

Nov. 8, 1927.

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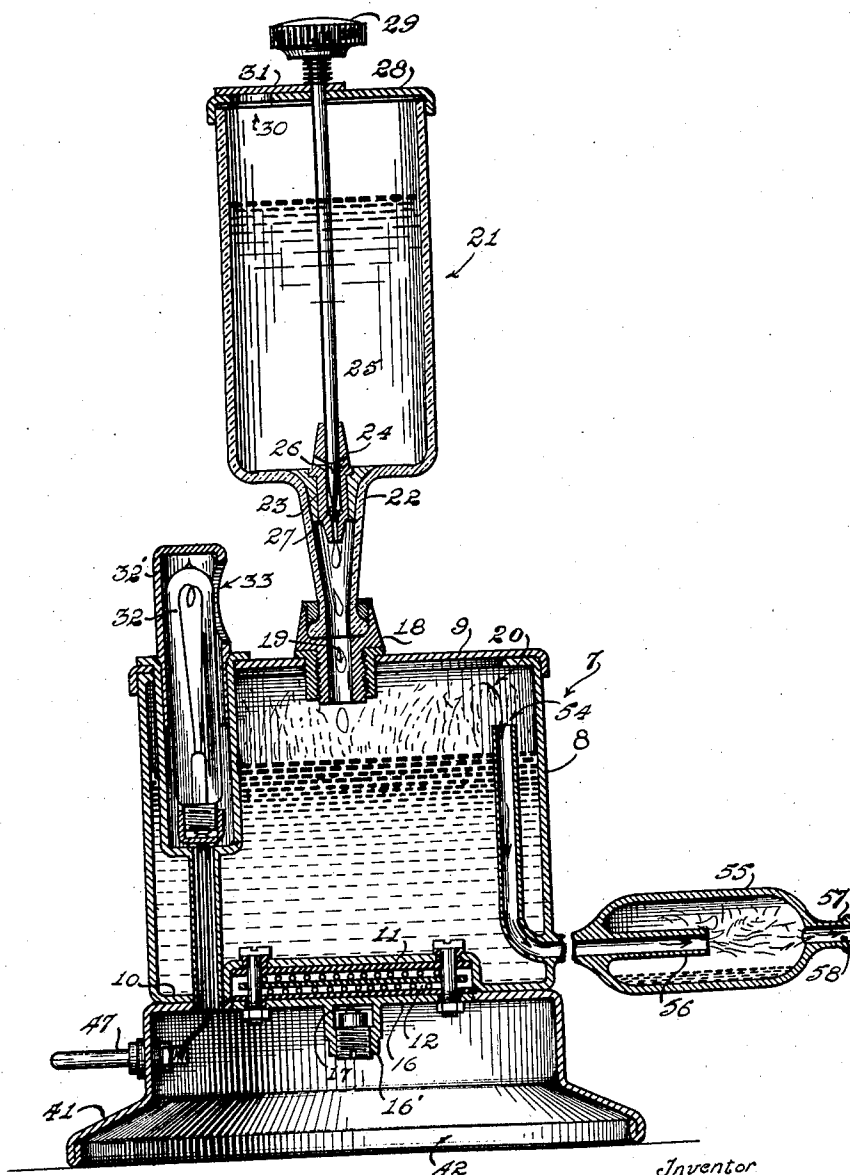
W. V. GOODFELLOW

METHOD FOR PRODUCING AN ANÆSTHETIC

Filed May 14, 1921

2 Sheets-Sheet 1

Fig. 1.



Inventor
Walter V. Goodfellow.

John L. Macs
Attorney.

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W. V. GOODFELLOW

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Fig. 2.

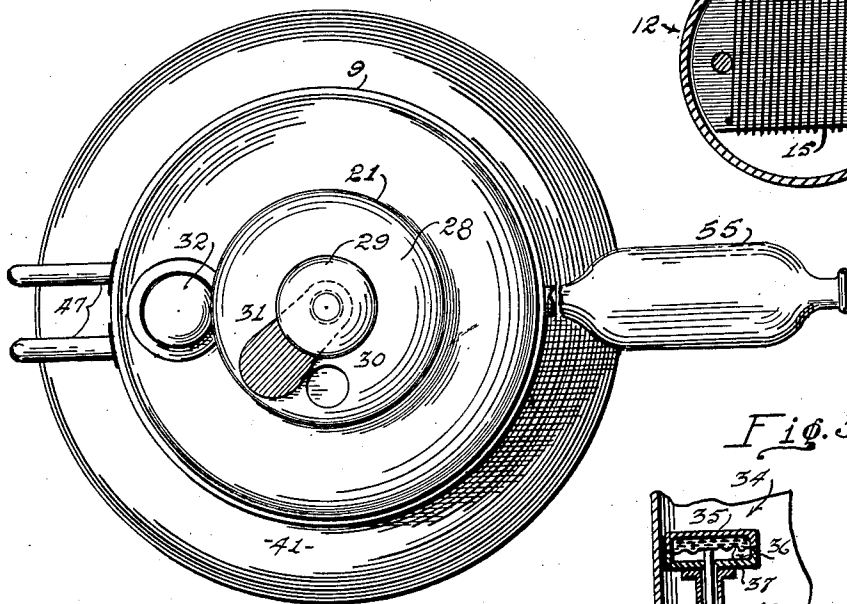


Fig. 4.

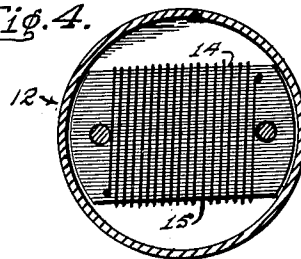


Fig. 5.

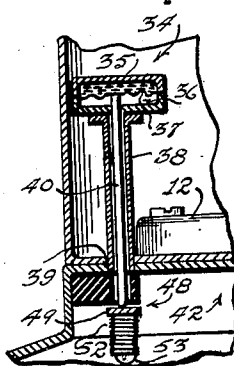
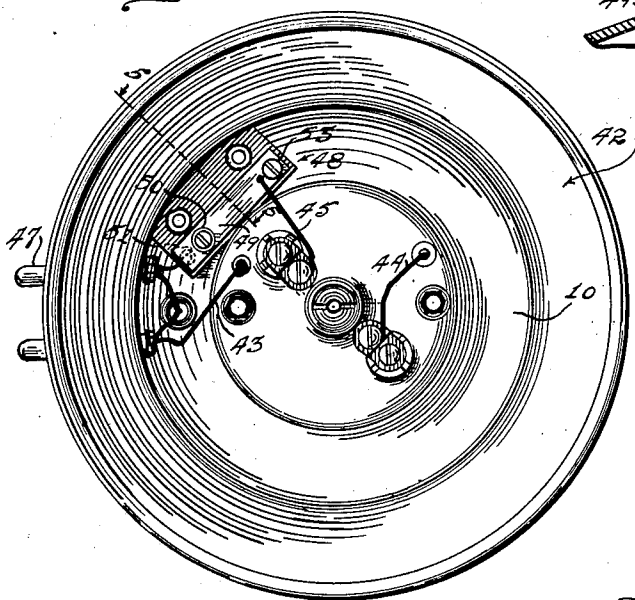


Fig. 3.



Inventor
Walter V. Goodfellow.

Arthur L. Macdonald
Attorney.

UNITED STATES PATENT OFFICE.

WALTER V. GOODFELLOW, OF LOS ANGELES, CALIFORNIA.

METHOD FOR PRODUCING AN ANÆSTHETIC.

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My invention relates to and has for a principal object the provision of an improved process, or method, for producing an anæsthetic and for maintaining partial or complete anæsthesia when administered for ordinary purposes, where a general anæsthetic is indicated.

It is well known that modern processes for producing and maintaining anæsthesia, while generally efficient for producing the desired results, have many disadvantages which are a source of much discomfort and irritation to the patient and possible organic disorders, and when administered by present methods, the devices or mechanism by means of which the process is carried out are incapable of supplying a uniform amount of the anæsthetic of satisfactory character. Because of this fact the state of anæsthesia is more or less varied in its extent and consequently a source of much concern and worry to the surgeons and frequent suffering on the part of the patient.

Furthermore, unless and until a patient is completely under the influence of the anæsthetic, the use of present methods for administering the same irritates the membranes of the mouth, throat, and lungs to such an extent that the patient is caused unnecessary suffering and discomfort which frequently delays the work of the surgeons. This irritation of the membranes intensifies the natural desires of the patient for momentary cessations in the administration of the anæsthetic, the irritation being due to the absence of moisture in the mouth and throat.

It is an object, therefore, of my invention to provide a method of producing and administering an anæsthetic which will maintain and deliver a uniform volume of the anæsthetic to the patient at all times during the use of the process in an operation, and in addition, to provide and mix with the anæsthetic a sufficient quantity of vapor, such as may be produced by the heating of a body of fluid to a temperature of about 120 degrees, whereby moisture may be administered with the anæsthetic so as to wholly or partially prevent the irritation of the membranes which would otherwise occur, or at least to relieve and prevent discomfort to the patient, and shorten if not quite entirely obviate delays.

It will be readily understood by persons skilled in the art and use of anæsthetics that sulphurous ether and chloroform, which are

more commonly used than other elements normally exist in a fluid state at certain temperatures, and such elements are readily volatilized when the temperature is raised. When so volatilized the vapor, or gas, thus produced is usually administered to the patient through a mask of well known character, with moisture entirely absent.

Now, I have found that a uniform volume of the anæsthetic and vapor may be maintained and administered to a patient by the use of my process without the attendant discomfort and irritation produced by other well known processes. In carrying out my process I employ a specially designed apparatus including a container for supporting a quantity of fluid ether, chloroform or other fluid anæsthetic in readiness for use, and a closed generating receptacle adapted to be partially filled with water or other suitable fluid into which the fluid anæsthetic is discharged in a uniform and selected volume.

The water in said receptacle is heated to a temperature of about 120 degrees Fahrenheit, or to a temperature sufficient to generate a vapor within the receptacle. The anæsthetic receptacle being in communication with the water receptacle, a suitable valve is interposed in the communicating passage for regulating the volume of the anæsthetic discharged into the generator receptacle. The ether or chloroform being of lighter gravity than water and easily volatilized when the temperature is raised, will, when coming into contact with the volume of water immediately volatilize and unite with the water vapor generated, and the admixture, which contains a sufficient amount of moisture will fill the space in the water receptacle above the level of the volume of water and may thereafter be drawn off by suitable means for use.

The temperature of the water may be automatically regulated by a thermostat and connected with an electric heating element provided for heating the water.

The apparatus provided and the character of the process is such that positive control may at all times be had over the generation and volume of the anæsthetic administered to the patient, and the volume may be gradually increased or decreased from a normal quantity as each separate case may require, or a complete cessation of the anæsthetic may be instantly effected.

In the accompanying drawings I have

illustrated a practical embodiment of a specially designed apparatus for carrying out the several steps of my process and reference is had thereto in the further consideration of my invention, which I will now more fully describe in connection with said drawings.

Fig. 1 is a view in vertical section of an apparatus adapted to carry out the purpose of my invention, illustrating a manner in which the anæsthetic is fed to a volume of water or other fluid contained in a closed receptacle.

Fig. 2 is a plan view of the apparatus.

Fig. 3 is a view in bottom elevation thereof.

Fig. 4 is a view in sectional plan of the heating element.

Fig. 5 is a view in vertical section through a part of the apparatus as seen on the line 5—5 of Fig. 3, showing a thermostatic control device for regulating and maintaining a predetermined temperature.

In the apparatus shown, 7 indicates a closed fluid receptacle of hollow cylindrical form having an annular wall 8, a top closure 9, and a bottom closure 10. The bottom closure 10 is formed with an indented circular portion 11 leaving the bottom wall complete so that joints need not be employed that would tend to leak. Within the recess formed by the portion 11 is disposed a heating element 12, shown particularly in Fig. 3, which is of usual construction and includes a mica plate 14, wound with resistance wire 15, so that upon a current passing through the resistance wire heat is generated to maintain an increased temperature of the fluid contained within the receptacle. A closure wall 16 is provided below the heating element to protect it and is provided with a socket 16' formed integrally therewith. The ends (not shown) of the resistance wire are connected to contacts 17 disposed within the socket. A fusible plug is inserted in the socket and establishes a circuit, serving to prevent excess heat being attained within the heating element.

The upper closure wall is provided with a socket member 18 formed with a passage 19 communicating with the space 20 in the receptacle. A translucent container 21, for the anæsthetic fluid is provided and is detachably mounted upon the receptacle by having its neck 22 inserted in the socket. A valve 23 for controlling the flow of anæsthetic fluid by gravity to the receptacle is provided and is formed with an extended stem guide 24.

A vertically disposed stem 25 is provided formed with an end 26 tapering to a point 27 adapted to be inserted in the bore of the valve. The stem extends upward through the interior of the translucent container through a closure 28 provided thereon and terminates in a knurled knob 29, which upon

being turned may be caused to advance or retract the pointed end of the stem relative to the valve to change the area of flow there-through to control the frequency of the drops of anæsthetic fluid to the receptacle. The closure wall of the container is provided with a vent opening 30, to allow air to enter to replace the fluid used. The vent is closed by means of a shutter 31 pivoted to the closure wall and is normally in a position to close the opening when the apparatus is not in use in order to prevent evaporation of the anæsthetic fluid.

The neck of the container is translucent so that the drops of fluid emanating from the valve are visible and the operator is aware of the amount of flow of the fluid and is thereby enabled to accurately control the flow by manipulation of the valve. To increase the visibility an electric lamp 32, connected parallel with the heating element is provided and will continue to illumine the neck of the container when the heating coil is not being energized. The lamp is provided with a protective tubular guard 32 depending into the receptacle and having its upper end disposed above the top closure wall thereof and provided with an opening 33 to direct and confine the light to a limited area in proximity to the valve where the drops of fluid form.

Inasmuch as the invention contemplates maintaining a volume of fluid in the receptacle at predetermined temperature an adjustable thermostat 34 is provided for opening and closing the circuit in which the heating element is interposed as will appear. The thermostat comprises essentially a circular casing 35 of shallow depth formed with an enclosed space 36. The space is divided by a fluid tight corrugated diaphragm 37 upon which rests a volume of volatile fluid such as ether or acetone, which fluids attain a vapor state of relatively high tension in an enclosed space at or slightly below normal body temperatures. The casing 35 is held within the receptacle a suitable distance from the bottom thereof by a vertically disposed tube 38 communicating with the space below the diaphragm. The tube is fixed to the bottom wall in alignment with an opening 39 provided therein, and a nonconductive stem 40 passes through the tube downward through the opening 39 and protrudes slightly therefrom, the other end of the stem being in contact with the under surface of the diaphragm. Upon the temperature of the fluid within the receptacle attaining a temperature sufficient to generate a pressure within the space above the diaphragm the expansion thereof will act to force the stem downward in a manner common to such thermostats.

The apparatus is provided with a hollow base 41 enclosing a space 42 within which

are located wires 43, 44, and 45 which are arranged to convey current to the heating element and the lamp. Two terminal posts 47 are provided for the purpose of attachment to an electric socket (not shown). The electric circuit carrying current through the heating element is formed by the wire 43 passing from one terminal post to the heating element which has the other end of its resistance coil connected to the wire 44 of the circuit, which wire in turn is connected to the wire 45 through the fusible plug. In the circuit is interposed a circuit breaker 48 having a conductive member 49 pivoted as at 50 and adapted to be raised out of contact with a contact point 51 interposed in the circuit. A spring 52 rests against the conductive member to hold it yieldably in contact with the contact point. It is apparent that when a pressure is attained by the fluid in the thermostat the nonconductive stem will act on the conductive member to raise an end thereof out of contact with the contact point so that the circuit supplying current to the heating element is opened. By means of a screw 53 the tension of the spring may be varied so that the temperature attained by the fluid within the receptacle may be predetermined.

The operation of the anæsthetic generating apparatus is as follows: The anæsthetic fluid container is partially filled with the desired anæsthetic fluid such as sulphurous ether or chloroform thru the opening in the closure wall thereof, the valve being closed during filling. The resistance wire of the heating element is energized by connecting the terminal posts to a source of electricity, the receptacle being previously filled to about the level shown with a suitable fluid of higher boiling point than the anæsthetic fluid, such as water. The level of the fluid should be above the thermostat but below the outlet tube. As heat is generated by the heating element the fluid will increase in temperature to the predetermined degree, whereupon the thermostat will act to open the circuit to prevent the generation of additional heat. When this has occurred and it is desired to generate an anæsthetic vapor the valve is opened the proper degree as indicated by the frequency of the drops of fluid visible thru the translucent neck of the fluid container.

The highly volatile anæsthetic fluid dropping into the heated fluid in the receptacle will be turned practically instantly into a vapor. In fact it is found that fluids such as ether will vaporize almost instantly upon contact with the surface of a body of water maintained at or above 120 degrees Fahrenheit. It is apparent that inasmuch as the specific heat of the relatively large volume of water is not appreciably altered by subtraction of the latent and specific heat neces-

sary to vaporize the anæsthetic fluid, the temperature of the volume of water will not change rapidly between the periods at which the circuit is open. The heat of the water within the receptacle results in vapor from the water being generated which commingles with the vapor from the anæsthetic fluid. The resulting admixture which constitutes the anæsthetic vapor in condition for administering to the patient finds its way thru the outlet tube 54, a receptacle 55 to the anæsthetic mask or similar device (not shown) connected to said receptacle. Should globules of unvaporized fluid be carried thru the outlet tube 54, the reduced velocity of the vapor passing thru the receptacle 55 will result in the globules being deposited therein. The receptacle 55 is substantially larger in area than the tube 54, and the outer end 56 of said tube is projected inwardly for a substantial distance into said receptacle, while the outer end of said receptacle is provided with an outlet 57 having a passage 58 therein which may be connected with a suitable flexible tube, not shown, for administering the anæsthetic.

Upon the water being reduced in temperature the thermostat will again close the circuit and supply additional heat thus maintaining a practically constant temperature. During the generation of the vapor the amount of anæsthetic fluid admitted to the generator may be controlled by manipulation of the valve. The proportions between the vapors from the two fluids may thus be altered and independently the amount of vapor formed by the fluid in the generator may be increased by increasing the temperature at which the thermostat acts to close the circuit.

It will be observed from the foregoing that the anæsthetic vapor produced by the generator comprises the vapor from an anæsthetic fluid mixed with the vapor from a non-anæsthetizing fluid as water. Owing to the specific heat of the vapors, particularly that of the water vapor, the patient is not subject to quantities of cold air as in other methods now in use and the temperature of the vapors cannot decrease during passage to the mask, it being understood that saturated vapors maintain a constant temperature at constant pressure, the subtraction of heat from a saturated volume thereof merely resulting in condensation of a part of the volume, leaving the remainder at the same temperature. In methods where air is employed it is not possible to so accurately control the temperature of the anæsthetic vapor. We have found in the employment of our method and apparatus that the vapor from a non-anæsthetizing fluid, such as water, when mixed with the vapor from an anæsthetic fluid tends to prevent irritation of the membranes of the patient and inasmuch as

large quantities of air carrying the vapors of anæsthetic fluid are not set in motion by the method I have described, the physician and attendants are not subject to the discomfort accruing from the employment of other methods.

While I have shown a specific embodiment of my apparatus for carrying out the improved method, I do not limit myself to a specific apparatus for effecting the purpose of my invention, but may employ any suitable apparatus for generating an anæsthesia in conformance with the method substantially as set forth in the appended claims, without departing from the spirit of my invention.

What I claim is:

1. The method of producing an anæsthetic vapor which consists in continuously heating

a body of liquid in a closed chamber to a uniform temperature, and introducing a fluid having anæsthetic properties to the chamber in regulated volume, for generating and delivering an anæsthetic vapor of uniform density and pressure for administration.

2. The method of producing an anæsthetic vapor which consists in generating heat in a chamber containing water, introducing an anæsthetic fluid into the heated chamber and on the surface of the water, whereby a vapor will be generated thereabove, and regulating the volume of anæsthetic fluid so introduced for varying the volume and pressure of the anæsthetic vapor produced according to requirements of administration and use.

WALTER V. GOODFELLOW.