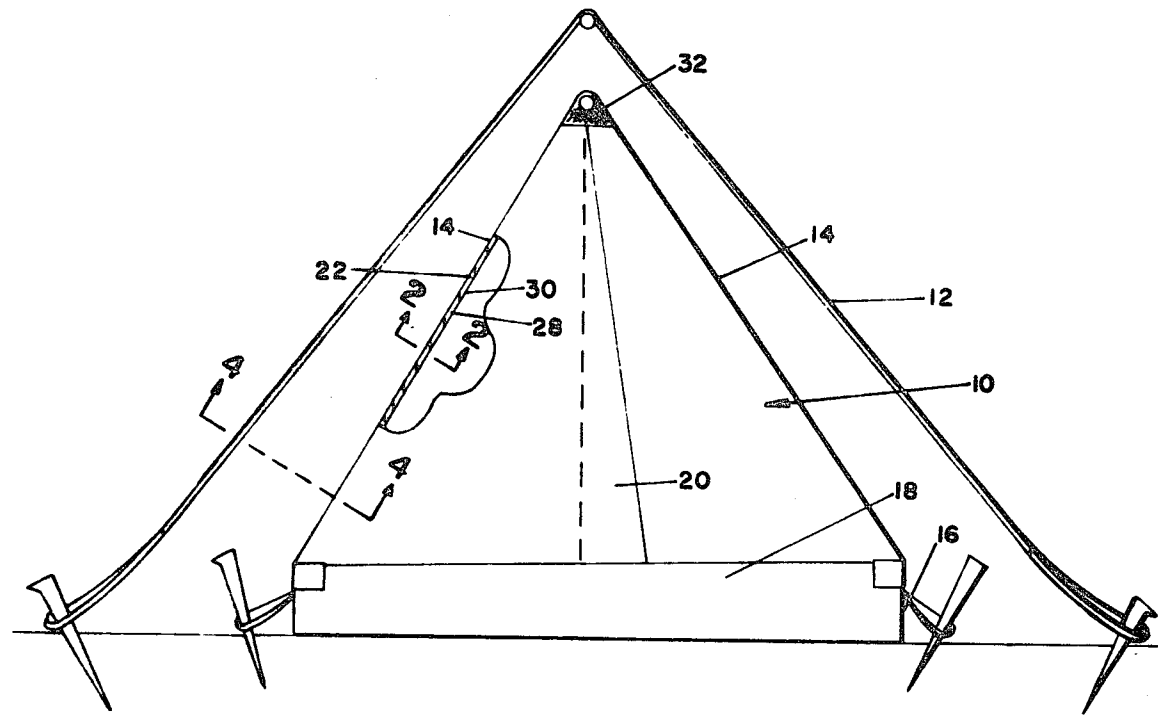


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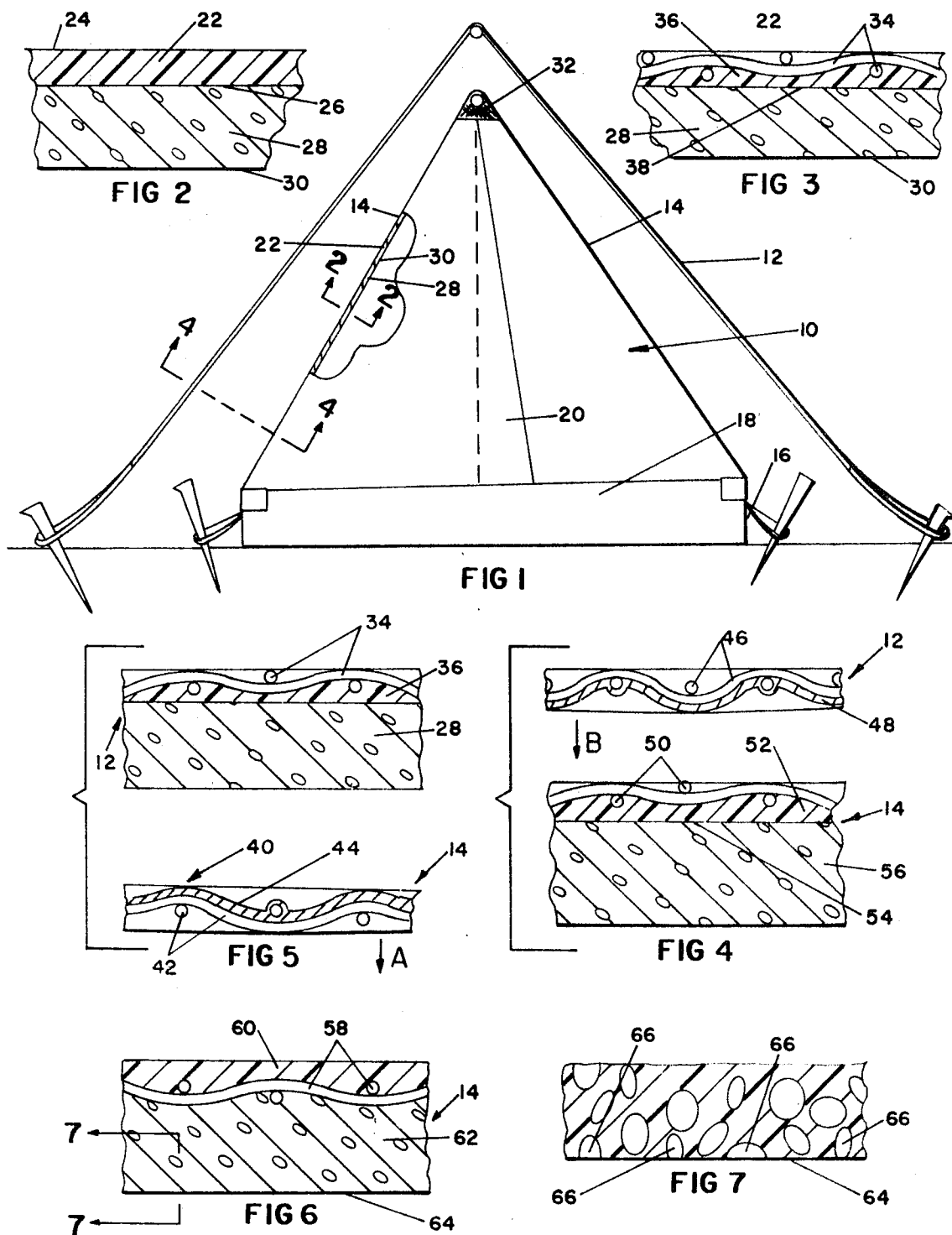
[54] **LIGHTWEIGHT TENT CONSTRUCTION**
1 Claim, 7 Drawing Figs.
[52] U.S. CL..... **135/1 R,**
135/14 V
[51] Int. Cl..... **A45f 1/00**
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14 V

ABSTRACT: A lightweight tent construction comprising a tent roof having an outer waterproof layer of thin lightweight material and an inner layer of insulating material, such as synthetic foam, or the like, wherein the waterproof layer may be of fabric or plastic material of high tensile strength ranging in thickness between 0.004 and 0.010 inches, and wherein the insulating foam material may range in thickness between one sixty-fourth of an inch to one-eighth of an inch.



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3,598,133



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LIGHTWEIGHT TENT CONSTRUCTION

BACKGROUND OF THE INVENTION

In response to a great need for lightweight tents, and particularly those which are weatherproof, there have been many prior art tent structures manufactured and sold, and particularly for the purpose of camping in remote areas, where all supplies and equipment must be carried on a pack frame or in a packsack on a person's back.

Many of the lightweight fabrics which may be used for tent construction, must of necessity, be made of material having high tensile strength, such as nylon or other comparable materials, and many fabrics made of such material are very light and durable, yet tend to leak or accumulate liquid condensate on the inner surfaces thereof, whereupon the condensate drains downward into contact with personnel effects, such as sleeping bags, or the like.

Very thin lightweight and strong nylon or other comparable fabrics have been used for lightweight tents, however, some of these, when untreated, tend to leak under heavy rain storms, and when such lightweight high strength fabrics are treated with a pliable or flexible resin to render them waterproof, they tend to accumulate moisture when located at the roof and wall portions of such a tent. Such condensation problems occur under dew point conditions which, of course, depend upon relative temperature and humidity.

In the background of the present invention, many of the lightweight tent structures have either been subject to leakage or collection of condensate or have been relatively heavy due to the necessity of making tents of material which will breathe air yet prevent rain from leaking therethrough.

While some of the prior art tents of comparable sizes have been somewhat compact, and fairly lightweight, they have lacked the desirable degree of lightweight in combination with the ability to withstand relatively low temperatures and high humidity conditions without accumulating a condensate on the inner surfaces thereof, and also the ability to withstand the impact of a driving rain without leaking.

Additionally, some of the prior art lightweight tents have required a great deal of open ventilation area in order to prevent condensation on the interior thereof to an undesirable degree, and for this reason, many of such tents have been very uncomfortable and relatively cold, particularly in areas where there are persistent winds. Accordingly, such tents requiring a great amount of ventilation impose the necessity of having additional sleeping facilities comprising a greater amount of clothing and/or sleeping bag weight. Many of the prior art lightweight tents, due to the necessity for great ventilation airflow therethrough, have therefore been subject to rather cold ambient conditions internally of the tent, and have consequently required that a camper or back packer maintain additionally warm sleeping facilities which, of course, imposes added weight of clothing and sleeping bags to maintain comfort at night.

SUMMARY OF THE INVENTION

In accordance with the present invention, an extremely lightweight tent construction combines the ability to function under great humidity and low temperature or critical dew point conditions without accumulating an undesirable condensation condition therein. The tent construction of the present invention is also very warm in comparison to prior art lightweight tent structures, and is completely waterproof so as to exclude moisture in a driving rain storm. Furthermore, the tent construction of the present invention employs a very novel combination of a high-strength waterproof external test wall having an insulation layer internally thereof which effectively prevents the inside of the tent from cooling down to reach a temperature at which a dew point condition occurs inside the tent to prevent the collection of condensate on the inner surfaces of the tent. Additionally, the insulation is of

very lightweight foamed resin structure which provides considerable conservation of heat energy, and thereby tends to minimize the need for thermal capacity in sleeping bags or sleeping clothing, and thus tends to reduce the overall weight of the tent and sleeping bag combined. This greatly improves the overall situation for a back packer who must carry his tent and sleeping bag into remote areas.

Accordingly, it is an object of the present invention to provide a novel tent construction having an external thin, high strength, waterproof layer of lightweight material, and a layer of insulation material fixed and contiguous with the inner surface of the outer waterproof layer to provide waterproof conditions, high resistance to dew point conditions internally of the tent, and also conservation of radiant and convective thermal energy internally of the tent.

Another object of the invention is to provide a novel tent construction having high strength tent roof and wall structures which are waterproof and which are insulative, as well as reflective, to conserve thermal energy which may tend to radiate outwardly or be conveyed outwardly; the reflective insulation being capable of reflecting thermal energy backwardly into the interior of the tent.

Another object of the invention is to provide a novel combination of a basic tent roof and tent fly disposed in superimposed spaced relation with the roof and being capable of reflectively radiating heat backward toward the roof of the tent to conserve energy which may tend to radiate from the tent to the far sky.

Another object of the invention is to provide a lightweight tent construction which may be constructed of high-strength, lightweight, synthetic material, such as nylon, polypropylene, polyethylene, polyurethane, polyvinyl plastic, and other equivalent materials, and foams thereof so as to provide a very tough, lightweight, water resistant tent having insulating characteristics to provide for warmth and resistance to dew point conditions internally or on the inner surfaces of the tent communicating with the interior thereof.

Another object of the invention is to provide a lightweight tent construction which includes a novel lightweight insulation internally thereof, which effectively prevents the interior of tent from reaching a dew point condition, and thereby permits the tent to be used with minimum of ventilation area, and thereby prevents convective losses of thermal energy from the interior of the tent, while at the same time, the atmospheric conditions internally of the tent, including the moisture of a person's breathe may be effectively dissipated to atmosphere without causing condensation internally of the tent due to face that the foam insulation on the interior of the tent does not cool sufficiently to reach a dew point condition.

Further objects and advantages of the present invention may be apparent from the following specification, appended claims, and accompanying drawings:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an end view of a tent construction in accordance with the present invention, and showing portions thereof broken away and in section to amplify the illustration;

FIG. 2 is an enlarged fragmentary sectional view taken from the line 2-2 of FIG. 1;

FIG. 3 is a view similar to FIG. 2, but showing a modification of the structure of the invention;

FIG. 4 is an enlarged fragmentary sectional view taken from the line 4-4 of FIG. 1, showing another modification of the invention;

FIG. 5 is a view similar to FIG. 4, showing a modification of the structures of the invention;

FIG. 6 is a view similar to FIGS. 2 and 3, but showing a further modification of the structure of the invention; and

FIG. 7 is an enlarged fragmentary sectional view taken from the line 7-7 of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. 1 of the drawings, the lightweight tent construction of the present invention may assume various configurations, and as an example only, the tent construction of the invention may include a basic tent 10 and a superimposed tent fly 12 forming a protective, as well as a reflective, insulating cover for the tent 10. This fly 12, according to the present invention, however, may not be required and the tent 10 alone may contain all the required advantages of the invention depending upon the use and application.

The tent 10 is provided with a gable roof 14 and side and end walls 16 and 18, respectively.

The conventional enclosure flap 20 may be provided in one of the end walls 18, as desired, and the general configuration of the tent may vary considerably in accordance with the size and use requirements.

As shown in FIG. 2 of the drawings, the roof sheet 14 of the tent 10 may comprise a thin, high-strength, waterproof sheet or layer of material designated 22. This sheet 22 is preferably of nylon, polypropylene, polyethylene, polyurethane, polyvinyl plastic, or other equivalent material, and may be very thin ranging from a few mills to a substantially thicker dimension. This outer sheet 22 is provided with an outer side 24 exposed and directed upwardly toward the weather side of the tent. The sheet 22 at its inner side 26 is contiguous with and adhered to a layer of insulating material designated 28. This material 28 is a foamed plastic, such as polyurethane or an equivalent foam, and this foam may range in thickness between one sixty-fourth of an inch to one-eighth of an inch. The foam layer 28 may be adhered to the inner surface 26 of the sheet 22 by any suitable adhesive material well known in the art for securing various plastics and/or resin materials together.

While the outer sheet 22 is of tough, waterproof material, the foam layer 28 provides for insulation of the interior of the tent roof 14. This insulation 28 retains thermal energy internally of the tent, particularly that supplied by humans sleeping in the tent, and due to this retention of energy, the temperature at the inner surface of the wall structure 14 is prevented from reaching a dew point temperature under most conditions. This foam insulation layer thus prevents the collection of moisture on the inner surface of the tent of the invention under very severe conditions. Normally the outer surface of a tent without the fly 12 is subject to radiation to the far sky which tends to cool the outer sheet 22 to such an extent that its inner side 26 would normally serve as a low-temperature condenser for vapor emitted in a person's breathe. The foam layer 28, however, does not conduct this low temperature, and therefore the inner surface 30 of the foam layer 28 does not reach a low temperature sufficient to attain a dew point condition with relation to the vaporous atmosphere on the interior of the tent.

Accordingly, only a small amount of ventilation space, such as shown at 32 in the gable of the tent 14, may be used to exchange moisture vapor to the outside atmosphere, and to maintain conditions which do not reach a dew point internally of the tent. Since small amount of ventilation is required under these conditions, a cold wind does not tend unduly to cool the interior of the tent, and thereby reducing the necessity for extremely warm sleeping bags and/or sleeping clothing so as to minimize the weight of the sleeping bags that must be carried in connection with the tent when a person is back packing in remote areas.

It will be appreciated that the foam layer 28 being of a thickness ranging between one sixty-fourth and one-eighth of an inch depending on the size of the tent is very lightweight foam, and that the very thin waterproof sheet 22 may range in thickness, as for example, between 0.004 and 0.010 inch, and in some instances, the waterproof sheet 22 may be made even thinner than 0.004, as for example, this sheet may be only 1 mill thick when extremely lightweight tents are produced, and which are of the inexpensive type, and those which are con-

sidered to be expendable in relation to perhaps one or two walking trips. These very thin outer layers 22 may be made of polyethylene and the foam layer 28 may be very thin, as for example, one sixty-fourth of an inch or so, and yet these thin materials are very effective in resisting the effects of rain storms and dew point conditions, and serve to provide for substantial comfort due to the warmth and thermal insulating effects of the two layers 22 and 28.

In the modification, as shown in FIG. 3 of the drawings, the waterproof sheet or layer 22 is composed of a high-strength, close-knit fabric 34 which may be made of filaments including nylon, polypropylene, polyurethane and other comparable high-strength fabrics. These fabrics are very thin and very tough, and may be coated on the inner side, as shown in FIG. 3, by means of a layer of polyurethane or other plastic, including polypropylene or polyethylene, or the like. This coating or layer is designated 36 in FIG. 3 of the drawings, and completely waterproofs the high-strength fabric 34 so that the fabric is extremely strong and tough, as well as being waterproof.

The foam insulation layer 28 is adhered to an inner surface of the coating 36, said inner surface being designated 38 in FIG. 3 of the drawings, and in this manner, the foam layer 28 is contiguous to the waterproof sheet which comprises the high strength fabric 34 and the waterproof coating 36.

In the modification, as shown in FIG. 4, the fly 12 comprises structure, as shown in FIG. 3 of the drawings, which is spaced from a modified tent wall structure designated 40. This wall structure 40 is disposed in the same position as the tent wall structure 14, shown in FIG. 1 of the drawings.

The modified tent wall structure 40, shown in FIG. 4, comprises an inner layer of breathable high-strength nylon, or other comparable fabric designated 42, and this fabric is covered by a layer of aluminum reflective material 44 or any other suitable reflective material which tends to insulate, as well as reflect thermal energy backwardly through the fabric 40 in a direction of an arrow A toward the interior of the tent, as shown in FIG. 4 of the drawings. This aluminized coating 44 is adhered to the fabric 42 and is well known in the art of fabrics for the purpose of coating reflective blankets, or the like.

It will be seen that the tent fly 12, as shown in FIG. 4 of the drawings, is highly insulative thermally it is also waterproof and shields the tent wall 14 which comprises a breathable fabric 42 and a breathable reflective insulation layer 44. Thus, the fly 12 is thermally insulated and waterproof, while the tent wall structure 14 is reflective and breathable. It will be understood by those skilled in the art that the modification, as shown in FIG. 4 of the drawings, is adapted to very lightweight tent construction and is useable for different purposes and uses depending upon tent sizes, as well as environmental conditions of heat, cold and moisture.

This construction, as shown in FIG. 4 of the drawings, is very adaptable to all of the most extreme weather conditions, including very high humidity and tendencies toward extreme dew point conditions, where most tents become very uncomfortable and/or unlivable.

This structure, as shown in FIG. 4, is waterproof, insulative, breathable and thermally reflective to conserve energy inside the tent.

In the modification, as shown in FIG. 5, the outer tent fly 12 is provided with high-strength nylon or other fabric 46 having a coating of reflective material 48 similar to the coating 44, hereinbefore described. This may be an aluminized coating of the well known thermal blanket type, as hereinbefore described.

The tent wall 14, as shown in FIG. 5 of the drawings, comprises a high-strength nylon or other comparable fabric 50 having a layer or coating 52 on the inner surface thereof. This coating may be any suitable flexible plastic, such as polyurethane, or the like, which may be compatible with the fabric 50. This coating 52 renders the fabric 50 waterproof, and secured to and contiguous with an inner side 54 of the coating 52 is an insulation layer 56 of polyurethane foam or other suitable foam material.

In this construction, as shown in FIG. 5 of the drawings, the reflective layer 48 of the fly 12 radiates thermal energy in a direction of an arrow B, as shown in FIG. 5, toward the tent roof or wall 14 so as to conserve thermal energy internally of the tent, and the tent wall 14 being of a construction similar to that shown in FIG. 3 is waterproof and strong, and provided with the foam insulation layer 56 internally thereof to prevent the interior of the tent from reaching a dew point condition.

Tents constructed, as shown in FIGS. 4 and 5 of the drawings, may be of very lightweight, strong, durable structure, and yet be compatible with use in the most extreme environmental conditions of moisture, temperature, wind, etc. and may tend to minimize the requirements for relatively heavy sleeping bags and/or sleeping equipment.

In the modification as shown in FIG. 6 of the drawings, it will be seen that the tent wall 14 or the tent fly 12 may be constructed to include a layer of high-strength fabric 58 similar to that hereinbefore described with a coating or layer 60 on the outer side thereof comprising polyurethane or other sealing material to render the fabric 58 waterproof.

The inner side of the fabric 58 is provided with a contiguous layer 62 of polyurethane or other foamed resin to provide for an insulating layer internally of the tent wall 14, as hereinbefore described.

As shown in FIG. 7, the insulation layer 62 is provided with an inner surface 64. This inner surface 64, as shown in FIG. 7, is provided by slicing the foam 62 so that voids 66 therein are open at the inner side 64 to provide a great aggregate of surface area communicating with the interior of the tent 10. This structure, as shown in FIG. 7 may apply to all of the insulation layers 28, 56 and 62, hereinbefore described, and this great aggregate surface area due to the character of the material from which the foam is made affords a great reflective surface area. All of the foam cells have smooth interiors and tend to reflect thermal energy inwardly toward the interior of the tent. This great reflective surface area is very effective with relation to the reflection of radiant thermal energy. Additionally, this great surface area tends to provide numerous air pockets in the foam which may stabilize humidity in the atmosphere internally of the tent and to assist in the dissipation of moist air with a minimum of ventilation through a vent, such as the vent 32, shown in FIG. 1 of the drawings, while at the same

time, the insulation layer 62 and other comparable layers disclosed herein, afford sufficient thermal insulation to prevent the inner surface 64 and the surfaces 66 of the voids in the foam material from reaching a dew point temperature to thereby prevent the collection or condensation of moisture in the interior of the tent construction of the invention.

It will be understood that all of the fabric and sealed coating structures, as disclosed herein, as for example, the fabric 34 and coating 36 may have a combined thickness ranging between 0.004 and 0.010 inch, yet when such structures are made of nylon, polypropylene, polyethylene, polyurethane, polyvinyl plastic, or other comparable materials, the wall or roof structures of the tent are very strong and yet very light in weight. Additionally, the foam insulation layer 28, 56 or 62 may be of a thickness ranging between one sixty-fourth of an inch to one-eighth of an inch, and accordingly, the overall structure of the tent may be very light, very strong, waterproof, thermally efficient, and highly desirable as a back packer's tent. As for example, such a tent construction may be of a size capable of providing shelter for two men and may weigh less than 3 pounds, and in some instances, a tent of this size may be equipped with thin walled aluminum poles and lightweight aluminum stakes, and yet weight less than 4 pounds. Such a tent used by two persons for back-packing purposes is highly practical, very comfortable, and tends to minimize the requirements for warm sleeping equipment, as compared to that known in the prior art in connection with the use of tents which have normally required a great amount of ventilation to prevent a dew point condition therein.

It will be obvious to those skilled in the art that various modifications may be resorted to without departing from the spirit of the present invention.

We claim:

1. In a tent roof construction the combination of:

- a. a flexible outer waterproof layer, the strength of which provides the mechanical integrity of said roof, and
- b. an inner layer of foamed resilient insulation material carried by said outer layer, said insulation layer having open voids in the inner surface thereof directed inwardly and communicating with the interior of said tent thereby increasing the interior surface area of said tent.