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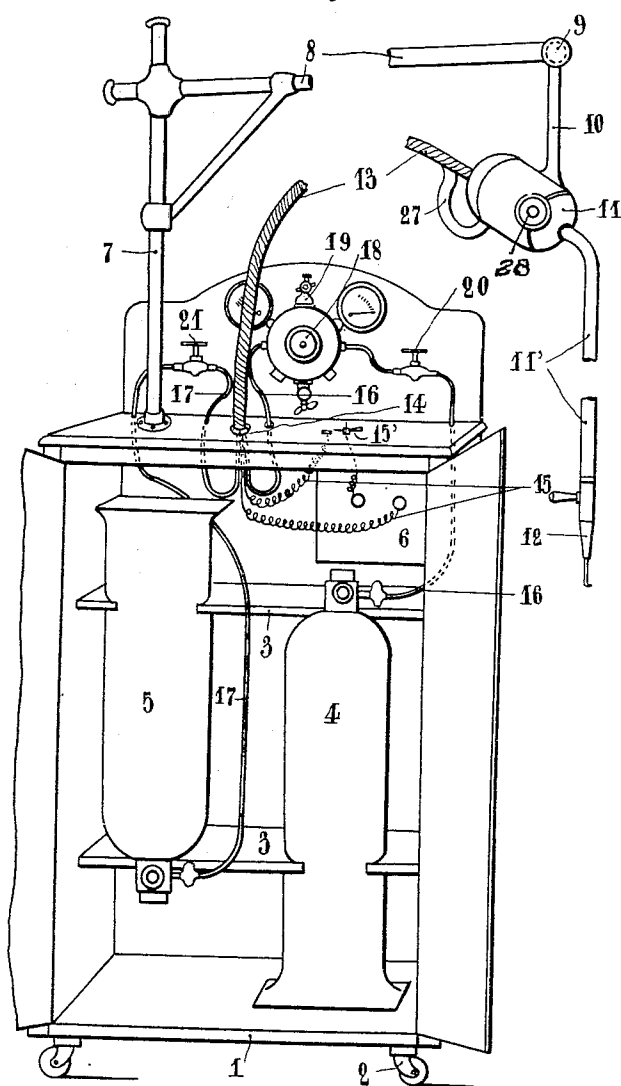
F. J. FABRET

LOCAL ANÆSTHESIS OUTFIT

Filed June 20, 1922

6 Sheets-Sheet 1

Fig. 1



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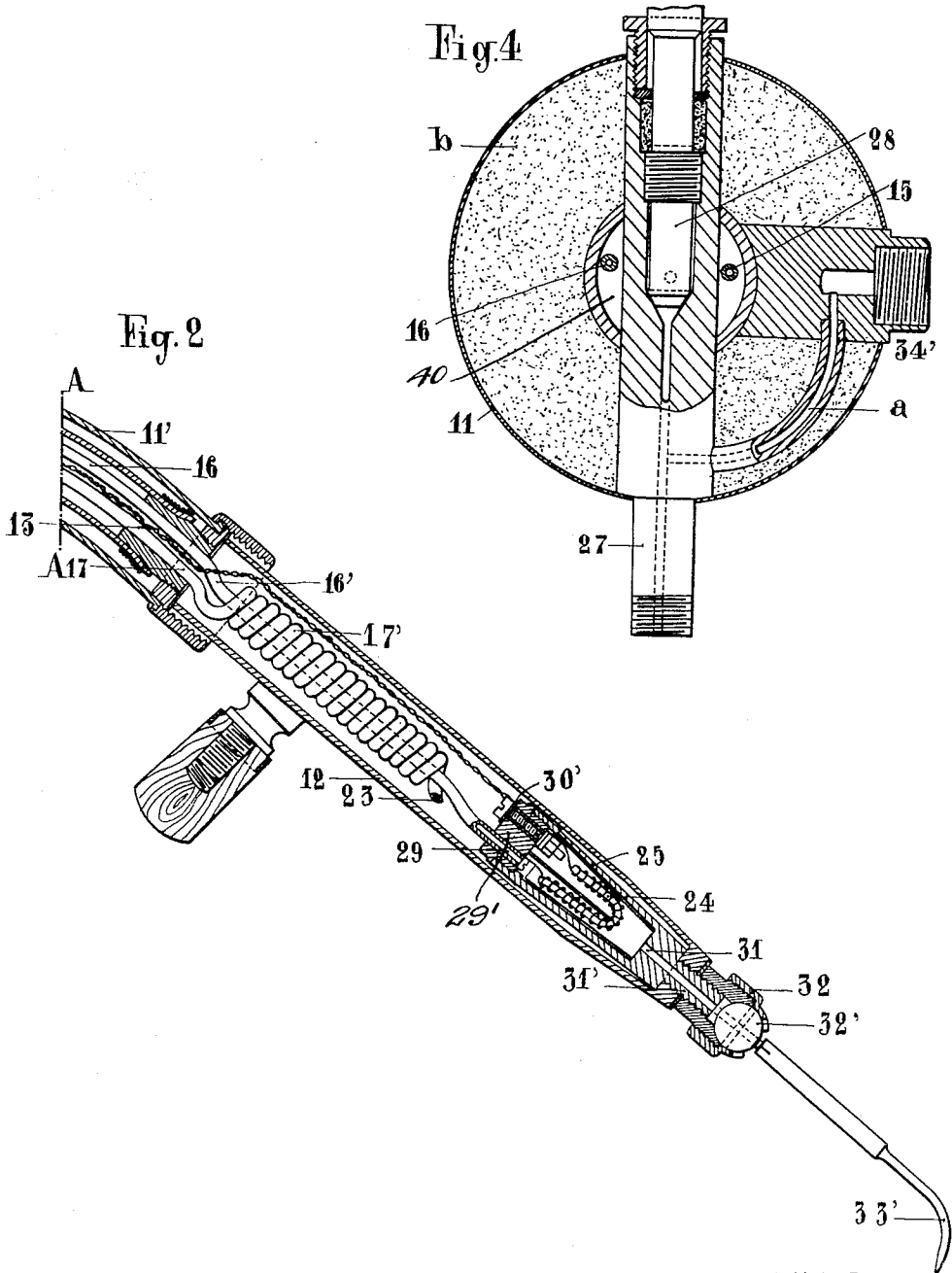
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6 Sheets-Sheet 2



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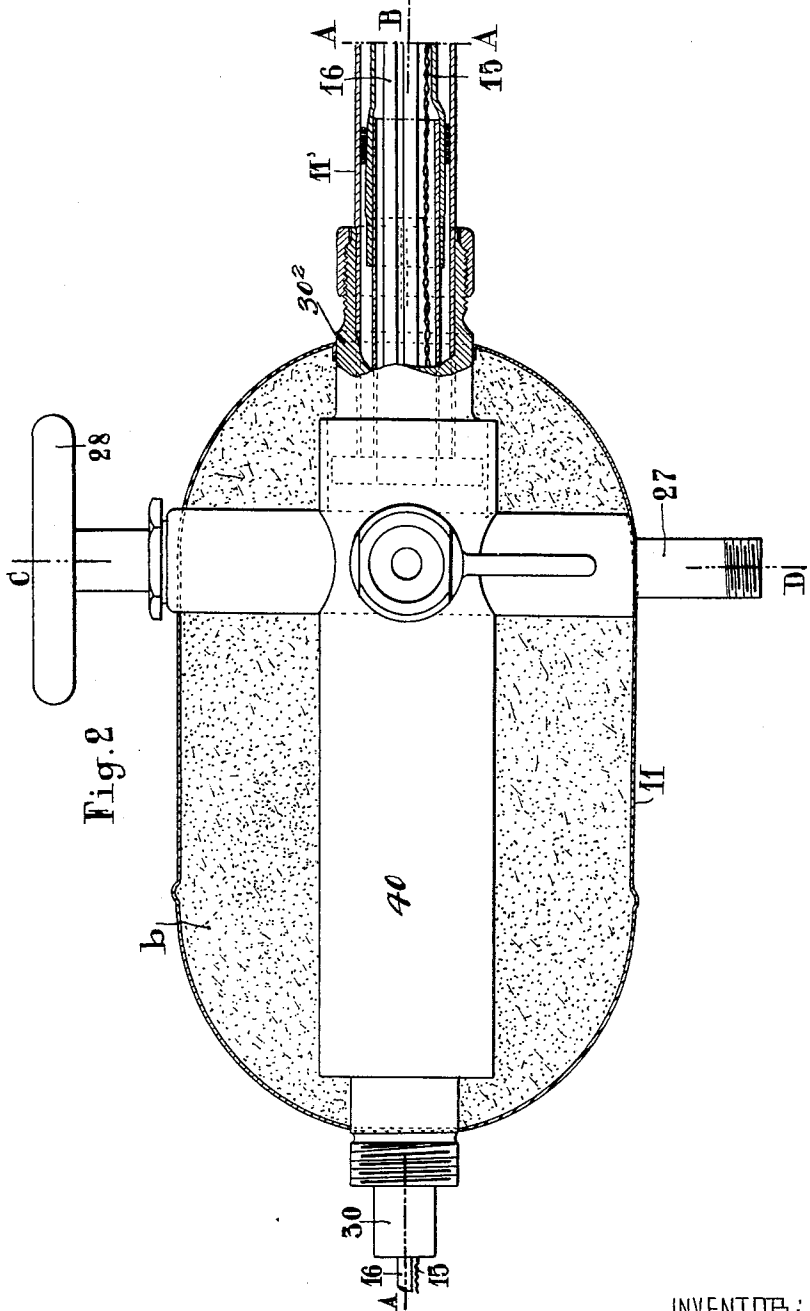
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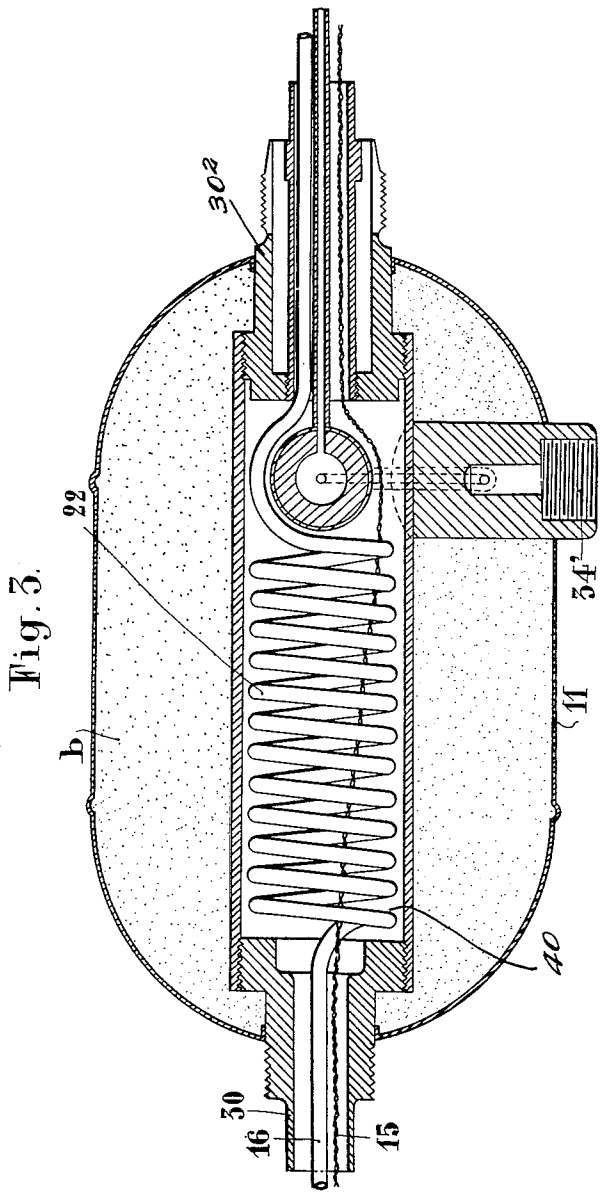
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LOCAL ANÆSTHESIS OUTFIT

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6 Sheets-Sheet 4



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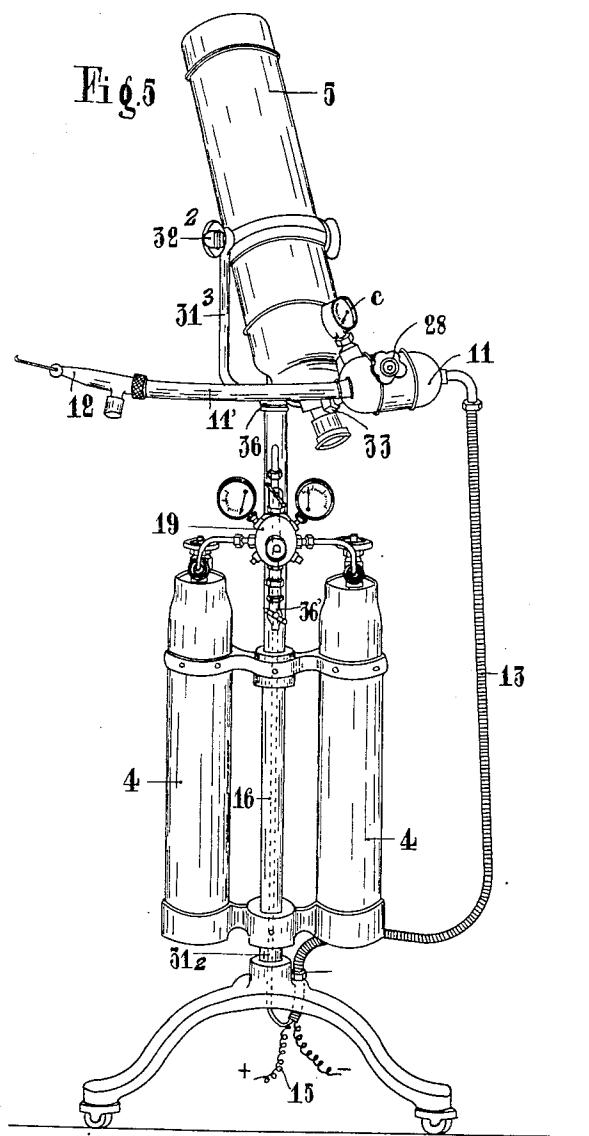
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LOCAL ANÆSTHESIS OUTFIT

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6 Sheets-Sheet 5



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1,503,528

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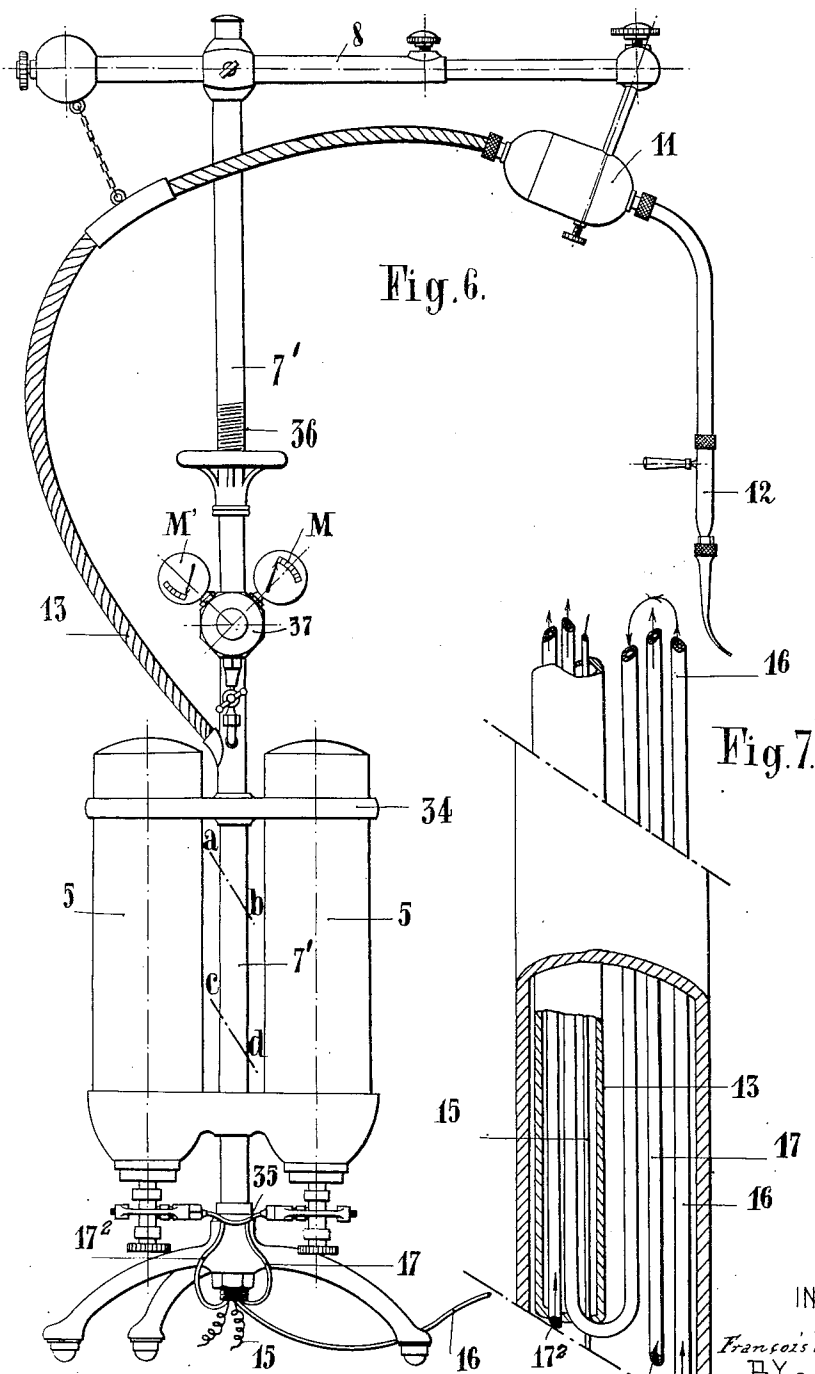


Fig. 7.

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UNITED STATES PATENT OFFICE.

FRANÇOIS JOSEPH FABRET, OF NICE, FRANCE.

LOCAL ANÆSTHESIS OUTFIT.

Application filed June 20, 1922. Serial No. 569,742.

To all whom it may concern:

Be it known that I, FRANÇOIS JOSEPH FABRET, citizen of the Republic of France, and resident of Nice, France (post-office address 6 Avenue de Verdun), have invented a new and useful Local Anæsthesia Outfit, which Improvements are fully set forth in the following specification.

This invention relates to an apparatus for producing local anæsthesia by first slowly and gradually lowering the temperature of the tissues to be anæsthetized with in a given region of the operating field, and then, after the operation has been finished, re-establishing the reduced circulation by an equally slow and gradual raising of the temperature. Such process is disclosed in my prior application, No. 429,194, filed December 8, 1920, and a form of apparatus for carrying it out is described and claimed therein; the present invention constituting an improvement or development of the earlier construction.

One form of apparatus embodying the present improvements is illustrated in the accompanying drawings, in which:

Figure 1 is a front view of a cabinet type of apparatus.

Fig. 2 is a part-sectional view, on a greatly enlarged scale, of a heat-exchanger comprised in the apparatus.

Figs. 3 and 4 are longitudinal and transverse sections of Fig. 2 taken on the lines A—B and C—D, respectively.

Figs. 5 and 6 are front views of two modifications of Fig. 1.

Fig. 7 is an enlarged part-sectional detail of Fig. 6, showing the portion thereof included between the lines *a—b* and *c—d*.

Referring to Fig. 1, the apparatus therein shown comprises a cabinet 1 of suitable size and shape, preferably, though not necessarily, provided with casters 2 and containing within it shelves or holders 3 for supporting an oxygen tank 4 and a carbonic acid tank 5. A storage battery 6 is also mounted in the upper portion of the cabinet for supplying current to a small electric resistance, hereinafter more fully described, which is utilized for heating the oxygen supplied to the blow-pipe 12, though obviously the heating action may be effected in some other way.

On the top of the cabinet is mounted a vertical bracket or standard 7 to which is attached a horizontal telescopic arm 8 ter-

minating at its free end in a swivel 9 from which a vertical rod or arm 10 is suspended, said rod carrying the heat-exchanging device 11. The latter has attached to it at one end a tube 11', which may be either flexible or rigid and which carries the blow-pipe 12, and at the other end a flexible cable 13 fitted at its opposite end in a sleeve or ring 14 fastened in an opening in the cabinet top; said cable enclosing the conducting wires 15 leading from the battery 6, as well as the supply pipes or tubes 16 and 17 leading from the oxygen and carbonic acid tanks 4 and 5, respectively, and the passage of the current through the conductors being controlled by a switch 15' on the cabinet top. A pressure regulator 19 is preferably connected to the oxygen supply pipe 16 and is equipped with a finger-piece or handle 18 for setting it; and check valves 20 and 21 are attached to said pipe and to the pipe 17, respectively, for controlling the passage of the oxygen and carbonic acid therethrough. Hence, it will be apparent that the supply of the oxygen and carbonic acid to the blow-pipe can be easily regulated at will, and that the blow-pipe itself, due to its connection to the flexible cable 13, can be readily directed against the part to be anæsthetized.

The heat-exchanger 11 above referred to is clearly shown in Figs. 2, 3 and 4; and as therein represented, it comprises an outer shell containing an axial tubular chamber 40 terminating at its opposite ends in a pair of sleeve-like members 30 and 30² which are in threaded engagement therewith and project outward through openings in the shell ends, the space between the chamber 40 and the wall of the shell being filled with insulating material *b* to prevent losses of heat by radiation. The conductors 15, which are twisted together in the usual way, and the oxygen supply pipe 16 pass through the sleeve or nipple 30 into and through the axial chamber 40 and thence through the other sleeve or nipple 30², and the pipe 16 is coiled upon itself, as shown to provide a spiral 22 within said chamber.

The blow-pipe 12, as previously stated, is carried by the tube 11', which latter has its front end attached to the end of the tubular body of the blow-pipe and its rear end attached to the sleeve 30². A tubular member 25 is disposed within the front portion of the blow-pipe body and provides a heating

chamber, while the portion of the aforesaid body in rear of this chamber forms a separate space or chamber into which the carbonic acid is discharged, as hereinafter explained. The rear end of the heating chamber 25 is closed by a metal plug 29' having an opening 29 formed through it to receive the outlet end of the oxygen supply pipe 16; said plug also carrying an insulated screw or binding post 30' to which one of the conductors 15 is attached, the other conductor being attached in some suitable manner to the plug itself. An electric resistance 24 is arranged within the chamber 25, its terminals being suitably connected to the screw 30' and the plug 29' so that when the battery circuit is closed through switch 15' the resistance 24 will be heated and, in turn, will heat the contents of the chamber. An outlet passage 31 is provided at the front end of the tubular member or chamber 25 and is continued through an extension or finger 31' on said chamber end, and to this extension there is connected by means of a ball-and-socket joint 32'—32 the nozzle 33' of the blow-pipe, the bore of said nozzle opening through the ball member 32' of the joint as indicated in dotted lines in Fig. 2.

The pipe 17 for supplying the carbonic acid leads from the cable 13 into the interior of the heat-exchanger 11 through a short flexible branch pipe or tube 27, the bore of which is continued axially into the casing of a regulating valve 28 wherein it is expanded, as shown in Fig. 4, to provide a seat for the valve end. The valve casing passes through the casing or chamber 40 at right angles to the axis of the latter; and from said casing the pipe 17 which, as will be understood, is made in two sections for that purpose, leads outwardly and forwardly through the sleeve 30² and tube 11' into the body of the blow-pipe where it is coiled around the oxygen supply pipe 16, as indicated at 17', and terminates in an open end 23 comparatively close to the plug 29'. A manometer, shown at *c* in Fig. 5, is connected to the heat-exchanger at 34' and communicates by way of a by-pass *a* with the carbonic acid supply pipe, so that it is thus possible to determine at any time whether any liquid carbonic acid is still contained in the tank 5.

As previously explained, in order to anesthetize the tissues to be operated on, the temperature of a given operating region must first be slowly and gradually reduced. For this purpose, the oxygen tank is opened and oxygen is admitted into the pipe 16, its pressure being controlled by manipulating the finger-piece 18 of the regulator 19. The switch 15' is operated to close the circuit in which the resistance 24 is included, and the latter thus acts to heat the oxygen flowing through pipe 16 into the chamber 25 where-

in the resistance is located, the heated oxygen flowing through said chamber into and through the nozzle 33'. When the temperature of the oxygen has been raised to such a point as will cause no disagreeable sensation to the patient, the heating operation is terminated by opening the switch, and the jet of oxygen is then gradually cooled down by the action of the carbonic acid. To effect this cooling action, the acid is admitted into the pipe 17 and flows therethrough into and through the coil 17', discharging through the open end 23 of the pipe into the body of the blow-pipe, whence it flows back through tube 11' into chamber 40 since it cannot pass through plug 29' into the heating chamber. During this backward movement of the acid, it vaporizes and expands and, in so doing, cools the oxygen current flowing through pipe 16; and on entering chamber 40, it completes its expansion, further cooling the oxygen and finally escaping to the atmosphere through sleeve 30 and cable 13. The location of the coil 22 within the chamber 40 ensures the oxygen passing therethrough being subjected to the refrigerating action of the acid for a considerable period of time.

The second part of the process consists in re-establishing the circulation of the anesthetized tissues and restoring it to normal after the operation has been completed; this action being effected by reversing the previous treatment—that is to say, by gradually re-heating the oxygen by means of the electric resistance.

In the form of apparatus represented in Fig. 5, a standard 31² is employed, which may or may not be mounted on casters and which may be utilized to support two or more oxygen tanks 4; although the oxygen may, if preferred, be supplied from a tank or tanks supported in any other desired manner. In any event, the oxygen output is controlled by a suitable regulating device 19, and passes therefrom into a valve-equipped tube 36' which conducts it to the supply pipe 16. This pipe 16 is disposed within the standard or upright 31², which is hollow, as shown; and it emerges through the open lower end of the standard and enters the cable 13 which, as in the first form, is connected to the heat-exchanger 11, the latter having connected to it the tube 11' and blow-pipe 12. The conductors 15 enter the cable 13 at the same point as the pipe 16, as shown.

The tank 5 containing the carbonic acid or other refrigerant is pivotally mounted in inverted position between the arms of a fork 31³, as indicated at 32²; said fork having its base adjustably connected at 36 to the top of the standard, so that it may be raised or lowered to a certain extent. The gaseous refrigerant enters the heat-exchanger 11 at 33 and escapes to the atmosphere through

the open lower end of the cable 13; the manometer *c* being attached to the said heat-exchanger by the connection 34' (Figs. 2 and 4).

In the further modification or development illustrated in Figs. 6 and 7, the hollow supporting standard or upright 7' is supported in the same manner as the standard 31² in Fig. 5, and carries at its upper end a horizontal telescopic arm 8 similar to the corresponding part in Fig. 1 and having the heat-exchanger 11 suspended from it. Standard 7' is preferably made in two sections which have an adjustable joint or connection 36, similar to the correspondingly-numbered part in Fig. 5, for the purpose of varying the height of the standard. In this form of the invention, however, two or more inverted carbonic acid tanks 5 are utilized, and are attached to the standard 7' in inverted position by means of suitable fastening devices 34. These tanks 5 are connected at their lower ends by a tube or pipe 35 from which leads a supply pipe individual to each tank, said supply pipes extending through the hollow standard 7' and one of them also leading into and through the cable 13.

The oxygen supply pipe 16, in this construction, instead of being connected to a tank or tanks carried by the standard, is connected to a source of supply (not shown) which is entirely independent of said standard and may be located in any desired position in the operating room. Referring to Fig. 7, it will be observed that this pipe includes branches arranged in ascending and descending relation in standard 7'; the ascending branch, which is the right-hand one, leading to the expander 37, while the descending branch leads downwardly from said expander, enters the lower end of the cable 13 and passes through said cable to the heat-exchanger 11. Two refrigerant supply pipes, indicated at 17 and 17² in Fig. 7, are shown, the right-hand pipe 17 leading through the standard to the manometer M' which is attached to the expander and which serves merely to give the pressure of the gas, while the left-hand pipe 17² enters the lower end of the cable 13 and passes there-through parallel with the conductors 15 and the second ascending branch of the oxygen supply pipe; the said pipe 17² leading into the heat-exchanger, as before. The other manometer M shown in Fig. 6 gives the pressure in the expander itself.

It is to be understood that the invention is not limited to the precise structural details above described but, on the contrary, is clearly susceptible of modifications and changes within its scope as hereinafter claimed. Changes may also be made in the two operating fluids or gases used: for example, air or other inert gas may replace the

oxygen, and other agents capable of effecting a refrigerating action by expansion and vaporization—such as ethyl chlorid or bromid—may be substituted for the carbonic acid.

I claim as my invention:—

1. Apparatus for producing local anaesthesia, comprising a refrigerant tank; a heat-exchanger; an inert gas supply pipe leading to the heat-exchanger; a refrigerant supply pipe leading from said tank to said heat-exchanger in juxtaposition to the gas-supplying pipe; a flexible cable wherein both supply pipes are disposed connected to the heat-exchanger; a delivery tube leading from the heat-exchanger; and a blow-pipe connected to the outer end of the delivery tube, both said supply pipes leading through said tube and discharging into separate portions of the blow-pipe.
2. Apparatus for producing local anaesthesia, comprising a refrigerant tank; a heat-exchanger; an inert gas supply pipe leading to the heat-exchanger; a refrigerant supply pipe leading from said tank to said heat-exchanger in juxtaposition to the gas-supplying pipe; a flexible cable wherein both supply pipes are disposed connected to the heat-exchanger; a delivery tube leading from the heat-exchanger; a blow-pipe connected to the outer end of the delivery tube, both said supply pipes leading through said tube and discharging into separate portions of the blow-pipe; and a heating device disposed in the portion of the blow-pipe wherein the gas is discharged.
3. An apparatus according to claim 2, in which the heater comprises an electric resistance, the terminals of which are connected to conductors which lead through the flexible cable and heat-exchanger into and through the delivery tube.
4. Apparatus for producing local anaesthesia, comprising a blow-pipe; a heat-exchanger; a support from which the heat-exchanger is suspended; and separate pipes extending to said heat-exchanger in juxtaposition to each other and leading therefrom to said blow-pipe for supplying to the latter an inert gas and a vaporizable and expandible refrigerant for cooling said gas.
5. Apparatus for producing local anaesthesia, comprising a blow-pipe; a heat-exchanger having an axial chamber; a pipe for supplying an inert gas to the blow-pipe connected to the latter and passing through said chamber; and a separate pipe for supplying a vaporizable and expansible refrigerant to said blow-pipe, the last-named pipe entering into said chamber and leading from the same to the blow-pipe in juxtaposition to the first-named pipe and having a portion coiled around said first-named pipe.
6. Apparatus for producing local anaesthesia,

thetia, comprising a blow-pipe; a heat-exchanger having an axial chamber; a pipe for supplying an inert gas to the blow-pipe connected to the latter and passing through
5 said chamber; a separate pipe for supplying a vaporizable and expansible refrigerant to said blow-pipe, the last-named pipe entering into said chamber and leading from the same in juxtaposition to the first-named pipe, and one of said pipes having
10 a portion thereof coiled around the other pipe; and a valve device carried by said heat-exchanger and connected to the refrigerant pipe within said chamber for
15 regulating the flow of refrigerant to the blow-pipe.

7. Apparatus for producing local anæsthesia, comprising a blow-pipe; a heat-exchanger having an axial chamber; a pipe
20 for supplying an inert gas to the blow-pipe connected to the latter and passing through said chamber; a separate pipe for supplying a vaporizable and expansible refrigerant to said blow-pipe, the last-named pipe
25 entering into said chamber and leading from the same in juxtaposition to the first-named pipe, and one of said pipes having a portion thereof coiled around the other

pipe; and a filling of insulating material within the heat-exchanger and enclosing
30 said chamber.

8. Apparatus for producing local anæsthesia, comprising a blow-pipe; a heat-exchanger having an axial chamber; a pipe
35 for supplying an inert gas to the blow-pipe connected to the latter and passing through said chamber; a separate pipe for supplying a vaporizable and expansible refrigerant to said blow-pipe, the last-named pipe
40 entering into said chamber and leading from the same in juxtaposition to the first-named pipe, and one of said pipes having a portion thereof coiled around the other
45 pipe; a valve device carried by the heat-exchanger and connected to the refrigerant pipe within said chamber for regulating the flow of refrigerant to the blow-pipe; and a filling of insulating material within the heat-exchanger and enclosing said chamber.

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

FRANÇOIS JOSEPH FABRET.

Witnesses:

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VINCENT GURDY.