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Roslonski

[11] **3,871,381**

[45] **Mar. 18, 1975**

[54] **COLD COMPRESS DEVICE**

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[21] Appl. No.: **358,899**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 213,978, Dec. 30, 1971, abandoned.

[52] **U.S. Cl.** ..... **128/400,** 128/402, 128/24 R

[51] **Int. Cl.** **A61f 7/00**

[58] **Field of Search** ..... 128/400, 382, 402, 82.1, 128/24.1, 24 R; 168/2; 54/82; 119/1

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Primary Examiner—Lawrence W. Trapp

Attorney, Agent, or Firm—Schuyler, Birch, Swindler, McKie & Beckett

[57] **ABSTRACT**

A cold compress device for treating injuries in mammals, including a flexible inflatable compress adapted to be placed adjacent an area to be treated and a source of compressed refrigerant connected to the compress. A channel is formed in a portion of the compress wall which must be traversed by incoming refrigerant before it enters the interior of the inflatable compress. The device also includes means interposed between the source of refrigerant and the compress for controlling the rate of flow of refrigerant from the source into the compress, and pressure relief means connected to the compress for regulating the maximum pressure therein. The compressed refrigerant expands in the compress to thus simultaneously cool and inflate the compress, with the temperature of the refrigerant within the compress being controlled by the flow rate control means.

28 Claims, 8 Drawing Figures

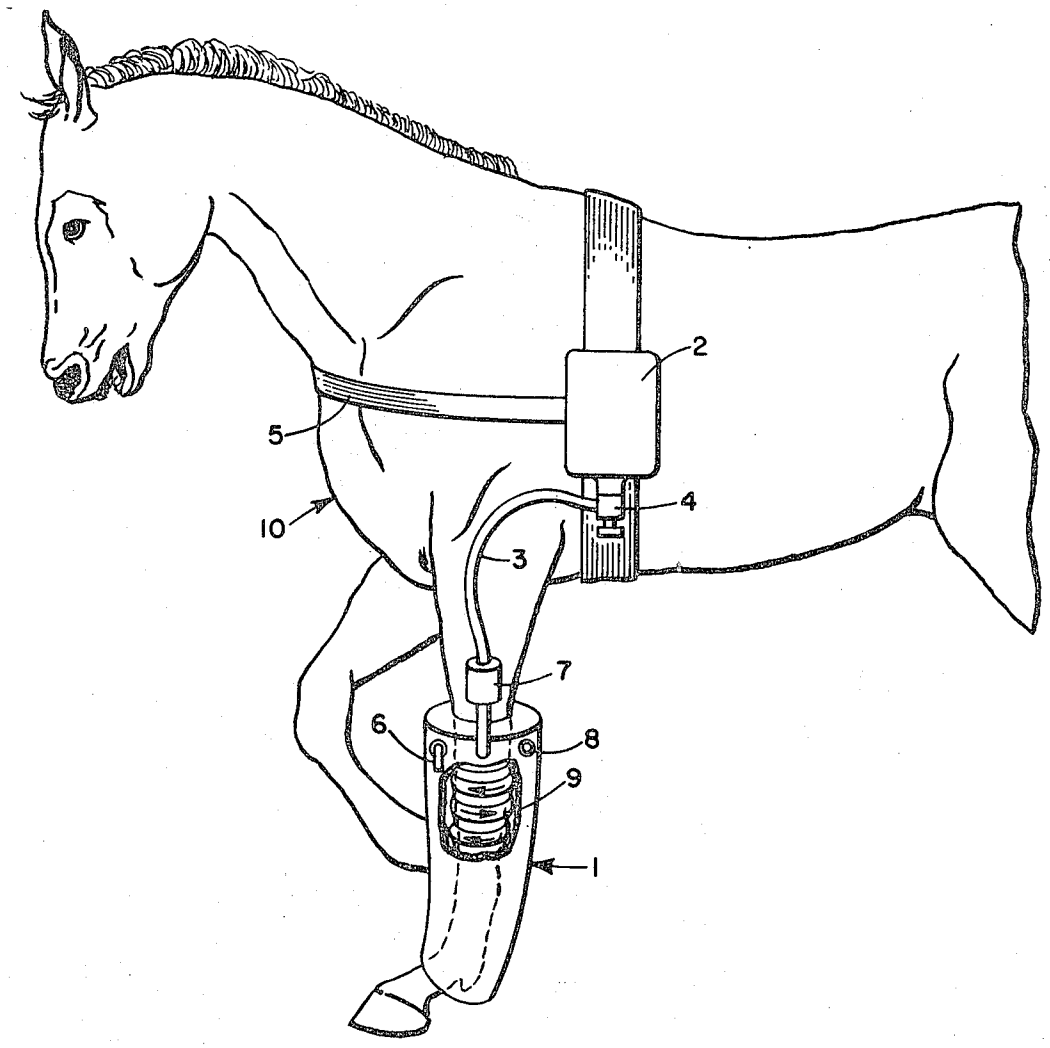


FIG. 1

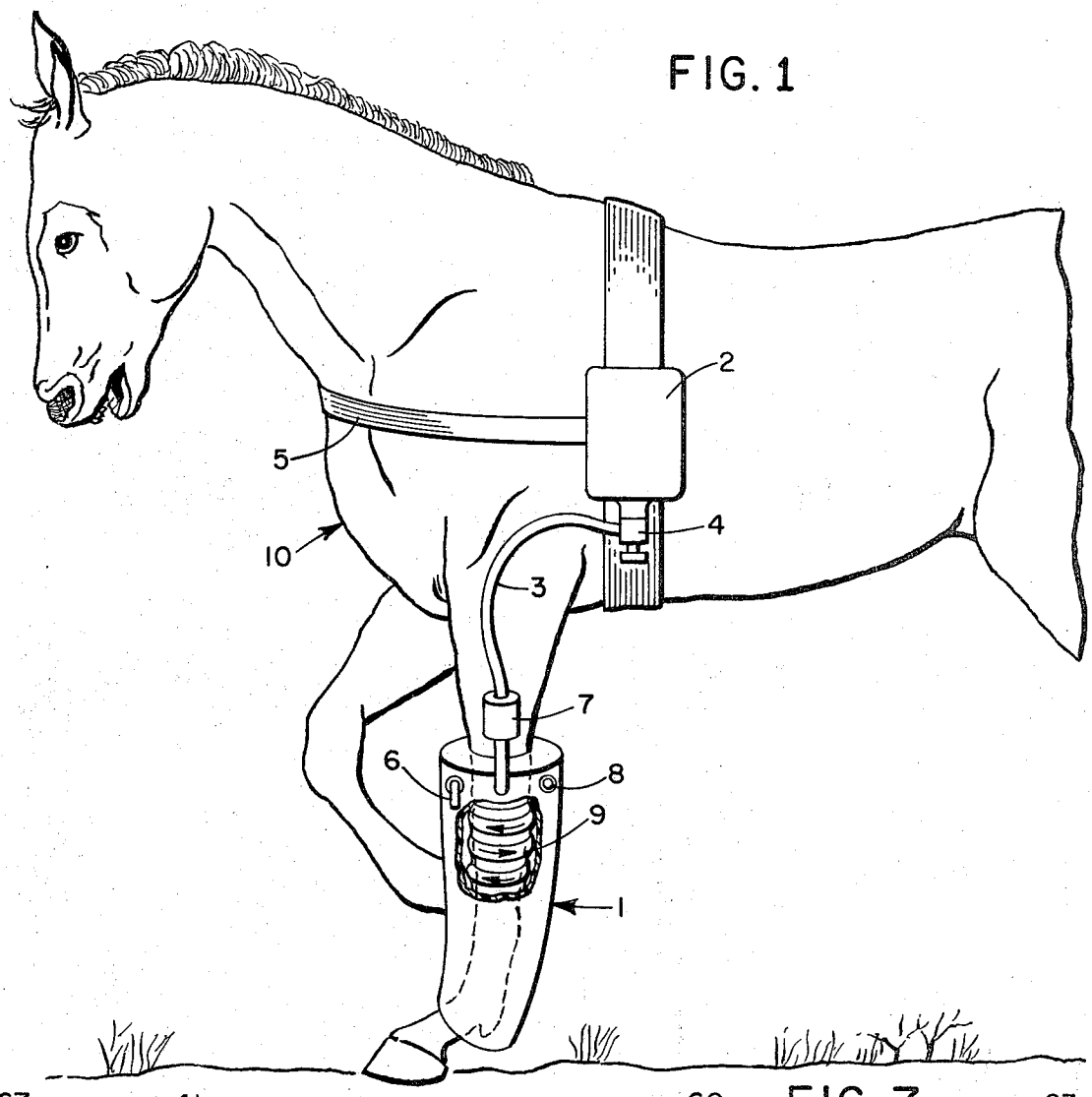

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FIG. 7

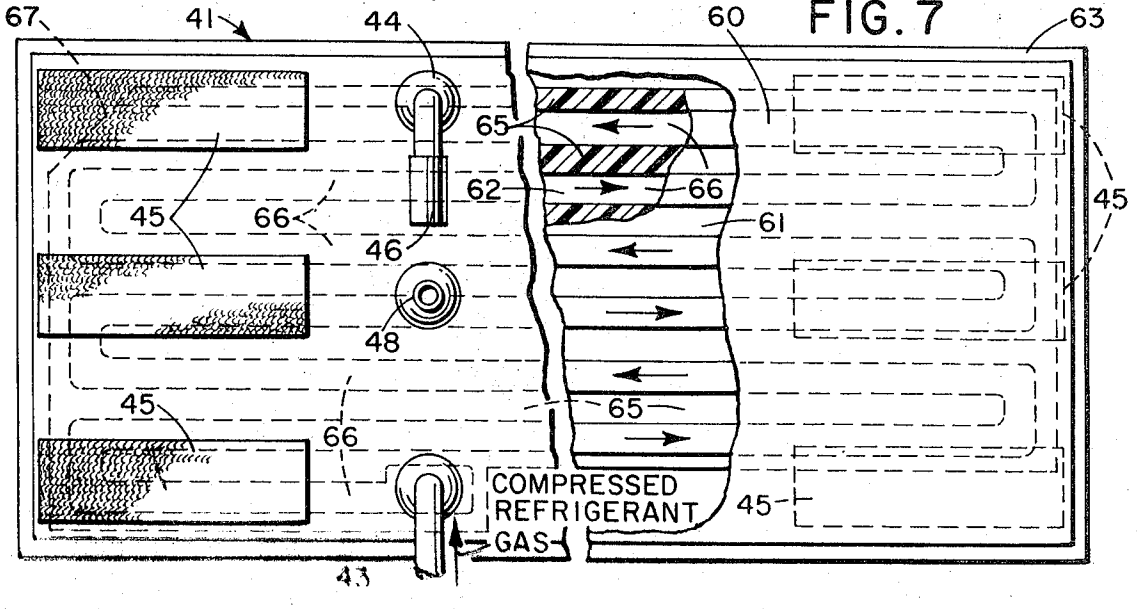

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COMPRESSED
REFRIGERANT
GAS
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FIG. 2

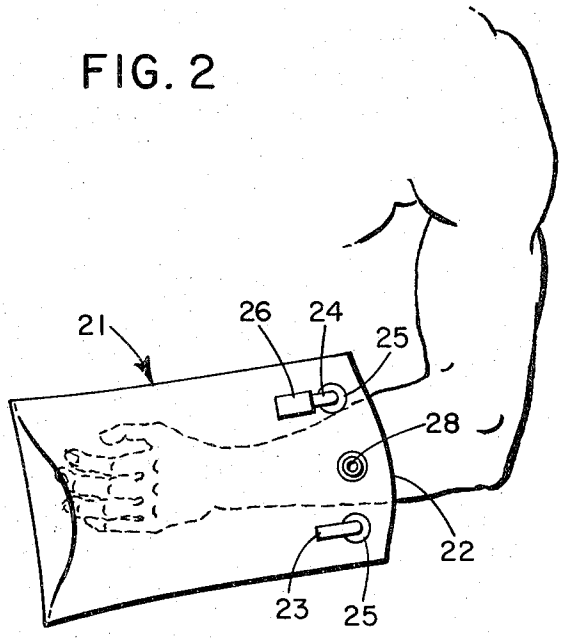


FIG. 6

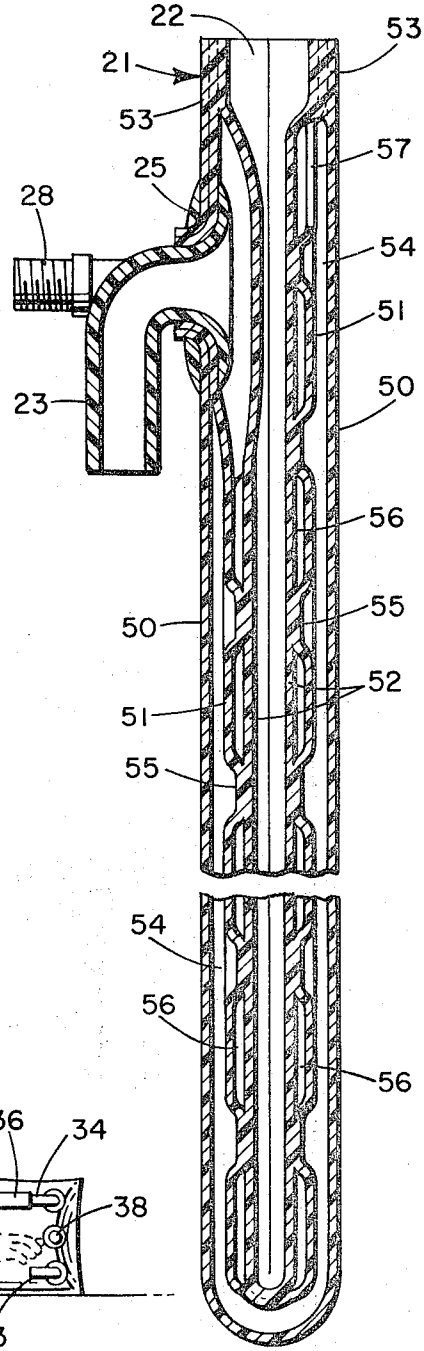
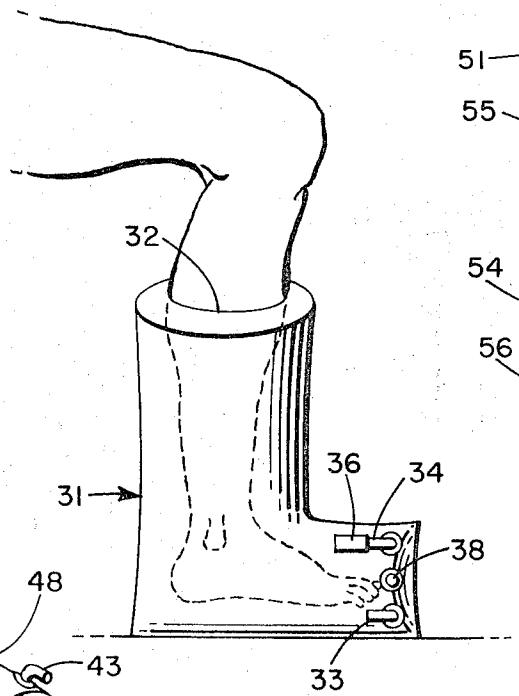


FIG. 3



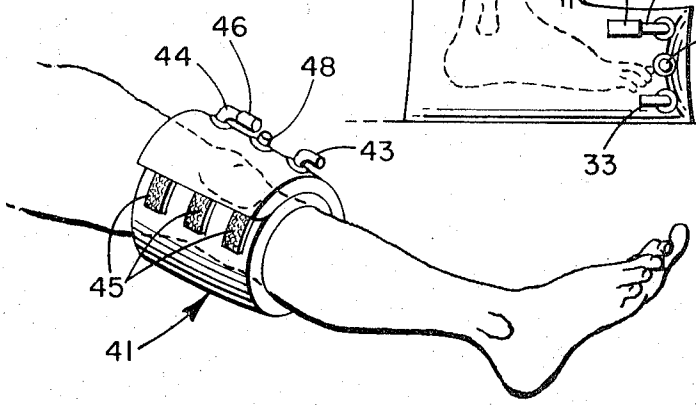
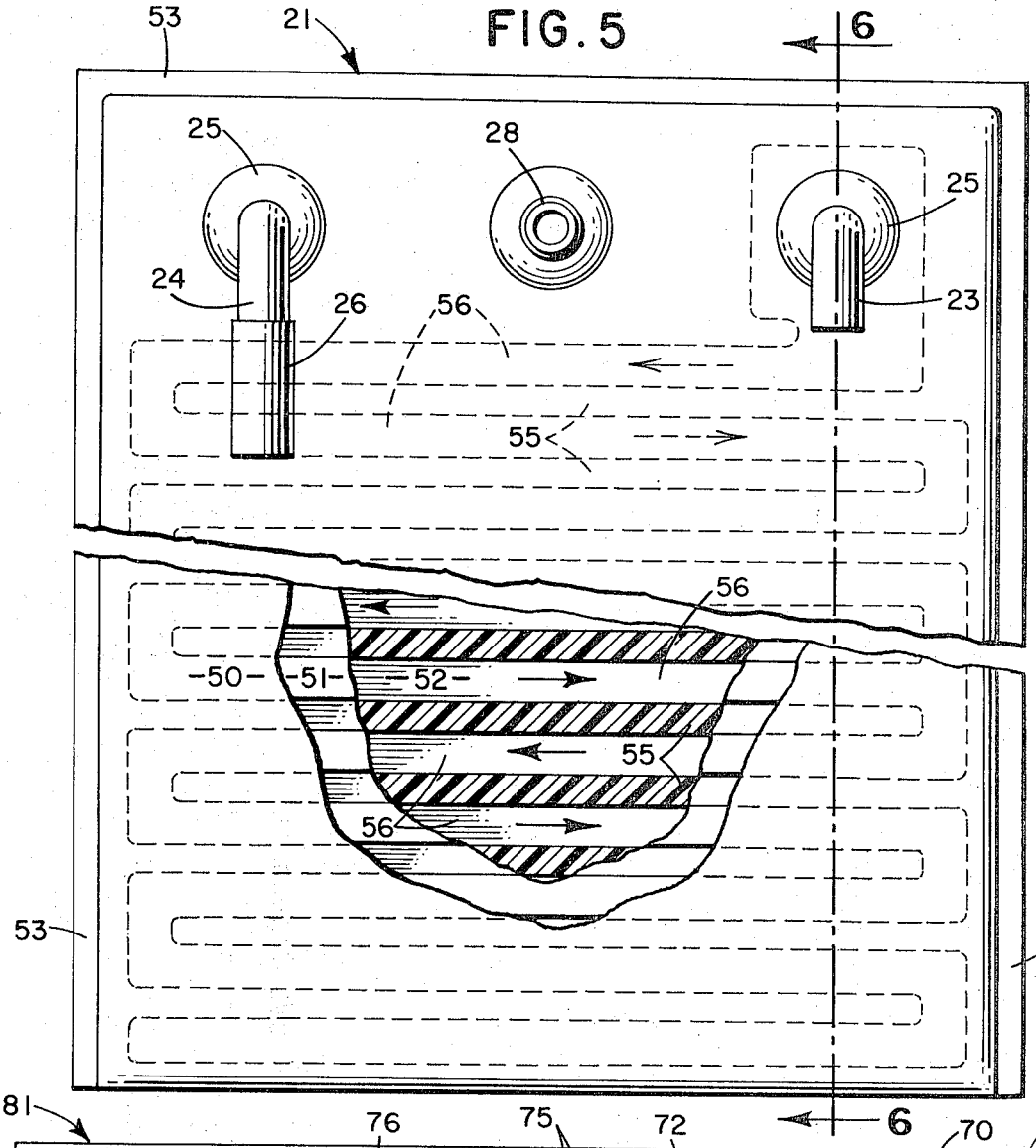


FIG. 4

FIG. 5


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-51-
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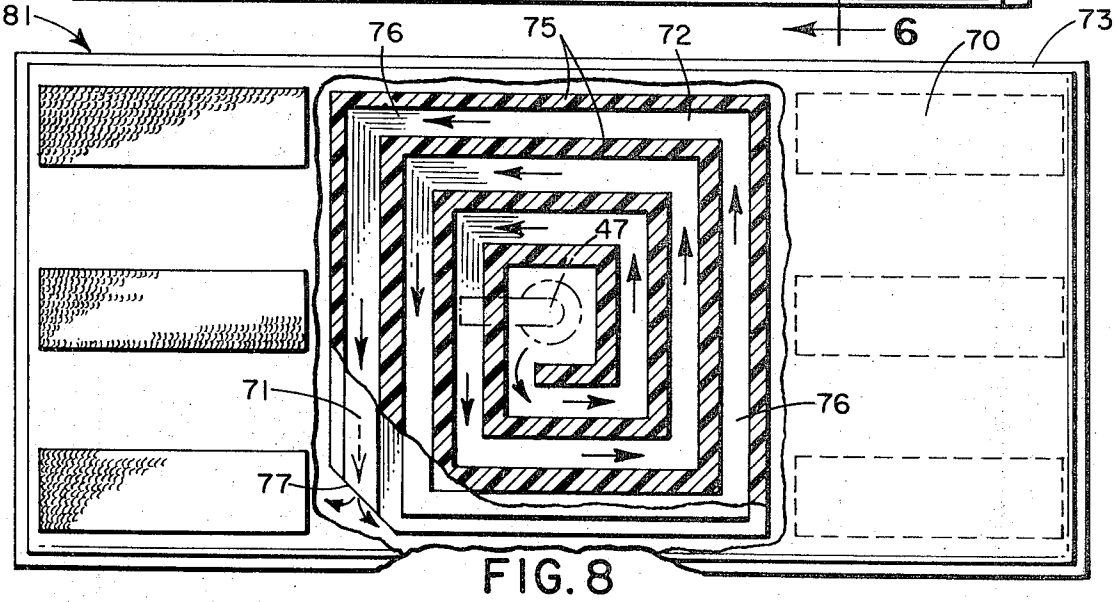

81
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71
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77

FIG. 8

COLD COMPRESS DEVICE

This application is a continuation-in-part of my copending application, Ser. No. 213,978 filed Dec. 30, 1971 now abandoned.

BACKGROUND OF THE INVENTION

Cold packing is a well known treatment for injuries such as bruises, muscle strain, and sprains. The conventional methods of applying such treatment include the application of ice bags, cold wet cloths, etc. Such methods are incapable of providing a sustained treatment over a relatively long period of time. The use of cold wet cloths also is objectionable in that it is difficult to prevent the patient and his surroundings becoming soaked with water from the cloths. Also, continuous treatment with cold wet cloths requires the constant attention of an attendant to continually change and rewet the cloths. To a somewhat lesser, but still objectionable, extent, continuous treatment with ice bags suffers from the same disadvantage.

Recently there have been introduced onto the market so-called chemical ice-packs. Chemical ice-packs contain amounts of separately stored chemical substances which are mixed to initiate a strongly endothermic chemical reaction when it is desired to use the chemical ice-pack. Chemical ice-packs also are effective only for a limited period of time and it is not possible to adjust the temperature of the cold pack.

Cold wet cloths, ice-packs and chemical ice-packs all have the disadvantage that it is not possible to maintain an accurate and uniform pressure on the area being treated since they all depend on hand application.

Also, devices have been proposed for passing a cooled fluid through an inflated bandage in order to treat various disorders. An example of such a device is disclosed in Gardner U.S. Pat. No. 3,186,404. While such devices are operable to provide a constant and uniform pressure against the injured area, in order to provide the desired cooling, they require the use of bulky and expensive external refrigeration equipment, thereby reducing the convenience and availability of the devices.

Another device is disclosed in Berndt U.S. Pat. No. 3,628,537. The Berndt device comprises an inflatable bandage with a sealable opening therein to facilitate introduction of a volatile refrigerant into a pouch in the interior of the bandage. It has the disadvantage that the means used to seal the bandage may fail when flexed or placed under pressure. More importantly the Berndt device does not provide adequate control of the temperature of the bandage inasmuch as the total amount of refrigerant is introduced into the bandage at one time and no means is provided for regulating the rate at which the refrigerant volatizes. Because accurate control of the temperature is often particularly crucial, this latter disadvantage is most serious.

It is an object of the present invention to provide a device for treating injuries in mammals by applying sustained cooling with pressure.

It is a further object of the invention to provide such a device in which the applied pressure may be accurately controlled.

It is also an object of this invention to provide a device of the aforesaid type in which the temperature may be accurately controlled.

It is a further object of this invention to provide a device in which the cooling effect may be concentrated

in a particular portion of the device or may be uniformly distributed across the device.

It is another object of the invention to provide a such device which does not require the constant attention of an attendant.

It is a further object of the invention to provide a device which is relatively compact and self-contained so as to be particularly adapted for portable operation.

It is another object of the invention to provide a device for treating injuries in mammals by applying sustained cooling with pressure which is relatively inexpensive in comparison to devices requiring external refrigeration equipment and thereby may be made more readily available.

SUMMARY OF THE INVENTION

These and other objects of the invention are acheived by providing a device for treating injuries in mammals comprising a flexible, inflatable compress adapted to be placed adjacent an area to be treated, a conducting channel formed in one wall of the compress opening into the interior of the compress, an external source of compressed refrigerant connected to the channel, means for controlling the rate of flow of refrigerant from the source into the compress interposed between the source and the channel, and pressure relief means connected to the compress communicating between the interior of the compress and the ambient atmosphere for regulating the maximum pressure in the compress.

The compressed refrigerant expands as it flows from the source thereof through the compress, and thereby simultaneously cools and inflates the compress.

The general temperature of the compress depends on the rate at which heat is absorbed by the refrigerant which in turn depends on the rate of expansion and/or volitization of the refrigerant. The invention provides for means to control the rate of flow of refrigerant from the source through the channel into the compress thereby controlling the rates of expansion and volitization and enabling accurate regulation of the general temperature of the compress. Conveniently, such means may comprise a manually adjustible valve interposed between the refrigerant source and the hose leading to the inflatable compress. The compress preferably is made from an inelastic flexible material or is surrounded by an inelastic flexible restraint so that the volume of the compress, when inflated, will be substantially constant to thereby provide a substantially constant refrigerant temperature for a particular refrigerant flow rate.

The pressure of the refrigerant within the compress is controlled by the pressure relief means, which conveniently comprises a conventional pressure relief valve connected to the compress and communicating between the interior thereof and ambient atmosphere.

The channel serves to conduct the incoming compressed refrigerant to a desired portion of the inflatable compress. The major expansion of the compressed refrigerant and, if the refrigerant is liquified, most of the volitization of the liquid will take place in the channel. Expansion and/or volitization of the refrigerant are the processes by which heat is absorbed and cooling is effected. Thus, by appropriately locating the channel in the compress wall, it is possible to control the location of the principal cooling effect. Accordingly, by extending the channel over the entire portion of the wall of

the compress which contacts the area being treated, it is possible to distribute the cooling effect generally uniformly over the entire area. Likewise by disposing the channel on a particular portion of the compress wall it is possible to concentrate and localize to a certain extent the cooling effect of the device.

The invention will be further described in connection with the following embodiments adapted for treating race horses and humans.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a device according to the invention in the form of an inflatable sleeve used for treating the foreleg of a horse.

FIG. 2 is a perspective view of another embodiment of the invention in the form of a mitten used for treating the hand, wrist and forearm of a human.

FIG. 3 is a perspective view of a third embodiment of the invention in the form of a boot for treating the foot and ankle of a human.

FIG. 4 is a perspective view of another embodiment of the invention in the form of a wrap-around bandage.

FIG. 5 is a plan view, partially in section, of the cold compress mitten of FIG. 2.

FIG. 6 is a vertical section view taken along the line 6—6 of FIG. 5.

FIG. 7 is a plan view, partially in section, of the wrap-around cold compress device of FIG. 4.

FIG. 8 is a plan view, partially in section, of a modified form of the wrap-around cold compress device of FIG. 4 showing an alternate arrangement for the conducting channel.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Race horses and show horses often suffer from disabling leg injuries, such as bruises, strains and sprains. This no doubt is the result of the strenuous training and competition to which they are subjected. Since race horses and show horses generally are quite valuable, and since leg injuries can drastically reduce the value of such horses, it is desirable to provide prompt and effective treatment for such injuries.

The device, shown in FIG. 1, is adapted to provide such prompt and effective treatment, and includes an inflatable compress in the form of an inflatable sleeve 1. Sleeve 1 may be made from any suitable gas-impervions, flexible material, such as rubber; and preferably is made from an inelastic, gas-impervious, flexible material, such as rubberized fabric or polyvinyl plastic material. Alternatively, sleeve 1 may be surrounded by a restraint made from an inelastic flexible material, such as a fabric material. Sleeve 1 is slipped over the foreleg of a horse 10 to be treated prior to inflation thereof, and is held in place by the pressure of the inflated device against the horse's leg.

The device of the invention also includes a source of compressed refrigerant, such as a tank 2 of liquified refrigerant. A large number of refrigerants, such as carbon dioxide, propane, monochlorodifluoromethane, dichlorodifluoromethane, or dichlorotetrafluoroethane may be used in the device of the invention. The foregoing refrigerants are mentioned merely by way of example, and it is understood that the invention embraces the use of any suitable hydrocarbon, halocarbon, or inert compound refrigerant. Preferably, the refrigerant chosen is comparatively non-toxic in accordance with the Underwriters Laboratories' classification of refrigerants. Materials such as sulfur dioxide, which is highly toxic, generally are not preferred.

In the embodiment of the invention illustrated in FIG. 1, tank 2 is connected to sleeve 1 by a flexible pressure hose 3. This is generally the most convenient arrangement, but it also is within the scope of the invention to connect the tank directly to the compress without the use of an intervening hose. Hose 3 is insulated to limit the absorbtion of heat by the refrigerant prior to entering the channel in the compress wall. Interposed between tank 2 and hose 3, and affixed to tank 2, is a manually operable valve 4 which controls the rate of flow of refrigerant from tank 2 into sleeve 1. More complex arrangements, such as an adjustable flow-responsive solenoid valve or even a valve controlled by a computer in response to a multiplicity of parameters affecting the treatment, may be substituted for manual valve 4. By controlling the rate of flow of refrigerant from tank 2 to bandage 1, valve 4 controls the temperature of the refrigerant within the compress.

An optional harness 5 may be used to support tank 2 on the patient, thereby providing for portable operation. If portable operation is not necessary or desired, tank 2 or other source of refrigerant may be supported next to the patient in any suitable manner, such as by means of a wall or floor rack or the like.

A pressure relief means such as a conventional pressure relief valve 6 is connected to the wall of sleeve 1 and communicates between the interior thereof and ambient atmosphere. Valve 6 opens and allows refrigerant vapors to escape from within sleeve 1 when the pressure of the vapors within the compress exceeds a predetermined level. When the pressure of the refrigerant within the sleeve has decreased to the desired level, valve 6 will again close. The valve may be detachably connected by threads or the like so that a given valve readily may be exchanged for another valve responsive to a different pressure level. Also, it is within the scope of the invention to use an adjustable valve. Since the pressure applied to the area being treated is equal to the pressure of the refrigerant within sleeve 1, valve 6 ensures that a substantially constant pressure is applied to the injured area.

A check valve 7 optionally may be interposed in line 3 between valve 4 and compress 1 to prevent back-flow of refrigerant from the compress should the flow of refrigerant from the source be interrupted. As mentioned hereinabove valve means 4 is provided to allow the operator to control the flow of refrigerant. The provision of valve means 4 and check valve 7 makes it possible to switch from an exhausted refrigerant tank to a fresh tank without disturbing treatment in progress. This also makes it possible to shut off the flow of refrigerant and allow gradual warm up of the compress to ambient temperature before the compress is removed if it is desired to avoid sudden changes in the temperature applied to the area being treated. Check valve 7 also serves as a safety feature to prevent deflation and loss of compress 1 should hose 3 be severed or pulled loose as sometimes may happen if an animal is being treated. In practice the basic construction of check valve 7 may be substantially similar to the structure of the pressure relief valve 6. If desired, the compress also may be provided with a quick release valve 8 which communicates between the interior of the compress and the ambient atmosphere. During treatment the valve is maintained in

closed position. Opening release valve 8 facilitates rapid deflation of the compress so that it may be quickly and easily removed when the treatment is ended. The structure of such valves is well known to those skilled in the art and accordingly, will not be described in detail here.

In FIG. 1, a central portion of the outer wall of sleeve compress 1 is shown cut away to reveal the underlying conducting channel 9 formed in the inner wall of the compress adjacent the horse's leg. Channel 9 commences at the point where hose 3 enters compress 1 and winds its way back and forth across substantially the entire inner wall of the sleeve before it ends at the opposite end of the compress near the horse's foot where it opens into the interior of the compress. The refrigerant which is passed directly into channel 9 from hose 3 is thus constrained to traverse substantially the entire area to be treated before passing into the interior of the compress. Accordingly, the cooling effect is distributed substantially uniformly across the entire area being treated. Almost all of the volitization of the refrigerant if it is a liquid, and in any event, the principal expansion of the compressed refrigerant whether liquid or gaseous will take place in the channel. Since these are the primary heat absorbtion processes, the cooling effect is thus concentrated to a certain extent immediately adjacent the area to be treated. Details of the construction of the channel will be explained hereinafter with reference to FIGS. 5 to 8.

In operation, sleeve 1 is placed over the area to be treated, and valve 4 is then opened allowing compressed refrigerant to flow from tank 2 through hose 3 and through channel 9 in the sleeve wall into the interior of sleeve 1, thereby inflating the compress. The pressure of the refrigerant within sleeve 1 is maintained substantially constant by valve 6. The expansion of the refrigerant as it flows from the tank, through the channel and the interior chamber of the compress into ambient atmosphere cools the compress. The amount of cooling is dependent on the particular refrigerant used and the rate of flow of refrigerant from tank 2 into compress 1. The refrigerant flow rate is controlled by valve 4, thereby facilitating control of the temperature of the bandage.

As described above, in the preferred embodiment of the device of the invention, sleeve 1 is made from an inelastic material, or is surrounded by an inelastic restraint. Therefore, the compress, when inflated, will have a substantially constant volume. With this arrangement, and since the pressure of the refrigerant within the compress is maintained at a substantially constant level by valve 6, for a particular flow rate of refrigerant, the rate of volitization and expansion and consequently the temperature of the refrigerant within the bandage also will remain substantially constant. The pressure and temperature applied to the area to be treated can thus be accurately controlled by the appropriate selection of valve 6 and regulation of valve 4.

FIG. 2 is a perspective view of an embodiment of the invention in the form of an inflatable mitten for treating the hand, wrist and forearm of a human. Mitten compress 21 takes the general form of a triple-walled envelope which is open at one end 22 through which the hand and arm of the patient can be extended. An inlet fitting 23 is provided in communication with a channel formed between the second and third wall layers. An outlet fitting 24 communicates between the ambient atmosphere and an interior cavity formed in the space between the first and second wall layers. A pressure relief valve 26 is mounted in outlet fitting 24. Fittings 23 and 24 are secured in position through the respective layers by means of gripping collars 25. Also provided is a quick release valve 28 communicating between the ambient atmosphere and the interior cavity between the first and second wall layers. Valve 28 may be opened to facilitate rapid deflation of the compress when desired. Further details of the wall construction of mitten 21 will be explained hereinafter in conjunction with FIGS. 5 and 6.

FIG. 3 is a perspective view of a third embodiment of the instant invention in the form of an inflatable boot adapted to be used to treat the foot and ankle of a human. Except for its L-shape, boot 31 essentially is the same in construction as mitten 21. The foot and leg of the patient are inserted through opening 32 at the top of the boot. Inlet fitting 33, outlet fitting 34, pressure release valve 36 and quick release valve 38 correspond to the fittings and valves 22–28 previously discussed in conjunction with FIG. 2.

FIG. 4 is a perspective view of yet another preferred embodiment of the instant invention which takes the form of an inflatable wrap-around bandage. Inflatable bandage 41 takes the form of a tri-layer pad with an inlet fitting 43 provided in communication with a channel formed between the second and third layers and a quick release valve 48 and an outlet fitting 44 with a pressure relief valve 46 therein both communicating between the ambient atmosphere and the interior cavity formed in the space between the first and second layers. Locking strips 45 on the outside of the bandage mate with corresponding strips (not shown) on the back of the bandage when the bandage is wrapped around a portion of the body of a patient being treated to secure the bandage in position. Suitable locking strips are distributed by the 3M Company, Minneapolis, Minnesota, under the trademark VELCRO. When the bandage is inflated, the internal pressure which forces the bandage against the body of the patient firmly holds the bandage in place. Further details of the construction of the bandage shown in FIG. 4 will be discussed hereinafter in conjuction with FIGS. 7 and 8.

FIG. 5 is a plan view of the inflatable mitten shown in FIG. 2, and FIG. 6 is a vertical section of the same mitten taken along line 6—6 of FIG. 5. As previously mentioned each of the walls of mitten 21 comprises three layers of flexible thermoplastic material designated respectively from the outside to the inside by reference numerals 50, 51 and 52. Layers 50 and 51 are shown partially cut away in FIG. 5 to reveal the underlying structure. The outer margins of all three of the layers are joined together by means such as heat seal 53 forming a closed interior chamber 54 between layer 50 and layers 51 and 52. Layer 51 and layer 52 are further joined to each other by a pattern of heat seals 55 which may be visualized as a pair of interlocking combs extending generally over the entire surface of the two layers, whereby a continuous channel 56 extending back and forth between the "teeth" of the comb-like seals 55 is formed between layer 51 and layer 52. One end of channel 56 communicates with inlet fitting 23. At the opposite end of channel 56, a hole 57 is provided in layer 51 through which channel 56 opens into the interior cavity 54 between layer 50 and layers 51 and 52. Refrigerant entering the compress through inlet fitting

23 is thus constrained to pass through channel 56 over substantially the entire surface of layer 52 immediately adjacent the hand, wrist and arm of the patient being treated before the refrigerant enters the interior cavity 54 thereby inflating the bandage. Thus, the cooling effect of the refrigerant is substantially uniformly distributed over the entire surface of the inflatable mitten, and uneven warm and cool spots are largely prevented. Since almost all of the volitization and most of the expansion of the refrigerant will take place in the channel, the channel arrangement also assures that the principal cooling effect will be concentrated immediately adjacent the portion of the patient's body being treated thus reducing the absorbtion of heat from the ambient atmosphere and thereby conserving on the amount of refrigerant necessary to maintain the cold compress mitten at a given temperature. Refrigerant vapors in excess of the amount needed to maintain the desired pressure in the inflated compress are gradually released from interior chamber 54 through outlet fitting 24 and pressure relief valve 26.

FIG. 7 is a plan view, partially in section, of the embodiment of the invention shown in FIG. 4 in the form of an inflatable wrap-around bandage. Bandage 41 comprises three layers of flexible thermoplastic material designated respectively from top to bottom by reference numerals 60, 61 and 62. The outer margins of layer 60 and layer 62 are joined to each other by a heat seal 63 forming an enclosed interior chamber therebetween. Layer 61 is smaller in size than either of layers 60 and 62 and is positioned in the interior space formed between layers 60 and 62. The outer margins of layer 61 and elongated strips extending alternately from the sides into the center region of layer 61 are joined to layer 62 by heat seals 65, thereby forming a channel 66 which winds its way back and forth between layers 61 and 62 over substantially the entire surface of layer 61. One end of channel 66 is in communication with inlet fitting 43. The opposite end of channel 66 opens through a hole 67 in layer 61 into the interior chamber formed in the space between layers 60 and 62. Outlet fitting 44 with pressure relief valve 46 attached thereto and quick release valve 48 both communicate through layer 60 between the interior chamber of the inflatable bandage and the ambient atmosphere. Locking strips 45 are disposed at each end of the wrap-around bandage on opposite sides thereof so that when the bandage is wrapped around a portion of the body of a patient being treated, they will mate and secure the inflatable bandage in position.

FIG. 8 illustrates a modification of the wrap-around cold compress shown in FIGS. 4 and 7 which is designed to concentrate the cooling effect of the refrigerant adjacent a particular area instead of dispersing the cooling effect over substantially the entire face of the bandage. As before, the top layer 70 and bottom layer 72 of the inflatable compress are joined to each other around the margins by a heat seal 73 whereby an interior chamber is formed therebetween. An interior layer 71, corresponding in size to the general dimensions of the area over which it is desired to concentrate the cooling effect of the refrigerant, is disposed in the interior chamber between layers 70 and 72. The margins and a portion of the center region of layer 71 are joined to inner layer 72 by a heat seal 75 which is arranged in a spiral pattern whereby a spiral channel is formed between layers 71 and 72. A refrigerant inlet fitting 47 is attached to the inflatable wrap-around bandage in communication with the centrally disposed end of spiral channel 76. Layer 71 is cut away at corner 77 to form an outlet for the outer end of channel 76 into the interior chamber between layer 70 and layer 72. The general operation of inflatable bandage 81 is essentially the same as the operation of the previously described embodiments except for the fact that the cooling effect of the refrigerant which enters through inlet fitting 47 is more concentrated in the region of the bandage corresponding to the area traversed by spiral channel 76. The remainder of the bandage will exert a somewhat lesser cooling effect on the adjacent portions of the body of the patient being treated.

It is also contemplated within the scope of the invention to locate the refrigerant conducting channel in a portion of the wall of the compress which is adapted to be disposed remote from the body of the patient being treated so that the patient is not directly subjected to the full cooling effect of the refrigerant.

The devices of the present invention are capable of operating throughout a wide range of temperatures and pressures. As a general rule, the pressure of the compress should be slightly higher than the internal pressure of the body fluids of the patient. The temperature of the compress should be somewhere between the body temperature of the patient and the temperature at which the body tissue of the patient will freeze. The precise pressure and temperature applied will of course depend on the injury being treated and on the nature of the patient, whether a human, a horse or another mammal.

As will be apparent from the foregoing description, the present invention provides a means for promptly and effectively treating injuries in mammals by cooling with pressure which is capable of sustained operation for a substantial period of time. Moreover, the device does not require constant attention, is not messy or inconvenient to use, and is inexpensive in comparison to systems which require external refrigeration equipment. In addition, the device is compact and self-contained so as to be particularly adapted for portable operation.

While the foregoing constitutes a detailed description of a preferred embodiment of the device of the invention, it is recognized that modifications thereof undoubtedly will occur to those skilled in the art. Therefore, the scope of the invention is to be limited solely by the scope of the appended claims.

I claim:

1. A device for treating mammals comprising:
- a flexible, inflatable compress adapted to be placed adjacent a body area to be treated;
- said compress comprising a surrounding wall and an inflatable interior cavity formed by said wall;
- said compress further comprising an enclosed channel formed in a portion of the compress wall adapted to conduct a fluid refrigerant over said compress wall portion;
- said channel opening into the inflatable interior cavity of said compress and being connected to an external source of compressed refrigerant whereby refrigerant from said source is constrained to pass over said compress wall portion by traversing said channel before entering the inflatable interior cavity of said compress;

means interposed between said source and said channel for controlling the rate of flow of refrigerant from the source into the compress whereby the rate of cooling of said compress can be controlled; and

pressure relief means connected to said compress and communicating between the inflatable interior cavity of the compress and the ambient atmosphere for regulating the maximum pressure in the compress whereby the pressure applied to the body area being treated can be controlled.

2. A device as recited in claim **1**, wherein the conducting channel is formed in a portion of the wall of the compress adapted to be disposed adjacent the area to be treated when the device is used.

3. A device as recited in claim **2**, wherein the conducting channel extends over the entire portion of the compress wall adapted to be disposed adjacent the area to be treated when the device is used.

4. A device as recited in claim **1**, wherein the conducting channel is formed in a portion of the wall of the compress adapted to be disposed remote from the area to be treated when the device is used.

5. A device as recited in claim **1**, wherein said compress is made from an inelastic material.

6. A device as recited in claim **5**, wherein said halocarbon refrigerant is dichlorodifluoromethane.

7. A device as recited in claim **1**, wherein said compress is an inflatable, wrap-around bandage.

8. A device as recited in claim **1**, wherein the compress is an inflatable sleeve.

9. A device as recited in claim **1**, wherein the compress is an inflatable mitten.

10. A device as recited in claim **1**, wherein the compress is an inflatable boot.

11. A device as recited in claim **1**, wherein said refrigerant source is a tank of liquified carbon dioxide.

12. A device as recited in claim **1**, wherein said refrigerant source is a tank of liquified halocarbon refrigerant.

13. A device as recited in claim **5**, wherein said halocarbon refrigerant is monochlorodifluoromethane.

14. A device as recited in claim **5**, wherein said halocarbon refrigerant is dichlorotetrafluoroethane.

15. A device as recited in claim **1**, wherein said flow rate control means is a manually operated valve.

16. A device as recited in claim **1**, wherein said pressure relief means is a pressure relief valve.

17. A device as recited in claim **16**, wherein said pressure relief valve is detachably connected to said compress.

18. A device as recited in claim **1**, further comprising a harness for supporting said refrigerant source on the mammal being treated.

19. A device as recited in claim **1**, further comprising a quick release valve communicating between the interior of compress and the ambient atmosphere for facilitating rapid deflation of the compress when treatment with the device is to be ended.

20. A device as recited in claim **1**, further comprising check valve means interposed between the refrigerant source and said channel for preventing back-flow of the refrigerant.

21. A device as recited in claim **1** wherein said compress wall portion comprises two layers of flexible, thermoplastic material; joined to each other by a pattern of heat seals; said pattern of heat seals forming an elongated fluid conducting conduit between said layers; one end of said elongated conduit opening into the inflatable interior cavity of said compress and the other end of said conduit being connected to said source of compressed refrigerant whereby refrigerant from said source is constrained to traverse the entire length of said conduit before entering said interior cavity.

22. A device as recited in claim **21** wherein said pattern of heat seals is a pair of interlocking combs.

23. A device as recited in claim **21** wherein said pattern of heat seals is a spiral.

24. A flexible, inflatable compress adapted to be placed adjacent a body area of a mammal to be treated;

said compress comprising a surrounding wall and an inflatable interior cavity formed by said wall;

a portion of said wall comprising two layers of flexible thermoplastic material joined to each other by a pattern of heat seals;

said pattern of heat seals forming an elongated fluid conducting channel extending over said wall portion between said layers; and

one end of said channel opening into the inflatable interior cavity of said compress, and the other end of said channel being adapted to be connected to an external source of compressed refrigerant.

25. A compress as recited in claim **24** wherein said pattern of heat seals is a pair of interlocking combs.

26. A compress as recited in claim **24** wherein said pattern of heat seals is spiral.

27. A flexible, inflatable compress adapted to be placed adjacent a body area to be treated;

said compress comprising a surrounding wall and an inflatable interior cavity formed by said wall;

a portion of said wall comprising two layers of flexible, fluid-impervious material;

a pattern of secured and unsecured areas over said two layer portion; said secured areas joining said two layers to each other; said unsecured areas constituting an elongated, enclosed fluid conducting channel extending over said wall portion between said two layers; and

one end of said channel opening into the inflatable interior cavity of said compress, and the other end of said channel being adapted to be connected to an external source of compressed refrigerant.

28. A compress as recited in claim **27** further comprising a pressure relief valve communicating between the inflatable interior cavity of the compress and the external atmosphere.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,871,381 Dated March 18, 1975

Inventor(s) Donald J. Roslonski

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 6, line 1, "5" should read -- 12 --.

Claim 13, line 1, "5" should read -- 12 --.

Claim 14, line 1, "5" should read -- 12 --.

Signed and Sealed this

Twenty-third Day of *May 1978*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

LUTRELLE F. PARKER
Acting Commissioner of Patents and Trademarks