This invention relates to apparatus for the administration of volatile anesthetics and more particularly to an improved mounting of vaporizer means associated therewith for automatically excluding the vaporizer from the anesthetic circuit when it is not in use.

There are available a variety of so-called anesthetic machines having the various mechanical components required for the administration of inhalant anesthetic agents arranged and mounted in a suitable fashion on a portable cabinet or base which may be disposed conveniently next to the operating table for use by the anesthetist. Such machines may include, for example, cylinders of the various gases that may be used, including principally oxygen, together with the necessary pressure regulating and valve control means for introducing such gases into a conventional anesthetic breathing circuit wherein the controlled gas mixtures may be inhaled by the patient. Such machines conventionally include a vaporizer which is charged with a supply of liquid, volatile anesthetic agent such as diethyl ether and through which a stream of gas, such as oxygen, is passed and thence conveyed together with the vaporized anesthetic to the breathing or administering circuit. Alternatively another type of vaporizer may be employed for furnishing the required anesthetic vapors which is incorporated directly in the patient's breathing circuit and in which the vapors are obtained by passing the patient's respiratory gases directly therethrough. When the latter type of vaporizer is being used or when the anesthetic is furnished from still another source, the first-mentioned vaporizer is desirably excluded from the breathing circuit and rendered inoperative. It is, of course, important that the exclusion of this vaporizer from the circuit be assured, since otherwise the patient may receive an excessive quantity of anesthetic.

Heretofore, some of the anesthetic machines furnishing the type of vaporizer through which oxygen gas is metered and thence delivered to the patient's breathing circuit have afforded convenient supporting arrangements for the various components of the anesthetic machine. For example, some machines afford an arrangement for the support of the vaporizer permitting it to be withdrawn in an out-of-the-way position if it is not in use. The difficulty, however, with such supporting arrangements is that the vaporizer, when in an out-of-the-way position, is not exposed to the direct observation of the anesthetist and, if it has not been completely shut off so that oxygen or other gas cannot flow therethrough, will continue to introduce into the breathing circuit undesired amounts of anesthetic.

Accordingly, it is an object of the present invention to provide anesthetic administering apparatus of a compact and convenient arrangement having vaporizer means justably supported for placement in operative and inoperative positions and which has associated therewith valve means operable automatically to shut off the delivery source of gas thereto when in the inoperative position and operable to automatically admit gas thereto when in the operative position.

A further object of the invention is to provide an anesthetic administering apparatus comprising a vaporizer and a vaporizer support and shutoff valve means automatically to shut off the delivery source of gas thereto when not in use and to extend the same thence to be freely placed in the operative position and which has associated therewith a valve in the delivery line admitting gas to said vaporizer which is automatically closed when said vaporizer is retracted within said cabinet. A still further object of the invention is to provide such an improved anesthetic administering apparatus wherein said vaporizer is adjustably mounted on said cabinet by means of slideable extensions guided by supporting means in said cabinet and wherein the delivery control valve for said vaporizer is a normally closed valve and cam means are provided within the cabinet to open the valve when the vaporizer is extended into the operative position.

Another object of the invention is to provide such an improved anesthetic administering apparatus including an anesthetizing circuit in which the patient breathes, a vaporizer containing a volatile liquid anesthetic agent adjustably mounted in a base cabinet of the apparatus for movement between operative and inoperative positions, a source of gas connected to said circuit through said vaporizer and through separate conduit means independently of said vaporizer, and having valve means automatically closing said vaporizer when disposed in its inoperative position, and valve means normally effecting the closure of the conduit directly connecting said gas source with said circuit which is operative to deliver gas from said source to said circuit when said vaporizer is in the inoperative position.

Other objects and advantages of the present invention will be better understood by reference to the following description of the preferred embodiment taken in connection with the attached drawings wherein:

Figure 1 is a side elevation view partially in section showing the cabinet housing of an anesthetic machine broken away to expose an adjustably mounted vaporizer according to the present invention, having slideable vaporizer supporting means and automatic shut-off valve means associated therewith, and further illustrating, schematically, the gas delivery connection of said vaporizer with an anesthetic administering mask means;

Figure 2 is an enlarged sectional view of the vaporizer sliding support and shut-off valve seen in Figure 1;

Figure 3 is a partial, plan sectional view, showing the vaporizer support, taken substantially along the line 3-3 in Figure 1 looking in the direction of the arrows;

Figure 4 is a sectional view illustrating in greater detail the automatic shut-off valve seen in Figures 1 and 2, and showing said valve in closed position;

Figure 5 is a sectional view through the vaporizer supporting means taken along the line 5-5 in Figure 3 and looking in the direction of the arrows; and

Figure 6 is a partial section view illustrating the by-pass check valve employed in the carrier gas delivery line for metering the carrier gas flow in by-pass relation to the vaporizer.

Referring now to the drawings, 10 designates a port-
able cabinet of a conventional type of anesthetic machine on which various elements of an anesthetic admin-
istering circuit are well known. As shown in this figure, the cabinet 10 has the usual side and back metal walls, of which the rear wall 12 may be seen in cross section, and is open at the front as shown by the opening 14. The top of cabinet 16 may furnish a useful work surface and a bank of flow meters 18 for indicating the flow rates of the various gases is shown supported thereon. The gas connections of the flow meters to the gas administering conduits, hereinafter described, have not been shown. A horizontal partition is arranged slightly below the top of the cabinet on which various of the gas fittings are conventionally supported and on which the vaporizer means of the present apparatus is supported as will be hereinafter more fully described.

A conduit 19 receives gas such as oxygen at a suitable delivery pressure, it being understood that such gas may be furnished in the conventional manner from a cylinder supported at the outside of the cabinet and furnished with the usual delivery valve and pressure regulating device. The delivery oxygen is admitted to the inlet T-fitting 20 of a by-pass check valve 21, one branch of said T admitting gas to the inlet side of the valve 21 and the other branch connecting the gas source directly with the inlet side of normally closed shut-off valve 24 through a flexible tubing 26. The delivery side of the vaporizer shut-off valve 24 is connected by tube 28 to the inlet of vaporizer 30. As will be described hereinafter in more detail, the passage of the inlet gas through the vaporizer and the control of the anesthetic vapor discharged from the vaporizer therewith is controlled by the adjusting knob 32. The gas, after passage through the vaporizer, is discharged through a flexible tube 34 which is received on an outlet T-fitting 41 of the by-pass valve 21. The by-pass valve 21 is shown in section in Figure 6 and will be seen to include a ball element 21' which is urged downwardly toward its closed, seated position by a loading stem 42. In operation, gas at normal delivery pressures from supply line 19 is metered at a controllable rate through the by-pass valve by upward movement of the ball element in response to delivery pressure and a divided portion of the delivery flow is conducted through the vaporizer, depending upon the adjustment of the vaporizer control knob 32. The latter flow is then returned to the outlet fitting as above described. Gas conduit 44 extends from the fitting 41 and delivers the resultant gas from the anesthetic vapor mixture through a suitable connector fitting 45, as is conventionally furnished in the usual type of anesthetic machine, and a conduit 46 detachably connected thereto, to any suitable patient inhalation apparatus.

As shown schematically in Figure 1, such inhalation apparatus may comprise a closed anesthetic administering circuit designated generally by the numeral 48. As will be well understood to those skilled in the art, such a circuit has the usual face mask 50 which is equipped with a conventional exhalation conduit 52 and an inhalation conduit 54 which are received on an absorber shown at 56 in which the respiratory gases are conducted through a suitable absorbent for the removal of carbon dioxide, and recirculated to the patient. The flow of the respiratory gases in the circuit 48 is controlled by conventional check valve 58 means. In the present example the delivery mixture of oxygen and anesthetic vapor from the vaporizer 30 are shown as introduced into the inhalation conduit 54 which gas mixture is inhaled with the gas mixture delivered from the absorber 56. The amount of oxygen mixed with the anesthetic vapors in this manner of operation conventionally constitutes the amount of oxygen required to make up the oxygen consumed by the patient. It will be understood, of course, that the vaporizer 30 may be employed to deliver anesthetic vapors to the patient in connection with any of the variously well known anesthetic administering circuits and that its use is not necessarily limited to the specific closed type of circuit illustrated by the schematic apparatus shown.

It will be seen that the vaporizer 30 and shut-off valve 24 are fixedly mounted on opposite ends of a pair of parallel slide rods 60. These rods are slidably received and supported within elongated collars 62 of a bracket member 64 secured by means of screws 66 to the hori-

ification or saturation of the oxygen gas with the ether vapor which is then carried off therewith and delivered to the patient or vapor which is delivered to the patient.

Having now described the embodiment of the present invention shown in the drawings, its operation may now be described as follows. It may be assumed at the outset that the vaporizer 30 is not in use and, accordingly, is retracted within the cabinet as shown in Figure 1. In this position, it will be seen that the delivery valve 24 governing the flow of gas to the vaporizer is displaced rearwardly out of contact with the cam plate 74 so that the valve is in closed position as shown in Figure 4. The vaporizer may be thus positioned while the anesthetic machine is completely out of service, or it may be similarly positioned if anesthesia is being carried out by a mixture of anesthetic gases, such as nitrous oxide, cyclopropane and oxygen which may be delivered through the gas delivery line 22 and through the by-pass valve 21 separately from the vaporizer circuit. Thus, with such an arrangement in operation, the by-pass check valve at 48 is in use but with the necessary anesthetic gases being delivered to the delivery conduit 19 thence through the by-pass check valve 21 and gas conduit 44 as hereinbefore described.

When the anesthetist desires to employ the vaporizer 30, he merely grasps the vaporizer and manually moves it to its extended or operative position. Such movement, it will be seen, is made possible by extension of the supporting rods 60 through the supporting fixture 64 which simultaneously causes the delivery control valve 24 to be brought into position in contact with the cam plate 74 thence opening the inlet valve. The flexible hoses 26 and 40 which connect respectively with the inlet to the vaporizer delivery valve and to the outlet of the vaporizer accommodate the displacement of the vaporizer relative to the fixed points of connection of these hose members, thus making it possible to maintain gas connections during movement of the vaporizer assembly between its respective operative and inoperative positions.

With the delivery valve in open position as shown in Figure 2, oxygen from the delivery line 22 is permitted access to the vaporizer in which the needle control valve is then adjusted to meter the desired rate of flow according to the concentration of anesthetic agent desired. The oxygen-anesthetic vapor mixture is thence carried as before described to the anesthetic administering device.

In the event that the anesthetist desires to remove the vaporizer 30 from the circuit, he manually reverses the control knob which cuts off the supply of oxygen or other carrier gas to the vaporizer. By so doing, substantially no anesthetic vapor is permitted access to the breathing circuit. The anesthetist, if he so desires, may then also push in the vaporizer until it is retracted within the cabinet and thus out of the way. Retraction of the vaporizer moves the valve 24 from contact with cam plate 74 allowing the valve 24 to close. It will be seen, in accordance with significant features of the present invention hereinabove described that, not only is a convenient and reliable mechanism furnished for support and adjustment of the vaporizer unit, but it is impossible for the anesthetist inadvertently to retract the vaporizer to its operative position without also automatically, positively shutting off and excluding the vaporizer from the anesthetic circuit. Thus, the construction of the apparatus herein described and the operation thereof furnish a highly advantageous apparatus for use in the administration of inhalant anesthetic agents which affords a high degree of safety in overall operation.

While a preferred embodiment of this invention has been shown and described herein, it will be understood that other modifications thereof will readily occur to those skilled in the art and that the invention is intended to be limited only to the appended claims.

We claim:

1. Inhalant anesthetic administering apparatus comprising a housing forming a cabinet having an anesthetic vaporizer adjustable supported therein for movement between an inoperative position in which said vaporizer is retracted within said housing and operative position in which said vaporizer is extended externally of said housing, respirator means adapted to be applied to a patient to permit the inhalation by said patient of inhalant anesthetic mixtures, gas inlet means connected to said vaporizer for delivering a carrier gas thereto, discharge means connecting said vaporizer with said respirator means for delivering said carrier gas and anesthetic vapor from said vaporizer to said respirator, a normally closed inlet control valve in said gas inlet means and valve actuating means supported in said housing operatively arranged to open said inlet control valve in response to movement of said vaporizer to said operative position.

2. Inhalant anesthetic administering apparatus according to claim 1 wherein said inlet control valve has a normally closed spring-loaded valve element, a depressible plunger means arranged to oppose said closing spring force and open said valve when depressed and said valve actuating means comprising a cam arranged, upon relative movement of said control valve and said cam, to engage and depress said plunger when said vaporizer is moved to said operative position.

3. Inhalant anesthetic administering apparatus according to claim 2 wherein said inlet control valve is mounted in fixed relation with respect to said vaporizer and movable in unison therewith during movement between said operative and inoperative positions and said cam is fixedly mounted to said housing.

4. Inhalant anesthetic administering apparatus according to claim 1 having gas by-pass means connected in parallel across said vaporizer, said by-pass means including a flow restricting valve and being effective to permit the passage of said carrier gas therethrough to said respirator means independently of said vaporizer.

5. Apparatus for administering inhalant anesthetic compositions comprising a portable, self-supporting cabinet, a vaporizer for holding a supply of a liquid anesthetic agent having an inlet for receiving a supply of a carrier gas and an outlet for delivering therefrom a mixture of said carrier gas and the volatilized liquid agent, control valve means forming a part of said vaporizer for adjusting the flow of said carrier gas therethrough, a longitudinally extendible supporting fixture for carrying said vaporizer and permitting its movement manually between an inoperative position in which said vaporizer is retracted within said cabinet and an operative position in which said vaporizer is extended on said cabinet means for transporting said vaporizer to a position outside of said cabinet, and means for connecting said manifold to said vaporizer inlet, gas connector means forming a part of said cabinet adapted to be connected by a gas conduit to a patient inhaler device, flexible conduit means connecting said vaporizer outlet with said gas connector means, an inlet control valve interposed in said flexible conduit means connecting said gas supply manifold and said vaporizer inlet and valve actuating means normally closed when said vaporizer is in an inoperative position operatively arranged to open said inlet control valve in response to movement of said vaporizer to said operative position.

6. Inhalant anesthetic administering apparatus according to claim 5 wherein said inlet control valve means is
carried by said longitudinally extendible supporting fixture so as to be movable in unison therewith and said valve actuating means comprises cam means rigidly mounted in said cabinet and arranged upon relative movement of said inlet valve means to actuate said valve means when said vaporizer is placed in operative position.

7. Inhalant anesthetic administering apparatus according to claim 5 having by-pass means including a flow restricting valve connecting said gas manifold means and said gas connector means in parallel flow arrangement with respect to said vaporizer.

No references cited.