May 11, 1954 L. H. BRAKE 2,678,202

IMPROVEMENTS IN AND RELATING TO APPARATUS FOR GENERATING GAS

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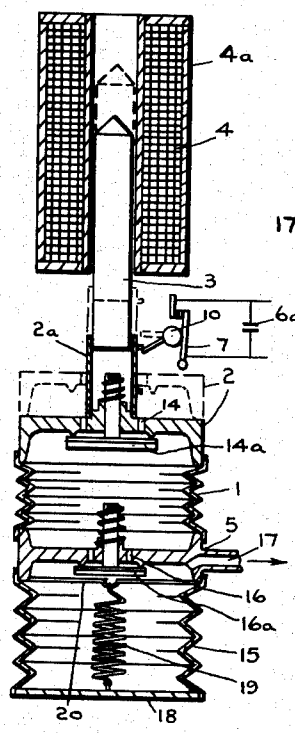


FIG. 1.

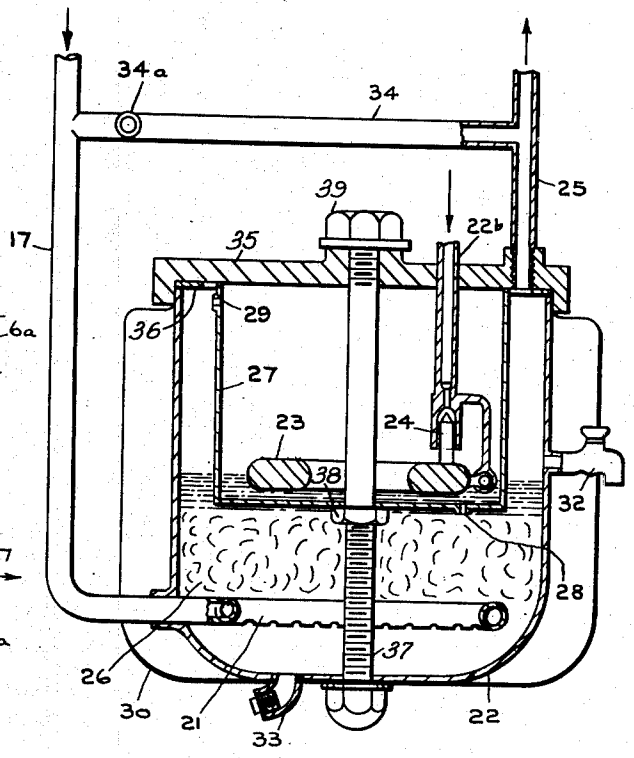


FIG. 4.

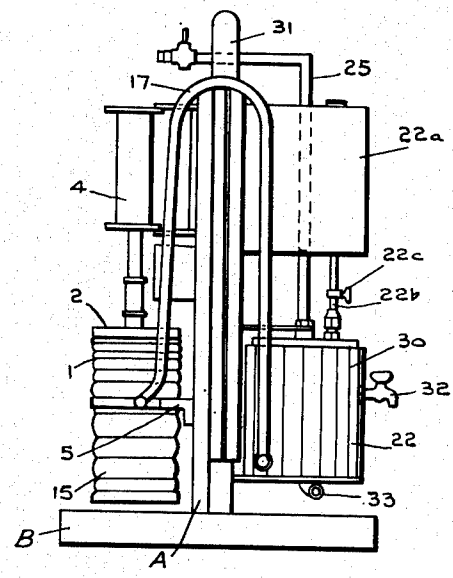


FIG. 3.

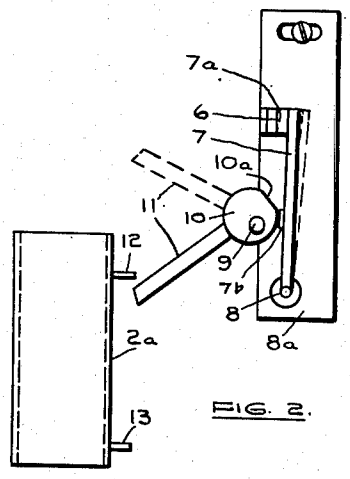


FIG. 2.

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IMPROVEMENTS IN AND RELATING TO APPARATUS FOR GENERATING GAS

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7 Claims. (Cl. 261—124)

1

The present invention relates to a gas generating apparatus. More particularly, the invention relates to a gas generating apparatus in which air is delivered through distributing means in a closed vessel to bubble up through a volatile liquid in the vessel. The invention has particular reference to improvements in the constructional features of such gas generating apparatus.

Accordingly, it is an object of the present invention to provide a compact, portable, economical gas generating apparatus including a closed vessel to receive a volatile liquid, an air distributing means within the vessel and a unique and novel air pump operable in response to the discharge of the produced gas from the vessel.

It is another object to provide in such a gas generating apparatus an economical construction as far as operation of the apparatus is concerned embodying a solenoid actuated bellows pump rapidly movable on its suction stroke under the influence of the solenoid and having a slow delivery stroke, and in which the movement of the bellows on its suction and delivery stroke controls the current supply to the solenoid.

It is a further object to provide in such apparatus a float controlled valve for maintaining the volatile liquid at a substantially constant level in the vessel.

It is an additional object to provide in such apparatus a by-pass conduit between the air conduit to the distributing means within the vessel and the gas outlet conduit from the vessel so as to provide for adjustment of the richness of the gas so as to compensate for variations in the gas mixture, such as variations resulting from the effect of temperature variations on the volatility of the liquid.

The preferred form of gas generating apparatus according to the invention will now be described with reference to the accompanying partly diagrammatic drawings, in which:

Figure 1 is an axial section through an air or gas pump embodied with the apparatus of the invention, showing the actuating means therefor and a pressure equaliser associated with the pump outlet, some of the parts being shown in elevation,

Figure 2 is an enlarged elevation of the contacts and the operating means for the moving contact,

Figure 3 is a side elevation of a portable gas generating apparatus according to the invention and incorporating the pump shown in Figures 1 and 2, and

Figure 4 is a vertical axial section through the vessel in which the gas is generated, showing

2

various features of the same, some of the parts being shown in elevation.

The apparatus includes a pump shown in Figures 1 and 2, comprising a substantially vertical bellows 1, the upper end or head 2 of such bellows constituting the free end and being connected by a sleeve 2a to the core 3 of a high-efficiency and low consumption electrical solenoid 4 mounted at a fixed position above the bellows. The base 5 of the bellows is also mounted at a fixed position on an upright A carried by a base B.

The electrical current supply to the solenoid 4 is controlled by a fixed contact 6 and a contact 7a on a bar 7 pivoted at 8 to a fixed member 8a, the contact 7a being adapted, for instance under action of a spring, to make electrical connection with the fixed contact 6, thus completing the circuit in known manner and so causing the solenoid 4 to become energised.

A condenser 6a of suitable capacity is connected across the two contacts 6 and 7a to minimise arcing.

A cam or eccentric 10 is pivoted at 9 to a fixed member such as the member 8a and engages and bears against a fibre block 7b carried by the contact 7a, such cam 10 having an arm 11 adapted to be engaged or tripped by a pair of stops or projections 12 and 13 fixed at a suitable interval apart to the sleeve 2a associated with the core 3 so that the stops or projections move with the core.

The arrangement is such that, when the head 2 of the bellows reaches its lower position at the end of its useful "pumping" stroke, performed as here shown by gravity due to the loading provided by the weight of such head and that of the core 3, the upper stop 12 trips the arm 11 and depresses the latter to a position as shown in Figures 1 and 2, in which it causes the cam 10 to present a minor radius portion of its eccentric working face to the block 7b on the contact bar 7, with the result that the contact 7a establishes electric connection with the fixed contact 6.

When this takes place, the solenoid 4 becomes energised and so raises the core 3 to its upper position, as indicated in Figure 1 by dotted lines.

The upward movement of the core 3 serves to raise the connected upper end or head 2 of the bellows, with the result that the fluid being pumped is drawn into the interior of the latter through ports 14 controlled by a lightly spring-loaded non-return inlet valve 14a faced with rubber or the like, this constituting the suction or return stroke of such bellows.

As the core 3 approaches its upper position, the

arm 11 is tripped by the lower stop 13 and assumes the position indicated in dotted lines which causes the cam 10 to present a major radius portion of its surface to the block 7b on the contact bar 7, thus causing the contact 7a to break its connection with the contact 6 and so open the circuit through the solenoid 4, whereupon the next useful stroke of the pump can take place. The cam is provided with a flat part 10 to ensure that the cam will remain in the latter position until next tripped.

In order to ensure substantially constant pressure of the fluid delivered from the pump, the said fluid is delivered through a pressure equaliser which takes the form of bellows 15 arranged beneath the base 5 of the pump bellows 1 and communicating with the latter by means of ports 16 controlled by a lightly spring-loaded non-return valve 16a which is faced with rubber or the like and is adapted to seat against the underside of the base 5 which is also formed with a delivery pipe 17 whereby the air is delivered from the equaliser 15. The chamber provided by the equalizer 15 constitutes an expansible pressure equalizing chamber or reservoir of the loaded bellows type.

The lower end 18 of the equaliser 15 is connected by a spring 19 with a bar 20 fixed across the base 5 in order to provide suitable loading for such equaliser to maintain its contained fluid—e. g. air at a suitable substantially constant pressure and so substantially obviate supply-line pressure pulsations produced by the action of the pump 1.

Referring now to Figures 3 and 4 of the drawings, wherein is shown gas generating apparatus embodying the pump shown in Figures 1 and 2 for passing air through a suitable volatile liquid to produce gas, the air from the pump bellows 1 is delivered through the equaliser 15 and pipe 17 and through distributing means having an annular distributing passage 21 perforated on its underside, into the lower part of a gas generator vessel 22 consisting of a closed vessel to which the volatile liquid is fed through a valve controlled pipe 22b from a reservoir 22a under control of a float 23 controlling a needle-valve 24 whereby such liquid is maintained at a substantially constant level in the generator vessel 22. The passage 21 is disposed below the level of the liquid in the vessel.

The arrangement is such that the air is ejected through the apertures in the lower part of the distributing passage 21 and is bubbled through the liquid in the vessel 22, producing a gas in the upper part of the latter from whence such gas is led by a pipe 25 to supply heating or lighting burners, preferably of the Bunsen type, or to discharge the gas for any other suitable purpose.

To ensure sufficient richness of the gas, the vessel 22 is packed with steel or brass wool, cotton waste or other suitable flocculent material 26 to make the path of the air bubbles through the liquid more tortuous, thereby bringing such air into more intimate contact with the liquid. This is an important feature of the invention where the invention is in use under lower temperature conditions.

In order to allow for variations in the richness of the gas mixture leaving the vessel, for instance where the fluctuations are due to temperature fluctuations, the apparatus can be designed to produce a rather rich mixture and an auxiliary air supply can be taken from the pipe 17 to the pipe 25 by way of a bye-pass pipe 34 (Figure 4) in which are located a control valve 34a operated manually or thermostatically from the temperature of the liquid in the vessel 22.

To shield the float valve from the flocculent material, that is, to prevent the packing material 26 from coming in contact with and impeding the movements of the float 23 and its needle valve 24, such parts 23 and 24 are enclosed in an inner chamber 27 disposed in the vessel 22 and in the bottom of which is a hole 28 communicating with the interior of the vessel, to permit the liquid to flow into the interior of the vessel 22, while near the upper end of such chamber 27 is a hole 29 providing a vent for gas to pass from the chamber 27 to the vessel 22.

The external surface of the vessel 22 is formed with ribs or fins 30 to increase its area in contact with the atmosphere and so prevent an undue fall of temperature from occurring in such vessel as the result of the evaporation of the liquid therein.

To ensure the maximum of efficiency the armature or core 3 is preferably made of an appropriate ferrous material of such dimensions that at no stage is magnetic saturation reached. For the same reason the solenoid is preferably "iron-clad"—that is, a return path for the magnetic field is provided through a casing 4a of suitable ferrous metal covering the outside of the winding.

The apparatus of Figure 3 constitutes a compact and portable gas generating apparatus in which the horizontal base B has mounted thereon the upright A. A carrying handle 31 is provided so that the apparatus can be easily lifted and carried around to its desired location since the particular pump structure occupies small dimensions, the entire apparatus encompasses a cross-sectional area of relatively small dimensions. As shown in the drawing, the volatile liquid receiving reservoir 22a is carried by the upright near the top thereof and the gas generating tank or vessel 22 is supported by this upright subjacent the reservoir. The liquid feed pipe 22b provides communication between the reservoir and the generating tank under combined control of the manually operable shut-off valve 22c and the float control valve 24. As indicated in Figure 4, the gas generating vessel or tank includes the externally ribbed tank having upper edges and a removable top 35. The top has a depending marginal flange which, when the top is in position, projects downwardly below the upper edges of the tank 22. The inner chamber 27 constitutes a combined liquid receiving and float containing chamber and includes a lateral extending flange 36 which rests on the upper edge of the tank 22 and is held thereagainst when the top 35 which is removable is clamped thereon. To effect this clamping action a headed bolt member 37 passes through an aperture in the bottom of the tank 22 and includes a threaded portion which receives a nut 38 against which rests the bottom of the chamber 27. The upper extremity of this bolt 37 is likewise threaded so that when its upper end passes through a central aperture in the top 35, a nut 39 threaded on to this bolt clamps the top 35 to the flange 36 resting on the upper edges of the tank 22. As indicated, the space between the side walls of the chamber 27 and the tank 22 is the gas receiving space and the gas delivery pipe 25 communicates with the top 35 near the periphery thereof so as to be in communication with this gas receiving space. The distributing member 21 effectively introduces air in a downward direction into the liquid from whence the

gas generated bubbles upwardly through the flocculent material 26 and the liquid and thence into the gas receiving space.

The liquid employed may be any suitable liquid fuel with an appropriate low boiling range—for example between 30° C. and 60° C.

In operation, the appropriate liquid is introduced into the reservoir 22*a* and assuming the valve 22*c* to be open the liquid will flow by gravity under float valve control into the vessel 22 until the normal operating level is reached, the fuel being automatically kept substantially at this level by the float valve during operation.

Assuming the electrical power to be switched on and the pump head to be in its lowest position, with the contacts 6 and 7*a* closed, the solenoid will be energised, thereby raising the core 3 and the head of the pump. The upward movement of the head 2 of the pump is so rapid that the inertia of the mass of the valve 14*a* is not overcome by the valve spring, and consequently the ports 14 are opened to the influx of air into the pump. This is assisted by the use of only a light spring on the valve 14*a*, and the effect of this action is to ensure ready opening of the said valve and consequent reduction of load on the pump and low consumption of electrical energy.

As the core approaches its upper position, the mechanism operates to open the contacts 6 and 7*a* and assuming that the operating pressure has not already been built up, the pump head 2 sinks by gravity, ejecting the air through the ports 16 into the pressure equaliser from whence it travels through the pipe 17 and distributing passage 21 to bubble upwards among the flocculent material and through the liquid, thus forming a gas in the upper part of the vessel 22 from which the said gas is taken away through the pipe 25 as desired. As the pump head approaches its lowest position the contacts 6 and 7*a* are again closed.

The pumping action is automatic during discharge of gas from the vessel 22, and ceases whenever the normal pressure has been built up, whereupon the pump head ceases to move by gravity and the electrical circuit remains open. Electrical power is only consumed during the return or suction strokes, and it will be appreciated therefore that when the flow of gas from the generator ceases, as the result of the closing of a tap in the outlet pipe 25 or on a burner or other appliance connected with such pipe, no electrical power will be consumed.

The apparatus may be designed to build up a working pressure of a degree similar to that employed for conventional gas fuelled domestic appliances.

Should the needle valve stick and admit liquid when the liquid level in the vessel 22 is already sufficiently high, the tap 32 can be used to drain away the surplus.

When desired, any foreign matter such as water of condensation can be drained away through the plug controlled outlet 33.

The inverted arrangement of the distributing passage 21, i. e. with its outlet apertures in its lower side, ensures that the said passage can be kept substantially free of liquid, and consequently assists in maintaining substantially even upward air flow through the liquid in the vessel 22.

The pointed upper end of the solenoid core 3 has been found in practice to give substantially even magnetic pull on the core throughout its stroke which may for example be about two inches.

The electric power necessary to energise the solenoid may be obtained from any small source of direct current, such for instance as a battery of 6, 12, 24 or 32 volts (which may be an existing car battery or a bach lighting battery).

By the provision of the equaliser 15, the air supplied to the generator vessel 22 will be maintained at substantially constant pressure and consequently such generator will supply gas at constant pressure to the burners.

Referring to Figure 3 of the drawings, the air delivery pipe 17 between the pump bellows 1 and the vessel 22 extends upwards above the normal level of the liquid in the reservoir 22*a*, in order to prevent back flow of liquid to the pump in the event of the vessel 22 flooding, such as through the needle valve sticking or leading.

The gas delivery pipe 25 extends upwards to a level higher than the normal liquid level in the reservoir in order to prevent overflowing of liquid through the outlet in the event of the vessel 22 flooding.

The method of operation may be substantially the same whether the gas is a combustible gas for burning, or whether it is any suitable form of gas for any other purpose such as fumigating.

Alternatively to, or in addition to, the loading means for the pump as constituted by the gravity operation of the pump bellows 1, the said pump bellows may be spring-loaded in a manner similar to the equaliser 15, or other resilient means such as a rubber band may be employed, the spring or other resilient means operating the pump in its useful stroke.

While modifications in structure can be made it is understood that the invention is not to be limited other than by the scope of the appended claims.

What is claimed is:

1. A compact portable gas generating apparatus comprising a supporting means, a carrying handle embodied therewith, a volatile liquid reservoir supported by the supporting means, a separate gas generating tank supported by the supporting means subjacent said reservoir and including upper edges and a removable top, a gas delivery pipe communicating with the tank through said top, a combined liquid receiving and float containing chamber including side walls and an apertured bottom supported within the upper portion of said tank with the bottom of the chamber spaced from the bottom of the tank, a liquid feed pipe communicating with the reservoir, passing through the top of the tank and terminating in spaced relation to the bottom of said chamber, a float within said chamber, a valve carried by said float and cooperable with said feed pipe to control liquid flow therethrough and thus flow from said reservoir to said chamber and thence to said tank responsive to the position of said float to maintain a substantially constantly constant liquid level in said chamber and tank, an air inlet pipe communicating with said tank subjacent the bottom of said chamber, and an air distributing member extending from said inlet pipe, disposed within the tank and having delivery apertures on the under side thereof so that air can flow downwardly into and upwardly through the volatile liquid to generate gas therefrom with the gas rising through the liquid into the space above the liquid level and between the side walls of the chamber and the tank for delivery through said gas delivery pipe.

2. A compact portable gas generating apparatus as defined in and by claim 1, in which the side walls of said chamber have a laterally

extending flange supported on the upper edges of said tank and means clamping the top to the tank to thereby clamp the chamber in supported position within the tank.

3. A compact portable gas generating apparatus comprising a supporting means including a base and an upright and a carrying handle embodied therewith, a volatile liquid reservoir supported by the upright, a separate gas generating tank supported by the upright subjacent said reservoir and including a top, a gas delivery pipe communicating with the tank through said top, a combined liquid receiving and float containing chamber including side walls and an apertured bottom supported within the upper portion of said tank with the bottom of the chamber spaced from the bottom of the tank, a liquid feed pipe communicating with the reservoir, passing through the top of the tank and terminating in spaced relation to the bottom of said chamber, a float within said chamber, a valve carried thereby and cooperable with the said feed pipe to control flow therethrough, an air inlet pipe communicating with said tank subjacent the bottom of said chamber, an air distributing member extending from said inlet pipe disposed within the chamber and having delivery apertures on the under side thereof so that air can flow downwardly into and upwardly through the volatile liquid to generate gas therefrom with the gas rising through the liquid into the space above the liquid level and between the side walls of the chamber and the tank, said air inlet pipe including a portion extending above said tank, and a valve controlled bypass extending between said portion and said gas delivery pipe, a valve in said bypass controlling gas flow from said inlet pipe to said delivery pipe to adjust the richness of the gas mixture flowing through said delivery pipe.

4. A compact portable gas generating apparatus as defined in and by claim 1, and a flocculent mass within the tank to provide a tortuous passage for the air through the liquid to increase the richness of the mixture.

5. Apparatus as claimed in claim 4, wherein the external surface of the vessel is ribbed in order to minimize the drop in the temperature of the contents of the vessel during use.

6. Apparatus as claimed in claim 1, wherein a drain tap is provided above the liquid level in the vessel.

7. Apparatus as claimed in claim 3, wherein the air inlet pipe includes a portion extending above the maximum liquid level of the tank and the gas delivery pipe includes a portion extending above the maximum liquid level of the tank.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,154,507	Gorton	Sept. 21, 1915
1,249,654	Muller	Dec. 11, 1917
1,752,851	Roesch	Apr. 1, 1930
1,922,749	Roush	Aug. 15, 1933
1,984,716	Wilhoefer	Dec. 18, 1934
1,986,267	Hoyt	Jan. 1, 1935
2,049,333	Snethkamp	July 28, 1936
2,207,689	Baker	July 9, 1940
2,384,609	De Vries	Sept. 11, 1945
2,429,441	Williams	Oct. 21, 1947

FOREIGN PATENTS

Number	Country	Date
342,067	Great Britain	Jan. 29, 1931
387,891	France	May 16, 1908
442,984	France	July 3, 1912
544,378	Great Britain	Apr. 10, 1942