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Sauder et al.

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[54] **PORTABLE COOLING APPARATUS**

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[52] **U.S. Cl.** **128/400;** 62/239; 62/259

[51] **Int. Cl.**[2] **A61F 7/00**

[58] **Field of Search** 128/399, 400, 402, 254, 128/379, 382; 62/239, 255, 259

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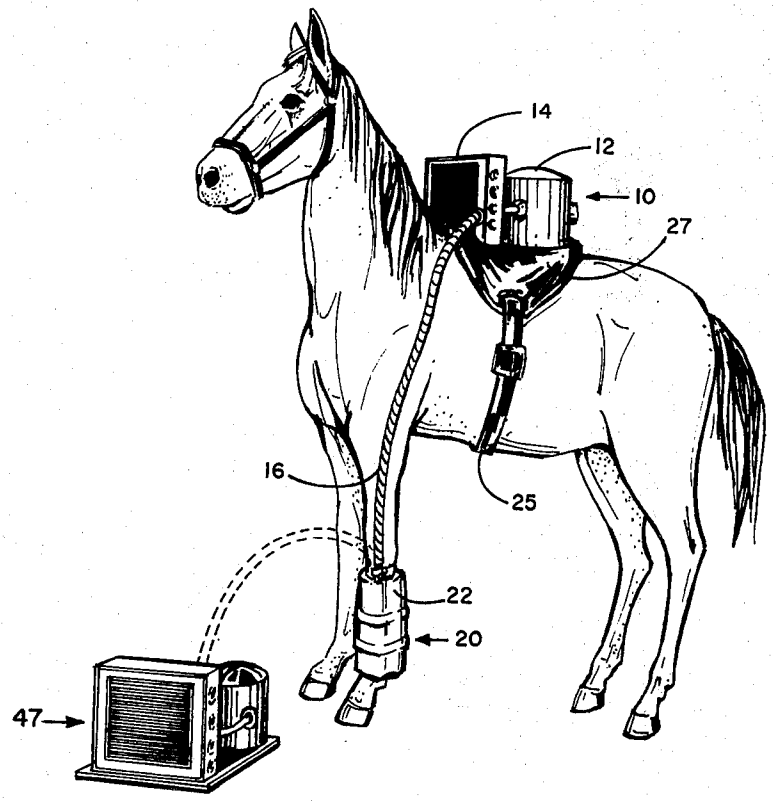
[57] **ABSTRACT**

A portable apparatus for cooling a portion of a warm body comprises a ductile evaporator coil having a shape which generally conforms to the body portion to be cooled, a flexible jacket for receiving the coil and wrapping around the body portion to be cooled and having means for securing the jacket around the body portion, compressor and condenser means for liquefying a refrigerant composition and conduit means for supplying the refrigerant to and from the evaporator coil.

11 Claims, 5 Drawing Figures



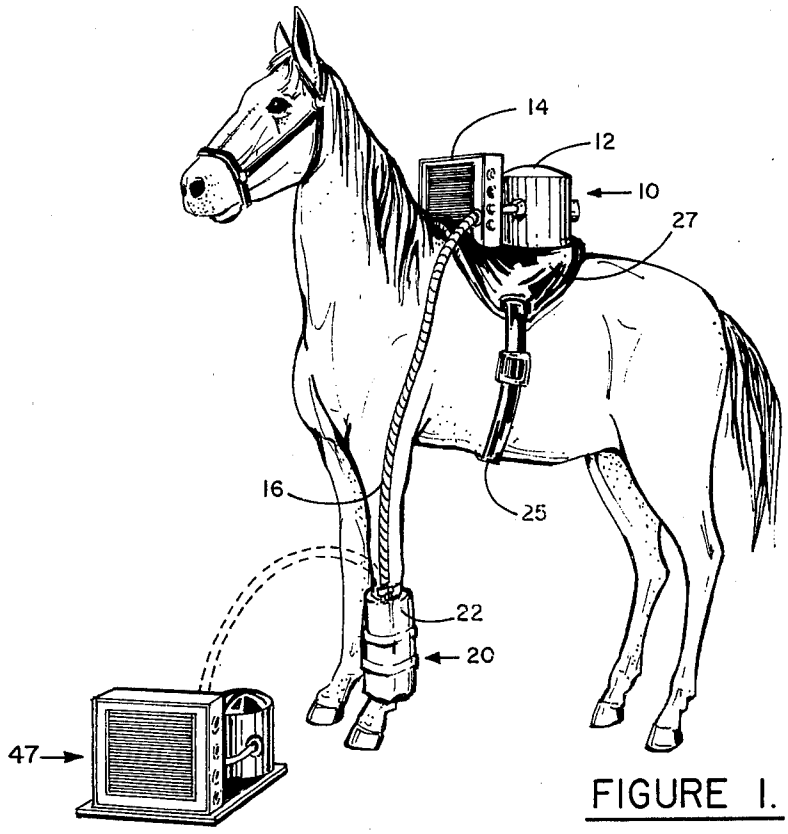


FIGURE 1.

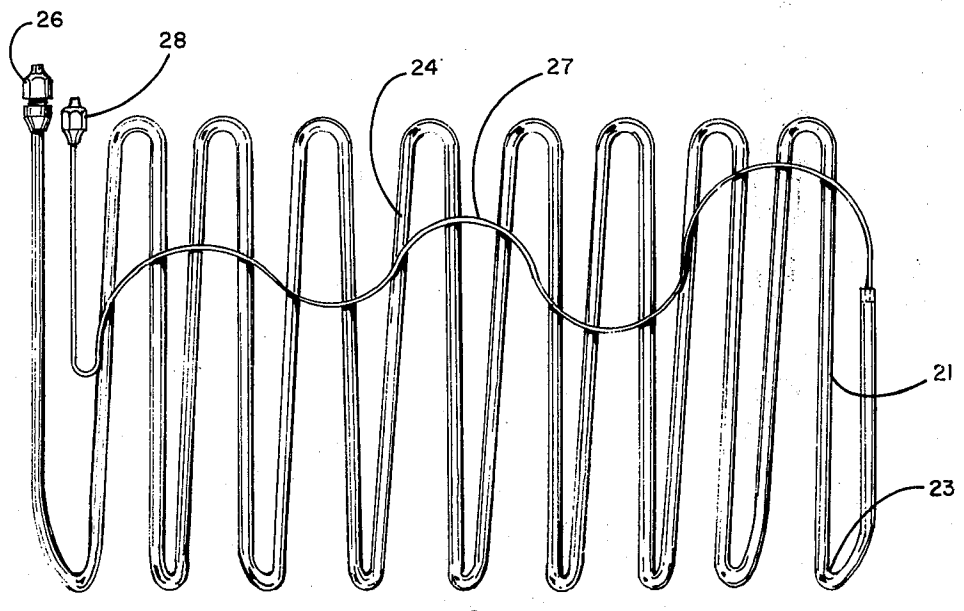


FIGURE 2.

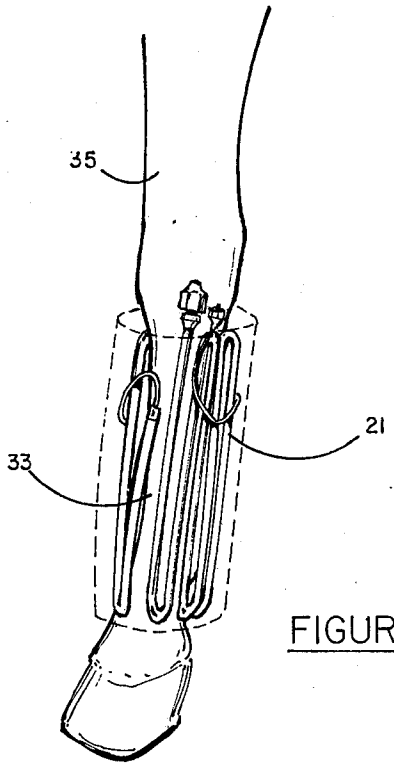


FIGURE 3.

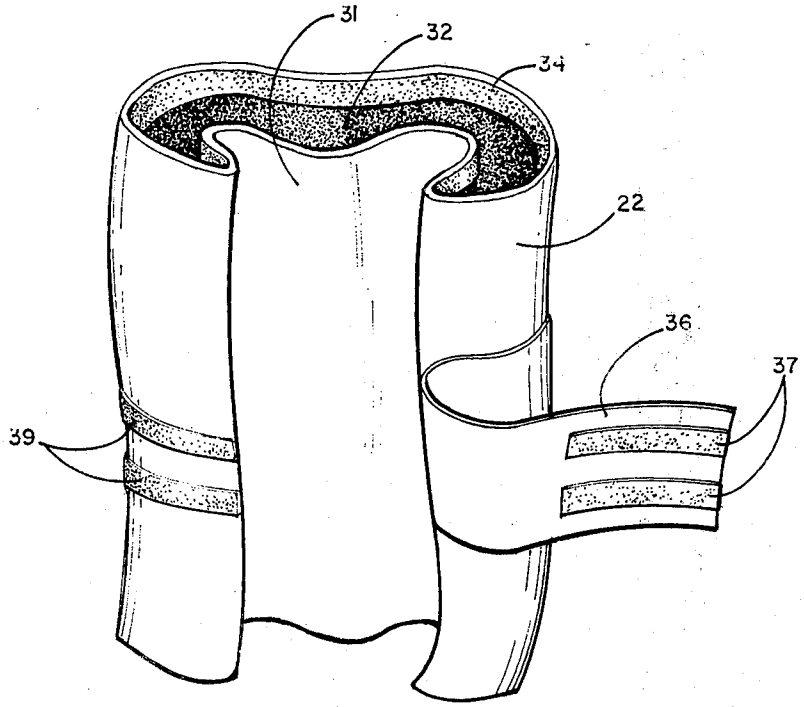


FIGURE 4.

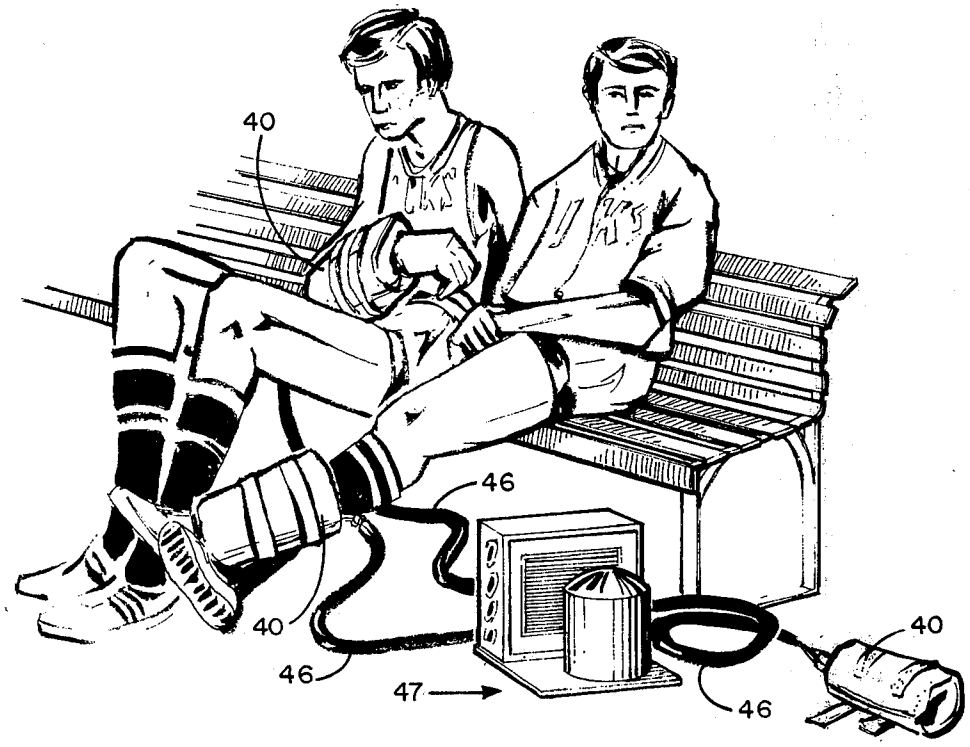


FIGURE 5.

PORTABLE COOLING APPARATUS

BACKGROUND OF THE INVENTION

The necessity of cooling inflamed portions of a body, and particularly for example, feet, ankles, legs, arms or shoulders of a person or the legs of a horse where a portion of the leg has become inflamed due to injury or disease is well understood by those skilled in the art. On the ankle or hind quarters of a horse and particularly the lower leg area below the knee, which may be referred to as the cannon, pasterns and fetlock, treatment for inflamation in order to reduce fever and swelling usually requires immersing the leg in an ice bucket or cold water bath. Ice packs are often used initially and temporarily for human injuries, for example, at athletic events where injuries are common. It will be appreciated that the use of ice packs or other cold treatment is often time consuming, is inconvenient, and in the case of an ice pack requires replenishment of the ice as it melts during the cooling process as does a cold ice water bath. Another disadvantage in using ice packs or similar cold water treatment is that it creates a wet cold which, although being usually considered more penetrating than dry cold, is also more painful. Usually a wet cooling process utilizing an ice pack, wrap or cold water, can only be maintained for a rather limited time because of discomfort.

A further disadvantage of using ice to reduce the inflammation, fever, swelling and relieving pain of an inflamed body is that there is a limit to the low temperature, usually between about **35°** and **40°**. However, for some treatment not only is a longer cooling time desirable, but colder temperatures as well as less painful treatment are often preferred.

SUMMARY OF THE INVENTION

The present invention is directed to an apparatus and method of cooling a portion of a warm body utilizing a portable cooling apparatus including a compressor and condenser portion for liquefying a refrigerant composition, a ductile evaporator coil which may be formed to a general shape of a body portion to be cooled, and a flexible jacket or sleeve in which the coil is received and which jacket may be secured around the body portion to be cooled. The design of the apparatus is such that it can be carried by a person, and more preferably can be secured on the back of a horse and remain there during the cooling treatment. Alternatively, the compressor and condenser secured to a platform can be placed on the ground, floor or table adjacent the person or animal to be treated. In this manner, the evaporator coil is placed in the jacket and then secured around the inflamed or swollen portion of the body to be cooled, and the compressor and condenser operated so as to circulate refrigerant to the evaporator coil. Moreover, with such an apparatus so secured, the person or animal is free to move about, especially where the apparatus is powered by a portable battery component of the apparatus, or an extension cord plugged into an AC source may be utilized, for example, in a sideline or stall area. Further, the device may be modified to function as a heat pump so that heat may be applied through the evaporator coil which acts as a condenser to give off heat as will be appreciated by those skilled in the art. Moreover, the device can be conveniently utilized to heat or cool water baths where desired, all due to the portability of the unit as will be more fully explained hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of the apparatus of the invention showing two alternative embodiments, one secured on a horse and the other on the ground;

FIG. **2** illustrates the evaporator coil portion of the apparatus;

FIG. **3** shows the evaporator coil placed on a portion of a horse's leg with the jacket shown in phantom;

FIG. **4** shows the jacket for receiving the evaporator coil; and

FIG. **5** illustrates the use of the apparatus for treating humans.

DETAILED DESCRIPTION OF THE INVENTION

Referring initially to FIG. **1**, there is shown the general apparatus **10** which includes the compressor and condenser portions which comprise the majority of the weight of the apparatus. Specifically, there is shown a compressor **12** and condenser **14** which includes the condenser coils and fan, the latter not shown. A refrigerant such as Freon or similar composition becomes compressed and cooled to liquid state by the compressor and condenser and is then directed to the evaporator coils where it absorbs heat transferred through the coil walls as it cools the body portion.

For convenience, these compressor and condenser components together with the additional components required including various electrical valves, solenoids, wiring, electrical fan motor, etc, all of which are known to those skilled in the art, are mounted on a platform **27** which may be conveniently arched or curved to fit comfortably over the back of the animal, much like a saddle. In addition, a strap **25** is also conveniently used so that the apparatus can be readily secured and is comfortable on the animal during operation.

Extending between the cooling component **20** of the apparatus are flexible conduit members **16** which provide a passageway for the cooled liquid refrigerant from condenser **14** to the evaporator or cooling coil and a return for the refrigerant vapors to compressor **12.**

Referring also to FIGS. **2–4,** the cooling component of the apparatus comprises a cooling coil **21** which is ductile and can be readily molded or formed to conform generally to the portion of the body which it is desirable to cool. As specifically shown in FIGS. **2** and **3,** the cooling coil **21** comprises a main or major tube portion **24** which consists of a length of ductile or tractable tubing which may be shaped so as to best distribute the cooling to the intended body area. For example, the lower portion **33** of a horse's leg **35** and particularly the area above the fetlock may become inflamed along its length whereby an advantageous cooling coil shape is shown. The tubing is drawn into relatively long lengths and which lengths are adjacent one another in an accordion fashion and the bottom of the adjacent tubing lengths extend angularly to the plane of the elongated portion of the tubing lengths. The angular displacement of the bottom portion **23** of each of the coil lengths is such that they extend inwardly toward one another in a finger-like fashion that will conveniently fit around the fetlock. Again, it will be appreciated that where a ductile metal coil such as copper is used for the cooling coil which metal has adventageous heat transfer prop-

erties, the cold refrigerant will absorb heat from the swollen or inflamed leg area. The tubing coil may also be stretched in an accordion-like manner around the leg or other body portion and the length of coils can be further shaped around that body portion as desired. Thus, although a specific coil shape shown in FIGS. **2** and **3** is one primarily intended for use around the fetlock area so that the coils will also surround the pastern, coronet and cannon of the horse's leg, it could instead be shaped to other parts of either front or hind legs. Where the device is to be used for other animals or on humans, for example, around a shoulder area where a dislocation or other inflammation causing injury has ocurred, the hand shaping of the coils to extend around such an area comfortably, will be appreciated.

Coil **21** shown in FIG. **2** also includes attachment members **26** and **28** therefor securing two conduits **16,** one being for directing liquid refrigerant into the coil and one for directing the vapor or vaporized refrigerant back to the compressor. In these specific coils shown, and which may be a preferred embodiment, rather than using an expansion or throttle valve, a length of capillary tube **27** is used instead in which the liquid refrigerant first enters the coil. This length of capillary tube is connected directly to the larger tube **24** where the liquid will expand throughout the remainder of the coil which acts as an evaporator. The refrigerant as it absorbs heat, becomes vaporized and is then circulated back to the compressor for recooling and liquefaction. The coil **21** viewed in FIG. **2** is shown somewhat expanded whereas its final shape when placed as shown in FIG. **3** will be modified with the tubing lengths being closer and the coil perimeter from end to end being generally crescent shaped. The tubing **24** is preferably soft copper tubing which can be shaped readily to conform to the shape of the desired body area. The size of the tubing may be, for example, between about one-fourth and about five-sixteenth inch, the smaller and softer tubing being more easily shaped than larger tubing.

Another portion of the apparatus comprises a flexible jacket **22** in which the coil is received and which jacket is then wrapped around the body portion to be cooled. This jacket **22** is shown in FIG. **1,** in phantom in FIG. **3** and in more detail in FIG. **4.** The jacket includes an interior between a front and back panel **31** and **32,** respectively, and between which panels is defined an interior cavity in which the coil is placed. The bottom of the jacket is preferably closed so that the coil cannot slip out. The jacket acts somewhat like a pocket in supporting the coil when it is properly in place on the animal or patient.

The opening at the top of the jacket in which the coil is placed, may have closure means and as shown mating Velcro strips **34** may be used on both front and back panels along the upper edge so that when the coil is placed in the jacket cavity it can be closed in order to further insulate the coil. However, it will be appreciated that snaps, zipper or other closure means may be used for this same purpose if desired. Moreover, the jacket should also incorporate means for further securing it when wrapped in position and accordingly, a strap portion **36** having Velcro strip portions **37** and which will interlock or mate with strip portion **39** is shown in the specific embodiment of FIG. **4.** The wrapped jacket can then be conveniently loosened or tightened around the leg as desired. However, it should also be appreciated that other means for securing the jacket when wrapped around the body portion may be used including snaps, belts and buckles. Alternatively, the jacket itself may be large so that a side of one of the panels can be overlapped with the other panel and secured by snapping, buttons, zipper means or the like. It should also be appreciated that the jacket can be made of any material, including expandable banding or wrapping material, fabric or leather, and may be padded. Also, it may be preferred that the back panel, the panel exposed to the outside, has an insulating backing or layer so that the cooling effect of the refrigerant will be further optimized. Moreover, the jacket itself can be sewn or otherwise formed so that it is more permanently secured to the coil in any manner as may be appreciated by those skilled in the art. Other modifications to the jacket so as to make it more easily adaptable for any specific or particular usage may also be made, which modifications will be understood to be within the purview of the present invention.

In using the device or apparatus shown, and as previously noted, compressor **12** and condenser **14** including required valves, switches and other components may be attached to a saddle board **27** or similar platform so that the apparatus can be comfortably secured on the back of a horse. The size of the compressor of course will depend on the amount of cooling required but which may be, for example, of ¼ to 1/6 horsepower capacity. Utilizing a condenser having sufficient coil surface area, the apparatus may weigh, for example, about **35** pounds which will be understood to be lightweight enough so as to be easily handled and placed on a horse. However, even a smaller unit could be as low as **15** pounds or larger units up to **50** pounds or more may also be produced as desired. The power for the apparatus may be supplied by a portable battery also attached to the platform, which could be rechargable thereby requiring no extension cord which need be plugged into an electrical outlet. Moreover, using such a battery, although the weight of the device may be increased somewhat, the animal may move about freely even outside a stall. However, where AC current is used to power the apparatus, an extension cord of any desired length and which may conveniently be retracted on a reel, may be used. If the apparatus is plugged into an outlet adjacent the stall area, if the extension cord is long enough, the horse is still free to move back within the limits of the length of the cord. In either case there is an obvious advantage of treating an animal in its familiar stall where is may also move about, at least somewhat, over the task at maintaining its leg in an ice bath or having the inconvenience of preparing an ice pack.

Although the apparatus is shown using only one evaporator or cooling coil, it will be understood that more than one coil, for example, two evaporators can be used with a single condenser and compressor. Of course, a second refrigerant supply conduit will also be required. Moreover, the apparatus may also include temperature control sensors, located around the evaporator coil which can act as a thermostat in regulating the extent of cooling. Thus, the attendant may simply set the desired temperature on the cooling unit component which can then automatically turn on and off the compressor as more or less cooling is required. In addition, a timer unit may also be used where the operator

can simply set the length of time for cooling, after which it is automatically shut off. Such features will be especially adventageous where there are a rather large number of animals to be attended to or where there may be danger of over exposing the animal to cold for a lengthy period of time.

Although the apparatus has been described as particularly adapted for use on a horse and secured like a saddle, it is to be understood that such a feature is only by way of convenient example and the compressor and evaporator portion of the apparatus may be elsewhere rather than on the animal. For example, any convenient base or supporting member may be used on which the compressor and condenser can be secured and which base may also be provided with a handle or similar means for conveniently carrying the apparatus. FIG. 1 also illustrates such an embodiment with the compressor and condenser portions secured on a flat portion lying on the ground with the flexible conduit members shown in phantom and extending to the cooling or evaporator component. Such an embodiment has an advantage that if the horse were to jump, the compressor would not become dislodged from the horse's back and at most the conduit members might be broken.

The device may be used to treat humans such as at sporting events and the like where foot, ankle, leg, arm or shoulder injuries should be cooled as soon as possible to reduce swelling. Such an embodiment is illustrated in FIG. **5** with a compressor and condenser portion **47** situated adjacent a bench and having three cooling components **40** and corresponding flexible conduits **46** extending therefrom. The cooling components each include a coil and jacket as previously described with the coil shaped to accommodate the arm or leg of the athlete being treated and around which the cooling components **40** are wrapped. A third cooling unit is available for the use on another person. Thus, the apparatus can be made to include multiple cooling units as shown depending on the intended use or purpose. Such apparatus may be placed in an ambulance, emergency ward or transported to any area or facility where its use may be needed. Since the apparatus is lightweight and may be provided with a convenient means for carrying, its portability will allow a braoder application and is within the purview of the invention.

The device is not only useful for direct application on a body portion as has been described, but the cooling coils may also be used to cool a water bath if desired. This is accomplished by placing the cooling coil in a bucket or other water receptacle and operating the apparatus in a normal manner. Moreover, the need not be limited to a cooling function, but may also be used for heating, as a heat pump, in which the evaporator coil becomes the heating coil, like a condenser as is well appreciated by those skilled in the art. If the apparatus is to be used to provide heat in addition to cooling, a four-way reversing valve is required for reversing the flow of refrigerant. Thus, for heating, the coil **21** becomes heated and acts as the condenser since the reversing or four-way valve causes the refrigerant to be directed from the compressor to the coil **21.** The refrigerant will be in a vapor state as it passes to the coil unit where it gives up its heat, becomes liquid and is then directed to the evaporator coils **14** where the refrigerant returns to a vapor state and is then directed to the compressor, and so on. The advantages of such a portable device which can be used described herein will be understood as will other uses and modifications of the equipment, all within the purview of the invention.

I claim:

1. Portable apparatus for cooling a portion of a warm body comprising:

a. a ductile cooling coil for being formed to the general exterior shape of the body portion to be cooled,

b. a flexible jacket for receiving the coil and having means for securing the jacket around said body portion,

c. compressor and condenser means for liquefying a refrigerant composition,

d. conduit means for supplying said refrigerant to and from said cooling coil,

e. a battery for operating said compressor and condenser, and

f. a platform on which said compressor and condenser means are secured.

2. The apparatus of claim **1** wherein said jacket comprises a front and rear panel secured together along their adjacent sides and bottom said panels defining a cavity therebetween for receiving said cooling coil.

3. The apparatus of claim **2** wherein said jacket includes means for being adjustably secured around said body portion.

4. Portable apparatus for selectively heating and cooling a body portion comprising:

a. a ductile coil member for being formed to the general exterior shape of the body portion to be treated,

b. a flexible jacket for receiving the coil and having means for securing the jacket around said body portion,

c. compressor and condenser means for liquefying a refrigerant composition,

d. conduit means for supplying said refrigerant to and from said coil, and

e. valve means for selectively reversing the flow of refrigerant to alternately cool and heat said coil member.

5. The apparatus of claim **4** including a platform on which said compressor and condenser means are secured.

6. The apparatus of claim **5** including a battery for operating said compressor and condenser secured on said platform.

7. A method of cooling reducing swelling of a warm body portion of a horse comprising:

a. securing a platform having an apparatus comprising a compressor and condenser attached thereon to the back of the horse, said apparatus including conduit means for directing a refrigerant to and from a cooling coil,

b. forming a ductile cooling coil to the general shape of the body portion to be treated,

c. inserting said coil in a jacket member,

d. wrapping said jacket member around the body portion, and

e. actuating said apparatus whereby the cooling coil absorbs heat from said body portion.

8. The apparatus of claim **4** wherein said jacket comprises a front and rear panel secured together along their adjacent sides and bottom said panels defining a cavity therebetween for receiving said cooling coil.

9. The apparatus of claim 4 wherein said jacket includes means for being adjustably secured around the body portion.

10. A method of selectively heating and cooling a body portion comprising:

a. forming a ductile cooling coil to the general shape of the body portion to be treated,

b. inserting said coil in a jacket,

c. wrapping said jacket around the body portion, and

d. actuating an apparatus having compressor and condenser means for liquefying a refrigerant composition, conduit means for supplying the refrigerant composition to and from said coil and valve means for selectively reversing the flow of refrigerant to selectively cool and heat said coil whereby said coil selectively heats or cools said body portion.

11. Portable apparatus for cooling a portion of a warm body comprising:

a. a ductile cooling coil for being formed to the general exterior shape of the body portion to be cooled,

b. a flexible jacket for receiving the coil and having means for securing the jacket around said body portion,

c. compressor and condenser means for liquefying a refrigerant composition,

d. conduit means for supplying said refrigerant to and from said cooling coils, and

e. a saddle shaped platform on which said compressor and condenser means are attached for being secured on a horse.

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