No. 675,566. Patented June 4, 1901.

# R. S. LAWRENCE.

## CARBURETER.

(Application filed Apr. 14, 1900.)

(No Model.) 3 Sheets—Sheet 1.

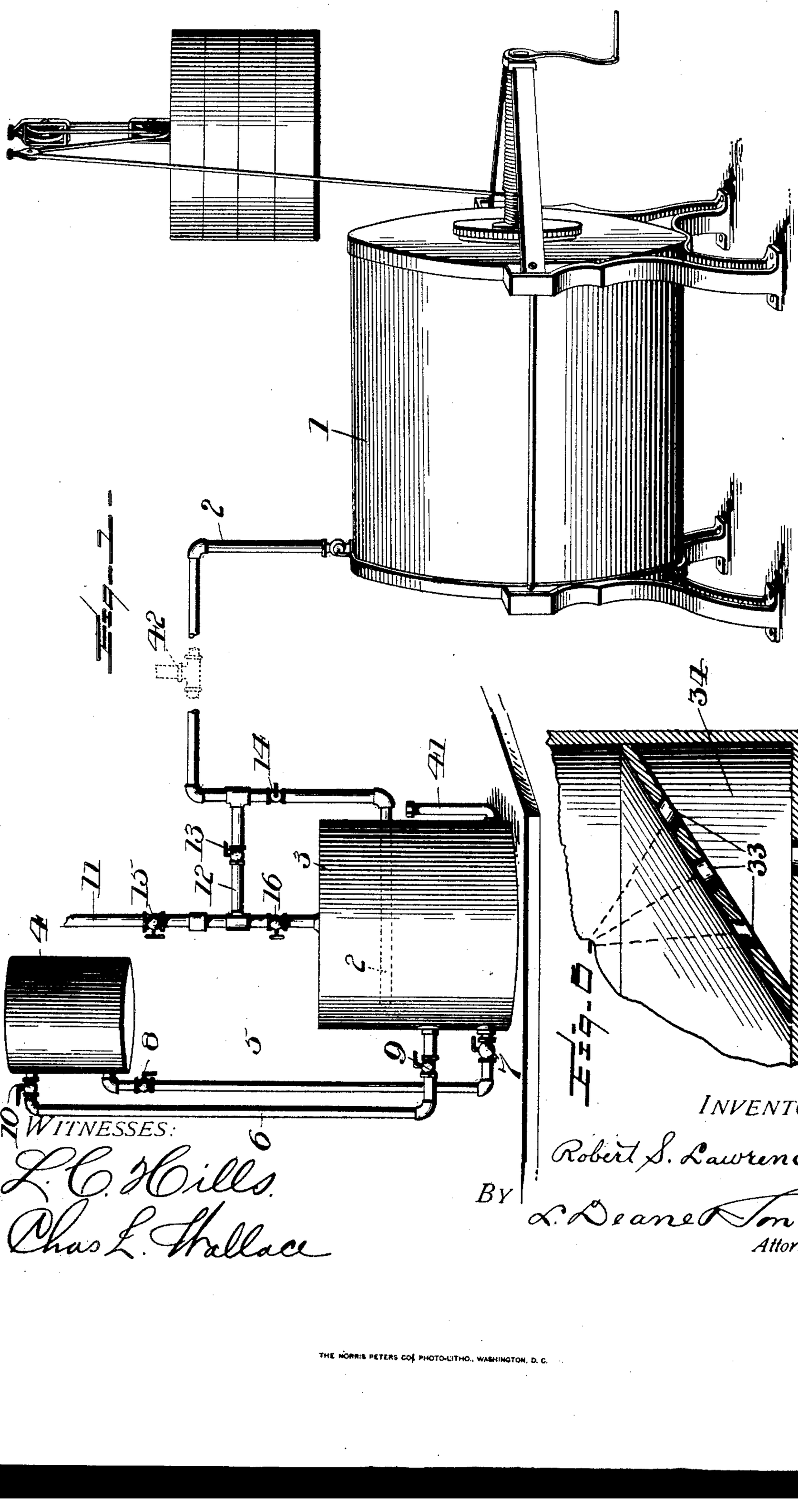


Fig. 7.

Fig. 8.

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## CARBURETER.

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(No Model.) 3 Sheets—Sheet 2.

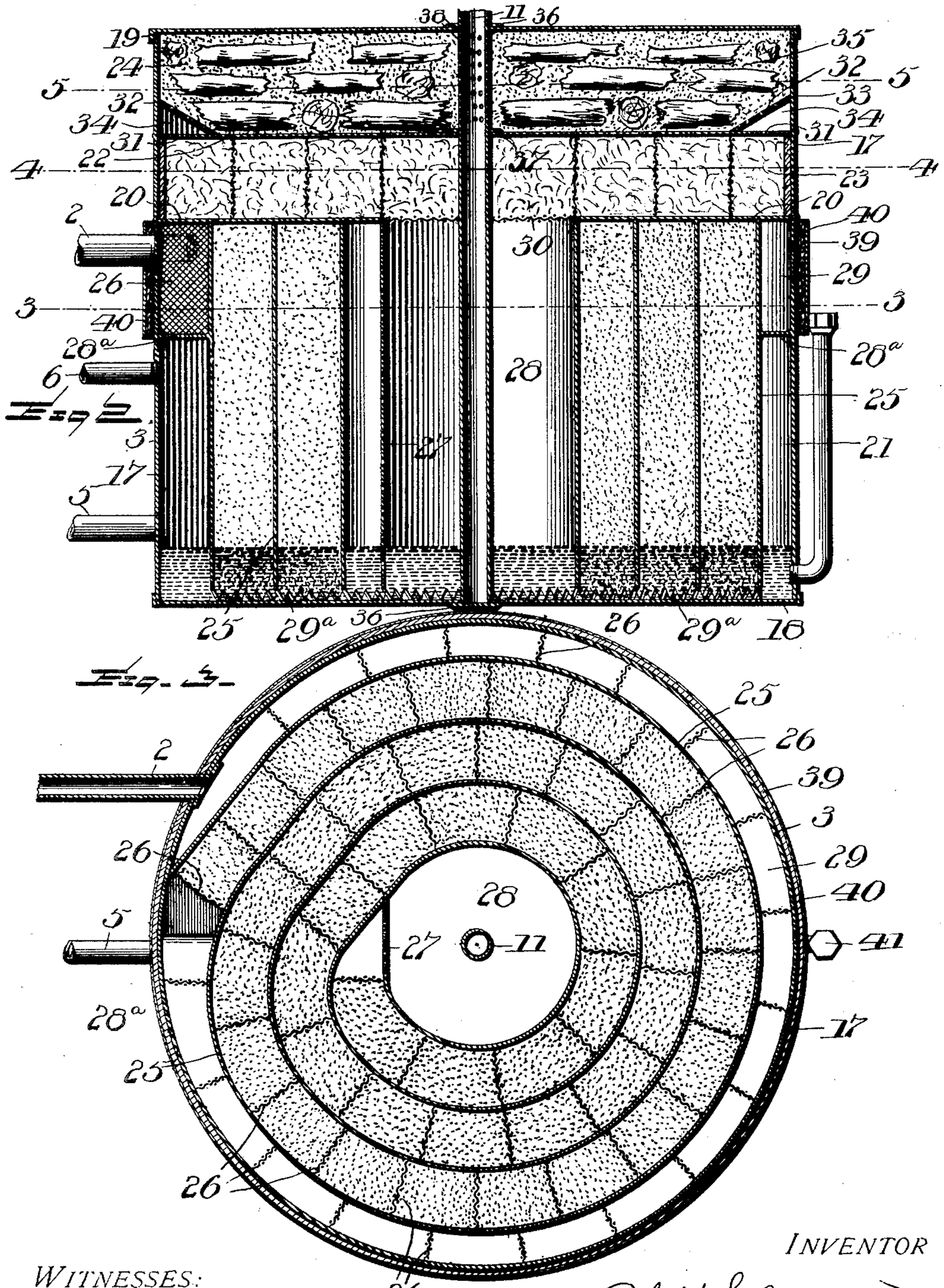


Fig. 2.

Fig. 3.

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(No Model.) 3 Sheets—Sheet 3.

Fig. 4.

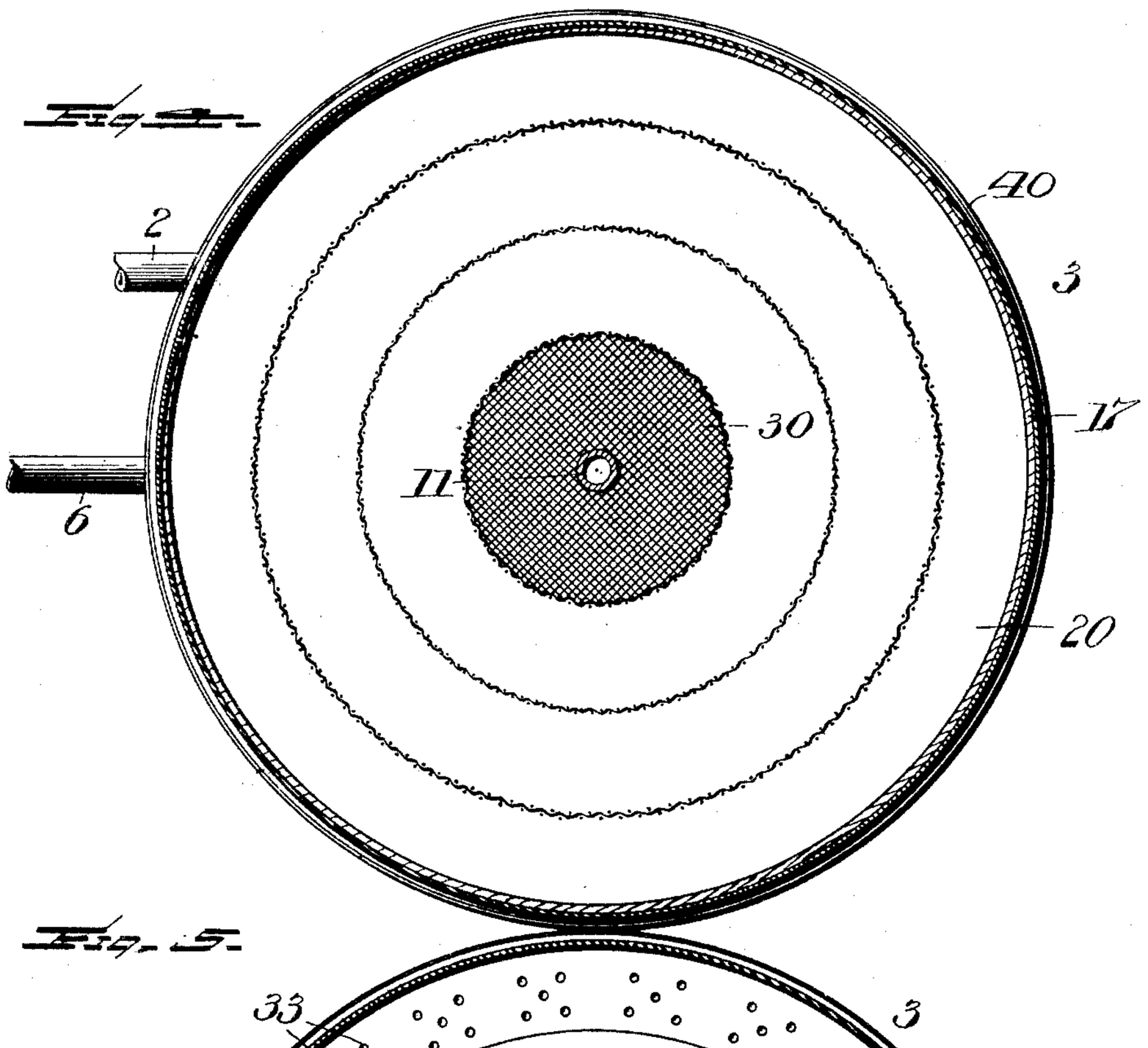
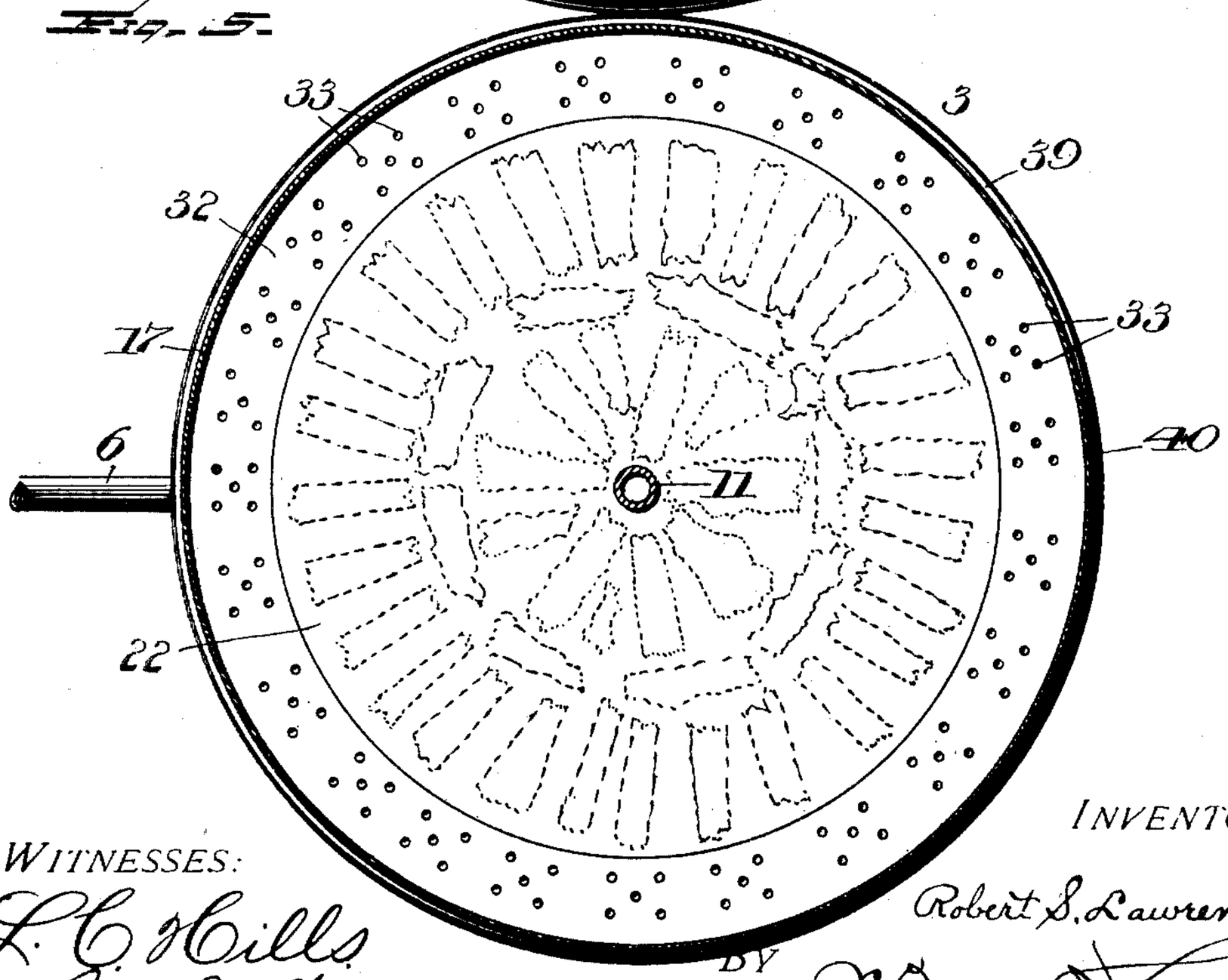



Fig. 5.

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# UNITED STATES PATENT OFFICE.

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## CARBURETER.

SPECIFICATION forming part of Letters Patent No. 675,566, dated June 4, 1901.

Application filed April 14, 1900. Serial No. 12,790. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT S. LAWRENCE, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Gas-Producing Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to gas-producing apparatus, and more particularly relates to apparatus for producing gas by atomization in contradistinction to vaporization.

To this end the main and primary object of the invention is the provision of an apparatus of the character mentioned whereby air under pressure may be brought into such intimate relation with hydrocarbons, whether the latter be light or heavy, that the same will be thoroughly saturated with the hydrocarbons, but free from overcarbonization, thus effecting, in the first place, the production of a high-quality gas.

A further object of the invention is the provision of a novel apparatus which is also adapted when connected with a source of ordinary illuminating and such gases to enrich the latter to a high degree, thoroughly atomizing the compound, and thereby produce a gas superior in candle-power to such ordinary gases, and also to induce more perfect combustion and consequent economy and improved sanitary condition.

A further object of the invention is to provide portable gas-works for camping-grounds of armies or other bodies of men on the march, the gas manufactured by the process when used for cooking and heating being smokeless and visible at night only at a distance of a few yards, while with incandescent burners brilliant illumination may be made in the hospital and operating-rooms and in the officers' tents when required.

The gathering of fuel with which to cook the food for an army on the march is always attended with inconvenience and vexation and often with devastation, while the smoke from the camp-fire by day and the light by night give information to the enemy and invite surprise and disaster. When opposing forces are in undefined proximity, fires are prohibited and uncooked rations are issued at a time when the soldier should be provided with the best possible strengthening nourishment.

A further object of the invention is to provide stationary gas-works for isolated buildings, factories, institutions, and residences for light, heat, and power purposes. The portable gas-works is designed to meet these conditions, and to the camp outfit, as described and illustrated, may be added a gas-engine for pumping water, driving wells, running a dynamo, moving pontoons, bridge material, &c.

With these and other objects in view, which will appear as the nature of the improvements is better understood, the invention consists, substantially, in the novel construction, combination, and arrangement of parts, as will be hereinafter fully described, illustrated in the accompanying drawings, and pointed out in the appended claims.

In the drawings, Figure 1 is a perspective view of a gas-producing apparatus constructed in accordance with the present invention, the same being designed for producing gas by bringing air under pressure into intimate relation with hydrocarbons. Fig. 2 is a transverse sectional view of the carbureter. Fig. 3 is a sectional plan view thereof on the line 3 3, Fig. 2. Figs. 4 and 5 are similar views on the lines 4 4 and 5 5, Fig. 2. Fig. 6 is a fragmentary sectional view, on an enlarged scale, of the lower portion of one side of the delivery-chamber, showing more clearly the arrangement of the openings formed in the inclined partition located in said chamber.

The herein-described apparatus is primarily designed for the manufacture of gas by the admixture of air under pressure with hydrocarbons, and in view of this the system for accomplishing this end will be first described, the carbureter, which is of peculiar construction, being described thereafter.

Referring to the drawings, the numeral 1 designates an air-pressure apparatus, which may be of any approved construction, but,

as shown, the same is preferably of that type which is operated through the medium of a weight. Connected to the air-pressure apparatus 1 through the medium of a valved pipe 2 is a carbureter 3, which is in turn connected to a hydrocarbon-tank 4. The tank 4 is arranged in a plane above the carbureter 3, in order that the hydrocarbon may freely flow from said tank to said carbureter, and in order that the latter and said tank may be connected a pipe 5 is employed, the pipe 5 having its upper end connected to the lower end of the tank 4 and its lower end arranged to discharge into the lower end of the carbureter 3. An outlet-pipe 6 likewise connects the carbureter 3 and hydrocarbon-tank 4, in order that any gas displaced from said carbureter may be discharged into the tank 4, and thereby avoid the danger and smell incident to the discharge of such displaced gas into the atmosphere. The tank or reservoir 4 may be set at a remote distance but on a direct line and may be in circumference sufficient to hold any desired quantity of hydrocarbon. The pipes 5 and 6 are provided with valves 7, 8, 9, and 10, by means of which said pipes may be closed when such is desired. A delivery-pipe 11 enters the carbureter 3 for conveying the generated gas to the point of consumption, and said pipe is connected to the pipe 2 by means of a branch pipe 12, having a valve 13. The pipe 2 is also provided with a valve 14, which valve is located below the point of connection of the pipe 12 with said pipe 2, and when said valve 14 is closed a short circuit is made between the pipe 2 and the pipe 11 for a purpose to be hereinafter stated. The pipe 11 is likewise provided with valves 15 and 16, arranged, respectively, above and below the point of connection of the pipe 12 with the pipe 11, and hence it is obvious that when the valves 14 and 16 are closed and the valves 13 and 15 opened the fluid flowing through the short circuit above referred to will be prevented passing into the carbureter 3.

As before premised, the carbureter is of peculiar construction, and by referring to Figs. 2 to 5, inclusive, it will be seen that the same comprises a cylindrical shell 17, which is preferably of thin metal, having a bottom 18 and a top 19. Arranged within the shell 17, at approximately two-thirds the height of the latter, is a horizontally-disposed partition 20, by means of which an enriching-chamber 21 is formed at the lower portion of said shell 17, and arranged above the partition 20, intermediate the latter and the top 19, is a similar partition 22, whereby a condensation-chamber 23 and a delivery-chamber 24 are formed, the condensation-chamber 23 being arranged immediately above the enriching-chamber 21, and the delivery-chamber 24 in turn located above said condensation-chamber. A spirally-arranged vertically-disposed partition 25 depends from the lower surface of the partition 20, and thereby subdivides the enriching-chamber 21 into a series of spiral channels, and said channels are provided at suitable intervals with a series of screens or perforated plates 26. It will be noted, however, at this point that the outer end of the partition 25 is secured at a point upon the inner surface of the shell 17, adjacent to the point of entrance of the pipe 2, and that the inner end terminates in a perforated plate 27, near the center of the enriching-chamber, and by reason of this latter construction it will be seen that a reservoir 28 is thereby provided at the center of the shell 17 in order to receive the air after it has traversed the spiral channels. It will also be noted that a horizontally-disposed partition $28^a$ is arranged in the outer channel of the spiral series at a point approximately two-thirds the height of said channels, and thus a cooling-chamber 29 is formed, the pipe 2 discharging into said chamber, as clearly shown in Fig. 2. At the termination of the outer channel the partition $28^a$ also terminates, and from this point to the inner end of the spiral series the channels extend from the bottom 18 to the partition 20, said channels being filled with suitable absorbent material, such as coarse and twisted white-pine shavings. The lower edge of the partition 26 throughout its length is serrated, as at $29^a$, in order that communication may be had with all of the channels throughout the entire diameter of the shell 17, by reason of which construction the hydrocarbon when the same has been permitted to flow from the tank 4 into the lower end of the carbureter enters the lower ends of all the channels, and is thereby brought into contact with the absorbent material arranged therein. The entire mass of such absorbent material thereby becomes through capillary attraction thoroughly saturated with the hydrocarbon, and as a result the air on its way from the pipe 2 to the reservoir 28 becomes impregnated with the particles of the hydrocarbon and issues in small streams through the plate 27 into said reservoir. The air, however, in its passage through the screens 26 is cut into thousands of streams, and thus the stratification tendencies are removed by thorough mixing.

A perforated diaphragm or screen 30 is arranged at the upper end of the reservoir 28 for separating the latter from the condensation-chamber 23, and said condensation-chamber is lined with asbestos cloth, as at 30′, to retain the cold incurred by the subdivision of the hydrocarbon in the enriching-channels and is divided into a series of circular chambers by perforated metal partitions 30″, the intervening spaces being filled with a packing of asbestos and crushed shavings. The chilling and stripping of the gas precipitates all surplus hydrocarbon and the perforated diaphragm 30 allows such hydrocarbon to flow down into the reservoir at the bottom of the

atomizer. The partition 22, which divides the condensation-chamber 23 from the delivery-chamber 24, is provided adjacent to its outer edge with a series of openings 31, and arranged at the lower edge of the delivery-chamber 24 and directly above said openings 31 is an inclined partition 32, provided at suitable intervals with a series of atomizing-openings 33, whereby a triangular chamber 34 is formed intermediate the condensation-chamber 23 and the delivery-chamber 24. It will thus be seen that the gas issues from the condensation-chamber 23 into the delivery-chamber 24; but said openings 33 are arranged in groups, as clearly shown in Fig. 5, the openings of each group being so directed that the streams of gas issuing therethrough will converge to a common center, and thus impinge upon each other for the purpose of separating any particles carried by the gas. The gas thus atomized enters the delivery-chamber 24, which chamber is filled with lumps of charcoal surrounded by fine particles of such material, as indicated at 35. The gas rests upon this charcoal until drawn off for use, the upper, and consequently the lightest, portion of the gas being first at the exit. The delivery-pipe 11 passes entirely through the carbureter 3 from top to bottom and is soldered or otherwise suitably secured to these parts by means of flanges 36, similar flanges 37 being also employed for securing the pipe 11 to the partition 22. The pipe 11 at its portion immediately surrounded by the delivery-chamber 24 is perforated, as at 38, to permit the gas readily entering said pipe from said chamber, and in order that the cooling-chamber 29 may be protected from the exterior heat said chamber is surrounded by a sheet of asbestos 39 or other suitable non-conductor of heat, which sheet is held in position by an encircling band 40, the latter being preferably of brass. A capped gage-tube 41 is also carried by the shell 17 and connected to the latter at its lower portion, said tube being provided with a float or other suitable means whereby the quantity of hydrocarbon within the carbureter may be easily determined.

While the invention, as previously described, is designed for the manufacture of gas by mixing air with hydrocarbon, the same is not restricted to such use, as if it is desired the pipe 2 may be connected by a suitable valve 42 (indicated by dotted lines) to a source of ordinary illuminating-gas in order that the latter may be enriched for the purpose of producing a gas superior in candle-power to such ordinary illuminating-gas. When the invention is used in this connection, communication from the air-pressure apparatus 1 is of course cut off and the illuminating or fuel gases drawn through the valve 42 permitted to pass through the carbureter 3, as in the manner described for the air, whereupon it will be seen that the intimate commingling of the gas with the hydrocarbon and the thorough atomization of the mixture greatly enriches the former, so that when the gas is conveyed through the pipe 11 to the point of consumption the same will possess superior illuminating qualities and more perfect combustion. If the apparatus is used in the connection stated and it is not desired to pass the gas through the carbureter, it is simply necessary to close the valves 14 and 16 and open the valve 13, whereby a short circuit is made and the gas allowed to pass through the branch pipe 12 to the pipe 11 for consumption at the desired point.

The operation of the herein-described apparatus is as follows: Hydrocarbon is admitted to the carbureter 3, so as to fill the latter to the desired extent, and by contact with the absorbent material within the spiral channels said material becomes saturated therewith. As the air enters the carbureter through the pipe 2 the same is discharged into the chamber 29, where its temperature is lowered to a uniform degree before it comes in contact with the absorbent material, and thus vaporization and overcarbonization at the initial point of entry of the absorbent material is prevented. As the air passes through the screens 26 the same is also divided into fine streams, thus removing the stratification tendencies by thorough mixing, which division occurs throughout the entire number of channels. The air passing through the absorbent material becomes impregnated with the hydrocarbon and is discharged into the reservoir 28 through the perforated plate 27, whence it enters the condensation-chamber 23. As the gas thus formed passes through the mineral wool contained in the condensation-chamber the surplus hydrocarbon is removed, and after such passage said gas enters the chamber 34 through the openings 31. The gas then becomes atomized by its passage from said chamber 34 through the openings 33, and as it issues from said openings the fine streams of gas formed by each group of said openings impinge upon each other, so that any particles carried by the gas are separated. The gas being thus delivered to the chamber 24 rests upon a bed of stick-charcoal in said chamber, the top of which is exposed to a temperature of practically the same degree as the riser or supply pipe, and the volume of gas at once begins to increase by expansion, thus rendering condensation impossible, the condensation-chamber being colder than any place the gas is likely to encounter in the service-pipes. The gas remains in said chamber until required for use, at which time the lightest portion of the gas being first at the openings 38 of the pipe 11 passes through the latter and is conveyed by said pipe to the point of consumption. Owing to the thorough mixing, stripping, and atomization, when the gas reaches the burner a greatly-increased number of surfaces are presented to the oxy-

gen, resulting in more perfect combustion, and consequently economy and freedom from the carbonic acid of coal-gas and carbonic oxid of motor-gas.

While the form of the invention herein shown and described is what is believed to be a preferable embodiment thereof, it is to be distinctly understood that the invention is in no sense restricted to such embodiment; but as the same is susceptible of various changes in the form, proportion, and minor details of construction the right is reserved to modify and vary the invention as falls within the scope and spirit thereof.

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

1. In an apparatus of the class described, a carbureter, and a partition located therein and provided with groups of atomizing-openings, the openings of each group being adapted to discharge to a common center, whereby the streams of fluid issuing therethrough impinge upon each other.

2. In an apparatus of the class described, a carbureter comprising an insulated cooling-chamber, a series of enriching-channels communicating with said chamber and surrounded thereby, and means for condensing the fluid after the same has passed through said enriching-channels.

3. In an apparatus of the class described, a carbureter comprising an insulated cooling-chamber, a series of spirally-arranged enriching-channels communicating therewith and surrounded thereby, and means for condensing the fluid after the same has passed through said channels.

4. In an apparatus of the class described, a carbureter comprising an insulated cooling-chamber, a series of enriching-channels communicating therewith and surrounded thereby, means for dividing the fluid during its passage through said chamber and channels, and means for condensing the fluid after the same has passed through said channels.

5. In an apparatus of the class described, a carbureter comprising an insulated cooling-chamber, a series of enriching-channels communicating therewith and surrounded thereby, a series of screens arranged in said chamber and channels for dividing the fluid during its passage therethrough, and means for condensing the fluid after its passage through said chamber and channels.

6. In an apparatus of the class described, a carbureter comprising an insulated cooling-chamber, a series of enriching-channels connected therewith and surrounded thereby, means for dividing the fluid during its passage through said chamber and channels, a condensing-chamber arranged above said cooling-chamber and enriching-channels, and means arranged in said chamber for condensing the fluid after its passage through the cooling-chamber and enriching-channels.

7. In an apparatus of the class described, a carbureter comprising an insulated cooling-chamber, a series of spirally-arranged enriching-channels communicating therewith and surrounded thereby, a condensation-chamber arranged above said cooling-chamber and enriching-channels, and means arranged within said chamber for condensing the fluid after the latter has passed through the enriching-channels.

8. In an apparatus of the class described, a carbureter comprising a casing closed at its top and bottom, a horizontally-disposed partition arranged therein, a spirally-arranged vertically-disposed partition depending from said horizontally-disposed partition and forming an insulated cooling-chamber and enriching-channels, the cooling-chamber surrounding said channels, and means arranged within said enriching-channels for distributing the hydrocarbon in the path of the fluid as the latter passes through said channels.

9. In an apparatus of the class described, a carbureter comprising a casing closed at its top and bottom, a horizontally-disposed partition arranged therein, a spirally-arranged vertically-disposed partition depending from said horizontally-disposed partition and forming an insulated cooling-chamber and a series of enriching-channels, said cooling-chamber surrounding the enriching-channels, means arranged within said chamber and channels for dividing the fluid during its passage therethrough, means also arranged in said channels for distributing hydrocarbon in the path of the fluid, a condensing-chamber arranged above said cooling-chamber and enriching-channels, and means arranged within said chamber for condensing the fluid during its passage therethrough.

10. In an apparatus of the class described, a carbureter comprising an insulated cooling-chamber, a series of enriching-channels communicating therewith and surrounded thereby, a condensing-chamber arranged above said cooling-chamber and enriching-channels, and a delivery-chamber arranged above said condensing-chamber.

11. In an apparatus of the class described, a carbureter comprising an insulated cooling-chamber, a series of enriching-channels communicating therewith and surrounded thereby, a condensing-chamber connected with said enriching channels, a delivery-chamber arranged above said condensing-chamber, and a partition located within said delivery-chamber and provided with groups of atomizing-openings, the openings of each group discharging to a common center, whereby the streams of the fluid issuing through said openings impinge upon each other.

12. In an apparatus of the class described, a carbureter comprising an insulated cooling-chamber, a series of enriching-channels communicating therewith and surrounded thereby, screens arranged within said chamber and

channels for dividing the fluid in its passage therethrough, means also arranged within said channels for distributing hydrocarbon in the path of said fluid, a condensing-chamber arranged above said cooling-chamber and enriching-channels, and a delivery-chamber arranged above said condensing-chamber.

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

ROBERT S. LAWRENCE.

Witnesses:
HENRY E. COOPER,
CHAS. L. WALLACE.