March 19, 1963 D. M. CLARK 3,081,459

PRESSURE SUIT

Filed Jan. 14, 1958

FIG. 1

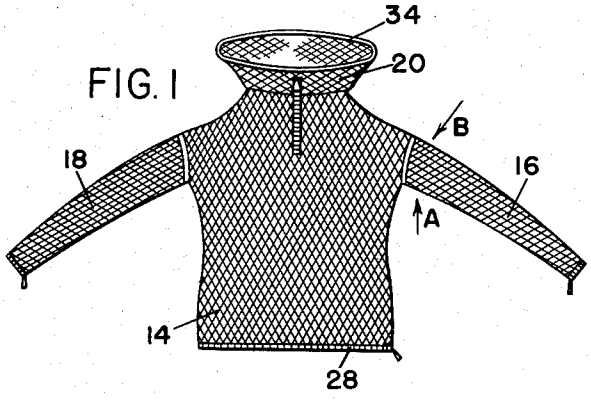


FIG. 3

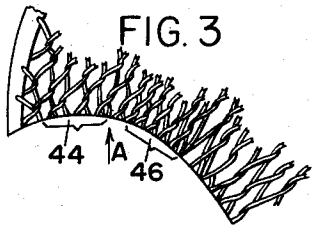


FIG. 2

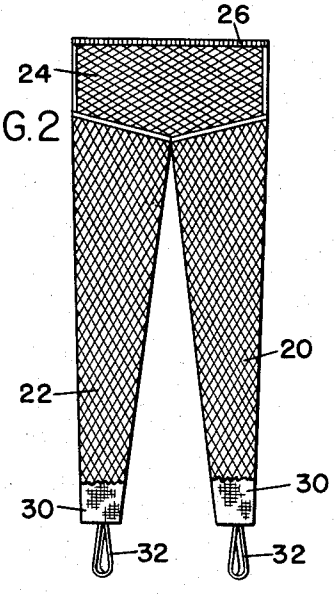


FIG. 5

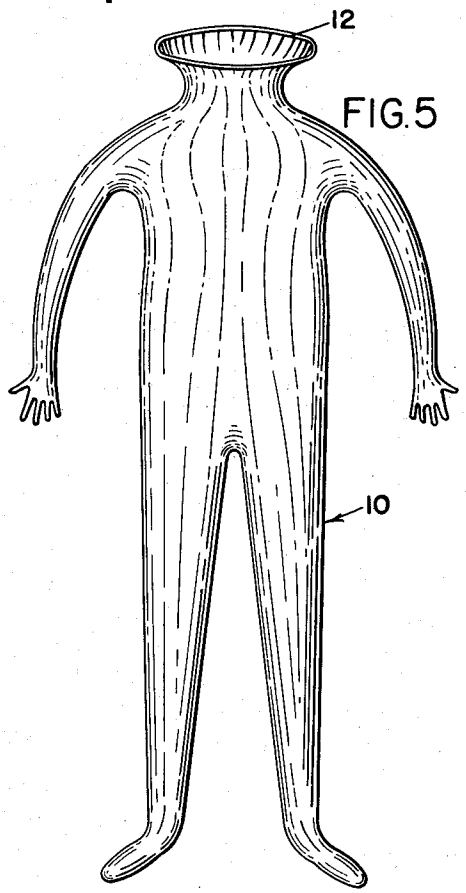
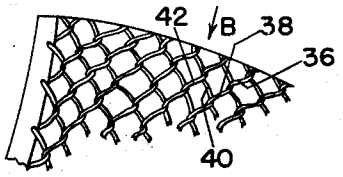


FIG. 4



INVENTOR
DAVID M. CLARK
by Charles R. Fay,

ATTORNEY

United States Patent Office 3,081,459 Patented Mar. 19, 1963

3,081,459

PRESSURE SUIT

David M. Clark, Worcester, Mass., assignor to David Clark Company Incorporated, Worcester, Mass., a corporation of Massachusetts

Filed Jan. 14, 1958, Ser. No. 708,863
7 Claims. (Cl. 2—2.1)

This invention relates to a new and improved pressure suit, and the primary object of the invention is to provide a new pressure suit which is constructed in a novel manner whereby the user is enabled to move his limbs while encased in the suit and with internal pressure applied in the use of the suit, as distinct from prior art devices which require the use of special mechanical joints, etc. in order to enable one portion of a pressure suit to move relative to another portion thereof when under pressure.

A further object of the invention resides in the provision of a pressure suit comprising two distinct and separate layers, one of which is an interior inflatable bladder substantially covering the body and containing the gases providing external pressure on the body of the wearer in order to equalize the low atmospheric external pressure; and an outer bladder covering member or members including a special new and improved net fabric which contains the bladder throughout and prevents the same from bulging outwardly under the pressure therein, while at the same time providing for relative motion of the limbs and other parts of the high pressure suit under influence of the wearer thereof, this beneficial and novel effect being obtained by reason of the combination layered garment, i.e. the bladder and the outside covering special net material.

A further object of the invention resides in the provision of the new and improved net fabric above mentioned, said net fabric being comprised of a series of more or less generally parallel filaments which are interlooped or linked in order to form a mesh or net, the individual filaments of which are not tied or secured together in any way at the loops, and therefore the filaments are able to slide with reference to each other, depending upon the demand of the particular situation where the wearer attempts to move his limbs; and the provision of a net as above stated which is very loosely woven and which the interstices vary in size according to the variation of slippage of the individual filaments upon each other as required during the motion of the limbs of the wearer of the suit.

Other objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings, in which:

FIG. 1 is a view in elevation illustrating a portion of the exterior net member of the suit;

FIG. 2 is a view similar to FIG. 1 but showing the set of a different part of the suit;

FIG. 3 is an enlarged view illustrating the net in the area of a portion of the suit which is required to be moved under influence of the wearer and illustrating the action of the filaments of the net;

FIG. 4 is a view similar to FIG. 3 but taken at a different portion of the suit; and

FIG. 5 is a view in elevation illustrating the bladder which underlies the net.

An instance of use for the present invention resides in pressure suits or partial pressure suits used in rarified atmospheres to apply normal external pressure to a human body to prevent explosion of the tissues due to the low atmospheric pressure. Pressure and partial pressure suits are well known and have been in use heretofore, but one disadvantage thereof resides in the fact that when the suits are pressurized, the fabrics of which they are made become rigid and it is impossible for the wearer to turn his head or move a limb, or even a hand or foot, and therefore in the prior art special means have had to be provided forming joints at specific locations in the suits as at the neck, shoulder, elbow, wrist, knee, etc.

Conventional fabrics become rigid when inflated and if rubber sheeting is used thin enough to provide any degree of flexibility under pressure, then the rubber is not strong enough to withhold the pressure and will bulge outwardly to a degree making the suit impractical.

The present invention provides a pressure suit which includes primarily two parts. One part is a rubber bladder generally indicated at **10** and this is adapted to surround the entire body of the wearer including the arms, body and legs, and even where desired the hands or feet. Such a bladder may be made in many different ways and it may be provided with different means for entry of the wearer thereinto as for instance by slide fasteners which are provided with hermetical seals, etc., all as well known in the art. In the present instance, however, the bladder **10** is shown as being provided with a ring **12** which is adapted to be secured to the usual seal or to the rigid helment attaching ring, so that the head of the wearer is located in the usual helmet which is hermetically sealed at ring **12**.

Therefore, by pumping up the rubber bladder, the entire body of the wearer becomes pressurized; the body except for the head, being in the area of the bladder, and the head being contained in the rigid helmet, of conventional design.

However, in order to apply sufficient pressure to the body, the rubber bladder becomes extremely extended and bulges out to such a degree as to be impractical in use. At the same time, if the rubber be made stiff enough to prevent bulging, then it becomes rigid in the same manner that a conventional woven fabric becomes rigid under pressure, and thus prevents movement of the limbs.

As shown in FIGS. 1 and 2, there is provided an outer garment which covers the entire bladder with the possible exception of the hands and feet, it being noted that ordinarily the hands and feet are encased in gloves and boots which may provide their own pressure. However, in any event, as shown in FIG. 1, there is formed a tubular net body member **14** having applied thereto tubular net sleeve members **16** and **18** and a neck **20**. This garment may also be provided with conventional slide fasteners for the entrance of the wearer thereinto. The body and sleeves may be tapered or tailored as desired.

A trouser-like member is illustrated in FIG. 2 including the tubular net legs **20** and **22** and a connecting tubular net body portion**24** having a detachable slide fastener as at **26** for securement to a matching member at **28**. The two members as shown in FIGS. 1 and 2 cover the entire body but as shown are normally provided without heads or feet and these may assume any construction desired, it being noted that the boots of the wearer may be applied over the normal woven fabric cuff members **30**, **30** at the lower ends of the legs and the straps **32**, **32** may be utilized for the feet in order to hold the woven net outer garment in position relative thereto.

The neck portion **20** is also provided with a ring at **34** which attaches to the helmet ring or to the ring **12** if desired as above described, so that substantially the entire body of the wearer is encased not only in the bladder but in the woven net material, with the exception of the head which is located in the rigid helmet.

The net material which goes to make up the garment illustrated in FIGS. 1 and 2 is made according to my invention as illustrated in my copending application Serial No. 639,550, filed February 11, 1957, now abandoned. This fabric comprises a series of filaments **36**, **38**, **40**, **42**, etc. which are generally parallel but are at spaced in-

tervals looped over each other loosely without being tied, to form a "link" type of fabric similar to a woven wire fence but with the differences that the filaments in the present case are freely flexible and preferably made of a material of low coefficient of friction such as nylon, so that when the fabric is twisted or distorted in any way, the individual filaments will slide upon and relative to each other. This is more clearly illustrated in FIG. 3 where it is shown with relation to areas **44** and **46** how the interstices of the novel net fabric vary to a great extent as provided by the slipping or sliding of the individual filaments relative to each other, in order to provide a conformance of the combined bladder and net garment to the desired motions of the wearer; and it is to be clearly understood that such motion of the parts would not be possible if the filaments were tied together or connected in any way in the manner of a conventional fabric.

The novel fabric can be stretched laterally and longitudinally and on the bias, and it may be twisted and distorted in any direction as also distinct from conventional fabrics. It has a dual purpose as pointed out in the application above identified and this is that it operates to allow the limbs of the user of the pressure suit to move more or less in a normal manner, although under some restraint; and at the same time the net provides a means for adequately restraining the thin bladder material under inflation and prevent the same from blowing or bulging outwardly.

The character A and its accompanying arrow indicate the net at the arm-pit, and FIG. 3 illustrates the extreme accommodation of the net to circumstance of strain, twist, and body motion; and the character B and its arrow indicate the shoulder portion of the net in the sleeve, showing the net in stretched condition. The body parts **14** and **24** and legs or trouser parts **20** and **22** are of course of the same type of weave.

I claim:

1. A garment adapted for use in low pressure atmospheres comprising an inner distensible bladder which surrounds a portion of the body of the wearer and is adapted to form a hermetic seal with the body such that the bladder can be inflated and thereby cause a pressure to be applied to the body surrounded by said bladder and an outer, substantially separate member of substantially net-like flexible material surrounding portions of the body covered by the bladder, to contain and limit the outward bulging of the bladder and at the same time providing for flexibility of the garment under pressure in the bladder, said net-like flexible material comprising a series of generally parallelly arranged filaments looped each with the next adjacent filament at spaced intervals, the filaments being otherwise free of each other.

2. A garment adapted for use in low pressure atmospheres comprising an inner distensible bladder which surrounds a portion of the body of the wearer and is adapted to form a hermetic seal with the body such that the bladder can be inflated and thereby cause a pressure to be applied to the body surround by said bladder and an outer, substantially separate member of substantially undistensible net-like flexible material to contain

and limit the outward bulging of the bladder and at the same time providing for flexibility of the garment under pressure in the bladder, said net-like material surrounding portions of the body covered by the bladder at points on the garments corresponding to joints in the body and comprising a series of generally parallelly arranged filaments looped each with the next adjacent filament at spaced intervals, the filaments being otherwise free of each other.

3. A garment adapted for use in low pressure atmospheres comprising an inner distensible bladder which surrounds a portion of the body of the wearer and is adapted to form a hermetic seal with the body such that the bladder can be inflated and thereby cause a pressure to be applied to the body surrounded by said bladder and an outer, substantially separate member of substantially undistensible net-like flexible material to contain and limit the outward bulging of the bladder and at the same time providing for flexibility of the garment under pressure in the bladder, said net-like material completely surrounding that portion of the body covered by the bladder and extending substantially throughout the garment and comprising a series of generally parallelly arranged filaments looped each with the next adjacent filament at spaced intervals, the filaments being otherwise free of each other.

4. A pressure suit comprising a body portion and means to secure a helmet thereto, a distensible bladder which surrounds a portion of the body of the wearer and is adapted to form a hermetic seal with the body such that the bladder can be inflated and thereby cause a pressure to be applied to the body surround by said bladder, a loose woven flexible net superposed on the bladder and surrounding portions of the body covered by the bladder, and means securing the loose net in position to with stand bulging of the bladder under internal pressure while providing for motion of the net covered parts of the suit at the will of the wearer, said loose net comprising a series of generally parallelly arranged filaments looped each with the next adjacent filament at spaced intervals, the filaments being otherwise free of each other.

5. The pressure suit of claim 4 wherein the net appears in the limb areas of the suit.

6. The pressure suit of claim 4 wherein the net appears at the joint areas of the suit.

7. The pressure suit of claim 4 wherein the net substantially covers the bladder throughout.

References Cited in the file of this patent

UNITED STATES PATENTS

897,551	Lundgren	Sept. 1, 1908
1,007,758	White	Nov. 7, 1911
2,401,990	Van Orman	June 11, 1946
2,605,065	Wilkins	July 29, 1952
2,834,965	Flagg et al.	May 20, 1958

FOREIGN PATENTS

564,676	France	Oct. 27, 1923
577,101	Great Britain	May 6, 1946