Sept. 21, 1965 T. MOORE 3,206,776

INSULATED AIR MATTRESS

Filed Oct. 19, 1962

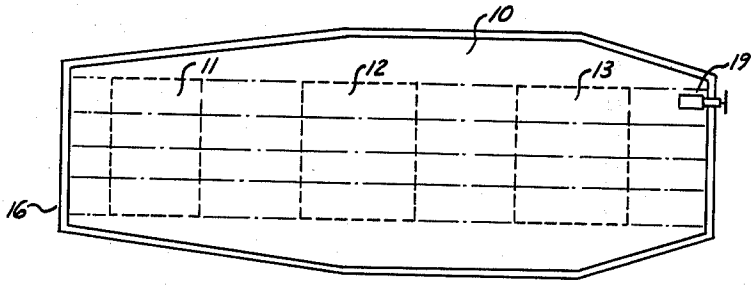

FIG-1

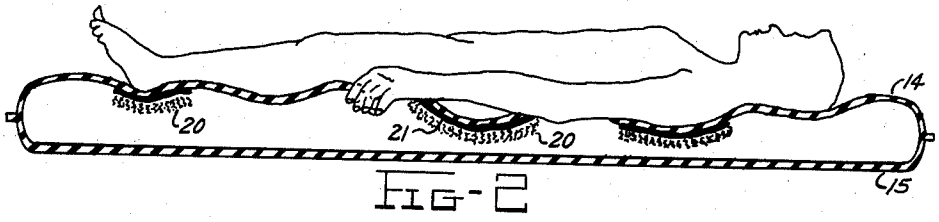

FIG-2

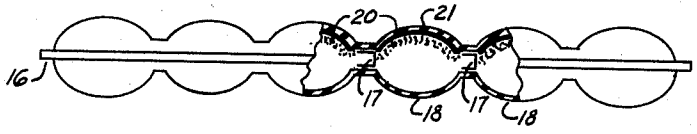

FIG-3

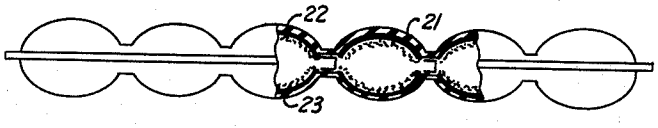

FIG-4

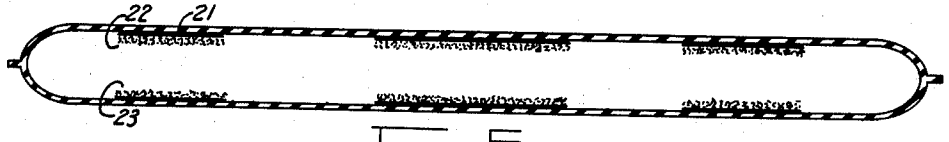

FIG-5

INVENTOR.
TERRIS MOORE

BY Herbert Berl

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INSULATED AIR MATTRESS

Terris Moore, Monson, Maine, assignor to the United States of America as represented by the Secretary of the Army

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This invention relates to an improved air mattress and more particularly to an air mattress having improved insulating properties.

Air inflated mattresses have long been used for resting and sleeping purposes in connection with military activities in the field and civilian outdoor recreational activities. Air mattresses are particularly suitable for such use because of their very low weight and bulk in the uninflated condition such that they may be easily carried when not in use. This characteristic is particularly important where various other items of equipment must also be carried as in hiking-camping activities and especially in military field activities where the weight and bulk of equipment to be carried is a critical problem.

Conventional air mattresses comprising essentially inflatable air impermeable enclosures of appropriate size and shape quite adequately meet the requirements for low weight and bulk for transportability purposes and, when inflated, provide a very effective cushion over hard or slightly uneven terrain. By virtue of the entrapped volume of air maintained between a body reclining on the mattress and the ground, such mattresses also afford some degree of insulation to reduce heat loss from the body to cold, wet, or frozen terrain. However, under many conditions the degree of insulation afforded by the mattress alone is not sufficient to prevent discomfort from cold. Various methods have been proposed for overcoming this problem either by the introduction of insulating material into the interior of the air mattress or, more commonly, by the use of insulating material such as sleeping bags or blankets around the body of the user of the mattress. The use of insulating material within the mattress has thus far not found acceptance since it has either added such weight and bulk as to seriously reduce the portability characteristics of the mattress or, in the case of downy materials, presented thus far unsolvable problems of maintaining such material in position within the mattress without using prohibitively expensive construction techniques. Downy insulating material tends to migrate away from the points of heavy pressure during use of the mattress and has been found to present serious problems when the mattress is deflated. As air rushes out of the mattress the downy material is carried with it either to be discharged to the exterior of the mattress or to clog a screen or other device incorporated to prevent such discharge. It is significant to note that despite wide recognition of the desirability of improving the insulating properties of a plain air mattress, no form of supplemental insulation incorporated in the mattress has yet been found acceptable by either military or civilian users.

The problem of keeping warm in colder climates has therefore been met by the use of one or more sleeping bags, blankets and clothing, arranged around the body reclining on the inflated mattress. This warmth is obtained at a substantial penalty in the weight, bulk and cost of equipment which must be carried by the individual camper or soldier. Further, I have discovered that the insulation afforded by these materials is greatly reduced in certain areas where it is most highly compressed during use, primarily in those areas supporting the hips and shoulders of the reclining body and to a somewhat lesser extent, the area supporting the feet. The concentration of body weight in these areas reduces the effective thickness of the insulating material whether it be sleeping bags, blankets or just clothing, such that heat loss from the body is accentuated in these areas. As a result, in order to maintain comfortable warmth in these areas, far more insulating material than actually necessary is being used over most of the body. In other words, considerably more weight and bulk in insulating material is being carried in colder climates primarily to provide sufficient warmth in certain specific areas where the insulation is most heavily compressed in use.

I have discovered that by providing insulating material in these areas within the inflated mattress such that the insulating material remains substantially uncompressed during use, makes it possible to effectively eliminate these areas of high heat loss and to thereby establish a balanced heat loss condition between the reclining body and the ground beneath the mattress. I have further found that because this insulation remains substantially uncompressed during use and is required only in certain specific limited areas, an extremely lightweight, resilient, highly compressible insulating material may be used, such that it will produce a negligible increase in the weight and bulk of the air mattress when uninflated and rolled or folded for carrying purposes.

I have found that by using an air mattress insulated in accordance with my invention it will generally be possible to use only one sleeping bag under conditions where a two-sleeping bag combination is now used or to use one or two blankets in situations where a single sleeping bag is now used. The economic and logistic advantages of this result are quite apparent.

While the greatest benefits of my invention will be realized in those situations where sleeping bags and blankets are now used, even ordinary clothing will suffer from loss in insulating value when it is compressed and, since the hip and shoulder areas comprise a substantial portion of the body surface in contact with the air mattress and portions which will always be in most intimate contact with the surface of the mattress, these areas will be points of maximum heat loss even where significant exterior insulation between the reclining body and the mattress is not being used.

It is, therefore, an object of this invention to provide an insulated air mattress which will permit a significant reduction in the amount of exterior insulation required when using the mattress in cold climates.

It is also an object of this invention to provide an air mattress having improved insulating properties without significantly increased weight or bulk. It is also an object of this invention to provide an insulated air mattress wherein the insulating material remains in a predetermined position within the mattress during normal use thereof including inflation and deflation. It is a further object of this invention to provide an air mattress of improved insulating properties which is simple and inexpensive to manufacture.

Other objects and advantages of this invention will become apparent from the following description and claims together with the accompanying drawings in which:

FIGURE 1 is a top plan view of an air mattress in accordance with the present invention in the inflated condition;

FIGURE 2 is a longitudinal section of the air mattress shown in FIGURE 1 showing a human body reclining thereon;

FIGURE 3 is an end elevation of the air mattress shown in FIGURE 1 on an enlarged scale partially broken away to show the insulating material in position within the mattress;

FIGURE 4 is a view similar to FIGURE 3 of one modification of the present invention; and

FIGURE 5 is a longitudinal section of the modification shown in FIGURE 4.

Referring now to FIGURES 1, 2 and 3 wherein there is illustrated one embodiment of the present invention comprising an air mattress 10 of generally conventional construction and pads or sheets of insulating material 11, 12 and 13 fixed to the inside surface of the top of the mattress. The mattress 10 comprises top and bottom panels 14 and 15 of conventional air impermeable coated fabric. This fabric may be comprised of a base fabric of plain weave, white nylon cloth, using 70 denier, 34 filament, type 200 nylon yarn having about five turns of twist per inch for both the warp and the filling. The fabric may be coated with natural or synthetic rubber or a mixture of both, suitably compounded and pigmented such as to be heat-vulcanizable. The top and bottom panels 14 and 15 are sealed together around their periphery to form a fin edge 16. The interior surfaces of the top and bottom panels are joined at spaced intervals over substantially their entire area by continuous strips 17 of coated fabric material such as is used in the top and bottom panels running longitudinally of the mattress substantially its entire length. These strips 17 are known as C-beams and are cemented and vulcanized to the interior surfaces of the top and bottom panels to maintain a substantially uniform thickness of the mattress when inflated. The strips 17 divide the mattress into a number of generally tubular compartments 18 which are manifolded together at the ends of the mattress since the strips 17 are not carried all the way to the ends. An inflation tube 19 is fixed to the mattress in a convenient position.

The mattress construction thus far described is, with the exception of the insulating material, conventional and is disclosed in detail in Military Specification MIL-M-10747C dated September 30, 1959 for "Mattress, Pneumatic. The present invention resides in the manner of insulating such a mattress.

Referring to FIGURE 1 of the drawing, there is shown a plan view of a conventional mattress with the areas of insulating material 11, 12 and 13 in accordance with the present invention outlined thereon. It will be observed that this particular style of mattress is generally shaped in accordance with the rough outline of a reclining human body, that is, the mattress is broadest in the torso area and tapers to narrower portions in the areas which support the extremities of the body. The general locations of the positions occupied by various portions of a human body reclining on this mattress can, therefore, be quite easily determined. In the embodiment shown in FIGURE 1 areas of insulation 11, 12 and 13 are provided in a manner to be described in those areas of the mattress which would support the feet, hips and shoulders respectively of a human body reclining thereon. These areas of insulation are comprised of sheets 20 of extremely lightweight, highly compressible, resilient insulating material which, while affording essentially no support to the mattress, has an inherent structural stability which enables it to resist migration or displacement during use of the mattress and during inflation and, especially, deflation. The material when uncompressed is, therefore, capable of retaining substantially its original form or shape throughout the normal life of the mattress. In the embodiment illustrated, the sheets of insulating material will most conveniently be sized to extend the full width of an internal tubular compartment 18 such that a number of these sheets, such as four as in FIGURE 1, of appropriate length will combine to complete one area of insulation or pad. One such material found suitable for this purpose is a resin-bonded, non-woven, crimped polyester fiber batting. This batting may be comprised of crimped staple virgin polyester fiber of about five denier cut to about 2 inches in length and bonded with a thermoplastic or thermosetting resin such as melamine formaldehyde, methylolstearamide or acrylonitrile or mixtures thereof. The maximum concentration of the bonding agent will generally not exceed 15% by weight. Batting of this type is available in weights of about 2, 3.3 and 4 ounces per square yard having respective thicknesses of about 0.3, 0.5 and 0.5 inch. Greater thicknesses can be produced or may be readily obtained by loosely stitching layers of batting together or by quilting the desired thickness of batting between two layers of very lightweight fabric. Other types of lightweight, resilient, compressible, migration-resistant insulating materials such as other types of battings and various foamed plastic or rubber materials may also be used to advantage in this invention.

In the embodiment illustrated in FIGURES 1 and 2, sheets 20 of insulating material are fixed to the underside of the top 14 of the mattress by cement 21 in those areas which support the feet, hips and shoulders of an average sized human body reclining on the mattress. The exact size of the insulated areas is not critical so long as a sufficient area is provided to cover the areas of maximum heat loss during use. In the embodiment shown, for example, utilizing the dimensions of the aforementioned Military Specification, namely, a mattress having overall dimensions of about 31½ inches in width by 73¾ inches in length, the insulated area for the feet desirably may be about 18 inches in width by about 12 inches in length, the hip area about 18 inches in width by about 18 to 24 inches in length and the shoulder area about 18 inches in width by about 18 inches to 24 inches in length.

The insulating value of most lightweight, resilient, compressible insulating materials is at a maximum when the material is uncompressed. Thus, the most efficient means of providing insulation in my invention is to use a material having an uncompressed thickness somewhat less than the thickness of the mattress when it is inflated and, preferably, not more than the minimum thickness of the inflated mattress when a human body is reclining thereon such that the insulating material will remain substantially uncompressed. I have found, for example, that in normal use the standard United States Army air mattress referred to above is inflated to the point where approximately 1 inch of air space is provided between the top and bottom panels of the mattress when a human body is reclining thereon. Inflation to a lesser degree generally fails to afford the comfort desired when the mattress is used on slightly uneven terrain while inflation to a greater degree tends to make the mattress uncomfortably hard. I have also found that a thickness of about one inch of the resin-bonded, non-woven, crimped polyester batting described above applied to the inside surface to the top of the mattress in the areas of maximum heat loss, namely, the areas supporting the hips and shoulders of a body reclining thereon, will effectively reduce the heat loss in these areas to the extent that substantially less insulation in the form of sleeping bags or blankets will be required over the entire body. I have obtained this thickness in the polyester batting described by lightly stitching together three layers of 2 ounces per square yard batting or two layers one of 4 ounces and one of 2 ounces per square yard or two layers each weighing approximately 3 ounces per square yard.

The amount of insulating material used directly affects the weight and bulk of the mattress in deflated condition. Since these factors are of the utmost importance, particularly in military operations, it is highly desirable to limit the amount of insulation to the minimum effective amount and thus, in accordance with this invention, to provide insulation only in the areas supporting the hips and shoulders of a reclining body since these areas have been found to be the most critical with regard to heat loss in an uninsulated air mattress. On the other hand where weight and bulk considerations are not so controlling, increased areas of insulation to include, for example, the area supporting the feet, may be tolerated or, for that matter, it may be found more convenient from a manufacturing standpoint to extend the sheets of insulating material over substantially the entire length of the mattress. The present invention, therefore, comprehends the use of a wide variety of insulation coverages of the type herein de-

scribed so long as the primary critical areas supporting the hips and shoulders are covered.

FIGURES 4 and 5 illustrate another embodiment of the present invention wherein the desired amount of insulation is provided by securing separate sheets **22** and **23** of insulating material to the inside surfaces of the top **14** and the bottom **15** of the mattress, respectively. In this manner the desired degree of insulation is provided by the combined effect of the two opposed sheets of insulating material. This embodiment is somewhat less efficient since the entire thickness of the insulating material will not necessarily be directly adjacent the underside of the top panel where it is most effective in reducing heat loss from a reclining body. It does, however, have the advantage of providing the same beneficial effect without regard to which side of the mattress is used as the top.

The fabrication of air mattresses in accordance with the present invention follows conventional methods with the exception of the additional steps of applying cement to those areas to which the insulating material is to be adhered and the placement of sheets of insulating material in these areas. Thus, according to one common method of fabricating air mattresses the bottom panel **15** having been cut to size is coated with a vulcanizable synthetic or natural rubber cement **21** around its periphery and in those areas to which strips **17** will be secured. The panel is then placed in the lower half of a heated mold. Strips **17** having been cut to size and folded in half along their entire length are coated with cement **21** on those surfaces which are to be joined respectively to the top and bottom panels and laid in place over the corresponding cement coated areas of the bottom panel **15**. The sheets of insulating material **20** having been cut to desired size are laid in place on the bottom panel between the strips **17**. The top panel **14** having been cut to size is also coated with cement **21** around the periphery of its inner surface in those areas to which strips **17** are to be adhered, and the areas where the sheets of insulating material **20** are to be fixed. The top panel is then placed in position over the bottom panel in the mold, the top of the mold is brought into position and heat and pressure are applied to the mattress assembly to join and cure the various cement coated areas. It should be noted that the mold is designed primarily to provide pressure on the joints to be formed around the periphery of the mattress and in those areas where strips **17** are to be joined to the top and bottom panels. It is not generally necessary to provide pressure to adequately adhere the insulating material to the inside of the top panel since mere contact between the insulating material and the cement coated surface of the top panel will normally provide adequate adhesion to maintain the insulating material in position.

Since the coated fabric material normally used in fabricating air mattresses is in an uncured or partially uncured condition, it is also possible to fix the insulating material in the desired positions without the use of cement by merely maintaining the insulating material in contact with the surface of the top panel under slight pressure during the curing process. As is readily understood in the art it will be necessary to remove any talc or other such material normally used in handling uncured or partially cured coated fabrics from the areas to which adhesion is desired.

The fabrication of that embodiment of the invention wherein insulating material is adhered to the inner surface of both the top and bottom panels is accomplished in essentially the same manner as described above with the exception of the preparation of the additional surfaces to which adhesion is desired in the inclusion of the additional layer of insulating material.

While I have described the adhesion of the insulating material to the panel surfaces of the entire area of contact between the two, it has also been found satisfactory to fix the insulating material in position by merely tacking it, that is, by the use of a number of spots of adhesive rather than covering the entire area of the contacting surfaces.

In the use of the present invention with a mattress of rectangular shape, or in fact, of some other shape which does not by its shape indicate a particular position to be occupied by a reclining figure thereon as is the case with the illustrated embodiment, the advantages of the invention may be obtained in at least two ways. The most obvious means is the use of printed indicia or other marking device to indicate the manner in which the mattress is to be used such as, for example, indicating the top surface and the end thereof at which the head should be placed. The other means involves the recognition of the fact that there are only a limited number of ways in which the mattress could normally be used and by providing the supplemental insulation in accordance with the present invention in such a manner that the benefits thereof would be obtained no matter which of the possible methods of use are selected. For example, in a rectangularly-shaped mattress three areas of insulation in a manner similar to that shown in FIGURE 1 would provide insulation in the proper areas no matter which way the figure reclines thereon. In this instance only the top of the mattress might be indicated or, where the embodiment of the invention shown in FIGURES 4 and 5 is utilized, the use of either side of the mattress would be equally effective.

The operation of the air mattress of the present invention is in all respects similar to the operation of an ordinary uninsulated air mattress. The mattress is unrolled and inflated with air through the inflation tube by mouth or by pump. Upon inflation to the desired degree, the resilient insulated material within the mattress will expand to its uncompressed condition thereby achieving its maximum insulating values. In accordance with the present invention, these values are maintained in the use of the mattress since the support furnished by the inflated mattress maintains the insulation in a substantially uncompressed condition. Upon completion of the period of use, the cap on the inflating nozzle is removed and the mattress allowed to deflate. With the cap still removed the mattress may be rolled starting from the end opposite the cap to expel any remaining air and permit rolling into a very compact bundle for storage or transportation until the next period of use.

It will be seen, therefore, that the present invention provides an air mattress having improved insulating qualities over conventional uninsulated air mattresses with essentially no increases in weight or bulk. The insulation provided in accordance with the present invention will add from two to eight ounces to the three-pound weight of the standard United States Army uninsulated air mattress in accordance with the military specification mentioned above. The provision of additional insulation in the critical heat loss areas in accordance with this invention will enable the user to dispense with extra blankets, a sleeping bag or one of two sleeping bags now used with the uninsulated air mattress primarily, as I have found, to provide additional insulation in these critical heat loss areas where the insulation is significantly reduced by compression under the weight of a body reclining thereon. Moreover, the present invention accomplishes its purpose at extremely low material and manufacturing cost over the standard uninsulated air mattress, while providing insulation which remains substantially uncompressed and which will not migrate from the areas where it is most needed.

While I have described certain embodiments of my invention, it will be obvious to those skilled in the art that a number of variations and modifications are possible without departing from the scope of the invention. It is to be understood, therefore, that the forms of the invention herein shown are described and to be taken as examples of same and that various other changes in the shape,

size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. An air mattress comprising an air-impermeable enclosure having top and bottom sides, means for admitting and releasing air to and from said enclosure and a resilient, compressible, migration-resistant insulating material fixed within said enclosure, said insulating material being confined substantially to those portions of said enclosure which support the hips and shoulders of a human body reclining on said mattress and extending over a total area which is not more than about one-half of the area of said top side, said insulating material offering no support to the mattress when inflated and permitting compact rolling or folding of the mattress when deflated.

2. An air mattress comprising an air-impermeable enclosure having top and bottom sides, means for admitting and releasing air to and from said enclosure and a resilient, compressible, migration-resistant insulating material fixed within said enclosure, said insulating material being confined substantially to those portions of said enclosure which support the hips, shoulders and feet of a human body reclining on said mattress and extending over a total area which is not more than about one-half of the area of said top sides, said insulating material offering no support to the mattress when inflated and permitting compact rolling or folding of the mattress when deflated.

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FRANK B. SHERRY, *Primary Examiner.*