UNITED STATES PATENT OFFICE

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APPLICATOR APPARATUS FOR REFRIGERATION ANAESTHESIA

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This invention relates to refrigerating apparatus for medical or hospital use and particularly to apparatus for carrying out refrigerating anaesthesia in amputation cases.

It is an object of the invention to provide refrigerating apparatus which may be readily applied to the human limbs and which may be adapted to the limbs to provide for efficient refrigeration thereof.

A further object of the invention is to provide apparatus of this kind which is readily portable and may be employed at various locations and in various positions at a distance from the power-operating refrigerating unit.

A further object of the invention is to provide apparatus of this kind which may be employed with different types of refrigerating unit and which is readily adaptable to mobile units.

With these and other objects in view the invention particularly resides in a refrigerant applicator designed to be brought into intimate contact with the limb or a portion of the limb of a patient together with means for applying the applicator to the limb in a practical and efficient manner, and means for subjecting all areas of the applicator to the effect of the refrigerant to produce efficient refrigerating conditions and thus chill the limb or a portion thereof in a uniform manner to a suitable low degree in the neighborhood of 40°F.

The invention will be more fully understood by reference to the accompanying drawings, wherein—

Figure 1 is a front view of the unit showing two types of refrigerants connected thereto and illustrating the manner in which such refrigerants may be employed at a distance from the power refrigerating unit.

Figure 2 is a plan view of one of the applicators illustrated in Figure 1.

Figure 3 is a vertical sectional view on the line 3—3 in Figure 2.

Figure 4 is a plan view taken on the line 4—4 in Figure 3, and

Figure 5 is a perspective view of the type of applicator illustrated in the lower portion of Figure 1.

Referring to the drawings, the numeral 10 indicates any suitable movable cabinet or the like carrying power-operated refrigerating apparatus and having the refrigerant circuit controls indicated by the numerals 11, 12, 13 and 14.

Flexibly connected to the controls are the pipe circuits 15 and 16 having the return leads 17 and 18, respectively, the pipe circuit 15 being adapted to feed refrigerant to the applicator 19.

The applicator 19 comprises the lower framework 20 and upper framework 28 connected thereto.

The framework may be made of metal tubing bent as shown and connected together to provide a central longitudinal channel 21 which is adapted to carry lower limb plates 22, 23 and 24 which are suspended by suitable flexible means, such as the straps 25 from the lateral members 26 and 27.

Suspended from the upper framework 28 by the removably securable brackets 29 are corresponding upper limb plates 30, 31 and 32, while integrally projecting from the brackets 28 are the bars 33 having adjusting members 34, securable to the limb plates, threaded through their extremities.

In order to enable intimate contact to be effected with all parts of a limb inserted between the limb plates, or those parts of a limb which it may be necessary to encircle, each limb plate comprises a curved portion, and it will be seen that the upper limb plates may be adjusted longitudinally by means of the brackets 29 and diametrically by means of the members 34, the lower limb plates being longitudinally adjustable by the members 35.

The refrigerant limb plates have mounted thereon tubing 35 for conveying the refrigerant to the plates, the tubing 35 being disposed on the plates so as to provide for chilling of the whole area of the plates. The terminal parts of the tubing indicated by the numeral 36 are arranged to connect with suitable sections of flexible hose or tubing 37 which may be connected to suitable fittings or headers 38 which are in turn fed with refrigerant by the long flexible members 39, the return conduits being indicated by the numeral 40, the feed members 39 being connected with suitable members on the cabinet or refrigerant power supply so that the refrigerant may be fed to the applicator under suitable control.

As distinct from the applicator 19 having the framework 20 supporting an upper member 28, the type of applicator represented by the numeral 41 may be employed having no rigid framework and this type may be wrapped around a portion of the limb and fastened round the limb by suitable straps 42.

The limb plates of this type, as in the other applicator structure described, include the tubing integrally connected therewith in the same manner as is clearly indicated in Figure 1, and by means of suitable flexible conduits 43 and 44 such applicator is operably connectable with the power refrigerating unit,
The latter type of applicator is particularly useful where a smaller area of the limb is to be chilled, but it is of course equally apparent that the applicator 19, having a rigid framework, may also be used to chill parts of the limb, if desired, by reason of the readily adjustable framework, and the manner in which the plates are supported on the framework.

It will be evident that the main difference in structure between the two types of applicators 19 and 41 is that, in the former, the applicator comprises two main cooperating parts swingably hinged together, the lower part of the framework thus forming a bed to receive the limb and the upper part of the framework being swingingly mounted by the arm 45 enabling the upper part of the framework to be applied as a cover to the limb. In the case of the applicator 41 the limb is effectively encircled, more or less completely, and this structure may take the form of a relatively flexible member or of flexible sections which can be strapped on the limb.

Figure 5 illustrates a modification of the type of applicator indicated by the numeral 41 and comprises the upper limb plates 46 and the lower limb plates 47 suitably connected to one or more hinge means 48, each limb plate having the tubing externally disposed thereon so as to provide for the chilling of each of the plates and connectable by the members 49 and 50 to the power refrigerating unit. In addition, since two series of limb plates are employed, lateral strengthening members 51 and 52 are provided suitably connected to certain of the upper and lower plates so that when the limb plates are placed so as to encircle the limb, they are maintained in longitudinal alignment and may be adjusted longitudinally by means of the members 51 and 52.

In order to provide for small amounts of longitudinal displacements of the plates, the members 51 and 52 are resiliently mounted to the resilient supporting members 53 mounted in the supporting bracket 54 (visible in Fig. 5) secured to the rim of the plates 46 and 47.

From the foregoing it is apparent that the applicators may be used very conveniently, are adapted to contact with a limb or part thereof in a practical and efficient manner so as to provide for an efficient chilling operation, while it is clear that they may be used at a distance from the refrigerating unit without any difficulty. Moreover, the manner of chilling the plates will provide for a uniform chilling of the limb or a part thereof and thus there is made available an apparatus for efficiently carrying out refrigeration anaesthesia. As previously stated any suitable refrigerating cabinet or unit may be employed and the invention is readily adaptable to mobile units where the applicators may be readily stored and made readily available for use in a convenient manner. In the form of cabinet shown in the present illustrations, it will be noted that a suitable rack 28c may be employed to receive applicator 14 whereas by means of a suitable shelf the applicator 15 is readily stored.

What we claim as our invention is:

1. Anesthetia refrigerating apparatus including in combination a refrigerant supply means, control means therefor, and refrigerant conduit means connectable with a refrigerant applicator, said applicator comprising a plurality of shaped substantially rigid plates flexibly connected to form a yieldable channel-like element for engaging and partially enclosing portions of the human body, one face of said plates being adapted to contact said body portions and conduit means whereby the other face of said plates in intimate contact therewith over selected areas thereof for the passage of a refrigerant, in intimate contact with said plates minutely to cool them, said plate conduit means being flexibly connected from plate to plate to establish a circuit designed to connect with said refrigerant supply means, and means for securing said applicator in contact with selected portions of the body to cool the latter to a predetermined degree.

2. Anesthetia refrigerating apparatus, including in combination a refrigerant supply means, control means therefor and refrigerant conduit means connectable with a refrigerant applicator, said applicator comprising a framework having spaced apart side members, a plurality of shaped substantially rigid plates disposed between said side members, means for flexibly suspending said plates from said side members to form a channel-like element for supporting a portion of the body in contact with the exposed faces of said plates and conduit means carried by the other faces of said plates in intimate contact therewith over selected areas thereof for the passage of a refrigerant, minutely to cool said plates, said plate conduit means being connected from plate to plate to establish a circuit designed to connect with said refrigerant supply means, whereby to cool said portions of the body to a predetermined degree.

3. Anesthetia refrigerating apparatus as claimed in claim 2 in which said framework includes a movable section carrying a plurality of shaped substantially rigid plates disposed in opposed relation to said first mentioned plates, said second mentioned plates being supported to form a channel-like element having one face of the plates disposed to contact a portion of the body, the other face carrying conduit means in intimate contact therewith over selected areas thereof for the passage of a refrigerant, said second plate conduit means being connected with the refrigerant supply means to establish a closed circuit, said second group of plates being movable towards the first group to engage and substantially surround together with said first mentioned plates a portion of the body supported by the latter.

4. Anesthetia refrigerating apparatus, including in combination a refrigerant supply means, control means therefor and refrigerant conduit means connectable with a refrigerant applicator, said applicator comprising a framework having spaced apart side members and a superstructure at one end, a plurality of shaped substantially rigid plates disposed between said side members, means for flexibly suspending said plates from said side members to form a channel-like element for supporting a portion of the body in contact with the exposed faces of said plates, a swingable support means on said superstructure, a plurality of shaped substantially rigid plates carried by said support and disposed in spaced apart relation to form a channel-like element for engaging one face of said plates with a portion of said body, conduit means carried by the opposite faces of each of said groups of plates in intimate contact therewith over selected areas thereof for the passage of a refrigerant, minutely to cool said plates, said plate conduit means of each group of plates being connected from plate to plate to establish a circuit for each group designed to connect with said refrigerant supply means.
5 means whereby to cool said portion of the body to a predetermined degree, said support being swingable towards said framework to engage its plates with and substantially encircle a portion of the body supported by the plates of said framework, whereby to cool said portions of the body to a predetermined degree.

5. Anaesthesia refrigerating apparatus as claimed in claim 4 in which the swingable support comprises a bar swingably connected to said superstructure and having a plurality of supporting arms for adjustably carrying a plate.

6. Anaesthesia refrigerating apparatus as claimed in claim 1, in which the applicator comprises two series of said shaped substantially rigid plates connected to form a channel-like element, the plates of each series being in substantially longitudinal alignment and each series being flexibly connected in spaced apart relation and adjustable means connecting the two series of plates whereby the two series may be longitudinally adjusted relatively to one another.

7. In an anesthesia refrigerating apparatus, a refrigerant applicator comprising a plurality of shaped substantially rigid, thin metal plates flexibly connected together and designed to be disposed in engagement with a predetermined portion of the body for cooling the latter, one face of said plates being designed to contact said body portion, the opposite face having tubular conduit means, for receiving a refrigerant, integrally secured thereto and extending over selected substantial areas thereof, to cool them, and flexible tubular means connecting said tubular means between said plates, whereby said plates may be caused to move relatively to one another and to engage varied contours of the body in intimate contact.

8. An anaesthesia refrigerating apparatus as claimed in claim 7 in which two series of plates are included, the plates of each series being flexibly connected with one another, both series being connected together in spaced and yieldable relation.

9. An anaesthesia refrigerating apparatus as claimed in claim 7 in which two series of plates are included, the plates of each series being flexibly connected with one another, both series being connected together in spaced and yieldable relation, said yieldable connection between each series including rod members extending between each series and a flexible joint forming a connection between the rod members and certain plates of each series.

10. An anaesthesia refrigerating apparatus as claimed in claim 7 in which two series of plates are included, the plates of each series being flexibly connected with one another, both series being connected together in adjustable relation to one another.

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