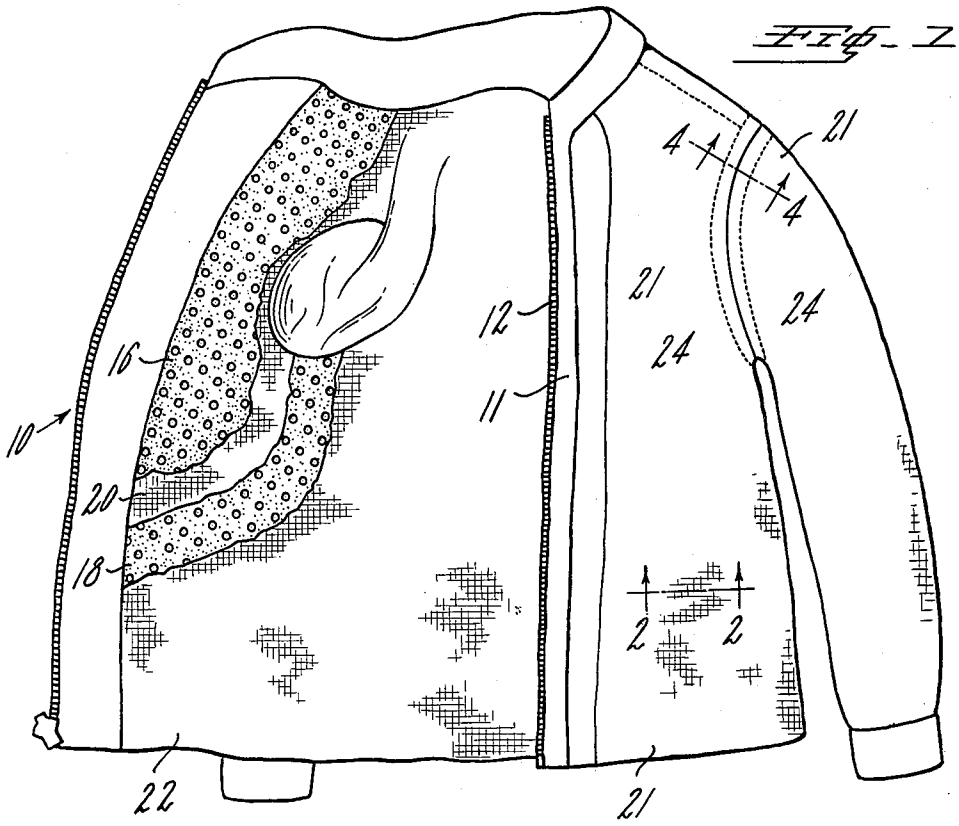
March 28, 1961 N. H. BROWN, JR 2,976,539

COLD WEATHER CLOTHING

Filed Dec. 8, 1953

Fig. 1



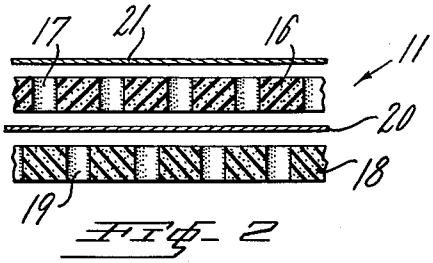


Fig. 2

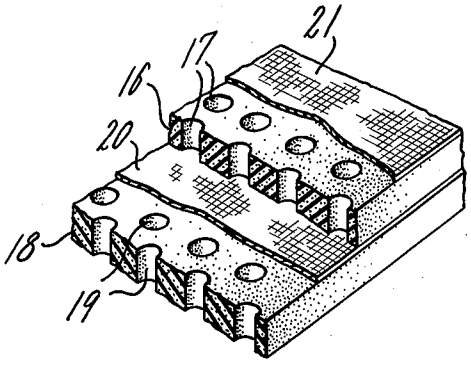


Fig. 3

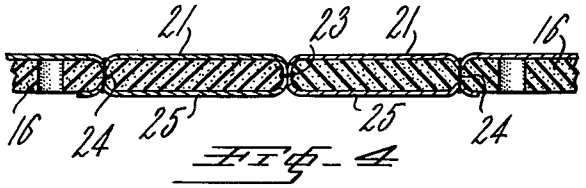


Fig. 4

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COLD WEATHER CLOTHING

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10 Claims. (Cl. 2—2)

This invention relates to a novel form of cold weather clothing.

Heretofore clothing designed to withstand cold weather has been fashioned of a variety of materials and in a variety of structures. Thus cold weather garments have been fashioned of cloth, hide, furs, fur and fleece lined fabrics, etc., in an effort to provide a heat insulating envelope about a wearer's body.

It has been proposed heretofore to make garments of this type from an expanded closed cell cellular material such as cellular rubber and the like because this material provides an excellent heat insulating body for the garment. Garments constructed of these closed cell cellular materials make excellent cold weather clothing because the material is light, it is soft and flexible, and the material forms an excellent thermal insulating layer about the wearer's body. These materials are air and moisture vapor impervious, so that the wind may not penetrate them to cool the wearer's body unduly, and so that liquids inside the garment which are converted into moisture vapor by the heat from the wearer's body cannot escape from the garment to cool the wearer unduly. In fact, garments constructed of these materials provide such excellent thermally insulating garments that they are frequently uncomfortable at moderately cold climates such as 0° F. when the wearer is active.

It is well known that bodily exertion will generate heat and that the body will perspire, so that the evaporation of this perspiration from the body surface may cool the body. When garments heretofore constructed of these closed cell cellular materials were worn during strenuous activity, the atmosphere within these garments soon became saturated with moisture vapor so that evaporation of perspiration would be retarded, and since escape of this atmosphere from the garment was retarded by the impervious nature of the material from which the garment was made, the wearer soon found himself enclosed in a hot, humid and sometimes uncomfortable atmosphere.

It is an object of this invention to provide a cold weather garment which will have good thermally insulating properties so that its wearer will be kept warm at low temperatures and particularly when the wearer is inactive at these low temperatures, yet which garment is so constructed that when its wearer is active the garment may be worn in comfort.

In cold weather clothing in accordance with this invention at least two sheets of heat insulating material, such as expanded closed cell cellular material, are used. Each of these sheets are provided with a multiplicity of openings therethrough. These sheets are assembled in juxtaposition and a garment formed therefrom with the sheets arranged such that the openings through the individual sheets generally are disposed in non-registering relation. Such a garment will permit escape and entrance thereto of air and moisture vapor through the holes in the individual layers along a tortuous path which proceeds through openings in a first layer, then laterally of

the layers between them and finally through openings in the second layer.

A garment constructed in this manner provides a high comfort factor to a wearer both when he is active and when he is inactive. When the wearer is inactive, the several layers lie adjacent each other with the holes in substantially non-registering relation, so that together they provide a thermally insulating layer about the wearer's body within which is trapped an atmosphere that is substantially inhibited from escape from the garment by the layers of material. It is possible for some air, wind and moisture vapor to penetrate this garment through the holes, but the arrangement of these holes is such that this penetration is substantially inhibited. However, when a wearer of the garment is active, his movements cause the two layers to separate and to draw air in through the holes to the space between the layers of material. Upon further movement these layers will be forced together to expel this air from this space either into or out of the garment. In this manner, the garment functions in a manner somewhat akin to that of a bellows to draw air and vapor into and expel it from the garment continuously during movement by its wearer to ventilate the wearer's body and thus to cool him. It is of course essential that the layers be sufficiently free of each other to permit this bellows-like action. The bellows-like function of the garment is not regular but occurs somewhat randomly at various parts of the garment, but since a large surface area of the garment is provided with these holes therethrough, such random function is sufficient to ventilate the garment when its wearer is active. It will thus be seen that a garment constructed in accordance with this invention functions to provide high insulating values when its wearer is colder, i.e., inactive, and to ventilate his body when he is warmer, i.e., active, to provide maximum comfort to its wearer.

The thicknesses of the layers and the number of layers used may be varied as dictated by such factors as thermal insulation, weight, drape, flexibility, etc., desired or needed in the garment. So also the quantity and size of the holes may be varied within limits as will occur to those skilled in the art. However it must be borne in mind that the holes should not be too large else they may provide too much ventilation, and too much surface area of each layer cannot be perforated else much of the insulating properties of the garment will be lost. Preferably however, the openings occupy from 10 to 50% of the surface of the layers. So also manufacturing problems may dictate to some extent the size and spacing of holes. Thus it is believed that in manufacturing these garments it will be found expedient to perforate the sheets and then to place them together randomly with little or no care being taken to assure that the holes in each of the sheets do not substantially coincide. When the garments are manufactured in this manner, if the holes are not too numerous they may be thus assembled with a relatively minor and insignificant proportion of the holes coinciding in the two layers.

Bearing in mind these considerations, I have found that a satisfactory garment for climates of 0° F., or thereabouts, can be fashioned of two ⅛" thick layers of expanded closed cell cellular material. These layers were each perforated with ⅛" diameter holes which were evenly spaced about the surface of each layer to occupy 30% of its surface area. The holes preferably are uniformly spaced about the surface of the layers, but it will be appreciated that they need not necessarily be so spaced. Preferably the entire surface area of the layers in the garment is provided with these holes, but it will be appreciated that for some garments in some applications only selected portions of the surface area may be provided with these openings to ventilate the garment properly.

Although in such a garment there is no very rigid control over the manner in which air is introduced to or exhausted from the garment from the bellows action, this is relatively immaterial, for if air is exhausted through the openings from the garment other air will be introduced through other openings in the garment to ventilate it.

Expanded closed cell cellular rubbers and rubber-like materials are suitable for the perforated layers forming the garment of this invention. Such materials are well known in the rubber industry. However, it is preferred to form the layers of a closed cell cellular rubber-like material comprising plasticized polyvinyl chloride such as that made in accordance with the U.S. Patent No. 2,570,182, for it provides an excellent thermal insulator, it can be made in densities as low as 4 to 5 pounds per cubic foot, it does not absorb and retain moisture, and is soft and flexible, hence is excellently well suited for garments of this type. An incidental advantage of this material for garments is that the closed cell cellular material will float in water because of the myriad gas entrapping cells therein, and this material is sufficiently buoyant so that a garment formed thereof will maintain its wearer afloat when he is immersed in water, so that the garment also provides a life saving jacket.

Although it is preferred to make the garment of just two layers of material, it will be evident that the number of layers may be increased if desired in certain applications. In addition to the two layers of heat insulating material, it is preferred to construct the garment with a layer of fabric or the like sandwiched between these layers. This layer of fabric will permit the passage of air and moisture vapor therethrough, and it will serve the important function of separating the layers of heat insulating material so that these two layers will not tend to stick together where they are adjacent each other, as may otherwise occur when such fabric is not interposed. Such sticking may occur either through the inherent nature of the materials, or it may be caused by moisture or other foreign substances which are admitted between the layers to cause them to tend to adhere to each other. It is further preferred to construct the garment with a layer of fabric or the like about the outside of these insulating layers. This outer fabric layer similarly will permit the passage of air and moisture vapor, but it will serve as a protective coating for the cellular material and will therefore protect this relatively soft cellular material from tearing, snagging and the like. Furthermore, this outer fabric layer will tend to reduce the velocity of wind which impinges upon the garment by scattering, in effect, the air which strikes this cloth so that the wind may not blow through the openings and into the garment. The layers of heat insulating material, because of the staggered relation of the openings in each layer, also serve to scatter the air as does the intermediate layer of fabric or the like, so that air at high velocity cannot penetrate the garment.

For a better understanding of the nature of this invention, reference should be had to the following detailed description of one specific embodiment thereof when read in conjunction with the accompanying drawing, wherein:

Fig. 1 is an elevational view partly broken away of a jacket embodying this invention;

Fig. 2 is a sectional view substantially along the line 2—2 of Fig. 1;

Fig. 3 is a perspective view partly broken away of the materials forming the garment of this invention showing the disposition of the layers of perforated material and the fabrics therein, and

Fig. 4 is a view substantially along the line 4—4 of Fig. 1 showing a seam which may be used to join the parts of the garment.

Referring now to the drawings, there is shown a garment 10 constructed to cover the upper part of the torso and the arms. Although a jacket is shown, the invention may be embodied in coats, trousers, underwear, etc.

This garment 10 may be worn either in the form of an outer jacket, or it may be worn as underwear as desired. As shown, this jacket is formed of heat insulating material 11 and is provided with a zipper 12 arranged in the customary manner to close the garment. Preferably a collar 13 is provided for the garment which may be arranged to embrace the neck of the wearer snugly. So also the sleeves 14 may be provided with a wrist closure which is adapted to embrace the wrist of the wearer snugly so that the garment when closed may be arranged to prevent substantially escape of the atmosphere trapped within the garment. The garment is constructed such that it embraces the wearer's body loosely to provide a heat insulating atmosphere between the garment and the wearer's body that may be trapped therein by closing the garment snugly about the wearer's body. A drawstring or belt may be provided about the waist of the garment so that the waist may be drawn snugly about the wearer's waist if desired.

Referring next to Figs. 2 and 3 there is shown in detail the heat insulating material 11 used to construct a garment in accordance with this invention. As there shown, this material comprises a sheet 16 of expanded closed cell cellular material which has a multiplicity of openings 17 extending therethrough. Preferably, the material 16 is an expanded closed cell cellular material comprising plasticized polyvinyl chloride made in accordance with the method of the above identified patent. As pointed out heretofore, these holes 17 in one embodiment have a diameter of approximately ⅛ inch, and are uniformly spaced about the surface of the sheet 16 so that they occupy approximately 30% of the surface area of the sheet 16. In juxtaposition with the sheet 16 is a second sheet of this material 18 having similar holes 19 therethrough which are similarly spaced over the surface of the sheet 18. As shown, the sheets 16 and 18 are arranged so that the holes 17 and 19 therethrough are in substantially non-registering relation. As heretofore pointed out the sheets 16 and 17 may for most applications be placed together randomly in constructing the garment, and most of the holes 17, 19 will not be in registering relation.

A fabric 20 is disposed between the sheets 16 and 18 to prevent the sheets from sticking together as heretofore described. A second fabric 21 is provided for the outside of the garment to provide a protective layer for the outer layer 16 of expanded closed cell cellular material. Any suitable materials may be substituted for the fabrics 20, 21 although it is thought that fabrics will generally be preferred for these materials. Thus, for example the fabric 20 may be replaced by an air and moisture vapor permeable sheeting such as polyvinyl alcohol, or by a perforated film, etc., if desired. If desired, the garment may be finished by providing an inner lining 22 as shown in Fig. 1 therefor.

When a garment is thus constructed, there will be provided a heat insulating vapor barrier about the wearer's body which will substantially maintain an atmosphere trapped within the garment and adjacent the wearer's body. This atmosphere will soon be warmed by heat given up from the wearer's body and since the atmosphere can be substantially retained within the garment, the wearer will remain warm with little further loss of body heat. However, when the wearer is active and further heat is given off by his body, air or moisture vapor will be drawn through the holes 17 and 19 as the layers 16 and 18 are separated by the flexing of the garment in much the same manner that air is drawn into a bellows. When the garment is next flexed to force the sheets 16 and 18 together as will occur during normal body movement, the air trapped between them will be exhausted through either the holes 17 or 19 to ventilate the space within the garment and thus to carry off excess heat which may be trapped therein to thereby cool the wearer. In this manner, means are provided for

ventilating the garment by the natural movements of its wearer, yet the garment still provides a thermally insulating jacket about the wearer's body. In order to provide this action, it is only necessary for the layers **16** and **18** to be substantially free of each other throughout most of their surface. This may be provided by forming the layers **16** and **18** in relatively large sheets which are joined together at the usual bindings of the garment such as its edges, a side seam, etc.

Referring next to Figs. 1 and 4, there is shown a seam which is especially adapted for joining adjacent sheets of the heat insulating material such as adjacent sheets **16** of the expanded closed cell cellular material. This material **16** generally will not withstand strains exerted thereon very well, and accordingly means are provided to relieve these materials of strains. The material is such that sheets thereof may not be stitched together to provide a strong seam, and it is difficult to cement adjacent slabs of this material together. Accordingly, the seam shown in Fig. 4 is preferably used. In this seam the fabric such as the outer fabric **21** used in the garment is folded down over the edge of the material so that an edge **25** of the fabric **21** extends on the other side of sheet **16** adjacent its edge for a short distance. The fabric **21** used with the other sheet **16** is similarly disposed over the edge of the sheet. These folded over portions of the two fabrics **21** are then joined by stitching a seam **23** through them. Thereafter, a further seam **24** is stitched through each outer fabric **21**, the sheet **16**, and the folded over edge **25** of the fabric **21** to join this edge **25** and the outer fabric **21** through the expanded closed cell cellular material **16**. In this manner, the two sheets of material **16** are held together by the stitches **23** and by the stitches **24**. The sheets **16** are held in place adjacent the fabric **21** by the stitches **24**, which are anchored on both sides of each sheet **16** in the fabric **21**, and any tensional strain exerted on the garment will be absorbed by the fabric **21** and the stitching **23**. By folding over the edge **25**, means are provided on both sides of the sheet **16** which will take and hold a stitch. Similarly, the sheets **18** may be stitched to the fabric **20**.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. Cold weather clothing, comprising a plurality of layers of expanded closed cell cellular plasticized polyvinyl chloride, each of said layers having a plurality of uniformly spaced openings therethrough, said layers having their surfaces adjacent each other and disposed with the openings in adjacent layers substantially in non-registering relation, a fabric sandwiched between adjacent layers of said material, and an outer wear-resistant material adjacent the outermost of said layers.

2. Cold weather clothing, comprising two layers of expanded closed cell cellular material secured together near their marginal edges only, each of said layers having a plurality of uniformly spaced openings therethrough, said layers having their surfaces adjacent each other and disposed with the openings in the two layers in substantially non-registering relation, and a fabric sandwiched between these layers.

3. Cold weather clothing, comprising a plurality of layers of expanded closed cell cellular material secured together near their marginal edges only, each of said layers having a plurality of uniformly spaced openings therethrough, said layers having their surfaces adjacent each other and disposed with the openings in adjacent layers in substantially non-registering relation, the openings through said layers occupying from 10 to 50% of the surface area of said layers, and a fabric sandwiched between adjacent layers of said material.

4. Clothing in accordance with claim 3 wherein said layers comprise expanded closed cell cellular plasticized polyvinyl chloride.

5. Cold weather clothing comprising a plurality of layers of expanded closed cell cellular plasticized polyvinyl chloride, each of said layers having a plurality of uniformly spaced openings therethrough, said openings occupying from 10 to 50% of the surface area of each of said layers, said layers having their surfaces adjacent each other and disposed with the openings in adjacent layers in substantially non-registering relation, a fabric sandwiched between adjacent layers of said material, and a wear-resistant fabric adjacent the outermost of said layers to protect said outermost layer.

6. Clothing in accordance with claim 5 which comprises two layers of expanded closed cell cellular plasticized polyvinyl chloride.

7. Cold weather clothing, comprising a garment formed of two layers of expanded closed cell cellular plasticized polyvinyl chloride, each of said layers having a plurality of uniformly spaced openings therethrough having a diameter of about one-eighth of an inch, said openings occupying about 30% of the surface area of each of said layers in the areas where said openings occur, said layers having their surfaces adjacent each other and disposed with the openings in the layers in substantially non-registering relation, a fabric sandwiched between the layers of said material, and an outer wear-resistant fabric over the outer layer of said material.

8. A cold weather garment having heat insulating properties which vary in proportion to variations in the degree of movement by the wearer, comprising at least two loosely superposed relatively thick layers of flexible liquid-impermeable and gas-impermeable cellular sheet material, each of said layers having a multiplicity of small apertures extending transversely therethrough in spaced relation over at least a larger portion of its area, thin flexible porous sheets of woven fabric arranged between and adjacent to the outer sides of said layers in loosely superposed relation thereto and substantially coextensive therewith, and means for securing said layers and sheets together near their marginal edges only, whereby said layers and sheets may move relative to each other during activity by the wearer of the garment and pump air through said apertures towards as well as away from the body of the wearer, while impeding passage of cold outside air through said layers to the body of the wearer when inactive.

9. A cold weather garment having heat insulating properties which vary in proportion to variations in the degree of movement by the wearer, comprising a pair of loosely superposed relatively thick layers of flexible liquid-impermeable and gas-impermeable cellular sheet material, each of said layers having a multiplicity of small apertures extending transversely therethrough in spaced relation over at least a larger portion of its area, said apertures of said layers being normally substantially out of registration when said layers are arranged generally flat and relatively stationary, an envelope of thin flexible porous woven fabric sheet material substantially enclosing said layers, and means for securing said layers and envelope together near their marginal edges only, whereby said layers may move relative to each other during activity by the wearer of the garment and pump air through said apertures towards as well as away from the body of the wearer, while impeding passage of cold outside air through said layers to the body of the wearer when inactive.

10. A cold weather garment having heat insulating properties which vary in proportion to variations in the degree of movement by the wearer, comprisng a pair of loosely superposed relatively thick layers of flexible liquid-impermeable and gas-impermeable cellular sheet material, each of said layers having a multiplicity of small apertures extending transversely therethrough in spaced relation over at least a larger portion of its area, said apertures of said layers being normally substantially out of registration when said layers are arranged generally flat and relatively stationary, thin flexible porous sheets of woven fabric arranged between and adjacent to the outer

sides of said layers in loosely superposed relation thereto and substantially coextensive therewith, and means for securing said layers and sheets together near their marginal edges only, whereby said layers and sheets may move relative to each other during activity by the wearer of the garment and pump air through said apertures towards as well as away from the body of the wearer, while impeding passage of cold outside air through said layers to the body of the wearer when inactive.

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