No. 762,477. PATENTED JUNE 14, 1904.

H. GARDE.

APPARATUS FOR CARBURETING AIR.

APPLICATION FILED FEB. 2, 1903.

NO MODEL.

FIG. 1.

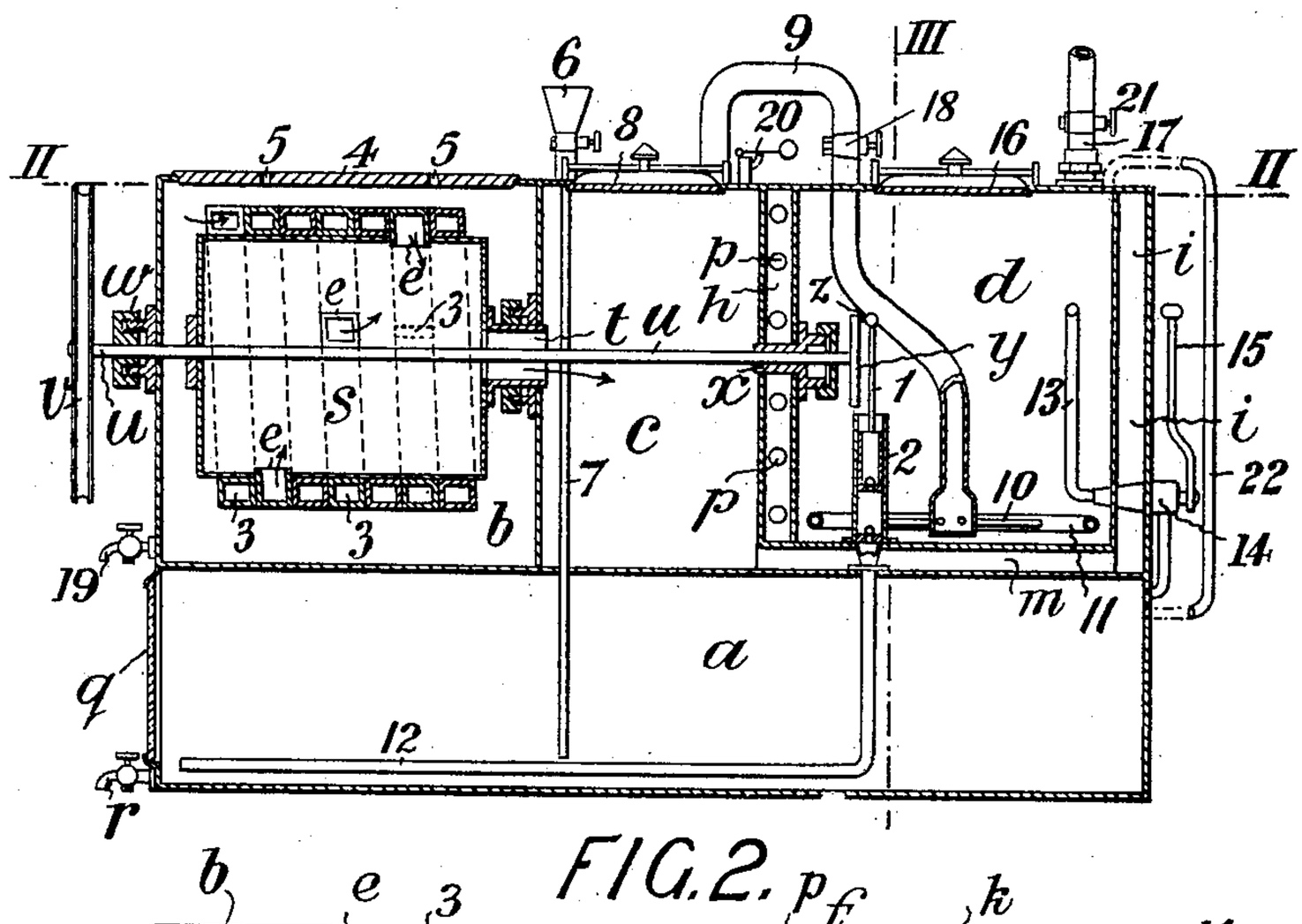


FIG. 2.

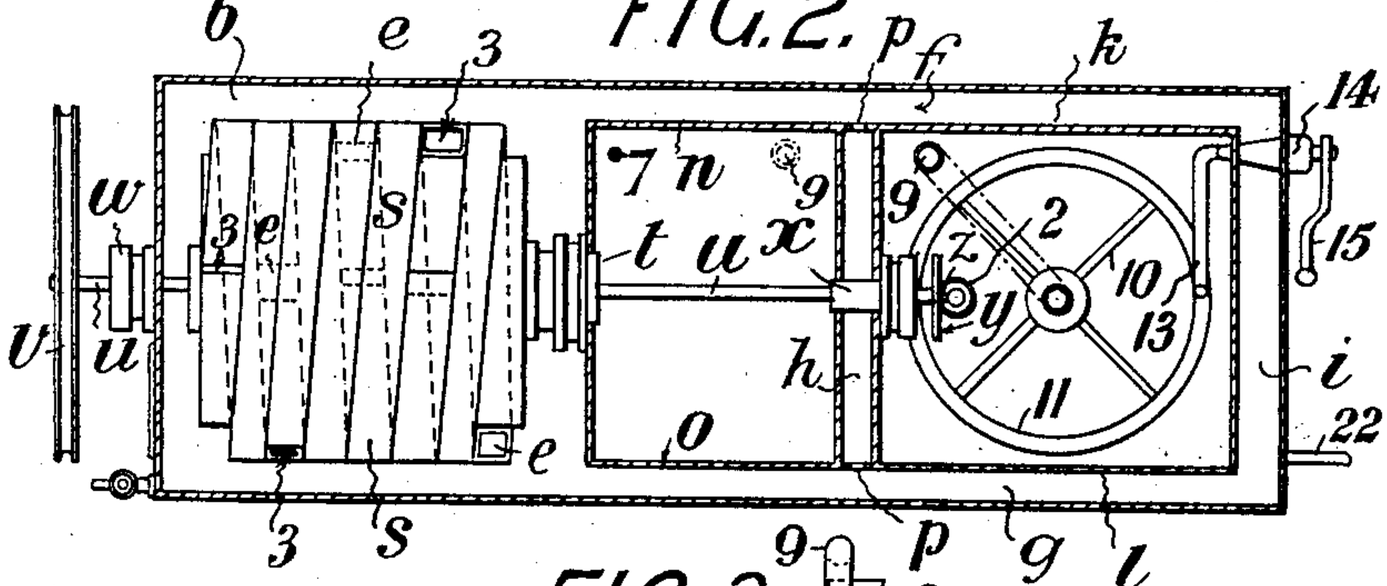
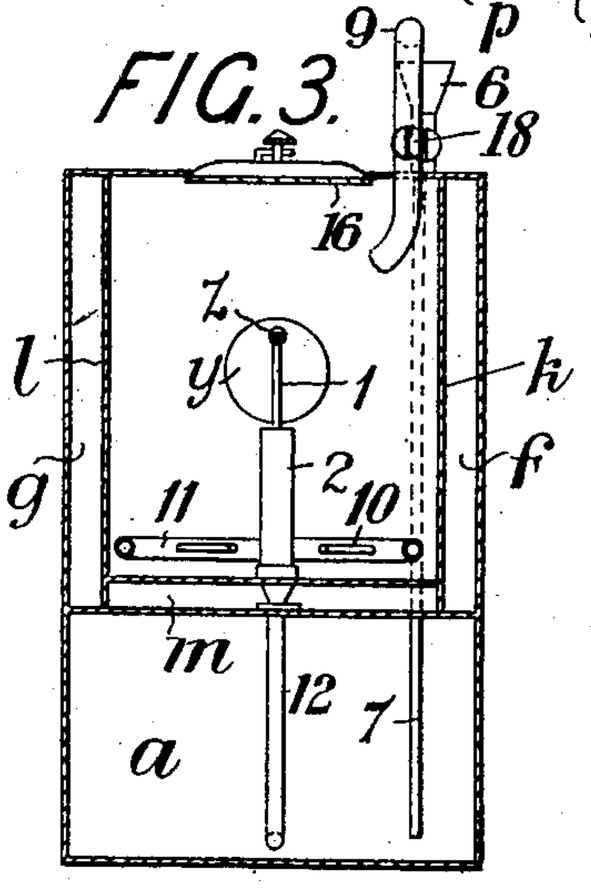


FIG. 3.



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UNITED STATES PATENT OFFICE.

HENRY GARDE, OF LONDON, ENGLAND.

APPARATUS FOR CARBURETING AIR.

SPECIFICATION forming part of Letters Patent No. 762,477, dated June 14, 1904.

Application filed February 2, 1903. Serial No. 141,493. (No model.)

To all whom it may concern:

Be it known that I, HENRY GARDE, a subject of the King of Great Britain and Ireland, residing at No. 2 James street, Haymarket, London, in the county of Middlesex, England, have invented new and useful Improvements in and Connected with Apparatus for Carbureting Air, of which the following is a specification.

My invention relates to apparatus for carbureting air in which I am enabled to carburize the air at a temperature below that of the normal atmosphere, by the use of which apparatus condensation in the pipes or mains is prevented and wherein a mixture of air and vapor of practically constant density is produced. The air is compressed by means of a pump of ordinary construction or by means of a pump made on the principle of an Archimedean pump or screw revolving in a chamber containing water, glycerin, oil, or other suitable liquid and provided with means for permitting of the access of air, and the air may also be dried by any suitable apparatus, if found necessary or advisable. The Archimedean screw takes up a certain amount of air and liquid at each revolution and discharges both air and liquid into an inclosed chamber which is in connection with the aforesaid pump-chamber. The inclosed compressed-air chamber is in communication with another chamber containing a suitable light hydrocarbon liquid in such manner that the compressed air is introduced below the surface of the hydrocarbon liquid in the form of a number of fine jets. The air being under pressure and lighter than the liquid rises and carries with it a certain amount of the hydrocarbon in the form of vapor, and the mixture of air and hydrocarbon vapor is carried off from this carbureting-chamber by a pipe to the burner or burners it is intended to supply. In order to keep the hydrocarbon liquid at as equable a temperature as possible, the carbureting-chamber, the compressed-air chamber, and the pump-chamber are all mounted on a reservoir containing the hydrocarbon liquid, and the carbureting-chamber is provided with a pump connected to the same shaft as the air-compressing pump, so that when the latter operates the hydrocarbon-pump also receives motion and pumps the hydrocarbon liquid from the farther end of the reservoir by means of a suction-pipe into the carbureting-chamber, thus keeping up a constant fresh supply of the hydrocarbon liquid. In order to maintain the proper level of the hydrocarbon liquid consistent with the requirements depending upon temperature of the atmospheric air, and so on, and to keep up a circulation of the liquid, the carbureting-chamber is provided with a surface overflow-pipe communicating with the reservoir, and this pipe is made adjustable as to height either by manual adjustment or mechanically or automatically by means of clockwork or a float or diaphragm or other device connected thereto which is sensitive to alterations in the temperature or in the density of air, gas, or mixture thereof in which it is situated. The carbureting-chamber is surrounded by water, glycerin, or other liquid, which is kept in constant circulation by the air-compressing pump for the purpose of still further aiding in keeping the temperature of the apparatus normal, or there may be a constant supply of water from the main or from any other source.

Figure 1 of the accompanying drawings illustrates in sectional elevation an apparatus constructed according to my invention. Fig. 2 is a plan on the line II II, Fig. 1; and Fig. 3 is a transverse section on the line III III, Fig. 1.

The apparatus consists of an oblong outer case or tank divided at about one-third its height by a partition, forming the oil-reservoir *a* below, and the air-chamber *b*, compression-chamber *c*, and carbureting-chamber *d* above. By thus inclosing the carbureting chamber or tank within the same casing containing the pump or the compression-chamber, or both, I obtain a decided advantage, as any tendency for lowering of temperature which would occur from the evaporation of the liquid in the carbureting-chamber is compensated by the increase of temperature in the pump or compression-chamber, or both. The air-chamber *b* extends the full width of the outer case, while the compression-chamber *c* and the carbureter *d* are of less width,

leaving a narrow channel along the sides of these two chambers, (marked *f* and *g* on drawing Fig. 2.) A similar channel *h* in connection with *f* and *g* is provided between the compression-chamber *c* and the carbureter *d* and another channel *i* between the carbureter and the right-hand end of the outer tank. The bottom of the air-chamber *b* and the compression-chamber *c* are formed by the top of the oil-reservoir *a;* but the bottoms of the channel *h* and of the carbureter *d* are at a higher level, as shown on drawings, the sides *k* and *l* extending down to the top of the oil-reservoir *a*, thus forming the tunnel *m*, extending from the right-hand side of the compression-chamber *c* under the channel *h* and carbureter *d*, communicating with the channel *i*. The plates forming the two sides *n* and *o* of the compression-chamber *c* and the carbureter *d* are perforated with holes *p* where they cross the channel *h*, as shown. The oil-reservoir *a* extends the full length and width of the apparatus, and it is provided at the left-hand end with a small glass panel or gage *q*, by which the level of liquid in the reservoir can be observed, and a draw-off valve or cock *r*.

In the air-chamber *b* is fixed a hollow drum or cylinder *s*, hermetically closed at the left-hand end. At the right-hand end it contains a central opening, on which is fixed the short hollow shaft *t*. A shaft *u*, having a pulley or wheel *v* mounted thereon, is fixed to the drum and projects at the left-hand end through bearings *w* in the outer tank and also runs in a bearing *x* into the carbureter, both bearings being provided with stuffing-boxes or other means for forming a tight joint. The right-hand end of this shaft *u* is suitably provided with a crank-disk *y*, having a crank-pin *z*, which is conveniently made adjustable as to its throw. Connected to the crank-pin is a connecting-rod 1, which is jointed to the plunger of a pump 2. Around this drum *s* are wound four tubes 3 of a square or other suitable section, beginning at the left-hand end. These tubes start with open ends at points opposite the ends of two diameters drawn at right angles to each other on the cross-section of the drum. Each tube is wound around the drum for a length of from one revolution and a half to two revolutions and a quarter of same and then enters the inside of the drum *s*, where it is cut off about flush with the inside periphery of same, as shown, for instance, at *e*, Fig. 1. A quarter of the circumference of the drum is left between the end of one tube and the commencement of another. The top of the chamber is provided with a lid or cover 4 with air-holes 5 in same. The said chamber is also provided with a draw-off or stop-cock 19.

On the top of the compression-chamber *c* is fixed a funnel 6, with stop-cock communicating by the pipe 7 with the oil-reservoir *a*, and there is also a safety or blow-off valve 20. The top of chamber *c* is hermetically closed by a manhole-cover 8 and has also connected to it the pipe 9, with stop-cock 18 communicating with the carbureter *d*. The pipe 9 is brought from the compression-chamber *c* through the top of the carbureter *d*, as shown, down near to the bottom, where it is connected by branch pipes 10 to a circular pipe 11. These branch pipes and circular pipe contain a number of fine perforations on their under sides. The pump 2 passes through the bottom of the carbureter *d* and through the tunnel *m*, and its suction-pipe 12 extends to the extreme left-hand end of the oil-reservoir. An overflow-pipe 13 is also fixed in the carbureter, connecting with the oil-reservoir, as shown, through a plug and barrel coupling 14 with a T or three-way bore and fitted with a handle or indicator 15 on the outside. The carbureter *d* is hermetically closed by a manhole-cover 16 and has an outlet or discharge pipe 17 with stop-cock, as shown. In order to equalize the pressure in the carbureting-chamber and the reservoir *a*, I connect the upper parts of the two chambers by means of a pipe 22.

The apparatus works as follows: The oil-reservoir *a* is filled with the carbureting liquid through the funnel 6, and the carbureter *d* is likewise filled to the level required. The level of the carbureting liquid is regulated by the handle 15, which raises or lowers the overflow-pipe 13, as desired. The air-chamber *b* is filled with water to the level of about the center of the drum *s*, the water at the same time rising to the same level in the channels *f*, *g*, *h*, and *i* and by means of the tunnel *m* in the compression-chamber *c* to such a height as the pressure of air in the chamber will admit when the apparatus is at work. When the wheel *v* is revolved by means of a water-wheel, clockwork-weight, or other suitable motor, it turns the drum *s*. The outer open ends of the tubes wound round same dip into and take up the water, which seals the air already in the tubes and drives it through them into the inside of the drum, from whence it passes through the hollow shaft *t* into the compression-chamber *c*. The result of this process is that continuous and steady streams of air and water emerge from the inside of the drum *s* into the compression-chamber *c*, where the air is gradually compressed, and forces the water in the chamber through the tunnel *m* to the channel *i*, where it rises and flows back through the other channels *f* and *g* to the air-chamber *b* again, where the same process is repeated. A constant circulation of the water is therefore provided from the air-chamber *c* to and around the carbureter *d* and back again to the air-chamber, at the same time forming a complete water-jacket

around and under the said carbureter. On opening the stop-cock 18 on the air-pipe 9 the compressed air in the compression-chamber *c* passes into the carbureter *d* through the air-pipe 9 and the circular pipe 11. It rises in very fine particles through the hydrocarbon already in the carbureter, with the result that it takes up and holds in suspension a certain quantity of the oil, thus forming a gas which may be drawn off through the outlet-pipe 17 to mains or pipes, to be used for lighting, heat, or power. The revolving of the drum *s* also operates the pump 2 by means of the shaft *u* and causes the carbureting liquid in the reservoir *a* to be pumped through the suction-pipe 12 from the extreme left-hand end of the reservoir into the carbureter *d*, where the surplus quantity brought up by the pump flows back again to the reservoir down the overflow-pipe 13, so that, as in the case of the water, there is also a constant circulation of the carbureting liquid from the left-hand end of the reservoir through the carbureter and back again to the reservoir. The quantity of carbureting liquid in the carbureter is regulated by the overflow-pipe 13, as this pipe can be raised or lowered at will by the handle 15, which also indicates on the outside of the apparatus the level of the carburating liquid in the carbureter *d*. As the density of the gas depends upon the temperature maintained in the carbureter and also upon the period of contact between the air and the oil therein, this pipe affords a simple means of keeping the gas produced at a constant density by increasing the column of the oil through which the air passes as the temperature decreases, and vice versa. Again, as the temperature of the carbureter depends not only upon the atmospheric temperature, but also upon the length of time the apparatus is working, (a certain quantity of heat being lost in the carbureting process,) means are provided to maintain this temperature at as level a point as possible. The water jacket and circulation already described afford protection against sudden changes in atmospheric temperature, while it also keeps up the temperature of the carbureter by conveying to it and causing it to retain the heat generated by the compressing of the air in the compression-chamber and the slight amount of friction created by the revolving of the drum. Furthermore, by the process of pumping and circulating the carbureting liquid between the reservoir *a* and the carbureter *d* a constantly fresh supply of oil of practically even temperature is maintained in the latter. In this manner and by these means the great difficulties of carbureting the air are surmounted and a gas of practically fixed density produced.

The power necessary to work the plant is very small. A one-sixteenth-horse-power hot-air engine would be quite sufficient for a a two-hundred-light plant, while smaller plants up to fifty lights could be worked by weights.

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

1. Apparatus for carbureting air, comprising means for compressing the air, a reservoir for containing hydrocarbon liquid, a carbureting-chamber supplied with hydrocarbon liquid from the said reservoir, a compressed-air chamber, means for supplying compressed air from said chamber to the carbureting-chamber below the level of the hydrocarbon liquid therein and means for causing a liquid to circulate from the air-compressor around the carbureting-chamber and back again, substantially as and for the purpose set forth.

2. Apparatus for carbureting air comprising means for compressing the air, a reservoir for containing hydrocarbon liquid, a carbureting-chamber supplied with hydrocarbon liquid from the said reservoir, means for supplying compressed air below the level of the hydrocarbon liquid, an adjustable overflow-pipe connecting the carbureting-chamber and the reservoir and means for continually circulating the hydrocarbon liquid from the reservoir to the carbureting-chamber, substantially as set forth.

3. In apparatus for carbureting air, a compression-chamber, the combination of a pump for forcing water or other liquid and air into said chamber, a reservoir for containing hydrocarbon liquid, a pump, a carbureting-chamber supplied with hydrocarbon liquid from the said reservoir by said pump, passages around the said carbureting-chamber for the circulation of water, an adjustable overflow-pipe connecting the carbureting-chamber and the reservoir, a connection for the passage of the compressed air from the upper part of the compression-chamber to below the level of the liquid in the carbureting-chamber and a delivery-pipe from the latter for the gas, substantially as set forth.

4. In apparatus for carbureting air, a compression-chamber, the combination of a pump for forcing water or other liquid and air into said chamber, a reservoir for containing hydrocarbon liquid, a pump, a carbureting-chamber supplied with hydrocarbon liquid from the said reservoir by means of said pump, a passage or tunnel for the water underneath the said carbureting-chamber in connection with the said compression-chamber, passages around the carbureting-chamber in connection with the tunnel and with the pump, an adjustable overflow-pipe connecting the carbureting-chamber and the hydrocarbon-liquid reservoir, a connection for the passage of the compressed air from the upper part of the compression-chamber to below the level of

the liquid in the carbureting-chamber and a delivery-pipe from the latter for the gas, substantially as set forth.

5. In apparatus for carbureting air, the combination of a casing divided into an upper and a lower tank, the upper tank for containing water or other liquid and air, the lower tank to serve as a reservoir for hydrocarbon liquid, a drum closed at one end and provided with a hollow shaft at the other end and mounted in the tank so as to be capable of revolving on its axis, a carbureting-chamber, pipes coiled round the drum, open to the outside at one end and to the interior of the drum at the other end for the purpose of compressing air and circulating water round and under a carbureting-chamber, an inclosed compression-chamber into which the hollow shaft projects, means for making a tight joint between the hollow shaft of the drum and the compression-chamber, a pipe connecting the upper part of the compression-chamber and the lower part of the carbureting-chamber containing hydrocarbon liquid, means for introducing the compressed air in a finely-divided condition below the level of the hydrocarbon liquid in the carbureting-chamber, a pump for circulating the hydrocarbon liquid between the carbureting-chamber and the hydrocarbon-reservoir, an adjustable overflow-pipe in the said carbureting-chamber and a pipe for the delivery of the gas, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY GARDE.

Witnesses:

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