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D. M. BASHORE ET AL

2,897,508

COLD WEATHER GARMENTS

Filed April 11, 1952

2 Sheets-Sheet 1

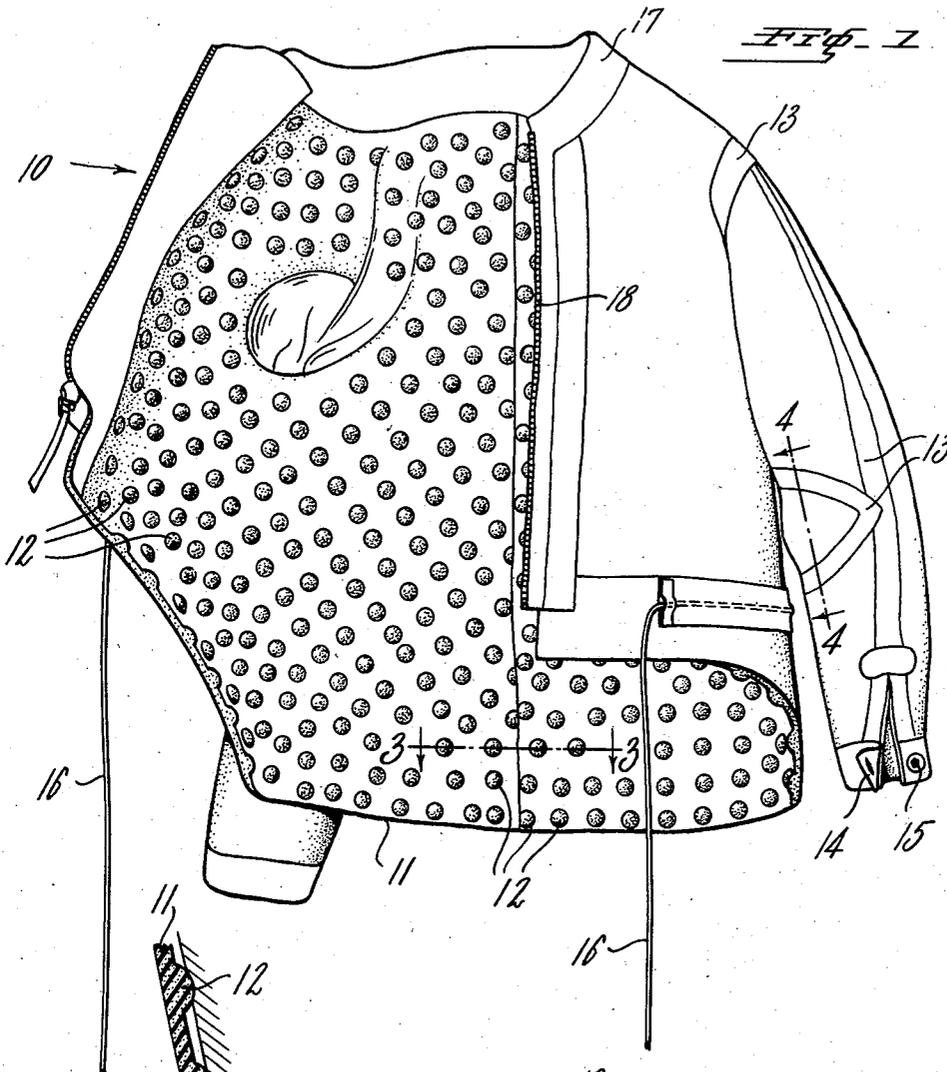


Fig. 1

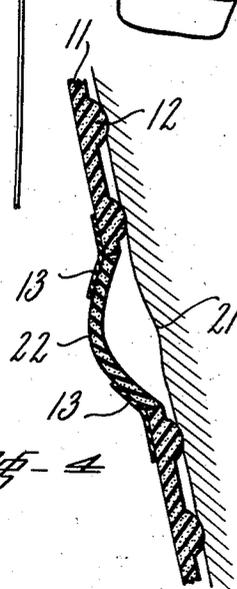


Fig. 4

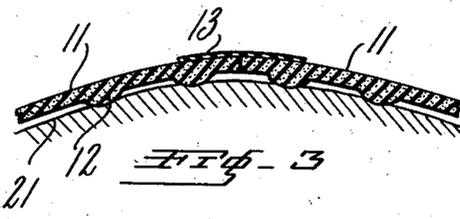


Fig. 3

INVENTORS
NUEBERNE H. BROWN, Jr.
DON M. BASHORE

BY
Charles C. Wilson

ATTORNEY

Aug. 4, 1959

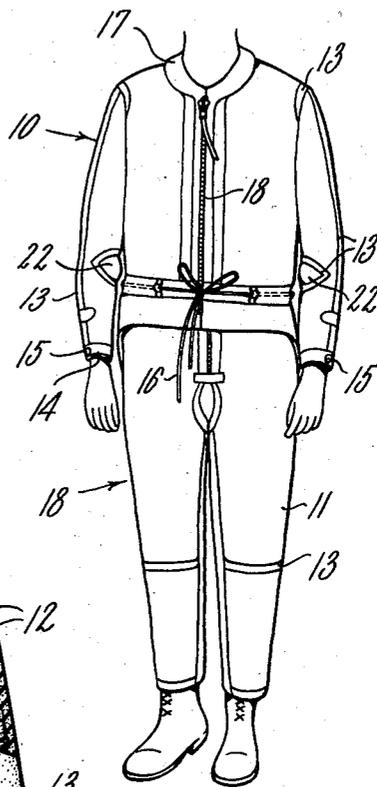
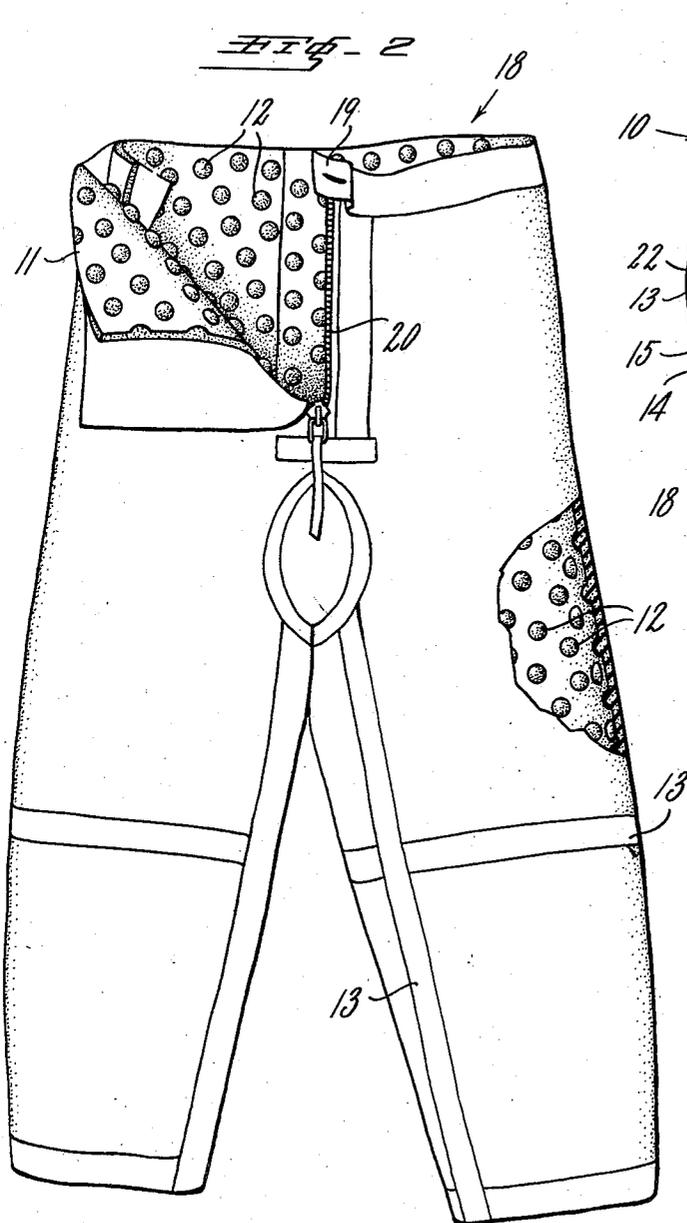
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2 Sheets-Sheet 2



INVENTORS
NUEBERNE H. BROWN, JR.
DON M. BASHORE

BY

Charles C. Willson

ATTORNEY

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2,897,508

COLD WEATHER GARMENTS

Don M. Bashore, Severna Park, Md., and Nueberne H. Brown, Jr., South Bend, Ind., assignors to United States Rubber Company, New York, N.Y., a corporation of New Jersey

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1 Claim. (Cl. 2—93)

This invention relates to cold weather garments and in particular to garments which are constructed so as to provide a thermally insulating atmosphere within the garment and surrounding the wearer's body which will retain within the garment the heat given up by the wearer's body.

Heretofore winter garments have been designed and constructed in a variety of ways in an effort to provide garments which will maintain a wearer warm under various climatic conditions. Generally cold weather clothing has been made of textile fabrics which are constructed in a manner to entrap layers of dead air within the garments about the wearer's body and thus to retain the body heat. These garments are satisfactory for moderately cold climates but they do not retain sufficiently the body heat in extremely cold climates. Consequently for these climates, garments using various special materials or constructions have been made in an effort to retain better the body heat or to supply the body with heat from an outside source. These garments are generally cumbersome and not entirely satisfactory heat insulators, and they are expensive to construct.

It is an object of this invention to provide improved cold weather clothing of the type which is designed to retain the body heat within the clothing.

A more specific object is to provide a cold weather garment constructed of a heat insulating material that is relatively impervious to moisture vapor and which is provided with means to maintain the garment spaced from the wearer's body to provide a thermally insulating atmosphere within the garment. A further object is to form a cold weather garment designed to be worn next to the skin which is formed of an expanded cellular material which has substantially a closed-cell construction, and which is provided with a multiplicity of spaced knobs or buttons on the inner surface of the garment adapted to bear against the skin of the wearer and to maintain the garment spaced from his body, so that a thermally insulating stratum is established between the garment and the wearer.

Still a further object of this invention is to provide a cold weather garment constructed of a closed-cell cellular material which has a plurality of spaced projections on its inner surface and which is provided with means operable to release from the garment selectively the atmosphere that is created between the wearer and the garment by the projections.

In cold weather clothing according to this invention, a garment is made of a light weight heat insulating material which is relatively impervious to moisture vapor. This garment is provided on its inner surface with a multiplicity of buttons or knobs which serve to space the garment from the wearer's body, and it is fitted to the body in such a manner that the portions thereof which define openings for body members, such as the neck and arm openings of a jacket, may be adjusted to embrace these members snugly. When a garment having this construction is donned, the buttons or knobs will bear against

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the body of the wearer to maintain the body of the garment spaced from the wearer, and thus provide a dead thermally insulating atmosphere which may be trapped within the garment and about the wearer's body.

An important characteristic of this invention resides in constructing the garment substantially of a material which is relatively impervious to moisture vapor. It is contemplated that such a garment will ordinarily be worn next to the skin, and that the thermally insulating atmosphere will be trapped between the wearer's skin and the garment. When the skin becomes moist from perspiration or from water entering the garment through an opening therein, the heat from the body is used to vaporize this moisture. As is well known, great amounts of heat are required to vaporize moisture. If the moisture vapors thus formed were permitted to escape freely from the garment, as is the case in garments formed of ordinary materials, the body temperature would be lowered rapidly as the cycle of deposition of water on the skin, vaporization of this water and escape of the moisture vapor from the garment continued. Inasmuch as the material forming the garment according to this invention is relatively impervious to moisture vapor, the garment forms a vapor barrier about the body. Within such a barrier, with respect to the moisture in the atmosphere an equilibrium condition is obtained between the body and the surrounding atmosphere, in which the excess moisture in the atmosphere is absorbed by the body through the pores of the skin and passed off through the lungs without excessively cooling the body. Accordingly in the garment of this invention, a thermally insulating atmosphere is established about the body within a vapor barrier to provide maximum heat insulation in the garment. The multiplicity of buttons or knobs on the garment permit a small loss of heat by direct conduction from the wearer through the garment, but since the garment is formed of a material which is a good thermal insulator and since the buttons have a relatively small body contacting surface, the heat lost in this way is relatively insignificant.

Inasmuch as a garment formed according to this invention is such an excellent heat insulator, it is found frequently that if a garment is formed so that the thermally insulating atmosphere is entirely retained within the garment, the wearer becomes uncomfortably warm in moderately cold climates. Whether such a garment would become too warm in any particular situation would depend upon a variety of factors in addition to the ambient temperature, but at temperatures in the range of 0° to -20° F. garments which are constructed completely of a closed-cell material are found frequently to be uncomfortably warm during normal activity. Consequently for these climates, or for any other occasion when the garment is found to be uncomfortably warm, means are provided in the garment to permit escape of the thermally insulating atmosphere from the garment. This atmosphere is retained in the garment more or less completely depending upon the snugness with which the garment openings fit the body members, hence the wearer may cool himself by adjusting the body openings to permit a portion of the thermally insulating atmosphere to escape in a manner akin to that in which smoke is carried off by a chimney. When this is done, a portion of the moisture vapor in the atmosphere escapes and additional body heat is required to vaporize moisture on the skin.

Since the spaced knobs or buttons contact the wearer's skin in ordinary usage, and since heat can be lost by conduction from the trapped atmosphere through the garment, to achieve maximum heat insulation the material forming the garment of this invention preferably is not only impervious to moisture vapor, but also is a good

insulator. Further to allow the wearer the greatest freedom of activity, the material should be sufficiently flexible and light enough to be worn when the wearer is active without unduly fatiguing him or hampering his activities. An expanded closed-cell cellular rubber-like material possesses these characteristics to a marked degree, and hence it is admirably suited to form the cold weather clothing according to this invention. Many types of these closed-cell cellular materials, which comprise a layer of material having a multiplicity of tiny closed gas entrapping cells, are well known in the rubber industry. These materials generally would be satisfactory for the garment according to this invention, and preferably the garment would be made of such materials having a density of less than 10 pounds per cubic foot. Although many of these closed-cell cellular materials would be suitable for the garment of this invention, 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, is especially desirable, for it can be made in densities as low as 4 to 5 pounds per cubic foot, and it is an excellent thermal insulator.

Although a garment formed completely of a closed-cell cellular material would have better insulating qualities than one having some open cells, as is pointed out above there are certain climates in which such a garment may be too warm. For these climates, the garment could be provided with holes through the garment, or with some open cells in the cellular material which would permit the escape at a limited rate of the atmosphere trapped within the garment. Thus a garment of material which is made having substantially a closed-cell cellular construction but which has a small percentage of open cells would provide a satisfactory cold weather garment for moderate climates. Consequently according to this invention, by a suitable selection of the ratio of closed to open cells in the cellular material, garments may be constructed to meet the needs of the wearer under various climatic conditions.

A garment according to this invention formed of a closed-cell cellular material possesses further advantages in that it would be buoyed up in water by the mass of gas trapped in the closed cells. Such a garment possesses sufficient buoyancy to maintain its wearer afloat when he is immersed in water, and thus it would act as an efficient life jacket.

For a better understanding of these and additional characteristics and advantages of cold weather clothing according to this invention, reference should be had to the following description and the accompanying drawings, wherein:

Fig. 1 is a perspective view of a jacket embodying this invention;

Fig. 2 is a perspective view partly broken away of trousers embodying this invention;

Fig. 3 is a sectional view along the lines 3—3 of Fig. 1 showing the manner in which two pieces of insulating material are joined in the completed garment;

Fig. 4 is a sectional view along the lines 4—4 of Fig. 1 showing a manner in which a garment constructed according to this invention may be made more flexible in the regions where they will receive the greatest flexing wearer; and

Fig. 5 is a view showing the disposition of the garments when they are donned.

Referring now to the drawings and in particular to Fig. 1, there is shown a jacket 10 constructed according to this invention of sheets 11 of an expanded closed-cell cellular material such as that disclosed in the above mentioned patent. These sheets 11 have disposed about the inner surface thereof a multiplicity of projecting knobs or buttons 12 which are shown here as molded integral with the sheets 11. These sheets 11 are formed into the jacket 10 by cutting the sheets to size and joining these sheets by means of taped butt joints as illustrated in Fig.

3. As shown in this latter figure, two sheets 11 are placed in abutting relationship and a tape 13 is placed along the outside of the seam to hold the sheets in juxtaposition.

To entrap a thermally insulating atmosphere within the garment, it is provided with means to permit openings in the garment to be closed tightly about the wearer's body. Thus the sleeves of the jacket 10 are provided with the flaps 14 and buttons 15, and the waist is provided with the draw string 16. These means may be used in an obvious manner to tighten the garment about the wearer's body to prevent the escape of the atmosphere which is provided by the buttons 12 between the wearer and the garment from the garment through these openings. The jacket collar has a smooth strip 17 of cellular material which is constructed so that it will embrace the wearer's neck snugly as shown in Fig. 5 when the zipper 18 is closed. Thus it will be seen that when the jacket 10 is donned, the buttons 12 will space the body of the jacket from the wearer, and the jacket is constructed so that the atmosphere which is thus formed within the garment and about the wearer's body may be retained within the garment. As pointed out above, should the garment become uncomfortably warm, the openings therein, such as the waist and neck openings, may be adjusted to permit the escape of the entrapped atmosphere and the cooling of the wearer which results from such ventilation.

Referring now to Fig. 2, there is shown a pair of trousers 18 embodying this invention which is constructed in substantially the same manner as the jacket 10. The trousers are provided with a flap 19 and a button (not shown) to tighten the trousers about the wearer's waist when the zipper 20 is closed. The trouser legs may be provided with separate means to tighten them about the wearer's ankles, or they may be free as shown in the drawing in which case they may be placed in the wearer's boots as shown in Fig. 5. The trousers provide a thermally insulating layer about the wearer's body in the same manner as the jacket, and they may be vented similarly to cool the wearer.

Referring now to Fig. 4, there is shown a construction by which the portions of a garment which are subjected to repeated flexing such as the inside of the elbow or the arm pit may be made more pliable than the remainder of the garment. As shown this construction provides an intermediate strip 22 of material which is thinner than the sheets 11 and which is free of the buttons 12. These strips 22 are fastened to the sheets 11 by means of tape 13 in the same manner that two of the sheets 11 are joined.

Although the projections 12 are shown as molded integrally with the sheets 11, it will be appreciated that this is merely the most convenient way of forming these projections. Thus the means for spacing the sheets 11 need not take the form shown, but may take any suitable form so long as the means maintains the garment spaced from the wearer to provide the thermally insulating atmosphere within the garment. Thus for example, separate knobs or ridges of suitable material may be fastened to the sheets 11 and any suitable manner such as by gluing or sewing.

Although the precise thickness of the sheets 11 and the height of the projections 12 are not critical, the sheets 11 should be thick enough to provide adequate heat insulation, and the projections 12 must be of substantial height to provide an atmosphere of substantial depth between the wearer and the garment as shown in Figs. 3 and 4. Further these means to space the garment should be disposed in such a manner that an atmosphere of substantial depth is maintained entirely surrounding the portion of the body enclosed in the garment.

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

A thermally insulating garment having a body cover-

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ing portion and a limb covering portion including a joint covering portion, comprising flexible liquid-impermeable and gas-impermeable sheet material conforming to the shape of said body and limb, said material having in its interior a multitude of cells not in communication with each other, and integral with said sheet material a large number of spaced substantially regularly arranged and substantially uniformly shaped blunt low projections on the inner surface of the sheet and adapted to face said body and limb except at the areas adjacent the regions of said body and limb where bending of a joint occurs, said sheet material being adapted to be spaced from said body and limb by said projections, and said garment being supple and smooth-surfaced at the area adjacent the regions of said body and limb covering

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portions where bending of a joint occurs; whereby said body and limb may be thermally insulated from inclement ambient temperatures, whereby circulation of air of substantially body temperature may be afforded on the surface region of said body and limb, and whereby mobility of the joint may be unimpaired.

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