

July 7, 1936.

C. W. JOHNSON

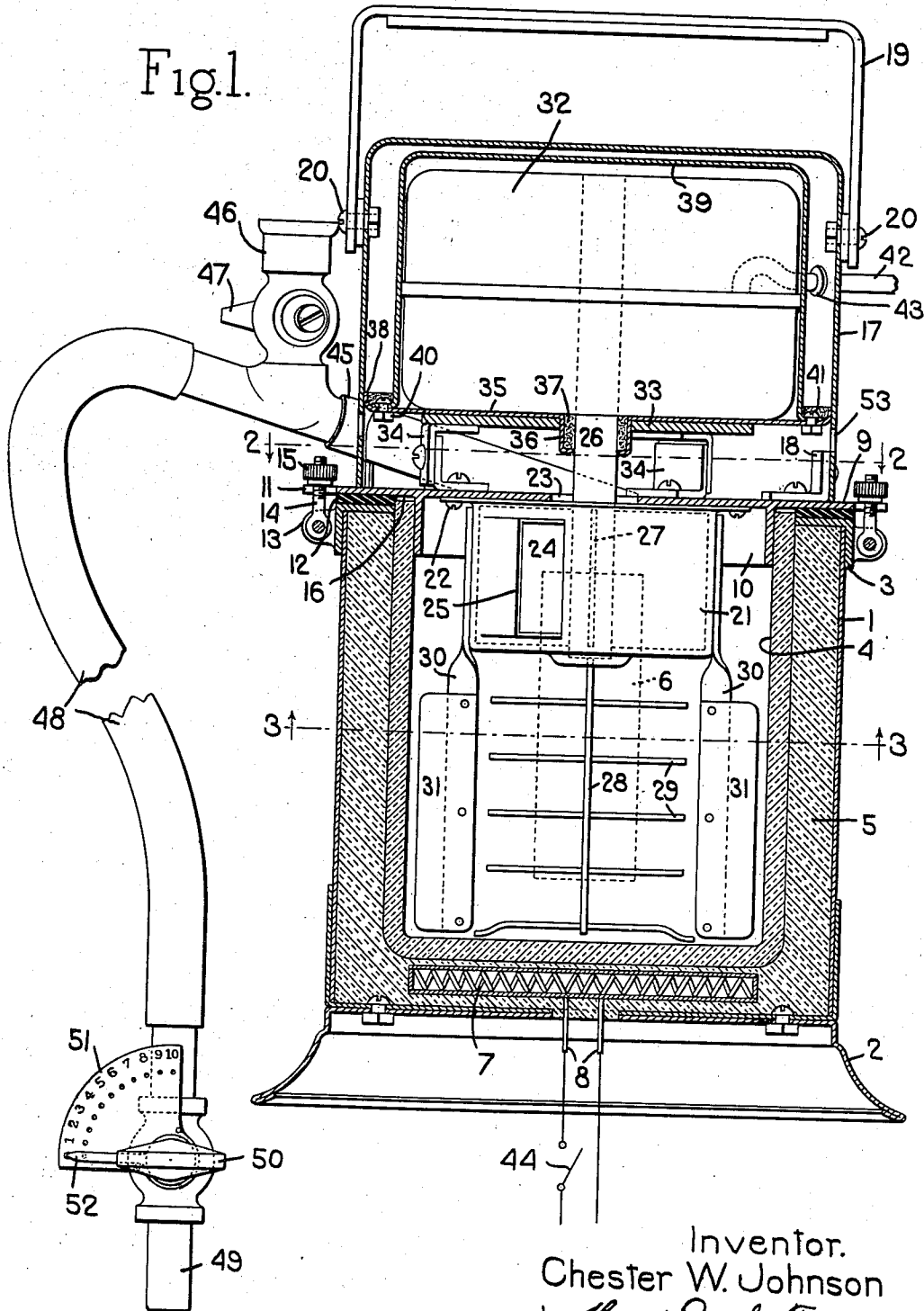
2,046,633

ANESTHETIC ADMINISTERING APPARATUS

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2 Sheets-Sheet 1

Fig. 1.



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2 Sheets-Sheet 2

Fig.2.

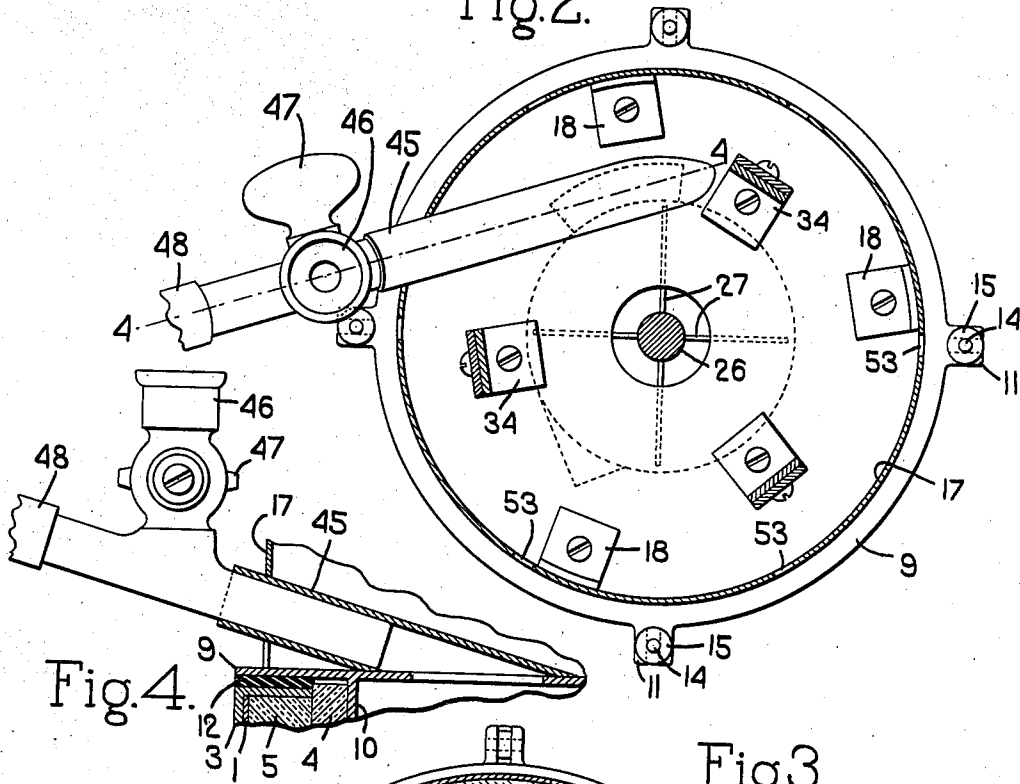


Fig.4.

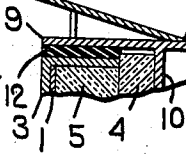
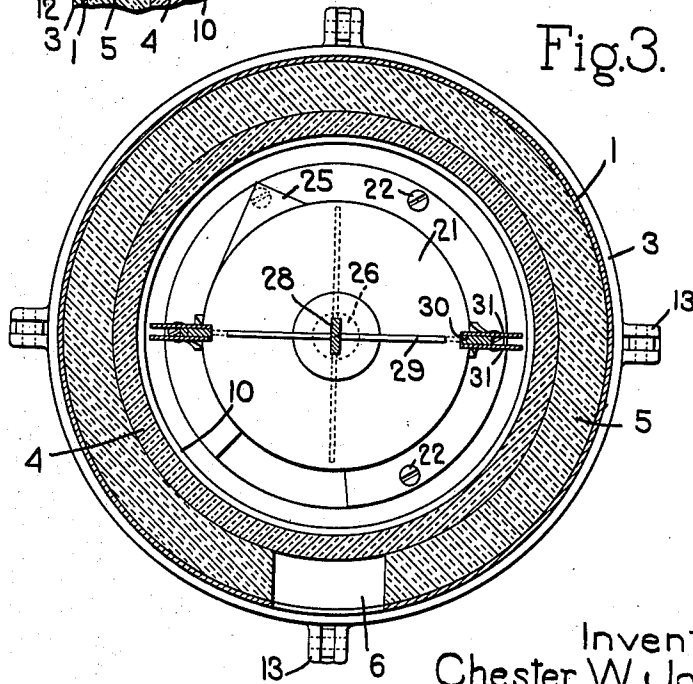


Fig.3.



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UNITED STATES PATENT OFFICE

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ANESTHETIC ADMINISTERING APPARATUS

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13 Claims. (Cl. 128—192)

This invention relates to an apparatus for administering a mixture of air and anesthetic vapor primarily in connection with surgical operations.

In the administration of anesthetics in vapor form to a patient or subject, it is of vital importance to secure and maintain the proper conditions. Since the administration takes place by inhalation, it has to be continued throughout the operation or other required period of anesthesia because the anesthetic vapor is excreted by the lungs as it is absorbed. Furthermore, the patient or subject must be brought to and maintained in a definite degree of anesthesia. If this degree is not reached, the desired condition is not obtained and, if it is passed, injury and even death may ensue. In surgical operations it is the aim to obtain what is known as the third degree of anesthesia or the stage of surgical anesthesia where there is a general muscular relaxation with the loss of many of the reflexes but with the vital reflexes and the vital centers in the medulla still active and the heart muscle not paralyzed.

The anesthetic vapor, such, for example, as that of ether or chloroform, must be administered in an air mixture because of the necessity of maintaining the supply of air to the patient or subject and the proportion of the anesthetic vapor in the air mixture must be controlled in order that the required quality of the mixture be administered. It is the quality of the vapor that decides the depth or stage of the anesthesia and not the quantity.

While in the administration of the anesthetic vapor the depth or stage of anesthesia depends largely upon the physiological characteristics and conditions of the subject at the time and must be determined by the experienced judgment of the anesthetists, yet the anesthetist is immeasurably aided by being able to predetermine the proportions of the vapor of the anesthetic and maintain the desired proportions during any desired period.

The present invention provides an apparatus which secures the desired result of maintaining a supply of a mixture of air and anesthetic vapor of substantially constant proportions and as required by the anesthetist.

These and other objects and features of the invention will appear more fully from the accompanying description and drawings and will be particularly pointed out in the claims.

In the drawings:

Fig. 1 is a view chiefly in vertical cross section of a preferred form of apparatus embodying the

invention as designed for the administration of ether.

Fig. 2 is a view in cross section taken on the line 2—2 of Fig. 1.

Fig. 3 is a view in cross section taken on the line 3—3 of Fig. 1.

Fig. 4 is a detail in vertical cross section taken on the line 4—4 of Fig. 2.

The apparatus as disclosed comprises a container section having a casing 1 of metal or suitable material and shown as of general cylindrical form terminating at the bottom in a supporting base 2 and having at the top a flanged rim member 3. In this casing is mounted a container or jar for the liquid anesthetic such as liquid ether. This container 4 is of glass or other suitable vitreous material and is of less size than, but of similar dimensions to, the body of the container 1 so that a substantial space is left between the bottom and side walls of the container and the casing, which space is filled with suitable heat-insulating material 5. A sight opening 6 is provided in the side wall of the container and the heat insulation to enable the level of the liquid in the container to be observed.

Means are provided for supplying heat continuously to the liquid anesthetic in the container and in the preferred form of the invention illustrated this is secured by embedding an electric heating element or unit 7 in the insulation adjacent the container wall with terminals 8 extending to a suitable current source.

The container section is provided with a detachable closure section comprising a cover and an auxiliary casing 17 and with means for detachably or removably sealing the cover in closed position on the top of the casing 1. For this purpose a flat metal cover 9 is provided having a depending annular flange 10 adapted to fit snugly the interior of the container and having at intervals about its periphery the bifurcated lugs 11 extending beyond the rim 3. A gasket 12 is seated on the top of the rim 3 and the rim is provided with bifurcated lugs 13 corresponding in position to the lugs 11. Screws 14 hinged in the lugs 13 and provided with nuts 15 enable the cover to be clamped down tightly on the gasket 12 but with a slight clearance 16 between it and the upper edge of the container.

An auxiliary casing 17 of inverted cup shape is mounted upon and secured to the top of the cover as by the angle connections 18 and a bail handle 19 is conveniently pivoted at 20 to the 55

auxiliary casing for handling and transporting the apparatus.

A cup-shaped metal fan housing 21 depends from and is secured to the bottom of the cover 9 by the screws 22. This fan housing has its inlet opening 23 formed centrally through the cover 9 and its outlet opening 24 at the end of the tangential projection 25.

A vertical shaft 26 extends centrally through the inlet opening 23 and to the bottom of the fan housing 21. Radial blades 27 extending from this shaft within the fan housing constitute an impeller or centrifugal fan acting to draw air into the fan housing through the opening 23 and discharge it tangentially from the outlet opening 24 into the container.

An agitator, shown as a vertical bar 28 and provided with radially extending blades 29, is secured to the lower end of the shaft 26 and extends preferably to the bottom of the container. Baffle blades cooperating with the agitator are conveniently shown secured to and depending from the periphery of the fan housing. Each of these baffle blades comprises a vertical support 30 secured to the housing and the baffle blades 31 secured to the support.

The shaft 26 is rotated simultaneously to rotate the centrifugal fan within the fan housing and the agitator beneath the fan housing in the container and for this purpose there is preferred an electric motor 32 attached to the upper end of the shaft 26 and mounted within the auxiliary casing 17. Preferably an electric motor of the induction type is provided so as to avoid sparking and any further danger of the electrical contact with the vapor is secured by sealing this motor within a special casing. For this purpose a base plate 33 is removably mounted by means of the duplex angle brackets 34 on top of the cover. The bottom plate 35 of the special casing is secured to or rests upon the base plate 33 and has an annular depending flanged projection 36 extending down through a central opening in the base plate 33 around the shaft 26 and this projection is filled with suitable packing 37 to form a packing gland for the shaft 26. At its outer periphery this plate 35 is upturned at 38. The motor 32 rests upon the bottom plate and is covered by the cup-shaped special casing member 39 outwardly flanged at its periphery and secured tightly to the bottom plate 35 by the bolts 40. After the bolts 40 have been secured, the annular recess formed by the upturned flange 38 is filled with a suitable sealing compound 41.

Thus it will be seen that any access of the vapor of the anesthetic to the motor is carefully guarded against by this type of construction. The electric terminals 42 lead out from the motor casing through an insulating bushing 43 in the auxiliary casing.

A suitable switch 44, shown diagrammatically, and which may be located at any convenient position controls the current to the heating element 7.

A discharging conduit opens out from the top of the container through the cover 9 and is shown as an inclined metal pipe or nipple 45 secured to and rigid with the top of the cover and extending tangentially with the container and opening into the space between the fan housing and the container wall. This conduit extends through the wall of the auxiliary casing 17 and exteriorly thereof has mounted therein a filler plug or cup 46 provided with a pet-cock 47 for opening and closing the filler plug.

Beyond the filler plug the conduit is continued by a suitable flexible hose 48 connected thereto and terminating in a nozzle 49 which may be connected to a mask or other device through which the anesthetic is directly to be administered to the patient or subject. The base section of the filler plug thus constitutes a coupling between the pipe or nipple 45 and the hose 48. This nozzle 49 is provided with a pet-cock 50 for controlling the flow therethrough. A graduated quadrant 51 is secured to the nozzle and a pointer 52 to the pet-cock 50 so that the exact degree of opening and closing of the pet-cock 50, and therefore the amount of opening through the nozzle, is indicated.

Ample openings 53 are provided in the wall of the auxiliary casing for the admission of the requisite air from the atmosphere therethrough and thence through the opening 23 into the fan housing.

The operation of the apparatus thus described as a simple and preferred embodiment of the invention will be apparent. The liquid anesthetic, such as ether, is poured into the container by opening the pet-cock 47 and pouring it in through the filler plug 46 until the liquid reaches a level slightly below the fan housing 21. This filler plug and pet-cock provides a simple and efficient means for maintaining the supply of liquid ether in the container while the apparatus is in operation and whenever the quantity in the container becomes reduced as ascertained by viewing the level through the sight opening 6.

When the motor is set in operation, the shaft 26 is revolved rapidly. This causes the revolution of the centrifugal fan in the housing and thus a current of air from the atmosphere is drawn through the openings 53 into the fan housing and out of the opening 24 of the fan housing over the surface of the liquid ether. At the same time the agitator is rotated with equal rapidity by the shaft 26 and the agitator blades coacting with the fixed blades 31 act violently to agitate the ether in the container and thus increase the surface of the liquid exposed to the air current induced by the centrifugal fan. The mixture of air and ether vapor then passes out through the discharge conduit and the hose 48 through the nozzle to the point of administration.

The heating element, such as the electric heating coil 7, acts to supply heat to the liquid ether in the container and the amount of heat of this element is calibrated so as to supply the amount of heat necessary to offset the loss of heat due to evaporation and maintain the liquid ether at a desired predetermined temperature below its boiling point. Unless such a liquid anesthetic is kept below its boiling point, the rate of evaporation becomes too rapid and the vapor would be rapidly dissipated and wasted. The switch 44 enables the heat supplied by the element 7 to be varied, as desired, or to be cut off if the conditions permit. The motor confined in the special sealed casing radiates a substantial amount of heat after the apparatus has been in operation and, as the entering air passes over the bottom of this sealed casing, this heat at times is sufficient to maintain the liquid ether at the desired temperature.

The evaporation of the ether, like that of any other vapor, depends upon the temperature, the quantity of the vapor in the surrounding atmosphere, the extent of renewal of the atmosphere and the extent of the surface of evaporation. The heat supplied maintains the temperature at the

proper point; the fan acts without building up pressure to pass through the container and over the liquid ether a current of air drawn from the atmosphere and the agitator which is preferably employed acts materially to increase the extent of the surface of the ether exposed to evaporation. These elements, that is, the amount of heat supplied to the apparatus, the volume and velocity of the air current passing through the container, and the action of the agitating means are constructed and correlated to maintain the ether at substantially atmospheric pressure and below its boiling point and to cause the current of air discharged from the apparatus to contain a predetermined and substantially constant proportion of the ether vapor. The pet-cock 50 further enables the operator to regulate the amount of flow.

The centrifugal type of fan employed and the relatively large area of the inlet and outlet openings to and from the fan chamber ensure the maintenance of the air current at a very low pressure and avoid any discharge of entrained liquid anesthetic from the apparatus.

There is thus presented a simple, compact, and efficient apparatus which greatly increases the efficiency of the administration of an anesthetic vapor and enables the anesthetist to regulate and maintain the quality of vapor desired.

While the apparatus is specifically illustrated as designed for the administration of ether, it may readily be adapted to use other liquid anesthetics.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. An apparatus for administering a mixture of air and anesthetic vapor comprising a casing, a container within the casing for the liquid anesthetic, heat insulation within the casing surrounding the bottom and side walls of the container, an electric heating element in the insulation adjacent the container wall, a cover for the container, means for removably sealing the cover in closed position on the container, a fan housing within the casing having an inlet opening to the atmosphere and an outlet opening into the container, an electric motor supported above the cover and having its shaft extended through the fan housing, a centrifugal fan in the housing on said shaft, an agitator in the container on said shaft, and a discharging conduit for the mixture of air and the vapor of the anesthetic leading from the container above the liquid level.

2. An apparatus for administering a mixture of air and anesthetic vapor comprising a casing, a container within the casing for the liquid anesthetic, heat insulation within the casing surrounding the bottom and side walls of the container, an electric heating element in the insulation adjacent the container wall, a cover for the container, means for removably sealing the cover in closed position on the container, a fan housing supported from the cover within the container having an inlet opening through said cover to the atmosphere and an outlet opening into the container, an electric motor supported above the cover and having its shaft extended through the fan housing, a centrifugal fan in the housing on said shaft, an agitator in the container on said shaft, and a discharging conduit for the mixture of air and the vapor of the anesthetic leading from the container above the liquid level.

3. An apparatus for administering a mixture of air and anesthetic vapor comprising a casing,

a container within the casing for the liquid anesthetic, a cover for the container, means for removably sealing the cover in closed position on the container, a fan housing supported and depending from the cover within the casing having an inlet opening through the cover to the atmosphere and an outlet opening to the container, a centrifugal fan in the housing, an agitator in the container, a discharging conduit for the mixture of air and anesthetic vapor opening from the container through the cover, and means for operating the fan and the agitator.

4. In an anesthetic feeder, the combination with a liquid container having a vaporizing chamber, of a closure for the container having an agitator mounted thereon for the liquid in the container, an impeller mounted in the vaporizing chamber, means for operating the agitator and the impeller, and a discharge nipple for fumes communicating with the vaporizing chamber.

5. In an anesthetic feeder, the combination with a liquid container having a vaporizing chamber, and a heater for the liquid within the container, of a closure member for the container, an agitator mounted on said member and located in the liquid, an impeller for fumes from the liquid and located in the vaporizing chamber, a discharge nipple for fumes communicating with the vaporizing chamber and means for operating the agitator and impeller.

6. In an anesthetic feeder having a vaporizing chamber and a nipple communicating therewith, of a coupling pipe connected with the nipple, a filling-cup mounted on the pipe at a point below the outer end of the coupling pipe and a cut-off valve between the pipe and cup, and means for circulating air in the vaporizing chamber and impelling fumes through the nipple and pipe when the valve is closed.

7. In a portable appliance as described, the combination with a container section, of a detachable section mounted thereon, means for supplying the container section with liquid anesthetic, means for discharging anesthetic fumes from the container section through the detachable section, means mounted on the detachable section for agitating the liquid anesthetic, an impeller also mounted on the detachable section for passing fumes through the discharging means and means on the detachable section for operating the agitating means and the impeller.

8. In an anesthetic feeder, the combination with a holder and a liquid container, and means for heating the liquid in the container, of a detachable closure for the container and a motor mounted in the closure, a rotary agitator and shaft operated by the motor and a fumes impeller rotatable with the shaft, and a discharge nipple mounted on the detachable closure.

9. In an anesthetic feeder, the combination with a liquid container having a vaporizing chamber, of a closure member for the container having a fan casing located in the vaporizing chamber and communicating therewith, a motor supported in the closure member and an operating shaft on the motor, a fan on the shaft within its casing, an extension on the shaft located in the lower part of the container and laterally-extending agitating pins on the extension, and a discharge nipple mounted on the closure member communicating with the vaporizing chamber.

10. In a portable anesthetic feeder, the combi-

nation of a jar, a closure section on the jar, co-operating elements on the jar and closure section for detachably securing together the jar and closure section, a rigid supply-nipple rigid with
5 said section and opening within the jar, a motor and shaft mounted in the closure section, an agitator operatively connected with the shaft and located in the jar, and an impeller mounted on the shaft above the agitator for passing fumes
10 outwardly through the supply-nipple.

11. In a portable anesthetic feeder, the combination of a jar, a closure section on the jar, co-operating elements on the jar and closure section for detachably securing together the jar and
15 closure section, a liquid supply-nipple rigid with said section and opening within the jar, a motor and shaft mounted in the closure section, and an impeller mounted on the shaft above the liquid level of the jar for passing fumes outwardly
20 through the liquid supply-nipple.

12. In a portable anesthetic feeder, the combination with a jar forming a vaporizing cham-

ber, of a quick-detachable closure section for the jar, a fan casing rigid with the closure section and located in the chamber, a liquid supply nipple rigid with the closure section and opening
5 through said casing to said chamber, a motor mounted in the closure section, an impeller in the fan casing, and operative connections between said motor and impeller whereby fumes are passed outwardly from said chamber through the nipple.

13. In an anesthetic feeder, the combination
10 with a container section forming a vaporizing chamber, and a quick-detachable section forming a closure for the chamber, of a nipple connection rigid with the quick-detachable section and
15 adapted for use as a liquid-supply inlet to said chamber, means for vaporizing the liquid in the chamber, and means mounted on the quick-detachable section for impelling fumes from the vaporizing chamber through said nipple connection. 20

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