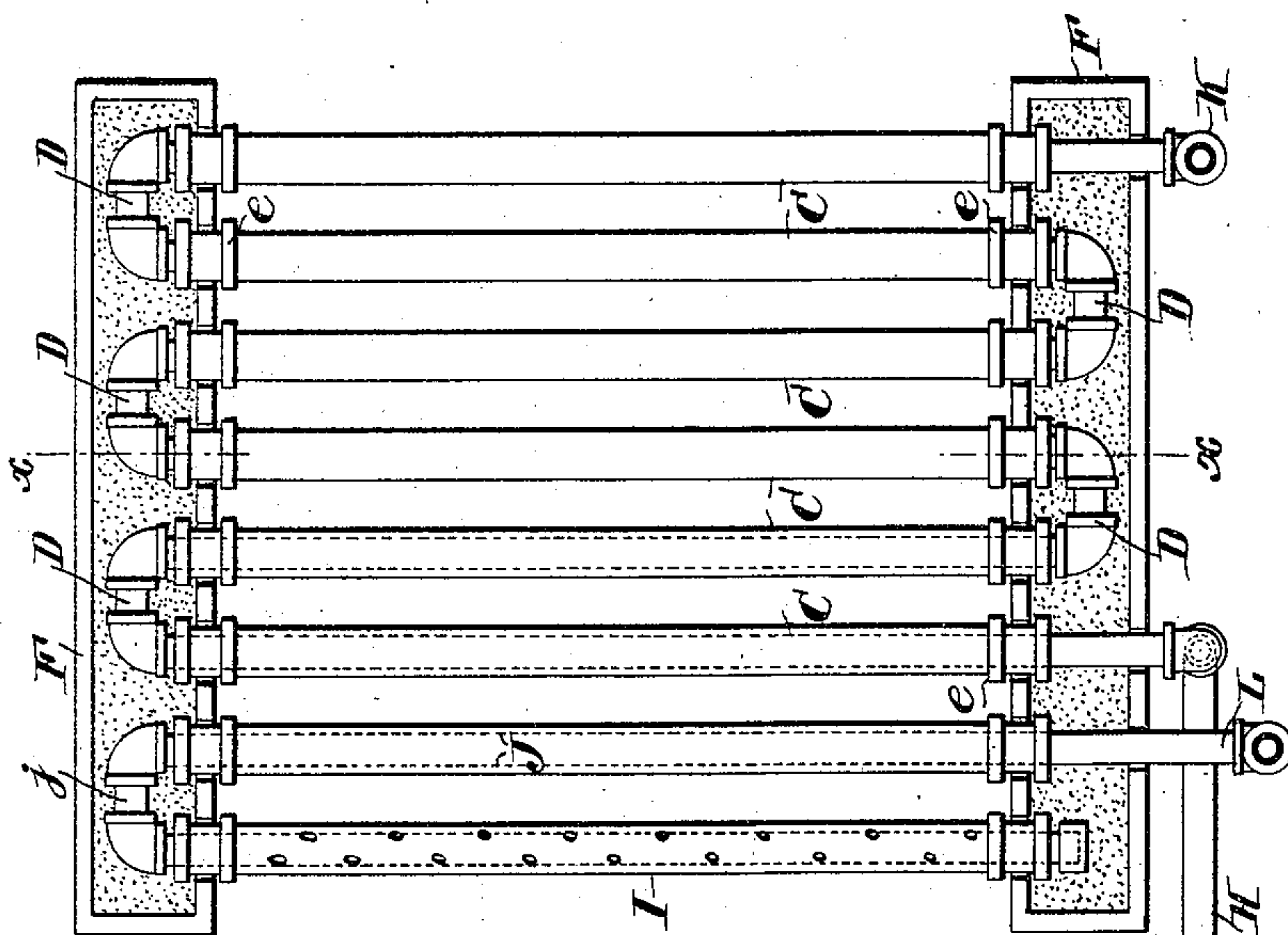
W. L. TETER.

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(Application filed Oct. 30, 1897.)

(No Model.)

4 Sheets—Sheet 2.



Witnesses.

Benny Dring
M. H. Evans

Wm. H. Sears

Inventor.

Wm. L. Teller

By John M. Smith

Attorney.

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W. L. TETER.

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Fig. 5.

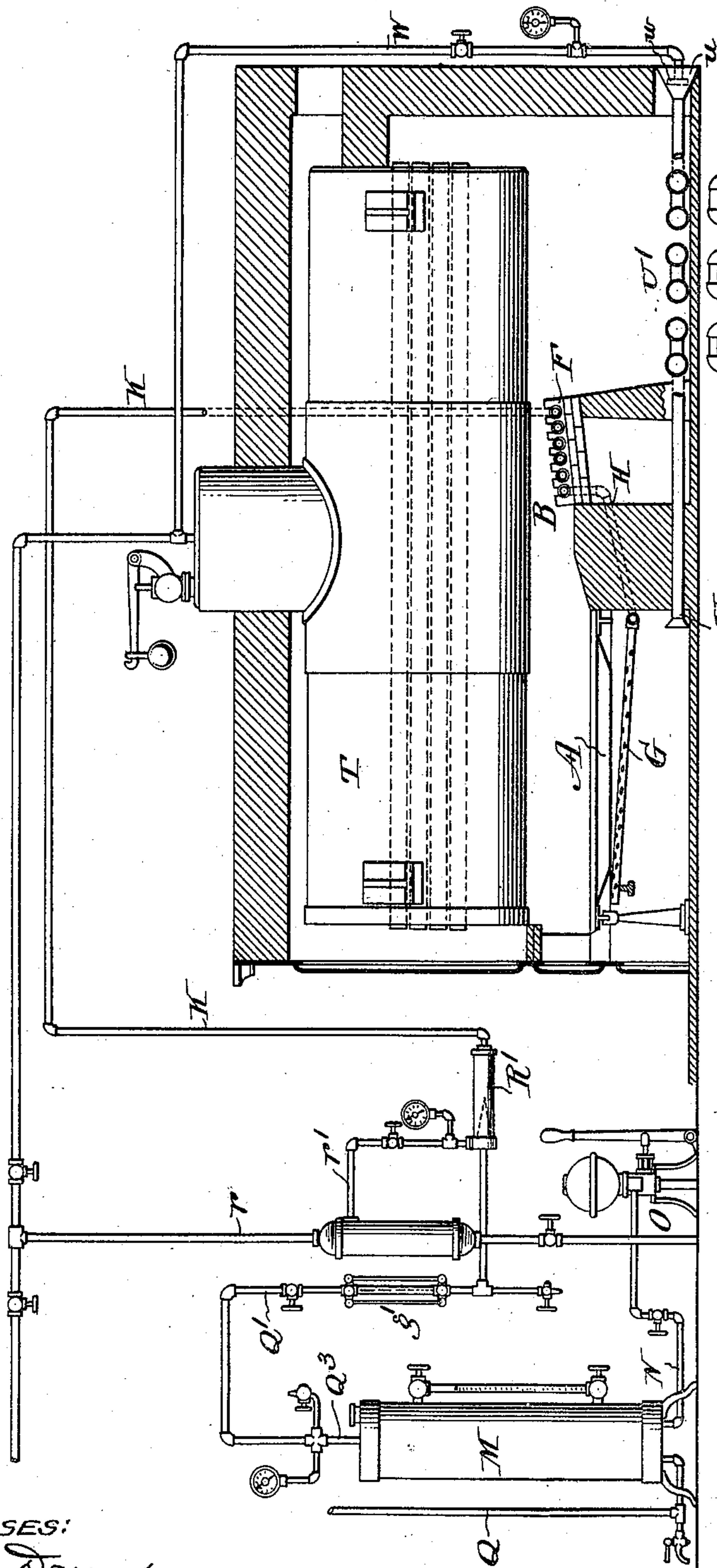


Fig. 2.

Fig. 6.



WITNESSES:
Henry Drury
M. L. Teter

INVENTOR:
W. L. Teter
By *[Signature]*
att'y.

No. 617,785.

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W. L. TETER.

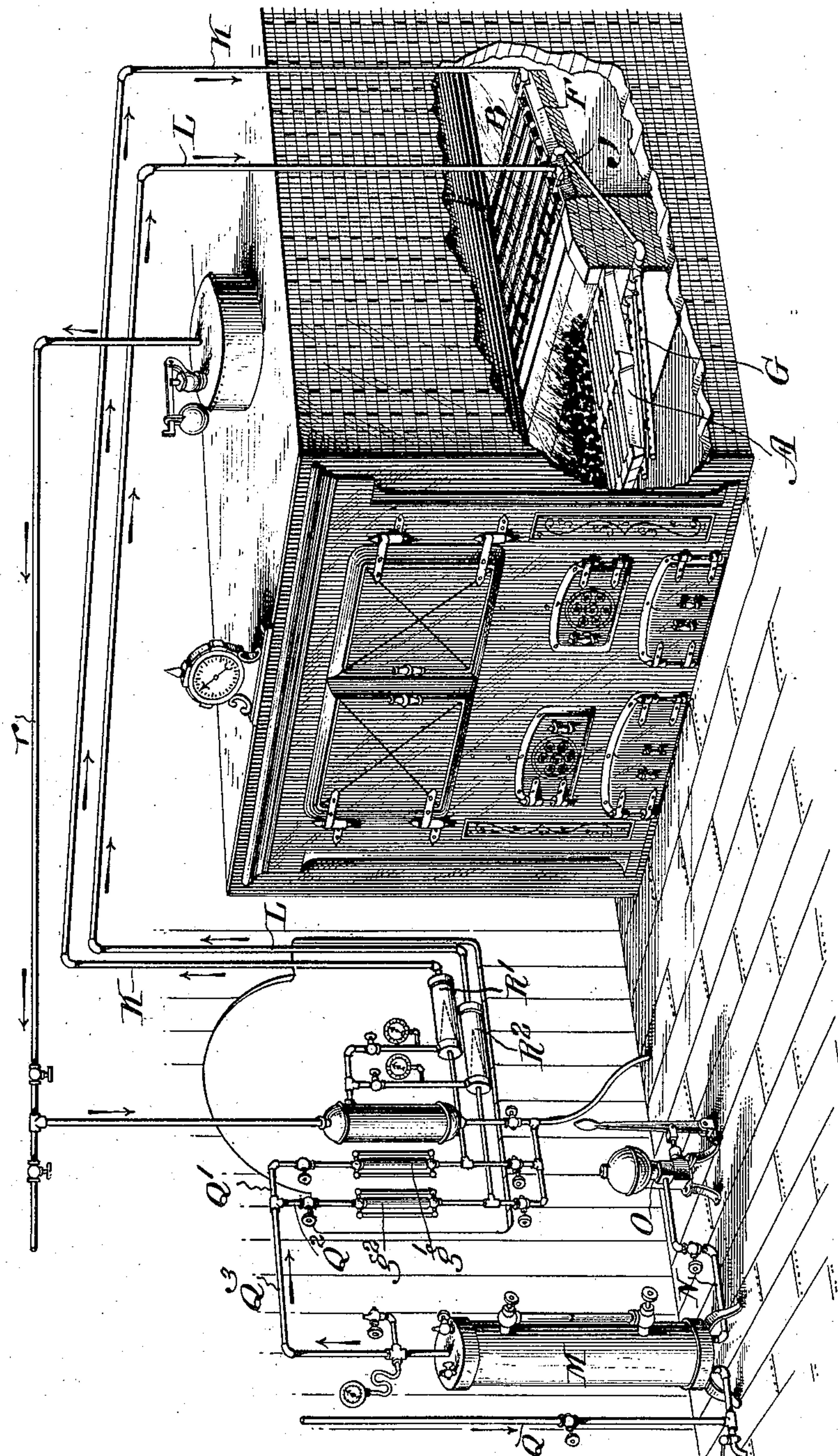
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(No Model.)

4 Sheets—Sheet 4.

Fig. 8.



WITNESSES:

Henry D. Dwyer
Wm. H. Evans

INVENTOR:

Wm. L. Teter
By *[Signature]*
att'y.

UNITED STATES PATENT OFFICE.

WILLIAM L. TETER, OF PHILADELPHIA, PENNSYLVANIA.

APPARATUS FOR GENERATING AND UTILIZING GASEOUS FUEL.

SPECIFICATION forming part of Letters Patent No. 617,785, dated January 17, 1899.

Application filed October 30, 1897. Serial No. 656,887. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. TETER, of the city and county of Philadelphia, State of Pennsylvania, have invented an Improvement in Apparatus for Generating and Utilizing Gaseous Fuel, of which the following is a specification.

My invention relates to apparatus for generating and utilizing gaseous fuel; and it consists of the improvements which are hereinafter fully described and claimed, reference being had to the accompanying drawings.

The objects of this invention are to provide a furnace for burning ordinary fuel with means to insure a complete combustion of the fuel and thereby to obtain a greater and more uniform heat, to increase the intensity of the heat by the utilization of gaseous fuel in addition to the ordinary fuel employed, and to effect the consumption of the smoke or unburned particles of fuel in the products of combustion.

The complete combustion of ordinary fuel renders the generation of heat much more economical, enables inferior and cheaper grades of coal to be used, and avoids the formation of "clinkers" or imperfectly-consumed portions of fuel.

In furnaces in which more or less rarefied fuel—such, *e. g.*, as steam and vaporized hydrocarbon—has been fed into a retort so located as to be directly subjected to the products of combustion arising from the consumption of the fuel on the grate and thereby raised to a high degree of heat, whereby the oil and steam are more or less decomposed into volatile gases which are supplied to the body of incandescent fuel on the grate by burners located under it, more or less difficulty has been experienced in constructing a retort capable of withstanding the great heat to which it is subjected and possessing a sufficient capacity for contraction and expansion without injury or loosening of the joints.

A part of the present invention relates to the construction of a retort whereby it is enabled to expand and contract to the required extent without injury and to withstand the intense heat to which it is subjected.

Another part of my invention relates to the employment of a smoke-consumer for consuming the smoke or unburned portions of the

products of combustion and to the construction thereof, whereby gaseous fuel may be utilized and the consumer may be directly subjected to the products of combustion of the fuel on the grate without liability to become injured or loosened at the joints by contraction and expansion or the intense heat to which it is subjected.

My invention also relates to means for supplying a forced draft of heated air or air and superheated steam to the fuel on the grate to assist the gaseous fuel supplied by the burners in effecting the complete combustion thereof.

A part of the present invention relates to improvements upon the apparatus described in my Letters Patent No. 499,054, dated June 6, 1893, in which is described an apparatus employing a gas-generating chamber located in the rear of the grate, so as to be directly subjected to the products of combustion arising therefrom, and a burner communicating with said generator and extending under the grate.

In the accompanying drawings, Figure 1 is a side elevation of a furnace embodying my invention, with the incasing brickwork in longitudinal section to expose the interior. Fig. 2 is a plan view, enlarged, of the retort-burners and smoke-consumer. Fig. 3 is a transverse sectional view of the retort on the line *x x* of Fig. 2. Fig. 4 is a perspective view of one of the retort-supporting frames. Fig. 5 is a side elevation, similar to Fig. 1, illustrating a modification. Fig. 6 is a longitudinal sectional view of one of the retort-tubes, illustrating a modification thereof. Fig. 7 is a plan view of the coil through which a forced draft may be supplied to the furnace-grate; and Fig. 8 is a perspective view of the furnace illustrated in Fig. 1, with part of the incasing brickwork broken away to expose the interior.

A is the ordinary furnace-grate.

B is the retort, located in the rear of the grate. This retort consists of a tubular structure and is preferably composed of a series of transversely-arranged tubes C, united at their ends by couplings D and forming a substantially unitary structure. In my preferred construction the retort-tubes C consist of ordinary wrought-iron tubes having a protecting-sheathing. This sheathing is shown in Fig. 3 as a continuous cast-iron sheath E, and in Fig. 6 it is shown as a series of cast-

iron sleeves or rings E' to permit of expansion and contraction and to avoid the liability of the retort-tubes to crack, owing to the inequality of the expansion of wrought and cast iron. In the latter case the spaces between the rings or sleeves E' may be filled with crucible clay or other refractory material, as indicated at e'. In this way the retort-tubes will be able to withstand the intense heat to which they are to be subjected without liability of cracking.

F F are supporting frames or boxes, of metal or refractory material, resting on fire-brick supports in which the couplings D of the retort-tubes are supported. I have shown the boxes F F provided with notches f on their inner faces adapted to receive flanged collars e on the ends of the retort-tubes. The couplings D within the boxes F are covered with or embedded in crucible clay or other refractory material and are thus protected from injury. The boxes F F may move to and from each other when the retort-tubes expand or contract, so that the retort will not be subjected to strain or be liable to become weakened or injured at the joints.

G are burners located under the grate A and communicating with the retort B by a pipe H.

K is a pipe communicating with the retort B, by means of which highly-inflammable fuel, such as oil in a more or less rarefied condition, is supplied thereto.

R' is an ejector connected with the pipe K, by means of which the oil is supplied through the pipe K to the retort. The ejector is connected, as by a supply-pipe Q', with the source of oil-supply. Steam is supplied to the ejector by a pipe r', leading from a supply-pipe r, communicating with the steam-boiler T or other source of steam-supply. I have shown the pipe r' communicating with the pipe r through a steam-chamber R.

The oil in a more or less vaporized condition mixed with steam is fed by the ejector R' through the pipe K to the retort B, where, being subjected to intense heat, it is converted with the steam into volatile gases, which pass through the pipe H to the burners G, where they escape and pass up into the body of incandescent fuel upon the grate A and are consumed partly therein and partly in the space above the grate, thereby greatly increasing the combustion of the fuel and adding to the intensity of the heat.

I is a smoke-consumer located in the rear of the grate A and adapted to consume the unburned particles which escape from the fuel in the form of smoke. This smoke-consumer is so located that it will be directly subjected to the products of combustion arising from the consumption of fuel on the grate A, whereby it will be raised to an intense heat, and inflammable fuel, such as steam and oil, in a more or less rarefied condition supplied to it may be composed to a greater or less extent into volatile gases, which are allowed to

escape into the products of combustion and be consumed therewith to burn the unburned particles of fuel escaping in the form of smoke. This smoke-consumer preferably consists of a closed portion or receptacle, into which the rarefied oil and steam are introduced and in which they are converted wholly or partly into volatile gases, and a perforated portion connected therewith, into which the volatile gases pass and from which they escape. As shown, this smoke-consumer consists of a perforated pipe I, supported at its ends by the frames F F and connected by a coupling j with a closed tube or receptacle J, similarly supported. The ends of the pipes I J and their coupling may be supported in the frames or boxes F F and protected by fire-clay in a manner similar to the ends of the retort-tubes C C and their couplings D.

L is a pipe leading to the smoke-consumer and connected with an ejector R², to which oil and steam are supplied through supply-pipes Q² and r² in a manner similar to that in which the oil and steam are supplied to the ejector R'. The mixed oil and steam in a more or less rarefied condition is thus fed by the ejector R² through the pipe L to the smoke-consumer, and being decomposed in the pipe J emerge from the burner I in the form of volatile gases, which are ignited by the flames from the grate and burning with an intense heat act to consume the unburned particles escaping in the form of smoke.

The oil (usually ordinary hydrocarbon oil) may be supplied to the ejectors in any convenient manner. To insure a steady and uniform supply of oil without the necessity of operating a pump continuously, I prefer to employ the following devices:

M is a tank communicating by a pipe N with a force-pump O, by which a quantity of oil may be pumped from a reservoir into the tank.

Q is a water-pipe by which water under pressure may be supplied to the tank M.

Q³ is a pipe leading from the tank M and having two branches Q' Q² leading to the injectors R' R², respectively. Sight-gages g' g² may be interposed in the pipes Q' Q² to show the passage of the oil.

R is a steam-chamber to which steam is supplied by the pipe r and from which it is supplied to the ejectors R' R² by the pipes r' r², respectively.

S is a drip-pipe from the steam-chamber.

Oil is supplied by the pump O to the tank M, to which water under pressure is admitted by the pipe Q. The oil floats on the top of the water and is forced by hydrostatic pressure into the pipe Q³, whence it is drawn by the injectors R' R² through the pipes Q' Q² and is forced in a finely-divided condition into the pipes K and L. As the oil is drawn by the injectors R' R² it becomes divided and falls in drops, and is therefore in condition to be more readily atomized or finely divided by the action of the injectors.

In the construction shown in Fig. 5 the smoke-consumer J is omitted, and a forced draft of superheated steam and air is supplied to the furnace under the grate.

U is a blast-pipe opening under the grate A and burners G and communicating with a funnel-inlet *u* communicating with the external air.

W is a steam-pipe leading from the boiler or other source of supply and provided with a nozzle *w* in the funnel-inlet *u*, by means of which a forced draft of air and steam is forced through the inlet *w* into the pipe U.

U' is a superheating-coil located within the furnace and interposed between the inlet *u* and outlet of the blast-pipe, through which the air and steam pass and become superheated before being supplied to the grate. This forced draft of air and superheated steam mingling with the volatile gases supplied from the burners G assists in producing a complete combustion of the fuel on the grate and a more intense heat.

The details of construction which have been shown for the purpose of illustrating my invention may be varied without departing from it.

What I claim as new, and desire to secure by Letters Patent, is as follows:

1. In apparatus for generating and utilizing gaseous fuel, the combination with the grate, of a retort, located adjacent thereto so as to be directly subjected to the products of combustion therefrom, and composed of a series of tubes coupled together at their ends, supporting-frames independent of one another supporting the ends of said tubes, means to supply steam and oil to said retort, and a burner located immediately under the grate and communicating with the retort.

2. The retort for generating gaseous fuel, consisting of a series of tubes C united at their ends by couplings D, and the supporting-frames F, F, each independent of the other supporting the ends of said tubes and containing said couplings.

3. The retort for generating gaseous fuel, consisting of a series of tubes C united at their ends by couplings D, and the supporting-frames F, F, each independent of the other supporting the ends of said tubes and containing said couplings, and fire-clay located in said boxes by which said couplings are covered.

4. The retort for generating gaseous fuel, consisting of a series of tubes C sheathed in cast-iron jackets and united at their ends by couplings D, and the supporting-frames F, F, each independent of the other supporting the ends of said tubes and containing said couplings.

5. The retort for generating gaseous fuel, consisting of a series of tubes C sheathed in jackets each composed of a series of independent cast-iron rings, and coupled together at their ends.

6. The retort for generating gaseous fuel,

consisting of a series of tubes C sheathed in jackets each composed of a series of independent cast-iron rings with a sheathing layer of refractory material between adjacent rings, and coupled together at their ends.

7. In apparatus for generating and utilizing gaseous fuel, the combination with the grate, of a retort, located adjacent thereto so as to be directly subjected to the products of combustion therefrom, and composed of a tubular structure, supporting-frames independent of one another supporting the ends of said tubular structure and having provision for movement relatively to one another under the action of the contraction and expansion of the tubular retort, and a burner located under the grate and communicating with the retort.

8. In apparatus for generating and utilizing gaseous fuel, the combination with the grate, of a retort, located adjacent thereto so as to be directly subjected to the products of combustion therefrom, and composed of a series of tubes united at their ends by couplings, supporting-frames independent of one another supporting the ends of said tubes and having provision for movement relatively to one another under the action of the contraction and expansion of the tubular retort, refractory material carried by said frames, by which the couplings of said tubes are covered, and a burner located under the grate and communicating with the retort.

9. In apparatus for generating and utilizing gaseous fuel, the combination with the grate, of a retort, located adjacent thereto so as to be directly subjected to the products of combustion arising therefrom, and consisting of a tubular structure, burners located under the grate and connected with the retort, a smoke-consumer embracing a perforated tube or receptacle, also located above the grate and adjacent to the retort so as to be subjected to the products of combustion arising from the grate, and means to supply a highly-inflammable fuel, such as rarefied hydrocarbon, to said smoke-consumer.

10. In apparatus for generating and utilizing gaseous fuel, the combination with the grate, of a retort, located adjacent thereto so as to be directly subjected to the products of combustion arising therefrom, and consisting of a tubular structure, supporting-frames supporting the ends of said tubular structure, burners located under the grate and connected with the retort, a smoke-consumer consisting of a tubular structure embracing a perforated tube, located above the grate and adjacent to the retort so as to be subjected to the products of combustion arising from the grate, and supported by the frames which support the retort, and means to supply a highly-inflammable fuel, such as rarefied hydrocarbon, to said smoke-consumer.

11. In apparatus for generating and utilizing gaseous fuel, the combination with the grate, of a smoke-consumer, located adjacent

thereto so as to be directly subjected to the products of combustion arising therefrom, and consisting of a tubular structure embracing a perforated tube, and supporting-frames supporting the ends of said tubular structure and having provision for movement relatively to one another to permit expansion and contraction of the tubular structure.

12. In apparatus for generating and utilizing gaseous fuel, the combination with the grate, of a smoke-consumer, located adjacent thereto so as to be directly subjected to the products of combustion arising therefrom, and consisting of a tubular structure embracing a perforated tube, supporting-frames supporting the ends of said tubular structure and having provision for movement relatively to one another to permit expansion and contraction of the tubular structure, and refractory material carried by said supporting-frames and covering the ends of said tubular structure.

13. In apparatus for generating and utilizing gaseous fuel, the combination of a retort consisting of a tubular structure, a smoke-consumer also consisting of a tubular structure and embracing a perforated tube for the escape of gases, and supporting-frames supporting the ends of said tubular structures

and free to move to and from each other under the expansion and contraction thereof.

14. In apparatus for generating and utilizing gaseous fuel the combination of a retort consisting of a closed tubular structure B, a second tubular structure independent of the first embracing a perforated tube or portion, and supporting-frames, supporting the ends of said tubular structures and free to move to and from each other under the expansion and contraction thereof.

15. In apparatus for generating and utilizing gaseous fuel the combination of a retort consisting of a closed tubular structure B, a second tubular structure independent of the first embracing a perforated tube or portion, supporting-frames, supporting the ends of said tubular structures and free to move to and from each other under the expansion and contraction thereof, and means for supplying a highly-inflammable fuel, such as rarefied oil and steam, to each of said tubular structures.

In testimony of which invention I hereunto set my hand.

WILLIAM L. TETER.

Witnesses:

ERNEST HOWARD HUNTER,
J. W. KENWORTHY.