COLD PRESSURE BANDAGE

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ABSTRACT

A cold bandage made of various sizes and shapes for application to various portions of the body of a patient, which patient may be either animal or human. The bandage includes outer enclosing means containing at least one bag of volatile refrigerant with an opening in that bag to enhance vaporization of the refrigerant. Where the outer enclosing means are in the form of an envelope, sealed gas tight, with at least one bag opening into the interior of that envelope, the bandage will become inflated by virtue of the refrigerant volatilizing and intimately conform to the portion of the body to which the bandage is applied, thus providing both reduced temperature and pressure. The bandage is highly desirable for use to relieve a traumatized area, reduce inflammatory edema and pain, rapidly decrease hemorrhage, reduce the possibility of infection, minimize tissue damage, and effectively treat burns, among many other applicatory uses.

14 Claims, 17 Drawing Figures
COLD PRESSURE BANDAGE

CROSS REFERENCE TO RELATED APPLICATION

This invention is an improvement upon the structure disclosed, described and claimed in our copending application entitled "Self-Retaining Cold Wrap", filed Apr. 6, 1970, Ser. No. 25,569, now issued in U.S. Pat. No. 3,628,537, dated Dec. 21, 1971.

SUMMARY OF THE INVENTION

The instant invention includes all of the advantages of the invention set forth in our aforesaid copending application, but in addition is easier to manipulate, more durable, and provides a wide selectivity of temperature control. Broadly, all embodiments of the instant invention set forth herein include an outer container in which there is at least one bag for containing a volatile refrigerant. The bag is made of heat-insulating material, and is selected from several bags of varying heat-insulating capabilities so as to provide a proper degree of coldness when applied to the body of a patient. In one form of the invention the outer container may merely be a wrapping where little or no pressure is needed. In other embodiments of the invention the outer container is in the form of a compartmented envelope-type of container, certain compartments being sealed gas tight to permit expansion thereof when the refrigerant in the bags volatilizes, thus providing pressure as well as coldness to the patient's body. One of the compartments may be left open for added insulation, such as a relatively thick sheet of chemical foam, which is more desirable when the bandage is utilized on a human rather than an animal, and which is always needed if the ambient air temperature is 45° F. or lower. The refrigerant bags are easily filled with volatile refrigerant and placed in position in the outer container. Suitable fastening means are provided that are quick acting and capable of holding the bandage in place until it is intentionally removed notwithstanding ambulation of the patient.

Other objects, features and advantages of the invention will be readily apparent from the following description of certain preferred embodiments thereof, taken in conjunction with the accompanying drawings, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary view in elevation of a bandage embodying the principles of the instant invention and operative in inflated position around the cannon or shank of the left foreleg of a horse;
FIG. 2 is an enlarged view of the outer face of the bandage itself;
FIG. 3 is a fragmentary view of the bandage looking at the inside or body contact face, the bandage having been turned over from left to right relatively to FIG. 2;
FIG. 4 is a reduced section through the bandage ready for application to a horse's leg, taken substantially as indicated by the section line IV—IV of FIG. 2;
FIG. 5 is an enlarged face view of one of the refrigerant bags utilized in the bandage;
FIG. 6 is a diagrammatic vertical sectional view, enlarged, and taken substantially as indicated by the line VI—VI of FIG. 5;
FIG. 7 is a fragmentary sectional view, highly magnified, illustrating the material of which the bag of FIGS. 5 and 6 is formed;
FIG. 8 is a view similar to FIG. 6 but showing a bag formed of two thicknesses of material;
FIG. 9 is a view similar to FIGS. 6 and 8 but showing a bag made of different insulating material;
FIG. 10 is a fragmentary enlargement of the inside face of the material used in the bag of FIG. 9;
FIG. 11 is a fragmentary view of a modified form of bandage embodying the principles of the instant invention in operating position on the forearm of a human;
FIG. 12 is an outside view in the flat of the bandage of FIG. 11, enlarged, and with parts broken away to illustrate parts therebehind;
FIG. 13 is a view of the inside or body contact face of the bandage of FIG. 11;
FIG. 14 is a view of the outside face of a bandage for application to a human head;
FIG. 15 is a fragmentary view of the inside face of the bandage of FIG. 14, with parts broken away to show parts therebehind;
FIG. 16 is a fragmentary view illustrating the bandage of FIGS. 14 and 15 in operative working position upon the head of a patient; and
FIG. 17 is an isometric view of a bandage of still different form but embodying the principles of the instant invention.

DETAILED DESCRIPTION

It will be understood that bandages embodying the principles of this invention may be made in various shapes and sizes to fit around the particular portion of a body on which treatment is indicated. Therefore, the embodiments of the invention herein disclosed and described are by way of example, and not by way of limitation.

The first embodiment of this invention, described in connection with FIGS. 1–10 of the drawings, is one for application to an animal, specifically to a leg of a horse. Over 90 percent of race horses required an ice water bath on the forelegs, especially before a race, and sometimes after a race. For many years this was accomplished by an attendant holding the horse with its forelegs in a tub of ice water for a period of 1 to 3 hours. The wages of the attendant and the ice itself were objectionably expensive. The first embodiment of the instant invention is a highly economical substitute for such procedure, but in addition to economy, provides the advantages of requiring but a few minutes time of an attendant, providing moderate pressure on a horse's leg as well as cold, and the horse is ambulatory while the bandage is on. Consequently, bandages of this character are desirable at race tracks, breeding farms, and substantially anywhere where a number of horses are worked in one way or another.

The first embodiment of this invention comprises a bandage, generally indicated by numeral 1 and shown in FIG. 1 in operative position on the foreleg 2 of a horse. The bandage is shown in inflated condition by virtue of the volatilizing of refrigerant within a sealed compartment in the bandage. When so inflated, the bandage intimately fits each variation in contour or size of the portion of the leg embraced by the bandage.

With reference more particularly to FIGS. 2, 3 and 4, it will be seen that the bandage 1 comprises a compart-
mental outside container made up of four sheets of material including an outside sheet 3, two intermediate sheets 4 and 5, and a rear sheet 6. While various materials could be used for the respective sheets, for abrasion resistance and durability over a lifetime of repeated usages, the sheets are preferably made of thermoplastic electronically heat-sealable sheets such as polyvinyl chloride or other thermoplastic that could be electronically heat sealed. The sheets form interior compartments 7, 8 and 9, by virtue of a peripheral heat seal seam 10 joining all four sheets. A horizontal heat seal seam 11 and spaced vertical heat seal seams 12 define pockets 13, 14, 15, 16 and 17 between sheets 4 and 5, which, with the exception of the central pocket 15, are accessible through a slit 18 extending across the rear portion of sheet 6, and a similar slit 19 extending across sheet 5. As seen in FIG. 3, a cross seam 20 closes off access to pocket 15 from the compartment 8, and a slit 21, FIG. 2, below that seam 20 in sheet 4, permits access to the central pocket from compartment 7. Access to pocket 15 is by way of an opening 22 in the front panel 3 which, when the device is in use, is closed by means of a plastic fastener 23, the component parts of which are heat sealed to the panel 3 around the opening 22 by a seam 24. This plastic fastener is preferably what is commonly termed a zipper of the type disclosed in Steven Ausnit et al. U.S. Pat. No. 3,054,434, issued Sept. 18, 1962 entitled “Bag Fastener”. Such a plastic zipper is finger operable but is gas tight. Means are provided for quickly and securely attaching the bandage around a horse’s leg and comprise the plastic strip 25 heat sealed at 26 to the front panel 3 and which carries a series of spaced eyelets therealong, and a similar strip 28 which carries hooks for engagement in those eyelets projects from the far side edge of the bandage. It will be noted that the strip 25 is set inwardly from the adjacent side edge of the bandage so that when the hooks are brought around and joined with the eyelets the side edges of the bandage 1 will be brought into abutment and that abutment will be tight when the bandage is inflated so that the coldness generated by the bandage will be uniform around the horse’s leg.

The compartment 7 between the sheets 3 and 4 is completely inflatable by evacuating refrigerant. Such refrigerant can build up a pressure which could possibly reach as high as a 90mm column of mercury per square inch. While a horse, for example, can stand that pressure in the fetlock or pastern area in case of a fracture, for most injuries, especially the tendons, a maximum pressure of 40–50mm of mercury is desired. Such lower pressure is maintained by virtue of a known type of pressure-release valve 30 in the front panel 3, which valve can be readily adjusted to release gas and maintain the desired pressure.

Refrigerant utilized in the bandage is contained in individual bags slidable into the aforesaid pockets 13, 14, 15, 16 and 17. While that refrigerant could be liquid carbon dioxide, liquid nitrogen, or other well known volatile refrigerants, in a proper container or cartridge that might be dropped into the pocket, for ease of handling and convenience it is preferred to use solidified carbon dioxide in the form of pellets, premolded or provided by way of crushing or shaving a larger block of solidified carbon dioxide. Such refrigerant changes from a solid to a gas at a temperature far below zero and therefore sufficient insulation must be provided to protect the part of the body covered by the bandage against injurious freezing.

To this end, with reference to FIGS. 5–7, an insulating bag 31 is provided to contain the refrigerant. It is a simple expedient to form such a bag by folding a strip of material along one side and then stitching the free edges of the folded sheet together across the bottom and up the side of the bag opposite the fold, as indicated at 32, utilizing a binding 33 if desired. The upper end of the bag is left open except for a simple form of a snap fastener 34 to prevent accidental spillage of refrigerant from the bag. The material used for the bag 31 is disclosed in FIG. 7 and comprises outer and inner laminations 35 and 36 of felt between which is a lamination 37 of gas porous rubber. Such material has a high heat insulating value and permits evaporation of the refrigerant not only through the top of the bag but also through the side walls of the bag and time of inflation of the bandage is reduced to a matter of a few minutes.

Where milder cooling of an affliction is desired, a bag 31a, FIG. 8, may be utilized which is identical with the bag 31, except it is of double thickness utilizing inside and outside sheets 38 and 39, respectively, of the above described insulating material.

A more economical form of bag 40, FIGS. 9 and 10, may be provided, the bag having the same general structure of the bag 31. The bag 40, however, utilizes a different but highly effective insulating material in the form of two layers of plastic film one of which is embossed with numerous trapped air bubbles, as indicated at 41. This material is far more economical than the material discussed above. The bubbles 41 should be on the inside of the bag, in contact with the CO₂ pellets, thus providing a temperature in the neighborhood of 23°F. on the outside surface of the bag. If the smooth face of the material were on the inside contacting the pellets, the outside temperature of the bag would be in the neighborhood of 6°F., which is more than desirably cold. Also, with the smooth side of the material on the outside of the bag, the bag is easier to slip into the pockets of the bandage. The material of the bag 40 is not gas porous so the only escape for the gas would be through the open top of the bag, and consequently, if bags of this type were the only ones utilized in the bandage, the time necessary to inflate the bandage would be, in most cases, objectionably lengthy.

Should more insulation be desired, a relatively thick sheet of foam latex, chemical foam, or similar insulating material may be inserted in the inner compartment 9 of the bandage, as indicated at 42 in FIG. 4. Usually, in regard to a horse, this sheet of foam material 42 would not be necessary on summer days, but in the event the ambient air temperature is 45°F. or lower the added sheet 42 should be utilized.

In use, the instant bandage is highly effective and simple to handle. It is a rapid expedient to fill the five bags this particular bandage uses with pellets of solidified carbon dioxide. The four bags are preferably first placed in the pockets 13, 14, 16 and 17 through the slits in the sheets 5 and 6, as indicated at 43 in FIG. 4. The pellets in these bags will not inflate the bandage
since they will merely gasify into the ambient air through the slits by which they were inserted in the pockets. Then, if the zipper 23 is not already open, it should be, and the other bag of pellets inserted in the pocket 15. The bandage should be lying flat at this time and the zipper may be pressed closed into gas-tight condition with the fingers, and the bandage is then immediately wrapped around the leg of the horse, since inflation has already started and the bandage must be attached before the bag is fully inflated. If it is desired or the ambient temperature warrants, the foam insulating element 42 may be left in the large compartment 9. The bags containing the pellets may be inserted into the four rearward pockets whether or not the element 42 is in position. If that element is not to be used it should be removed from the container prior to inserting the pellet bags.

If utmost economy is desired, four of the bags 40 may be used in the rear pockets, and a bag 31 used in the pocket 15 to acquire more rapid inflation of the compartment 7. Upon inflation, the bandage will be urging moderate pressure against the leg of the horse, and the valve 30 will prevent pressure from becoming too great. The bandage should be held on the horse’s leg in position until it is inflated, at which time the valve will make a slight hissing noise. The desired degree of coldness provided by the bandage can be determined to a satisfactory accuracy by the choice of pellet bags and the decision whether or not to utilize the foam insulator 42.

While the bandage is in use surface and subcutaneous temperatures drop slowly. In the area of the horse’s leg to which the bandage is shown applied in Fig. 1 surface skin temperatures after five minutes of application drop to approximately 80° and subcutaneous temperatures drop to approximately 95°F. from a start of 100°F. Surface temperatures slowly decrease over the next 20 minutes into the 60°F, and subcutaneous temperatures drop to approximately 92°F. After subcutaneous temperatures have been plateaued at 92°F. approximately 20 minutes, a further drop begins at approximately 1°F per minute until a subcutaneous temperature of 58°F to 60°F. is approached. Surface temperatures at that time would be approximately 35°F. When the subcutaneous temperature reaches 58°F to 60°F., the temperature stabilizes and remains relatively stable for the duration of the application which is from 55 minutes to 2 hours in most cases. When it is time to remove the bandage, it is first deflated by either opening the zipper 23 or by pulling out the valve stem after which the bandage can be very easily taken off.

If it is known that a particular horse is inclined to bother the bandage when in use, a stockinet sleeve at least twice as long as the bandage may be first pulled over the horse’s leg, and the bandage applied over a part of the sleeve, after which the outer part may be reverted over the outside of the bandage. If that does not discourage the horse’s activities, a little pepper may be sprinkled on the sleeve and the horse will leave the bandage alone. Such a sleeve should be used also where the bandage is applied for a long period of time, 2 or 3 hours or more, since after that length of time condensation may be formed inside the bandage, and the sleeve will prevent the bandage sticking to the hair of the horse.

The bandage will accomplish all of the remedial effects that result from a conjoint application of cold and pressure to an affliction, which effects are well known to those skilled in this art. Consequently, should the horse’s leg be injured to an extent requiring professional aid, the instant bandage is indicated as first aid procedure while waiting the arrival of a veterinarian.

The second embodiment of the instant invention disclosed herein is shown in Figs. 11, 12 and 13 and is a bandage for application to a human body on the leg or arm. In Fig. 11, this form of bandage, generally indicated by numeral 44, is shown applied to a human arm 45 over the wrist and lower forearm. This bandage 44 also includes four sheets of heatsealable thermoplastic material as above described. These are a front sheet 46, a shorter sheet 47, a third sheet 48 of the same size as the sheet 46, and a shorter inner sheet 49 open at the top to provide a pocket between itself and the sheet 48. All the sheets are heat sealed together across the bottom and up the side edges of the container by a seam 50. The sheet 47 is heat sealed to the sheet 48 by spaced vertical seams 51 to form a series of pockets for the reception of pellet-holding bags such as the bag 31. The pellets in the bags will usually inflate the entire space between the sheet 46 and the sheet 48. That space is closed by a plastic zipper 52 which is the same gas-tight type as discussed above. Half of this zipper 52a is heat sealed across the top of the sheet 46, while the complementary half 52b is heat sealed across the top of the sheet 48. A pressure-release valve 53 is mounted in the outer sheet 46. In this instance, since the bandage is on a human, snap fasteners are sufficient to hold the bandage in position. One series of snap fastener elements 54 is carried by a flap 55 extending from a side margin of the container, and the other complementary elements 56 are carried by a flap 57 inset from the opposite side margin of the container and heat sealed along the line 58 to the front sheet 46. When the bandage is placed on the arm of the user, the flap 55 is positioned over the space between the line 58 and the adjacent margin of the container, and the flap 57 is turned 180° to the left of the position seen in Fig. 12 and the snaps engaged, thus bringing the side edges of the container together to insure uniform cooling entirely around the arm of the patient.

Any of the pellet-carrying bags 31, 31a or 40 may be used in this bandage. However, if the bags 40 are selected, but time is of the essence, one of the bags 31 should also be used to provide rapid inflation of the bandage. Also, in view of the fact that human skin is far thinner than that of a horse, the relatively thick foam insulating element 59 should be inserted between the sheets 48 and 49, as seen in Fig. 13, in most all cases.

When inflated, the bandage will follow the exact contour of the part of the body around which it is placed, and also apply pressure to that part of the body. Obviously, the bandage will afford relief to burns, sprained ankles, sprained wrists, among other of its many remedial uses. In the case of a fracture, the use of the bandage is clearly indicated until a hard cast is applied, although if a bone is merely cracked, the bandage alone may be sufficient to afford adequate relief.

In Fig. 14, 15 and 16 we have illustrated a bandage for application to the human head. The structure of the container portion of this bandage is substantially the...
same as that of the bandage described above in connection with FIGS. 11, 12 and 13. The head bandage includes a front sheet 60 of the same thermoplastic material mentioned, a shorter sheet 61, a sheet 62 of the same height as the sheet 60, and a shorter rear or inner sheet 63 open at the top. Internally, vertical heat seal seams are utilized between the sheets 60 and 61 to provide a plurality of pellet bag-receiving pockets 64. The inflatable space between the sheets 60 and 62 is closed at the top by the same zipper 52, a portion of which is heat sealed to each of the sheets, as described above.

For securing the head bandage in position, a headband 65 extending from both sides of the container portion of the bandage is provided. This headband is double thickness and preferably formed integrally with the front sheet 60 and the third sheet 62. In communicates, therefore, with the inflatable portion between these sheets and so, also, becomes inflated when in use. Snap fasteners or equivalent folding means are provided on the closed ends of the head bandage, as indicated at 66 in FIG. 14. Also, preferably integral with the front sheet 60 and the third sheet 62 at the bottom thereof is a neckband 67 which also extends from both sides of the container part of the bandage and is provided with a suitable buckle 68 at one end. This neckband, however, is not inflatable, it being cut off from the inflatable compartment by means of the heat seal seam joining all the sheets, as indicated at 69.

Owing to the location where the head bandage is applied to the body, the use of double thickness pellet bags 31a in the pocket 64 is recommended. Also recommended is the usage of the thick foam insulating sheet 70 in the compartment between the container sheets 62 and 63, thus providing the maximum amount of insulation. The usual pressure-relief valve 71 is mounted in the outer sheet 60 of the container portion.

In FIG. 16 we have shown the bandage in operative position upon the head 72 of a patient. It will be noted that the bandage when inflated, intimately follows the contour of the head and a portion of the neck to apply both cold and moderate pressure thereto. The central portion of the body part is of sufficient height to extend around the surface area directly rearwardly of the medulla oblongata. It should be further noted that the bandage on each side extends slightly forwardly of the ear down onto the neck so as to overlie the carotid artery and its branches on each side of the neck. The neck strap rests beneath the chin of the patient, and the inflatable headband 65 is inflated over a portion of the forehead.

This cold plus pressure head bandage is, of course, useful for all injuries or affictions to the head where cold and pressure are indicated as a remedy. In addition, it is extremely useful in a number of cases of headache, such as migraine, the common types of headache, and others that do not require special medication or surgery to relieve. Using the bandage for a common type of headache, should greatly relieve if not eliminate the pain within a few minutes.

The final illustrated embodiment of the instant invention is that of FIG. 17. This structure requires the use of only one of the pellet bags 31, 31a or 40, which bag is filled with pellets and wrapped round and round to provide a few layers of sterile gauze or other sterile fabric completely around the pellet bag. It will be noted that the ends of the wrapping project beyond the pellet bag as indicated at 74—74. Doctors frequently order the application of cold packs or the equivalent to the perineal area, especially after an episiotomy. The bandage of FIG. 17 is especially adaptable for that purpose, since the pellet bag and the wrapping raise the temperature developed by the volatile refrigerant to a useful temperature of $28.5^\circ$F. This bandage can easily be placed in position over the perineal area and held in place by attaching the free ends 74—74 to a sanitary belt. Consequently, the bandage will prevent edema, eliminate hemorrhaging and infection, among other reliefs.

All of the embodiments of the invention herein disclosed and described are flexible and therefore shape themselves in accordance with the body area on which they are placed. Also, all of the bandages provide a useful range of temperatures and the temperature is released at a rate where the temperature adaptation mechanism of the body is not overburdened.

The invention claimed is:

1. A cold bandage, a bag for holding a volatile refrigerant, an outer container for removably covering said bag comprising a sterile fabric wrapped around the bag a plurality of times with the ends of the wrapped fabric projecting freely beyond the bag, and said bag being of temperature insulating material and open at one end to facilitate volatilization of the refrigerant.

2. The bandage of claim 1, wherein the material of which the bag is made comprises a sandwich laminate of felt, gas porous rubber, and felt.

3. The bandage of claim 1, wherein the material of which the bag is made comprises two layers of plastic film, one of which is embossed with trapped air bubbles.

4. A cold bandage, an outer container of the compartmental envelope type, a bag for holding a volatile refrigerant removably disposed in a compartment of said outer container, and said bag being of temperature insulating material and being open at one end to facilitate volatilization of the refrigerant, said compartment being inflatable by volatilizing refrigerant.

5. The bandage of claim 4, wherein the compartment nearest the skin of a patient is open at the top, and including a sheet of relatively thick foam insulation selectively insertable in said compartment.

6. The bandage of claim 4, wherein the outer container has a plurality of compartments, and including pockets formed in said container each to receive a refrigerant bag, a gas-tight closure for at least one of said compartments, and at least one of said pockets being located in said closable compartment whereby the same is inflated by volatilizing refrigerant.

7. The bandage of claim 6, including a plurality of refrigerant bags of varying insulating properties selectively insertable in said pockets.
8. The bandage of claim 6, wherein the closure equipped compartment is farthest from the skin of a patient when the bandage is applied.

9. The bandage of claim 6, wherein the compartment nearest the skin of a patient is open at the top for the selective reception of added insulation.

10. The bandage of claim 6, shaped to fit over the back of a patient’s head and upper neck, and including hollow head strap means in open communication with the inflatable compartment whereby said head strap means are also inflated along with the inflation of said compartment.

11. The bandage of claim 6, shaped to fit over the back of a patient’s head and upper neck rearwardly of the medulla oblongata and extend forwardly on each side of the head sufficiently to overlie portions of the respective carotid artery and branches.

12. The bandage of claim 11, including head and neck strap means to maintain the bandage in position on a patient.

13. The bandage of claim 1, wherein said outer container comprises a plurality of sheets of material secured together at least along the bottom and up both sides of the container, a pair of adjacent sheets being connected by spaced vertical seams to form pockets each removably receiving a refrigerant bag, the front sheet and an inner sheet forming an inflatable compartment, gas-tight closure means affording access to said inflatable compartment, and at least one said pocket being in said inflatable compartment.

14. The bandage of claim 13, including an open topped compartment being the sheet on the patient side of the bandage and the next adjacent sheet to selectively receive added insulation.

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