United States Patent

Szucs

[15] **3,699,958**

[45] **Oct. 24, 1972**

[54] **ANTIMICROBIAL WOVEN OR KNITTED FABRIC**

[72] Inventor: **Laszlo G. Szucs,** Ackermannstr. 6, Zurich, Switzerland

[22] Filed: **Dec. 31, 1970**

[21] Appl. No.: **103,145**

[52] **U.S. Cl.**.....**128/146.2,** 23/4

[51] **Int. Cl.**.....**A62b 23/06**

[58] **Field of Search**.....128/146.2, 139, 141, 146.6; 23/4; 55/103, 524, 273

[56] **References Cited**

UNITED STATES PATENTS

3,101,709	8/1963	Gruenewaelder	128/146.2
3,266,973	8/1966	Crowley	23/4 UX
3,322,119	5/1967	Szucs	128/156

FOREIGN PATENTS OR APPLICATIONS

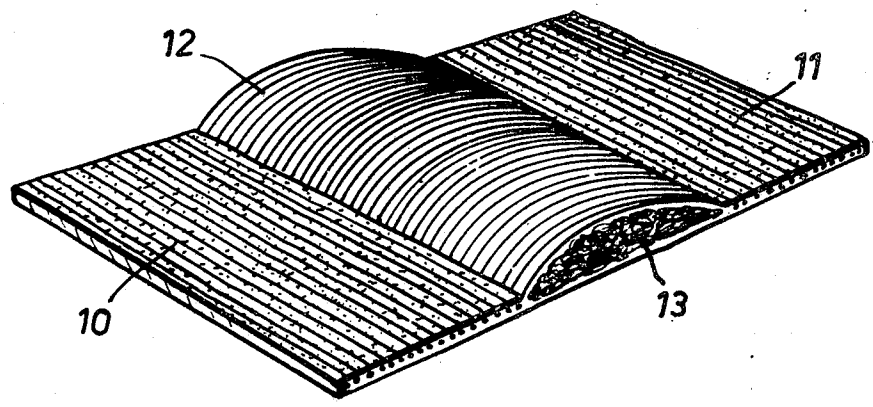
892,262	3/1962	Great Britain	128/146.2

Primary Examiner—Lawrence W. Trapp
Attorney—Craig & Antonelli

[57] **ABSTRACT**

An antimicrobial woven or knitted fabric which is made from crimp yarn and treated with cation-active antimicrobial compounds and the use of said fabric as surgical dressing or surgical face mask.

19 Claims, 6 Drawing Figures



PATENTED OCT 24 1972 3,699,958

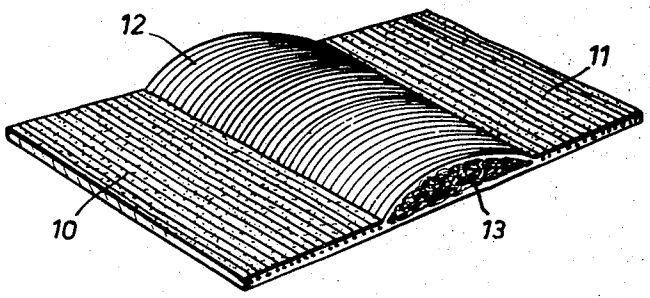


Fig. 1

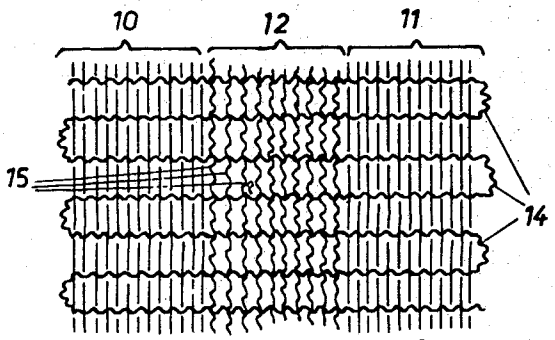


Fig. 2

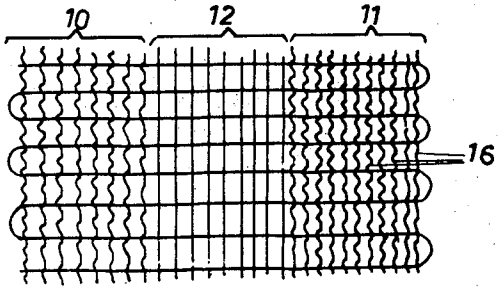


Fig. 3

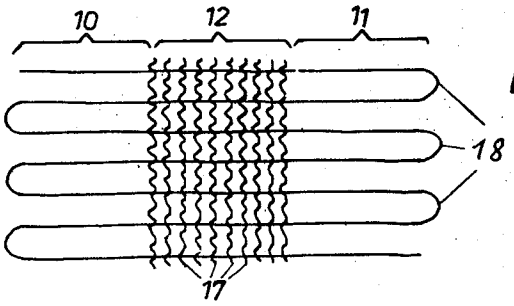


Fig. 4

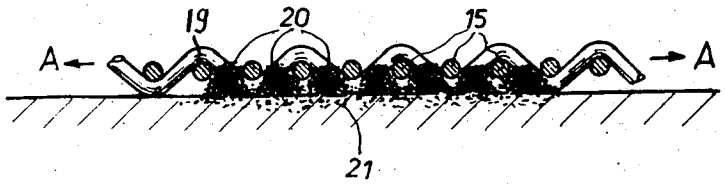


Fig. 5

INVENTOR

LASZLO G. SZUCS

BY

Craig, Antonelli, Stewart & Hill
ATTORNEYS

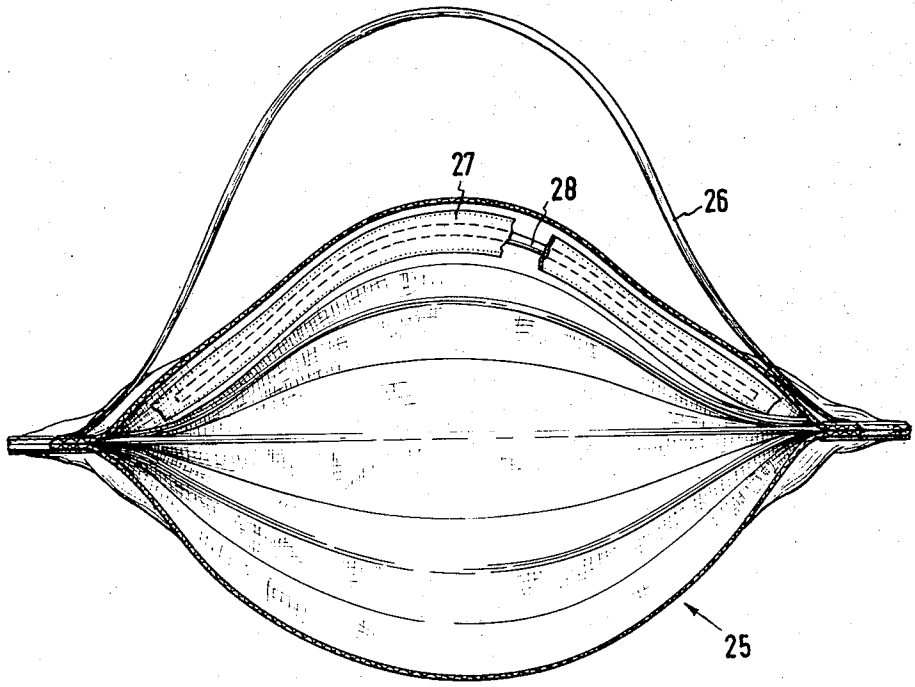


Fig. 6

INVENTOR
LASZLO G. SZUCS
BY
Craig, Antonelli, Stewart & Hill
ATTORNEYS

ANTIMICROBIAL WOVEN OR KNITTED FABRIC

This invention relates to a woven or knitted fabric having an antimicrobial effect.

The woven or knitted fabric according to the invention is characterized in that it is made using crimp yarn and is treated with cation-active antimicrobial compounds.

For the woven or knitted fabric according to the invention preferably polyamide endless crimp yarn threads are used having preferably 20 to 200 elementary filaments or fibrils of very high torsion crimp, the elementary filaments expediently having a titer of 3 denier or less.

According to the invention the antimicrobial woven or knitted fabric is made in such a manner that it has a high elasticity. This may be achieved for example in the case of weaving by making in the loom under tension a very loose fabric from crimp yarn threads for example in simple plain or linen weave. As it leaves the loom and during the subsequent heat treatment such a fabric made from crimp yarn shrinks greatly so that a dense fabric of high elasticity is formed.

The woven or knitted fabric according to the invention is treated with antimicrobial compounds of the type which due to their cation-active property are able to combine with the anion groups of the polyamide molecules; this process must not reduce the cavities of the crimp yarns consisting of a great number of elementary filaments or fibrils or have an effect on the dense network of extremely fine intimately intertwined elementary filaments or fibrils. The cavities are of decisive importance for the air supply and for high absorption effect of the woven or knitted fabric according to the invention. The dense network of the intertwined elementary filaments or fibrils which are compressed together in a very small space and between which the cavities are disposed ensures that this large internal filter area can develop its full antimicrobial effect.

As cation-active antimicrobial compound according to the invention benzalkyl ammonium derivatives or phenolic polyoxymethylene derivatives or alkylaryl ammonium chlorides may be used, especially "Eulan-Asept" of the Bayer company, Leverkusen.

The woven or knitted fabric according to the invention has proved particularly suitable as a surgical dressing.

The dressing according to the invention differs substantially from other dressings on the market, as is apparent from its properties listed below:

1. The polyamide fibers themselves do not have any absorption effect and do not absorb blood or secretions. For this reason, the polyamide fibers and the dressing according to the invention do not stick to wounds. The high suction and absorption effect of the dressing is due to the countless cavities which are disposed between the fibrils of the crimp yarn and absorb blood and secretions in the manner of blotting paper. Since it is precisely the accumulation of wound secretion which is responsible for the formation of germ colonies and infection, this property is of particular importance, especially since the antimicrobial elementary filaments or fibrils enclosing the cavities have a bacteriostatic effect on the germs in the secretions absorbed.

2. Air is constantly supplied to the wound through the cavities. This supply of air ensures the extremely important rapid drying of the wound, which is of great significance particularly in the case of burns and other wounds liable to infection. Since the air supplied must pass the great number of individual filaments or fibrils very many times and is thus subjected to their antimicrobial effect before it reaches the wound, the bacteriostatic effect makes it impossible for the germs to multiply and no infection can penetrate from the outside. The antimicrobial effect of the dressing according to the invention covers grampositive and gramnegative bacteria, yeast and filamentous fungi.

3. Before removing the dressing according to the invention from the wound a horizontal pull is exerted in the longitudinal direction on the two opposite sides of the dressing. This produces a "cutting effect." This pull stretches the loose individual filaments of the crimp yarn. The practically untearable individual filaments are very sharp. The stretching of the dressing cuts through the dried blood and secretion between the wound and the dressing. This is of great significance because it prevents traumatization of the wound and is not at all painful for the patient. As with conventional dressings, the dressing according to the invention should be changed several times in the case of wounds with a relatively large amount of secretion. Due to the atraumatic property of the dressing according to the invention the granulating tissue is not damaged; compared with conventional dressings there is more rapid healing and formation of epithelium of the wound.

4. The "cutting effect" of the dressing according to the invention is useful not only as regards the atraumatic removal of the dressing from the wound but also as regards the simultaneous painless removal of the portion of the dressing carrying the adhesive. To fix the dressing to the skin in addition to "Mastisol" resilient adhesive films are also employed.

When stretched the dressing according to the invention also cuts through Mastisol and all resilient adhesive films which have a lower stretchability than the crimp yarn fabric. Such adhesive may for example consist of 50 parts "Lutonal J 60 D" (dispersion of 55 percent polyvinyl ether) mixed with 75 parts of water. Usually a fairly firm pull is necessary to remove known dressings from the skin. This is not only painful for the patient but can also damage the granulation tissue on the healing wound.

The woven or knitted fabric according to the invention may also be advantageously used as face mask with antimicrobial filter effect.

Swiss Pat. No. 462,377 already describes a face mask of crimp yarn woven or knitted fabric whose filter effect is increased by finishing with synthetic resins. This face mask has the disadvantages that the antimicrobial effect is insufficient and that the synthetic resin finishing reduces the air permeability. These disadvantages are obviated with the face mask according to the invention.

The antimicrobial effect of the face mask according to the invention covers grampositive and gramnegative bacteria, yeast and filamentous fungi.

The air permeability of the face mask according to the invention is not less than that of the untreated fabric because the crimp yarns or the woven or knitted fabrics made therefrom are not coated or impregnated from the outside as is the case when finishing is carried

out with synthetic resins; instead, the antimicrobial active substances of the face mask according to the invention are added to the molecules of the crimp yarn fibers. Particularly suitable are crimp yarns of polyamide fibers. The polyamide molecules comprise anion groups which combine with the cation-active antimicrobial compounds used. As a result, the cavities of the crimp yarns are not reduced in volume and the antimicrobial fabric from which the face mask is made has a good air permeability.

The face mask according to the invention may also consist of two or more layers of these antimicrobial crimp yarn woven or knotted fabrics. Furthermore, the face mask may be provided with textile interlayers which may consist of natural and/or synthetic or regenerated fibers and which may have a woven or unwoven structure and also be treated with the cation-active antimicrobial compounds set forth herein.

If a suitable choice of crimp yarns and interlayers is made the face mask according to the invention has a good air permeability in addition to the antimicrobial effect. The air permeability is better than that of the hitherto known face masks. The face mask according to the invention is particularly suitable for use in hospitals. Its high elasticity means that it hampers normal speech far less than do the hitherto known face masks. Also, the face mask according to the invention does not unpleasantly heat the skin of the face when worn.

The crimp yarns of the face mask according to the invention comprise a network of very fine intertwined fibrils whose large surface area particularly promotes the antimicrobial properties. The breath of the face mask wearer is filtered from microorganisms, dust particles and atomized drops. Due to the countless cavities of the crimp yarn the air pressure drop is less than in commercially available face masks; the wearer thus finds it easier to breathe in the face mask according to the invention.

Some of the objects of this invention having been stated, other objects will appear as the description proceeds when taken in conjunction with the accompanying drawings, in which:

FIG. **1** represents a perspective view of an example of a surgical dressing according to the invention;

FIG. **2** is a diagrammatic view of a second example of a surgical dressing according to the invention;

FIGS. **3** and **4** show two further modifications of a dressing according to the invention;

FIG. **5** is a cross-sectional view of an applied dressing according to the invention;

FIG **6** represents a perspective rear view of a face mask according to the invention, with parts broken away.

Referring now to FIG. **1**, the represented dressing comprises two lateral portions **10** and **11**, which are coated with adhesive. A center portion **12** which forms the wound contacting area is provided with an absorbing pad **13** which is covered with a fabric made of crimp yarn.

Portions **10** and **11** consist of parallel threads which are bonded together by adhesive only. The stretchability of the threads is much higher than that of the adhesive, so that upon a certain stretch applied to the thread structure, the adhesive layer becomes torn apart.

When for instance the wound dressing of elastic fabric, as shown in FIG. **5**, is pulled in the direction of the arrows A, the extensible crimp yarns **19** are stretched, and when said fabric is pulled in perpendicular direction to the plane of the drawing, the crimp yarns **15** are stretched. In this manner the dried blood **20** between the threads **15** and **19**, forming the solid bond between the absorbing wound dressing and the wound **21**, is ruptured, so that the wound dressing may be removed from the wound **21** painlessly for the patient.

In FIG. **2** the weft threads **14** are formed by crimp yarn, and the warp threads **15** of the center portion **12** to be applied upon the wound, are also of crimp yarn.

FIG. **3** shows the application of crimp yarn only for the warp threads **16** of the marginal portions **10** and **11**.

In FIG. **4** the warp threads **17** of the center portion **12** are formed by crimp yarn, while the marginal portions **10** and **11** are formed by single threads **18** which are parallel in weft direction.

The inventive surgical dressings illustrated in FIGS. **1** to **5** are treated with a cation-active antimicrobial compound. As cation-active antimicrobial woven or knitted fabric for a surgical dressing also a fabric woven in the so-called "plain weave" may be used, in which both the warp threads and the weft threads each comprise two polyamide crimp yarns of 100 denier each having 34 individual filaments of about 3 denier. This fabric is produced as an initially loose fabric, the crimp yarns having a very high torsion crimp being woven under tension and the fabric having in the tensioned state about 7 warp threads and about 7 weft threads per centimeter. On releasing the tension and after the thermal treatment or heat setting the crimp yarn fabric exhibits a pronounced shrinking of about 100 percent in the warp direction and about 60 percent in the weft direction. This pronounced shrinking causes the initially loose fabric to become a very dense fabric of high elasticity, of which for example 2000 meters is then treated on a padding machine. As cation-active antimicrobial preparation 4.5 Kg of a benzalkyl ammonium derivate (Movin B of the Bayer company, Leverkusen) is diluted with 250 liters of water. The fabric is allowed to pass through the padding machine with a velocity of 20 meters per minute at a temperature of 50° C. The squeeze-off effect is 60 percent. As replenishment 45 g of Movin B per minute are added continuously to the chassis content.

A fabric woven and treated in the afore-mentioned manner may also be used as face mask. Such a face mask is illustrated in FIG. **6** and generally denoted by **25**. After such fabric, woven in the so-called "plain weave," has been treated in the afore-mentioned manner with a benzalkyl ammonium derivate (Movin B of the Bayer company, Leverkusen), acting as cation-active antimicrobial compound, and subsequently dried, this fabric is cut into sections corresponding to the desired form of the face mask, which sections are given a desired number of longitudinal folds on a pressing machine. A rubber band **26** is attached to both sides of the face mask. A reinforcing strip **28** is placed into a hem **27**. The reinforcing strip **28** may be adapted to the shape of the nose and the adjacent portions of the face of the wearer, so as to ensure that the face mask has an appropriate fit and tightness.

The resistance to washing of the antigermicidal effect is very good and the fabrics according to the invention can therefore be used for operation masks and dressings which are washed after use and used again.

To obtain this washproof property or to replenish the bacteriostatic effectiveness it is possible to add antimicrobial compounds during the washing operation. In such a case, for example 1 percent of Movin B is added to the final rinsing bath and the articles treated for 10 minutes. After this the washed materials may be removed from the machine without a further rinsing operation. Thus, it is possible under certain conditions to treat the novel fabric with Movin B so that it has a permanent antimicrobial effect.

In the drawings and in the specification there have been set forth preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

What is claimed is:

1. An antimicrobial woven or knitted fabric, characterized in that it is made using crimp yarn and is treated with cation-active antimicrobial compounds.

2. A woven or knitted fabric as claimed in claim 1, in which the crimp yarn consists of polyamide fibers.

3. A woven or knitted fabric as claimed in claim 2, characterized in that as cation-active antimicrobial compound alkylaryl ammonium chlorides are used, especially "Eulan-Asept" of Bayer, Leverkusen.

4. A woven or knitted fabric as claimed in claim 1, wherein the crimp yarn consists of endless threads having 20 to 200 elementary filaments or fibrils of very high torsion crimp.

5. A woven or knitted fabric as claimed in claim 4, wherein said elementary filaments have a titer of 3 denier or less.

6. A woven or knitted fabric as claimed in claim 1, characterized in that it is of high elasticity.

7. A woven or knitted fabric as claimed in claim 1, characterized in that it includes a plurality of layers which consist of crimp yarn and between which woven or unwoven textile interlayers of natural or synthetic or regenerated fibers are disposed, which are treated with cation-active antimicrobial compounds.

8. A woven or knitted fabric as claimed in claim 1, characterized in that as cation-active antimicrobial compound benzalkyl ammonium derivates are used.

9. A woven or knitted fabric as claimed in claim 1, characterized in that as cation-active antimicrobial compound phenolic polyoxymethylene derivates are used.

10. A woven or knitted fabric as claimed in claim 1, characterized in that as cation-active antimicrobial compound alkylaryl ammonium chlorides are used, especially "Eulan-Asept" of Bayer, Leverkusen.

11. A woven or knitted fabric as claimed in claim 1, characterized in that it is used as surgical dressing.

12. A woven or knitted fabric as claimed in claim 1, characterized in that it is used as surgical face mask.

13. A surgical dressing comprising one or more layers of woven or knitted fabric which fabric is made from crimp yarn and treated with cation-active antimicrobial compounds.

14. A surgical face mask comprising one or more layers of woven or knitted fabric which fabric is made from crimp yarn and treated with cation-active antimicrobial compounds.

15. An antimicrobial woven or knitted fabric comprising crimp yarn having molecules with anion groups, the fabric being treated with cation-active antimicrobial compounds such that the antimicrobial compounds are combined with the anion groups of the crimp yarn.

16. A woven or knitted fabric as claimed in claim 15, in which the crimp yarn consists of polyamide fibers.

17. A woven or knitted fabric as claimed in claim 16, wherein the crimp yarn consists of endless threads having 20 to 200 elementary filaments or fibrils of very high torsion crimp.

18. A woven or knitted fabric as claimed in claim 17, wherein said elementary filaments have a titer of 3 denier or less.

19. A woven or knitted fabric as claimed in claim 15, characterized in that as cation-active antimicrobial compound alkylaryl ammonium chlorides are used, especially "Eulan-Asept" of Bayer, Leverkusen.

* * * * *