No. 690,681. Patented Jan. 7, 1902.

P. R. VAN DER MADE.

APPARATUS FOR CARBURETING AIR.

(Application filed July 16, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

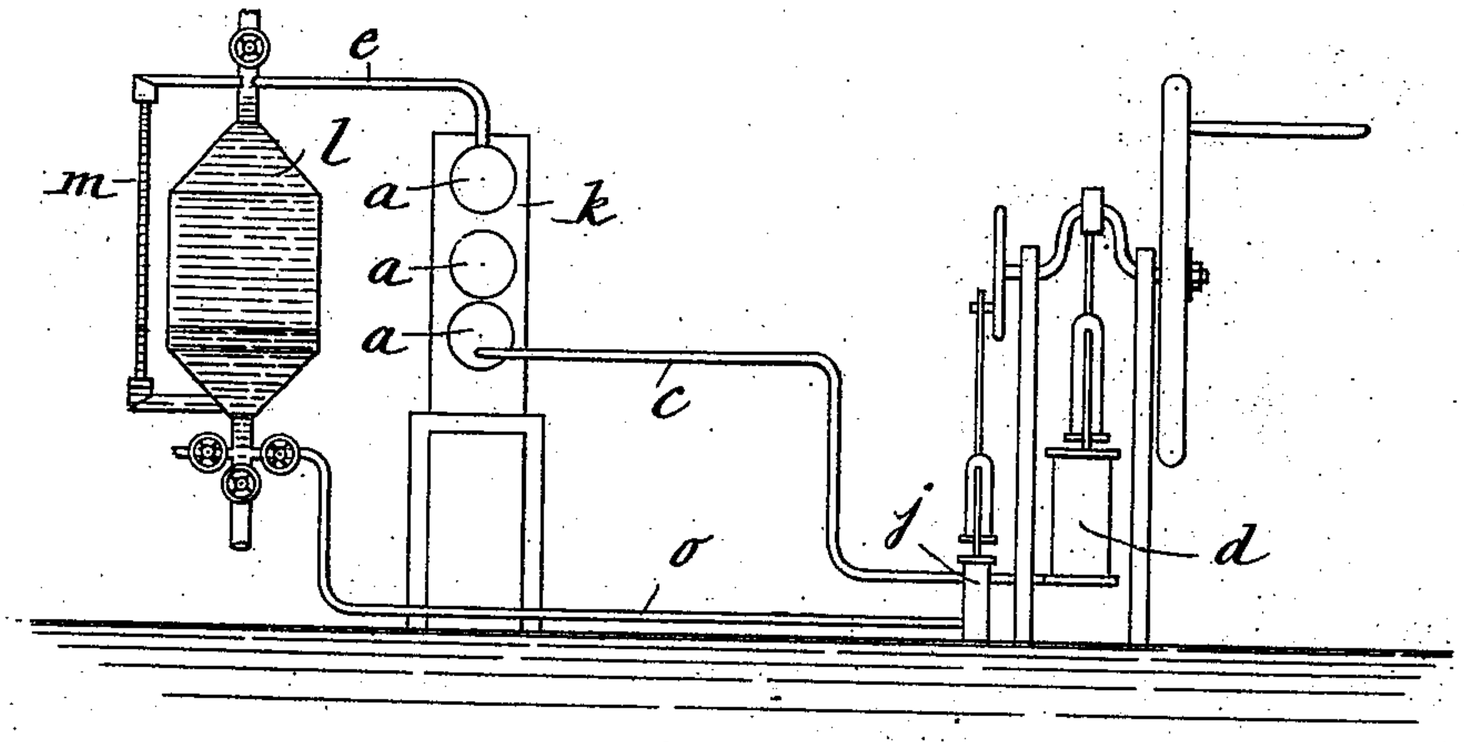
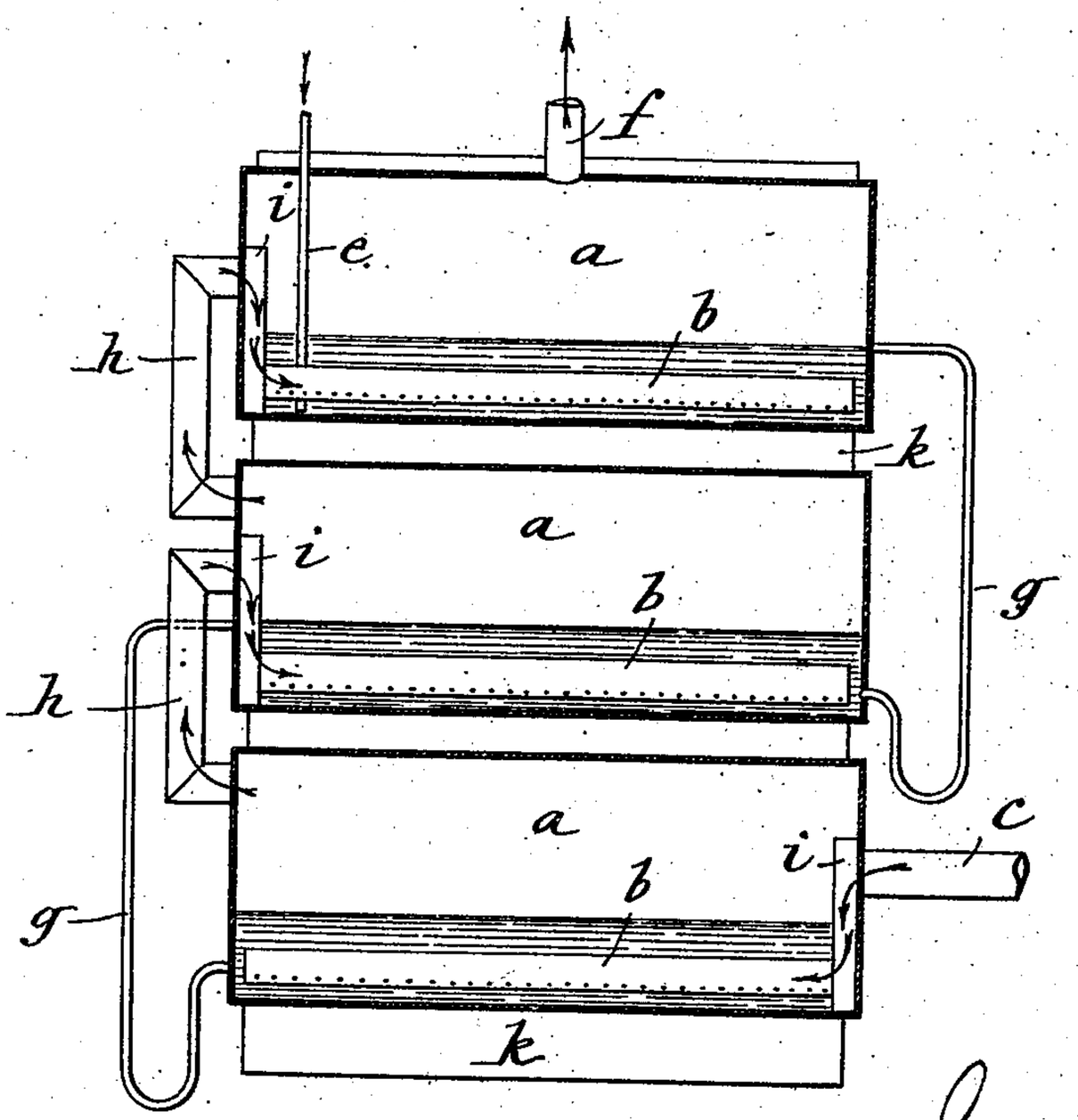


Fig. 3.



Witnesses:
J. Green
W. R. Hammond

Inventor
Paul Roelof van der Made
by Wright Brothers
Attys

No. 690,681. Patented Jan. 7, 1902.

P. R. VAN DER MADE.

APPARATUS FOR CARBURETING AIR.

(Application filed July 16, 1901.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

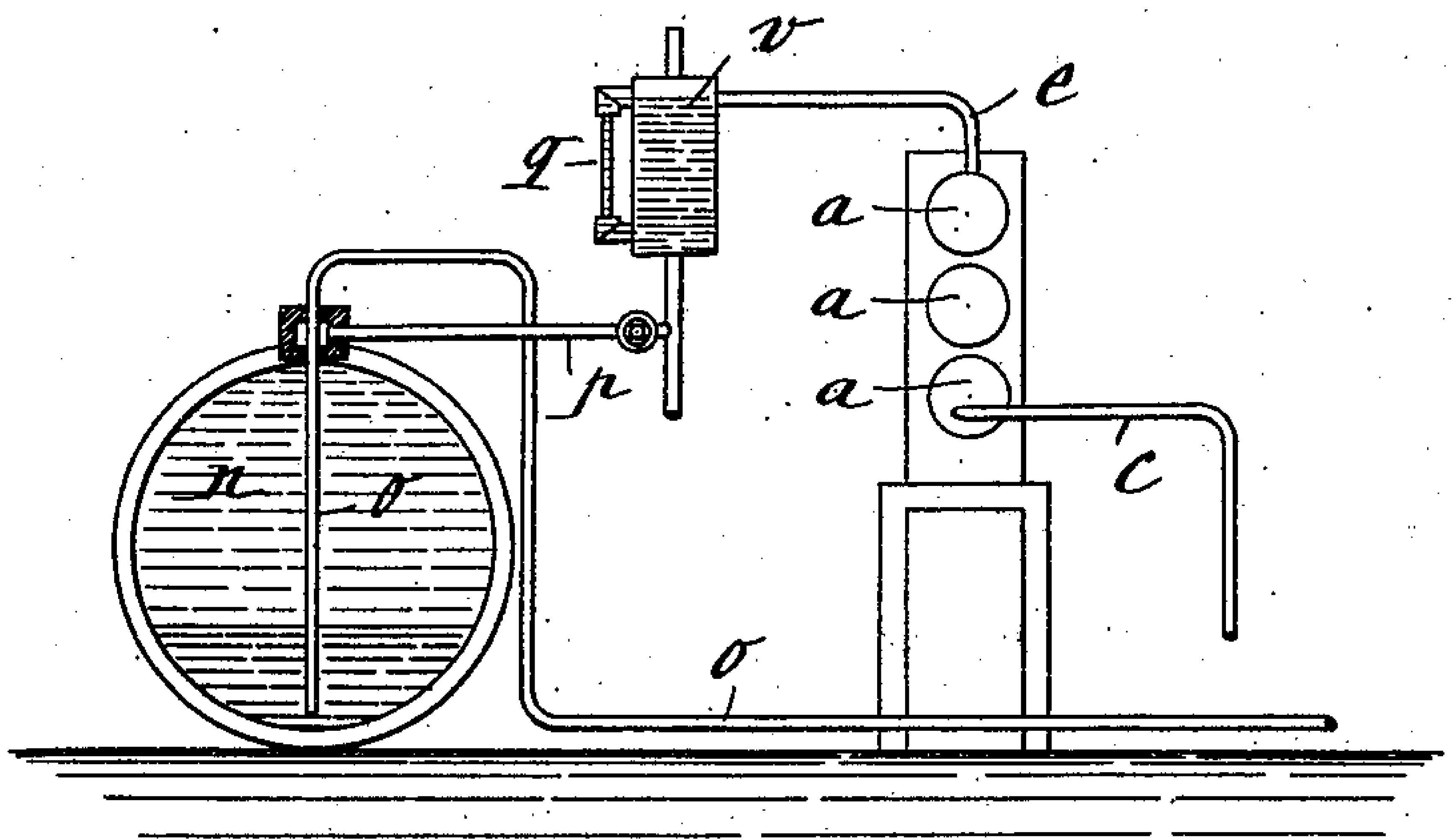


Fig. 4.

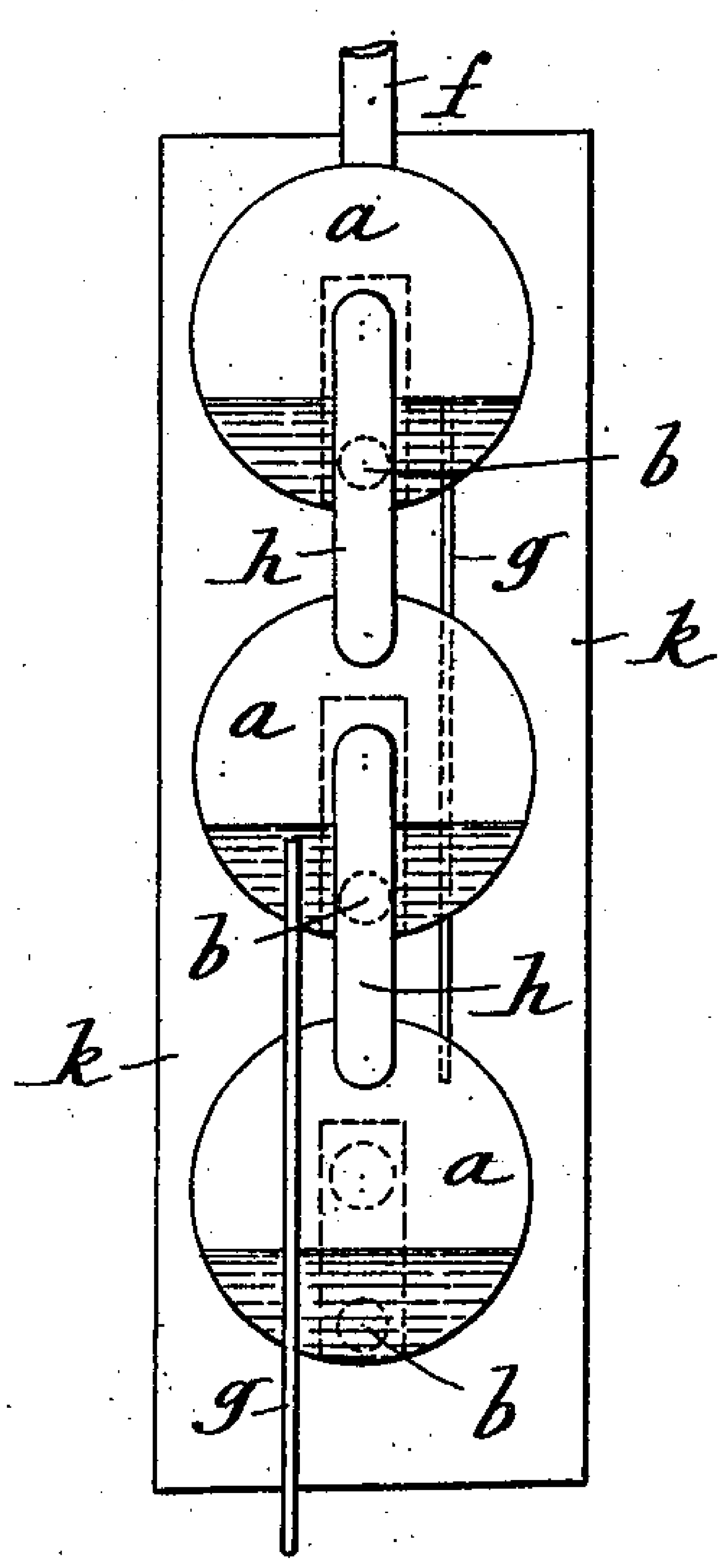
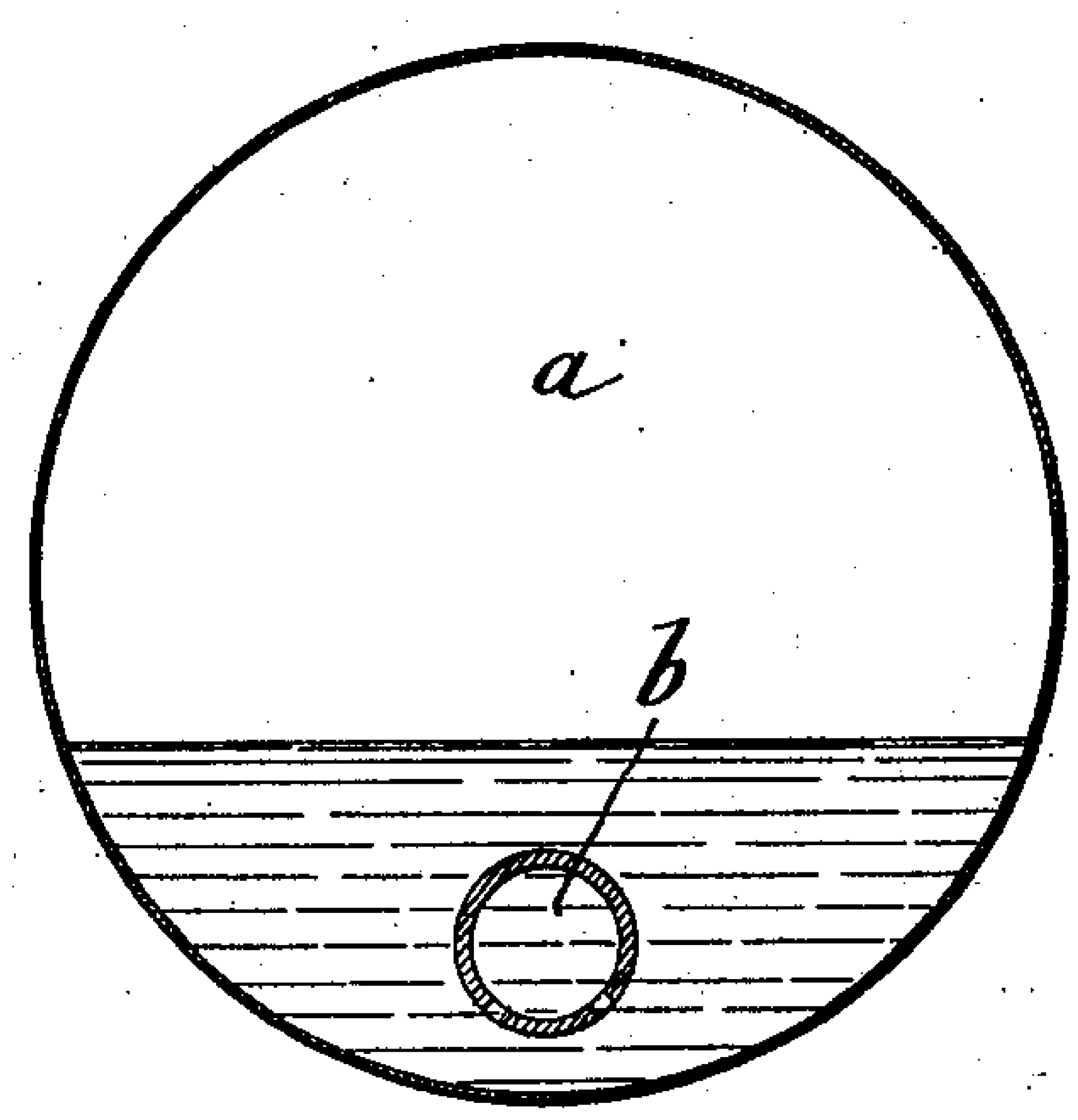


Fig. 5.



Witnesses:
J. Green
W. P. Hammond

Inventor:
Paul Roelof van der Made
by Knight Bros.
Attys.

UNITED STATES PATENT OFFICE.

PAUL ROELOF VAN DER MADE, OF BREUKELEN, NETHERLANDS.

APPARATUS FOR CARBURETING AIR.

SPECIFICATION forming part of Letters Patent No. 690,681, dated January 7, 1902.

Application filed July 16, 1901. Serial No. 68,488. (No model.)

To all whom it may concern:

Be it known that I, PAUL ROELOF VAN DER MADE, engineer, a subject of the Queen of the Netherlands, residing at Breukelen, in the Kingdom of the Netherlands, have invented new and useful Improvements in or Relating to Apparatus for Carbureting Air with Carbureted Hydrogen, (for which patents have been filed in Belgium, dated January 3, 1901, No. 154,057; in Germany, dated May 24, 1901, number of certificate 4,302; in France, dated May 31, 1901, number of certificate 299,924; in Denmark, dated June 4, 1901, number of certificate 724; in Sweden, dated June 7, 1901, number of certificate 1,078; in Norway, dated June 11, 1901, number of certificate 13,981, and in Great Britain, dated June 24, 1901, No. 12,858,) of which the following is a full, clear, and exact description.

The subject of my invention is an apparatus adapted to effect the carbureting of atmospheric air in a continuous and uniform manner and so that the constituents will be completely mixed and the carbureted air thus produced will be ready for immediate use.

To this end my improved apparatus comprises a plurality of pumps worked in regular sequence, one forcing water into a container and displacing a suitable volume of gasolene or other suitable hydrocarbon liquid, which is delivered into a carbureting-chamber, while another pump compresses a suitable volume of air and forces it in fine jets through the hydrocarbon liquid. These operations do not take place in the gas-bell itself, but in a carbureting-chamber especially designed for this purpose and which is of such dimensions that a volume of air is always being sent through a body of hydrocarbon liquid which is constantly replenished by forcing in at each stroke a volume of fresh hydrocarbon liquid corresponding with the volume of air injected, and the resulting volumes of gas, always of the same even contents, being led away into the gas-bell direct for use. In order to effect these operations—that is to say, the introduction of the hydrocarbon liquid into the carbureting-chamber and the passage of the compressed air through the same, the one operation being immediately followed by the other—two pumps worked from the same crank-shaft are employed, one of which forces in the hydrocarbon liquid while the other is compressing the necessary volume of air and forces it through the hydrocarbon liquid, so that at each stroke of both pumps a volume of carbureted air, with proportionate contents of hydrocarbon liquid, is manufactured and forced into the gas-bell, thus effecting continuous manufacture with one apparatus only.

In the accompanying drawings a type of apparatus constructed for carrying out this process is illustrated diagrammatically.

Figure 1 is an elevation of the whole installation; Fig. 2, a similar view showing a modified arrangement of the same. Fig. 3 is a longitudinal section through the carbureting-chamber. Fig. 4 is an end elevation of the same, and Fig. 5 is a transverse section through one of the elements of the carbureting-chamber. Figs. 3 and 4 are on a larger scale than Figs. 1 and 2, and Fig. 5 is on a still larger scale.

This carbureting-chamber consists, substantially, of a horizontal cylindrical plate boiler *a*, in which, near the bottom, a perforated pipe *b*, or, in other words, a tube *b*, bored with fine holes in its lower half, is laid for introducing the volume of air and is connected to the pipe *c*, coming from the air-pump *d*. This tube *b* is submerged in hydrocarbon liquid introduced through a dipping-pipe *e*, so that at each stroke of the pump the air thus compressed is expanded into or through the hydrocarbon liquid in fine jets, and thus volatilizes the same, so that the free space of the carbureting-chamber is filled with the volume of carbureted air thus formed, from whence it is conveyed by the outlet-pipe *f* to the collecting-bell.

To effectively prevent an imperfect volatilization of the necessary volume of hydrocarbon liquid when only one carbureting-chamber is employed, the volume in question is distributed between several carbureting-chambers arranged horizontally one above the other, (three are illustrated in the present case,) as seen in Fig. 3, where the dipping-tube *e* is inserted into the top carbureting-chamber and the latter is connected to the second and the second to the third by means of the tube *g*. Each one of the car-

bureting-chambers contains a third of the necessary hydrocarbon liquid, each of the spray-tubes *b* being submerged by the said thirds. In this case only the lowest carbureting-chamber has to be connected to the air-pump, while the upper two have their gas-spaces connected together to the carbureting-chamber immediately underneath by means of the pipes *h*, the chambers *i* preventing any flow of hydrocarbon liquid from one carbureting-chamber to the other. In this manner the whole of the volume of air only acts on a third of the corresponding volume of hydrocarbon liquid, so that the volatilization of the same is insured in each of the carbureting-chambers, and the volume of air in passing from one to the other gathers up its contents of hydrocarbon liquid in stages. If the temperature of the atmosphere should be too low to permit of perfect volatilization, it may be heated to the required degree by inclosing the mixer *a* with a hot-water mantle *k*.

The supply of the hydrocarbon liquid by means of the pump *j* is on account of its volatile character only effected with great difficulty, and special measures must be taken for this operation. These consist in substituting water in the pump for the hydrocarbon liquid and by means of the former forcing the latter out of a container *l*, situated between the pump *j* and mixing-chamber *a*, into the dipping-tube *e*. The container *l* is provided with a water-gage *m*, so that it may be ascertained when all the hydrocarbon liquid has been forced out of the container *l*, which is then full of water. This water is then drawn off from the bottom of the container *l* and fresh hydrocarbon liquid substituted therefor.

Instead of the container *l* the cask *n*, containing the hydrocarbon liquid, may be connected direct. (See Fig. 2.) In this modification the pump-pipe *o* dips direct to the bottom of the cask out of which the forced-in water drives the hydrocarbon liquid, as described above, this latter being forced through the pipe *p* into an auxiliary container *v*, situated between the cask *n* and carbureting-chamber *a* and provided with a water-gage *q*, and from thence into the tube *e* and mixer *a*.

In certain cases when the installation is to be used without a gasometer-bell it may be altered correspondingly without departing from the fundamental principle of the process.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. The combination of the carbureting-chamber *a*, air-pump *d*, force-pump *j*, for water or other liquid; a common motor operating the said pumps *d* and *j* in regular sequence; a perforated delivery-pipe *b* in lower part of the carbureting-chamber; a pipe *c* connecting the pump *d* with the delivery-pipe *b;* a reservoir *l* for hydrocarbon liquid; a pipe *o* connecting the pump *j* with reservoir *l* and a pipe *e* from the reservoir *l*, delivering a modicum of hydrocarbon liquid to the carbureting-chamber *a*, at each stroke of the pump *j*, and a suitable gas-discharge pipe *f*.

2. A plurality of superposed carbureting-chambers *a a;* perforated pipes *b* in the lower part of said carbureting-chambers; an air-pump *d;* a pipe *c* connecting the air-pump *d* with the delivery-pipe *b* in lower carbureting-chamber; a reservoir *l* for hydrocarbon liquid; a force-pump *j* for water or other liquid; a pipe *o* connecting the pump *j* with the reservoir *l;* a pipe *e* connecting the reservoir *l* with the uppermost carbureting-chamber; pipes *g* connecting the carbureting-chambers and permitting overflow of liquid from one carbureting-chamber to another; pipes *h* conveying gas from one carbureting-chamber to one above it; a suitable discharge *f* for the gas, and a common motor operating the pumps *d* and *j* in regular sequence, substantially as and for the purposes set forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

PAUL ROELOF VAN DER MADE.

Witnesses:

AUGUST SEIGFRIED DOCEN,

HENRI FRANCOIS ROBERT BRANDTS BRUSY.