No. 714,117. Patented Nov. 18, 1902.

W. F. STEELE.

GAS MAKING APPARATUS.

(Application filed Apr. 10, 1902.)

(No Model.) 3 Sheets—Sheet 1.

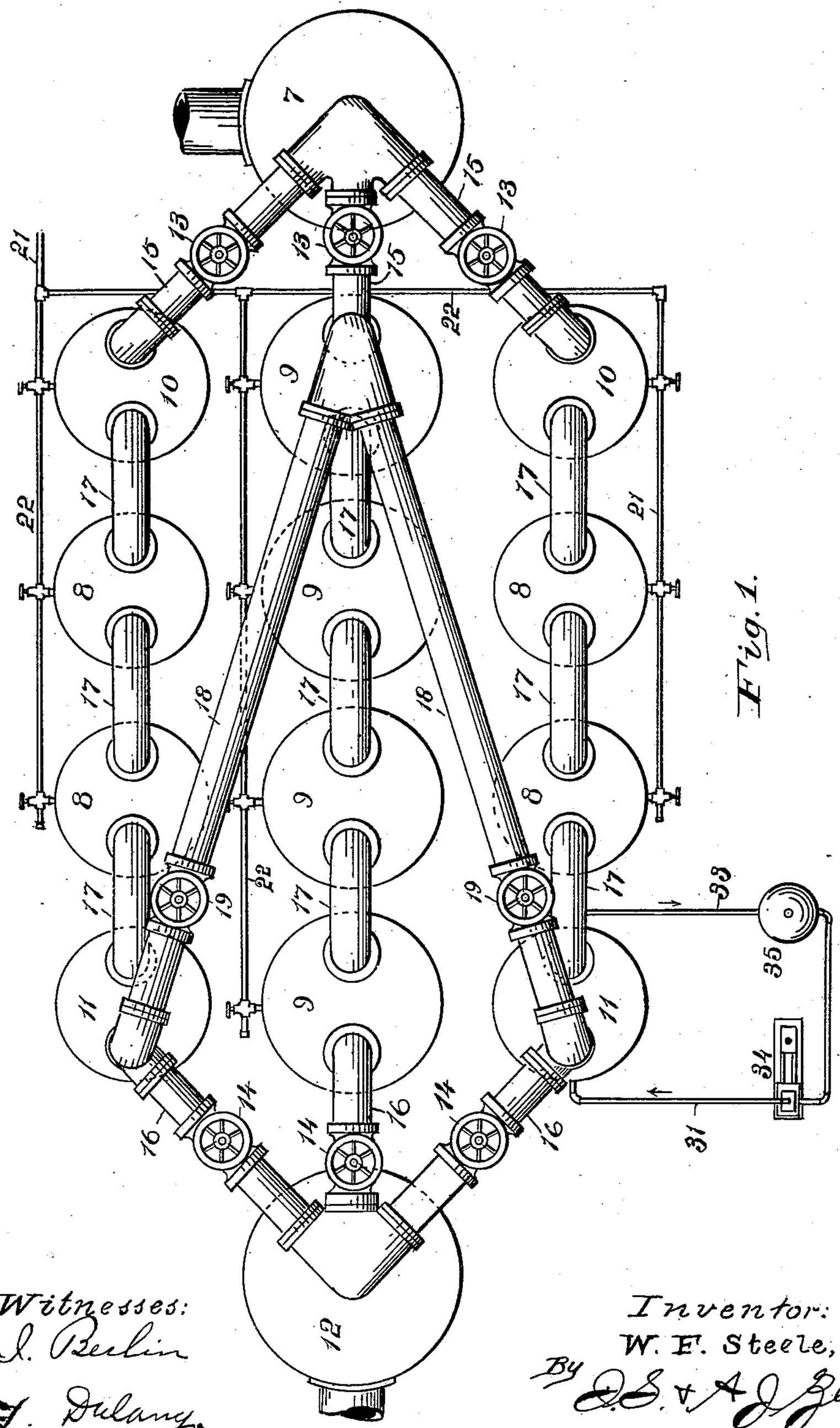

Fig. 1.

Witnesses:
J. L. Berlin
C. F. Dulany.

Inventor:
W. F. Steele,
By O. S. & A. J. Gerk
Atty's.

No. 714,117. Patented Nov. 18, 1902.

W. F. STEELE.

GAS MAKING APPARATUS.

(Application filed Apr. 10, 1902.)

(No Model.) 3 Sheets—Sheet 2.

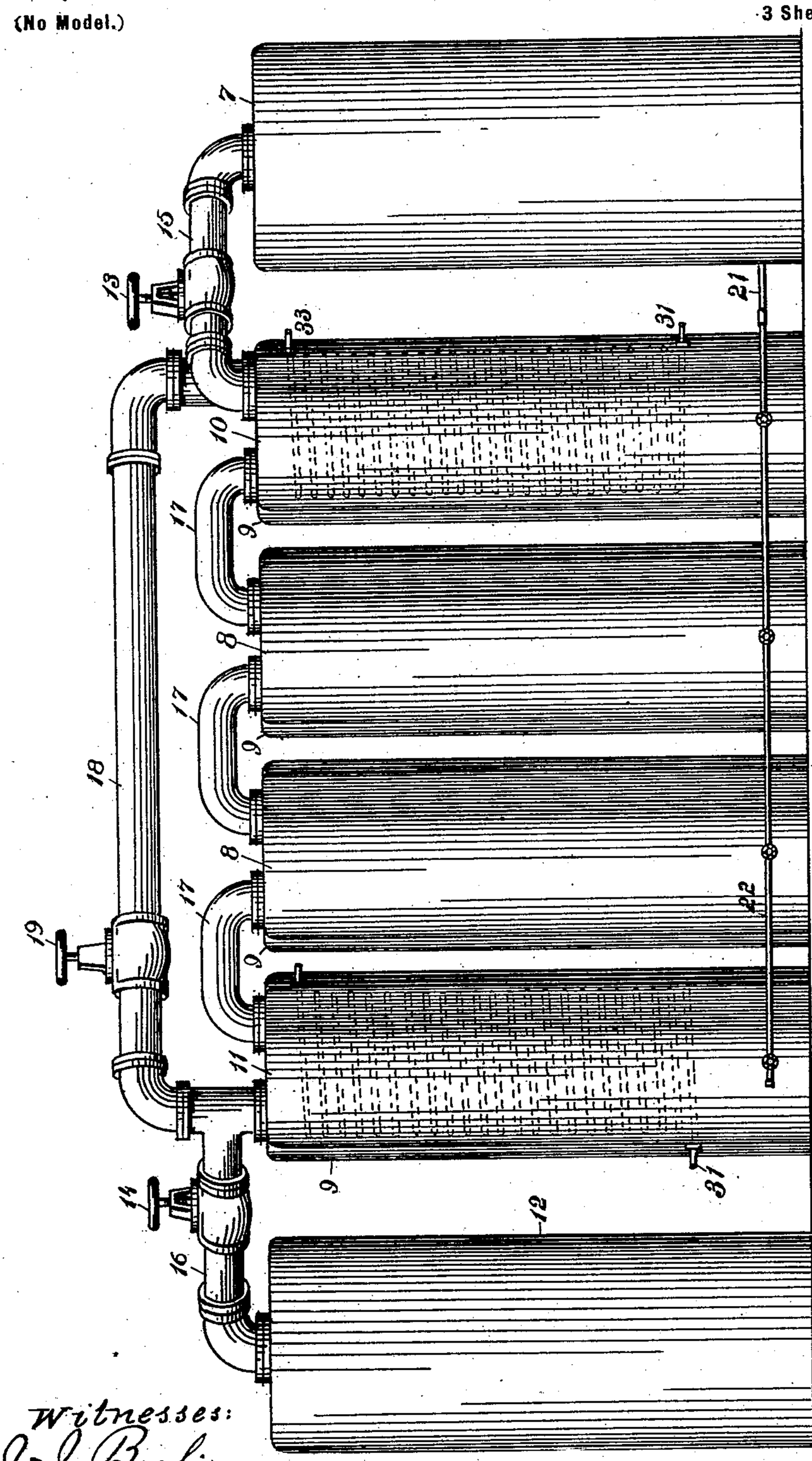

Fig. 2.

Witnesses:
J. L. Berlin
C. F. Dalany

Inventor:
W. F. Steele,
By J. L. & J. Berlin
Atty's.

No. 714,117. Patented Nov. 18, 1902.

W. F. STEELE.

GAS MAKING APPARATUS.

(Application filed Apr. 10, 1902.)

(No Model.) 3 Sheets—Sheet 3.

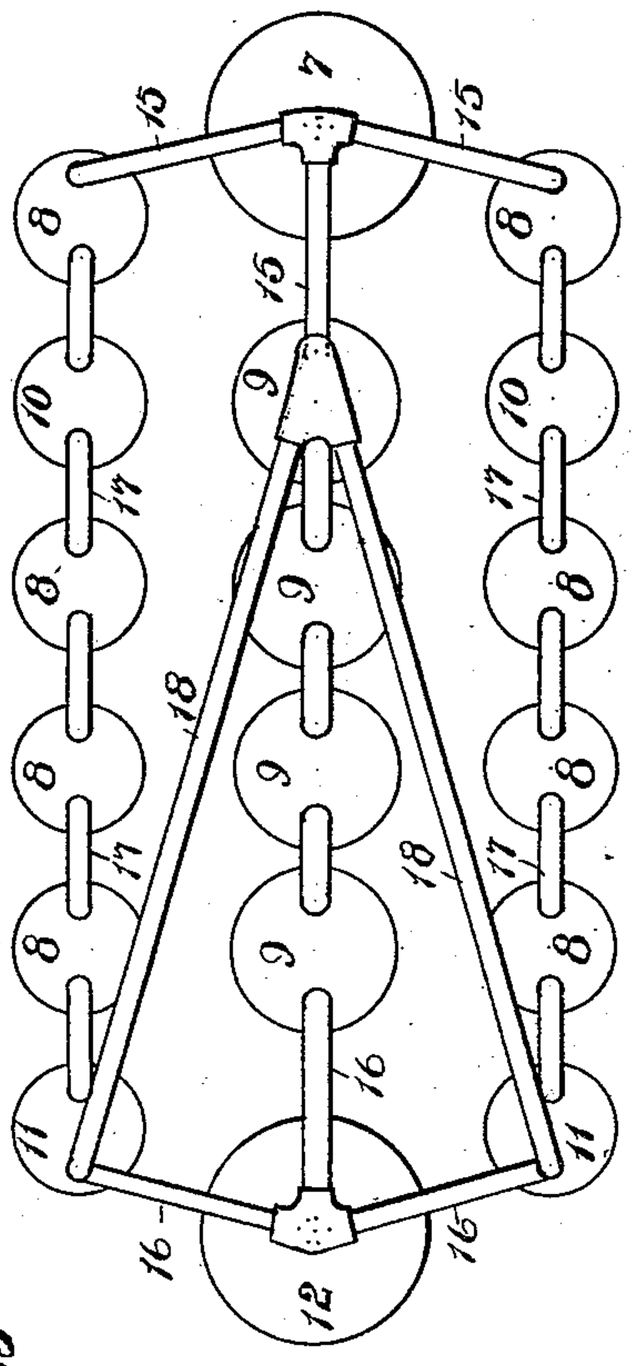

Fig. 4.

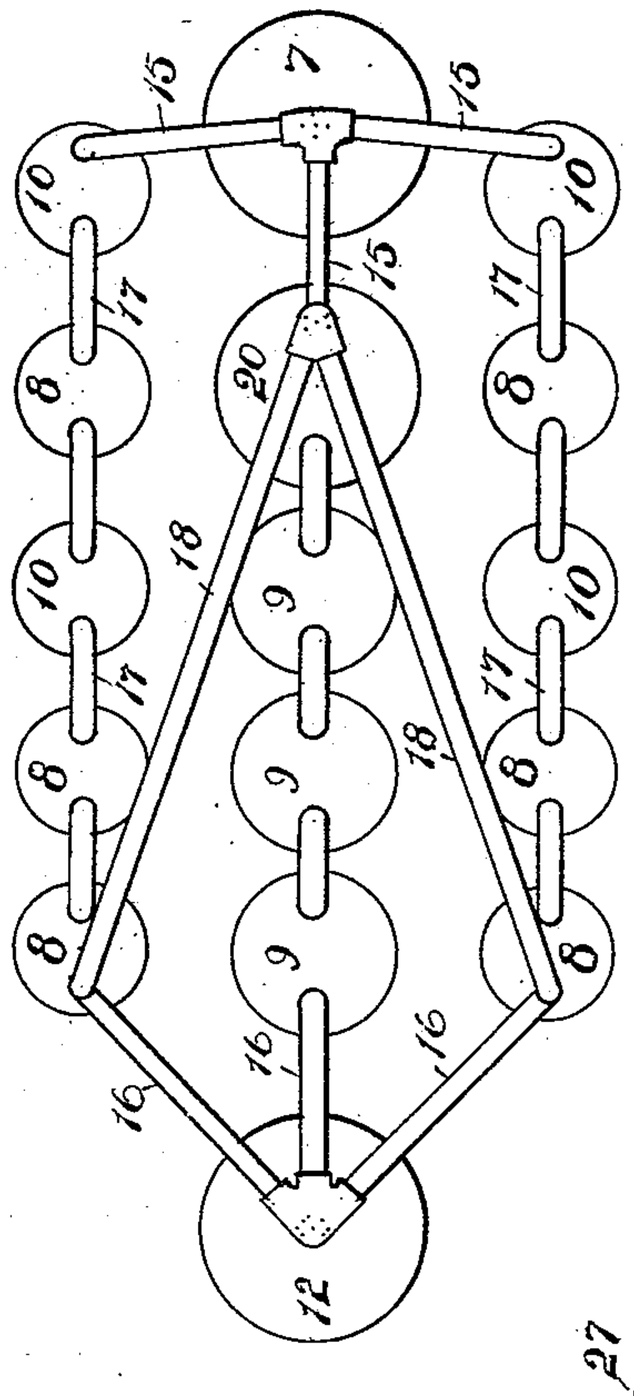

Fig. 5.

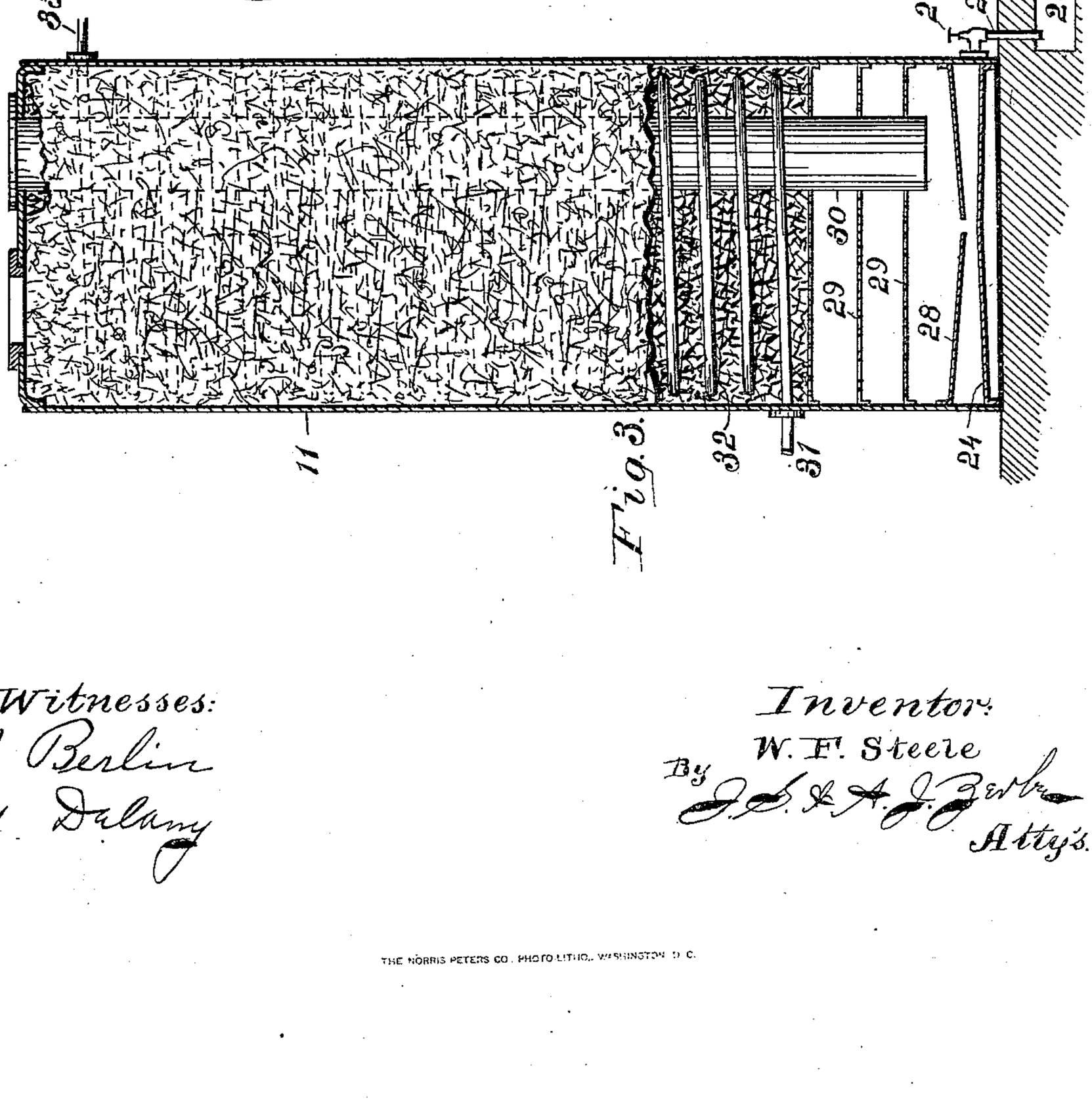

Fig. 3.

Witnesses:
J. L. Berlin
C. F. Dalany

Inventor:
W. F. Steele
By J. L. & A. J. Berlin
Atty's.

UNITED STATES PATENT OFFICE.

WILBUR F. STEELE, OF NEW YORK, N. Y., ASSIGNOR TO ACME GAS COMPANY, OF NEW YORK, N. Y., A CORPORATION.

GAS-MAKING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 714,117, dated November 18, 1902.

Application filed April 10, 1902. Serial No. 102,314. (No model.)

To all whom it may concern:

Be it known that I, WILBUR F. STEELE, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Gas-Making Apparatus, of which the following is a specification.

My invention relates to improvements in gas-making apparatus, and it has particular reference to that class of machines which use the lighter hydrocarbon oils; and the object is to obtain an absolute means of utilizing all the hydrocarbon vapor in the oil and to utilize what are termed the "low-grade" oils, or that product of the distillate of petroleum which has not heretofore been made available in the manufacture of gas.

The invention consists in employing a plurality of sets of carbureters which are connected up with each other, and each set of carbureters is connected up with a common air-supply pipe at one end and with a common gas-discharge pipe at the other end, this feature being well known in the arts as practiced by me and as such is well adapted to make gas from the higher-grade oils; but in order to utilize the lower grades of oil I employ in connection with these sets of carbureters, first, a heating and cooling means intermediate in the carbureting process, and, second, in providing a means whereby the air in the process of carburetion is diverted, so that the entire volume of the gas eventually produced will pass through a final series of carbureters, thus not only thoroughly drying the gas produced, but effectually purifying it and preventing stratification, as will now be set forth in detail.

In the drawings, Figure 1 is a plan view of my system for making gas. Fig. 2 is a side elevation of the same. Fig. 3 is a central vertical section of the cooling or heating chamber, and Figs. 4 and 5 are diagrammatic plan views of different structural methods of arranging and disposing of the carbureters and cooling and heating cylinders and the method of conducting the carbureted air through the system.

In the several figures, 7 represents the initial heater, which receives the air from a pressure-blower, (not shown;) 8 9, the ordinary carbureting-chambers; 10, the intermediate heaters or heated carbureters; 11, the cooling-chambers, and 12 the scrubber from which the manufactured gas finally issues.

The carbureting-chambers may be made in any manner best adapted to the purpose, as this invention has no bearing on their structural character, nor has the invention any reference to the construction of the initial heater, such as is usually employed in a system of this kind, or to the scrubber.

In the present invention I prefer to employ the well-known disposition and arrangement of the carbureters, in which three sets of carbureters are placed side by side, all being connected up in common with the initial heater 7 and with the scrubber 12, each set of carbureters having a valve 13 intermediate the initial heater and first carbureter of each series and also a valve 14 at the end of each set in the pipe leading to the scrubber.

The object of the heating-chamber 7 is to provide air at a high temperature—say from 120° to 140°—and the office of the scrubber is to eliminate the moisture and purify the gas, as in the ordinary gas-making apparatus.

In practice the central set of carbureters 9 are diametrically larger than the carbureters 8 in the other sets for reasons which will be explained hereinafter. I show in Fig. 1 four of these carbureters 9 in the central set and four cylindrical shells in the two outer sets, of which the two intermediate cylinders 8 8 are ordinary carbureters, while the first, 10, of each set is a carbureter with a heating-coil therein, and the last, 11, of each set is a cooling-chamber. It is obvious, however, that I need not confine myself to this specific number of cylinders—as, for instance, in Fig. 4 I show in the exterior row six shells. In either case, however, the design is to place within the train of carbureters one or more heaters and also intermediate the heater and the scrubber one or more cooling-chambers.

Pipes 15 connect the initial heater 7 with the carbureters 9 and carbureting-heaters 10 at one end of the system, and pipes 16 connect the scrubber 12 with the final central

carbureter 9 and with the coolers 11, while the pipes 17 connect the different cylinders in series in the ordinary manner.

It will be observed that each of the three series or sets of cylinders is connected up at one end with the initial heater 7 and at the other end with the scrubber 12, such construction being well known in the art. In addition to this I also connect the two outer series of cylinders with the intermediate series by pipes 18, this connection extending from the last cylinder 11 of the outer series to the first cylinder 9 of the intermediate series, each pipe having a valve 19. The object of this return connecting-pipe is to subject the carbureted air from the outer series of carbureters to final treatment after it has been cooled down to a normal temperature.

By reference to Fig. 4 it will be seen that the number of carbureters may be increased in the outer series and that an ordinary carbureter 8 may be placed between the initial heater 7 and the heated carbureter 10 and that a cooling-chamber 11 has been added to each outer series. Otherwise the connections and operation of the system are the same as illustrated with reference to Fig. 1.

In Fig. 5 the cooler is placed in the intermediate series, as shown at 20, and two heating-carbureters 10 10 are placed in each of the outer series.

I find in practice that to fully utilize the low-grade oils in the manufacture of gas in machines of this class an intense heat—from, say, 120° to 160°—is not the most serviceable, but that, on the other hand, more efficient work is possible by subjecting the distillate to a moderate temperature, averaging about 90° or less.

In my process the air from the heater 7 passes to the first generator at from 120° to 130° and would be gradually reduced to a very low temperature as it passes through several successive carbureters; but by continuing the heating process in such a manner as gradually to vaporize and combine the hydrocarbon with the air, thus assuring not only a better gas, but enabling me to take up in the process the heavier elements remaining in the oil, thus greatly economizing in the manufacture of the product, and enabling me to use distillate of very low specific gravity.

The system as herein shown possesses another advantage of considerable importance, whereby I can use oils of different specific gravity in the apparatus at the same time, the heavier oils in the outer series of carbureters, the product of which can be carried forward to the first of the intermediate series 9, and the latter series 9 to receive a high-gravity oil to enrich the product from the outer series. In practice, however, I prefer to use with this system a low-grade oil, as heretofore stated, all of the carbureters being supplied with oil from a common source through the main pipe 21 and distributed by the branch pipes 22.

In order to secure thorough carburetion with the lowest-grade oil, the valves 14 in the pipes 16, which lead from the outer series to the scrubber 12, are closed and the valves 19 in the pipes 18 opened and the intermediate pipe-valve 13 closed, so that all the carbureted gas must pass from the heater 7 to the heating-carbureter 10, thence through the ordinary carbureters 8 8, cooling-chamber 11, and back through the pipe 18 to the first of the intermediate carbureters 9, and through this series to the scrubber 12. As both of the outer series in this case discharge their contents into the central set of carbureters, they should be made larger in diameter to increase their capacity. For this reason also in case a single cooling-chamber is used, as shown at 20, Fig. 5, it is made considerably larger than the other cylinders. Each cooling-chamber is provided at its lower end with a slightly-convex bottom 24 and has at one side a drain-pipe 25, leading to a reservoir 26, the drain-pipe having a valve 27. Above this bottom is a concave partition 28, having a central aperture, the object being to trap all condensation and discharge it at intervals into the reservoir 26. Several horizontal perforated walls 29 are placed above the concave bottom, and the down-pipe 30, which supplies the carbureted gas to the cooler, discharges at a point below the lower perforated wall.

Above the upper perforated wall is an inlet-pipe 31, which connects with a coiled pipe 32 within the shell, the upper end of the coil being joined up to a discharge-pipe 33 near the upper end of the shell. The entire body of the shell around the coil is packed with coke or other similar material.

I connect the pipes 31 33 with a refrigerating system. (Shown in this instance by means of the pump 34 and reservoir 35 merely to show one form of connecting up the cooler.) It is obvious that water from a main may be employed or simply brine pumped through the coils in the manner best adapted to act as a cooling-surface for the coil.

The structure of the cooling-chamber, therefore, is practically the same in its interior construction as the carbureters, and the heaters 10 have similar construction interiorly, the principal difference being in the fact that in the chambers 10 heat is used in the coil, whereas in the chambers 11 cooling fluids are used.

The operation of the machine is as follows: An air-pump supplies air to the chamber 7, which is adapted to be heated by a coil of pipe or otherwise, and from this heater it passes through the outer pipes 15 to the first heater in each of the outer series, the two receiving-carbureters 10 having therein means for heating the oil and the carbureted air. The product of these carbureters passes to the

next carbureters 8 8 and finally through the cooling-chambers 11 11 and out through the scrubber 12. If necessary, the valves 14 in the outer pipes 16 may be closed and the valve 14 in the central pipe 15, as well as the valves 19 in the pipes 18, opened, in which case the carbureted product passes back through the pipes 18 to the first of the middle series of carbureters 9, thus more effectually carbureting the product before it enters the scrubber. In case, however, the oil is of very low gravity it is desirable to produce a change of temperature as the product passes through the carbureters. Thus in Fig. 4 I show two heating-carbureters in each of the outer series, which alternate with the ordinary carbureters, and one cooling-chamber is placed in the middle series of carbureters, the object being to vary the temperature and then finally to bring down the temperature of the product to a point less than the ordinary working temperature of, say, 80° to 90°.

What I claim as new is—

1. In apparatus for making gas, a plurality of series of carbureters connected up to an initial air-heater at one end of each series and at the other end to a scrubber, one or more of the carbureters having means for heating the same.

2. In apparatus for making gas, two or more series of carbureters, connected up in multiple with a heater, at one end and a scrubber at the other end, one or more of the carbureters having heating appliances.

3. In apparatus for making gas, two or more series of carbureters connected up in multiple with a heater at one end and a scrubber at the other end, a cooling-chamber intermediate carbureters of a single series of carbureters.

4. In apparatus for making gas, three series of carbureters connected up in multiple with a heater at one end and a scrubber at the other end, one or more cooling-chambers intermediate the outer and inner series of carbureters.

5. In apparatus for making gas, two or more series of carbureting-chambers, connected up in multiple with a heated chamber, and a scrubber, one or more heating-carbureters at one end of the train and one or more cooling-chambers at the other end of the train.

6. In apparatus for making gas three series of carbureters connected up in multiple with an air-heater at one end, and a scrubber at the other end, the first carbureter of each of the outer series having means for heating the same, as set forth.

7. In apparatus for making gas, three series of carbureters connected up in multiple with an air-heater at one end, and a scrubber at the other end, a cooling-chamber at the end of each of the outer series of carbureters, as set forth.

8. In apparatus for making gas three series of carbureters connected up in multiple with an air-heater at one end and a scrubber at the other end, a cooling-chamber at the end of each of the outer series of carbureters and connected up with the first carbureter of the central line of carbureters.

9. In apparatus for making gas, three series of carbureters connected up in multiple with an air-heater at one end and a scrubber at the other end, the first carbureter in each of the outer series having therein a heating appliance, and a cooler after the last carbureter in the outer series, and pipe connections between said cooler in each outer series with the first carbureter in the central series, as set forth.

10. In apparatus for making gas, two or more series of carbureting-chambers having intermediate of two independent series one or more cooling-chambers, as set forth.

11. In apparatus for making gas, two or more series of carbureting-chambers, one or more of said carbureters in one or more series having heating appliances therein, and one or more cooling-chambers intermediate the carbureters, as set forth.

12. In apparatus for making gas three parallel series of carbureting-chambers connected up in multiple with a heating-chamber at one end and a scrubber at the other end, the last chamber of the outer series connected up by a valved pipe with the first of the central line of carbureters.

13. In apparatus for making gas, three parallel series of carbureting-chambers connected up in multiple with a heating-chamber at one end, and a scrubber at the other end, the central series of carbureters being larger than the outer series and connected up with the outer series to receive the carbureted air from both of the outer series.

14. In apparatus for making gas, three series of carbureters connected up in multiple with a heating-chamber at one end, with a scrubber at the other end, each of the outer series having one or more carbureters with heating appliances therein, as set forth.

15. In apparatus for making gas, three or more series of carbureters connected up in multiple with a heating-chamber at one end, and with a scrubber at the other end, and having a cooling-chamber at each end of the outer series.

16. In a gas-carbureting system, the combination of two or more series of carbureters having intermediate, the carbureters of a single series, means for heating the carbureted air in its passage through the system and of cooling the said air.

17. In a gas-carbureting system, the combination of three series of carbureting-chambers connected up in multiple with a heater at one end and a scrubber at the other end, with intermediate means between any two independent series for heating and cooling the carbureted air in its passage through the system.

18. In a gas-carbureting system, three series of carbureting-chambers connected up in multiple with a heating-chamber at one end and a scrubber at the other end, each of the outer series having means for heating and cooling the carbureted air in its passage through the system, as set forth.

19. In a gas-carbureting system a cooler interposed between the carbureters comprising a vertical chamber, having the gas-inlet pipe terminating at the lower end of the chamber, a trap to receive the condensation, a series of perforated plates to distribute the gas and a coil of pipe in the upper portion of the chamber to receive the cooling fluid, the space surrounding the coil being filled with coke or other material, as set forth.

20. In apparatus for making gas, two or more series of carbureters connected up in multiple with a heater at one end and scrubber at the other end, and a cooling-chamber intermediate two independent series of carbureters.

Signed at New York, in the county of New York and State of New York, this 2d day of April, A. D. 1902.

WILBUR F. STEELE.

Witnesses:
J. S. ZERBE,
W. S. WARWICK.