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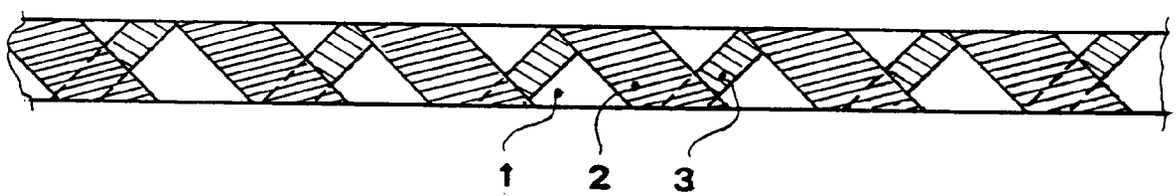
(54) A yarn for the production of knitted articles able to attenuate low and medium frequency electromagnetic fields.

(57) A yarn for the production of knitted articles having good properties of attenuation of low frequency and medium frequency electromagnetic fields. The yarn comprises a base yarn (1,2) made of natural or artificial fiber, such as cotton, wool, rayon and the like, to which a carbon yarn (3) is embodied in a percentage not lower than 1%. The attenuation of the intensity of the electromagnetic field at 50-60 Hz is higher than 30 times.

Fig. 1



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The present invention relates to the field of yarns for knitted products and more precisely to a yarn for the production of knitted articles able to screen the body of the person wearing them from electromagnetic waves by attenuating electromagnetic fields of low and medium frequency.

The risk connected with the exposure of living organisme to electromagnetic radiation especially when of high frequency is well known to experts in the field. Said exposure can have even lethal consequences. Although not immediately damaging, the radiation associated with magnetic fields of low and medium frequency, the sources of which are widespread in all environments (home, work, amusement), are considered a possible cause of many and sometimes serious physical and psychosomatic disturbances (insomnia, headaches, loss of appetite and concentration, stress) and it is suspected that prolonged exposure to them can increase the risk of development of certain type of tumours.

In the fabric field materials have been made which are able to absorb and dissipate electrostatic energy and can be used in the manufacture of work garments for special environment, for example shirts to wear in aseptic environments in which a total absence of dust must be assured. The characteristic of not being static is given to these fabrics by the presence in their fiber of small percentages of carbon yarn. With the object of absorbing electrostatic energy, carbon fabrics are used in articles of interior decorations such as carpets.

It has now been found, and this constitutes the object of the present invention, that the addition of at least 1% by weight of a carbon yarn to a knitting yarn made of essentially, natural or artificial fibers such as wool, cotton, rayon and the like, gives the knitted articles made with said yarns good attenuating properties with respect to electromagnetic fields of low and medium frequency avoiding, or at least limiting, the absorption of electromagnetic waves on the part of the person wearing the garment thus favoring physical well-being as well as reducing the risk of the development of the above-mentioned disturbances.

For the production of the yarn according to the invention a carbon yarn of commercial type, the socalled "nylon-carbon", composed of a support in nylon to which the carbon is anchored, is preferably used.

In a particular preferred embodiment of the invention, suited in particular for making lightweight knitted clothing for spring and summer, a base yarn, rayon viscose, chosen for its characteristics of fluidity and silkiness, was combined with 4 to 7% of nylon-carbon yarn. Said combination proved optimum for summer clothing to be worn in direct contact with the skin since rayon viscose, being fluid and silky, compensates for the apperance and feel of the carbon yarn which, otherwise, would be too rigid and rough to be worn in contact with the skin.

To obtain said result, the yarn according to the invention, is produced by means of a conventional process of twisting carried out with particular care and expressely in order to obtain by means of "spiraling" the final effect of the thread of viscose which embodies the nylon-carbon component.

Strictly as an example and not limitative, in figure 1, the yarn of the invention is shown schematically with 1 and 2 indicating two threads of rayon of equal characteristics and with 3 indicating a thread of nylon-carbon which is "spiraled" with threads 1 and 2. In this way the negative characteristics of the nylon-carbon thread can not be noted and aesthetically a light, grey effect, which can not be eliminated given that it is possible neither to color nor discolor the carbon fiber, is vaguely seen inside the yarn.

With the object of evaluating the effective capacity for attenuating electromagnetic fields with the yarn according to the invention, measurements of attenuation in an anechoic chamber and in a TEM cell were carried out respectively in the range of frequencies 300 MHz - 1 GHz and in the range 100 kHz - 300 MHz. The tests were carried out on pieces of knitted fabric made with the yarn according to the invention, containing 6% nylon-carbon yarn.

In the measurements taken in the anechoic chamber, a 2mx2m square piece of knitted fabric was used placed between the beam of radiation and the probe. In the TEM cell, the probe was instead covered with a square of knitted fabric of 1mx1m.

The attenuation factor in decibels as a function of the frequency of measurements executed in the interval 50 - $300x10^3$ Hz is shown in the diagram in figure 2. The attenuation factor in decibels is defined by the equation 20log E2/E1 where E1 and E2 measure respectively the intensity of the electromagnetic field in the presence and in the absence of the screen of knitted fabric.

From the tests it results that the fabric has screening properties inversely proportional to the frequency of irradiation. In fact the screening capacity of the electromagnetic field ranges from 8 dB (E2/E1=2.51) at 0.1 MHz to 0 dB (E2/E1=1) from 300 MHz up. In other words, already at 100 Mhz the screening effect becomes negligible, whereas it is appreciable and consistent in the presence of medium-low frequency field.

In particular the attenuation factor at 50-60 Hz is not lower than 30 dB, corresponding to an attenuation of the intensity of the electromagnetic field higher than 30 times.

Yarns according to the invention can also be made wherein the base yarn is in wool or cotton or other natural fibers which are compatible, both from a technological and economic point of view, or with artificial fibers. The yarn according to the invention can also utilize threads of a mixed base also comprising synthetic yarns, for example nylon or acrylics.

Variations and/or modifications can be brought to the yarn for knitted products according to the present invention without departing from the scope of the appended claims.

Claims

1. A yarn for the production of knitted articles able to attenuate electromagnetic fields of low and medium frequency characterized by the fact that it is formed essentially by natural or artificial yarn containing a carbon yarn in a percentage by weight of not less than 1%.

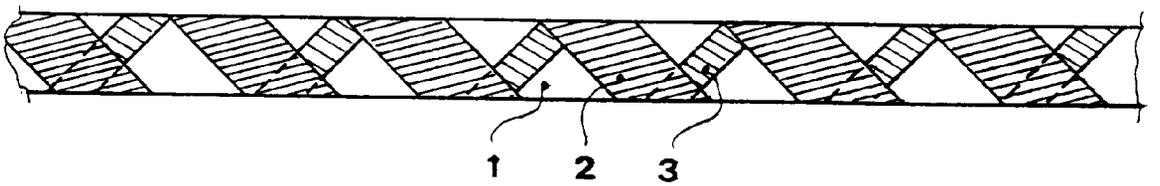
2. Yarn according to claim 1, wherein the percentage by weight of carbon yarn is comprised between 4 and 7%.

3. Yarn according to claim 2, wherein the percentage by weight of the carbon yarn is equal to 6%.

4. Yarn according to the previous claims, wherein said carbon and yarn is in nylon-carbon yarn.

5. Yarn according to the previous claims, wherein said essentially natural or artificial yarn, is chosen from among wool, cotton, rayon-viscose and the like.

Fig.1


1
2
3

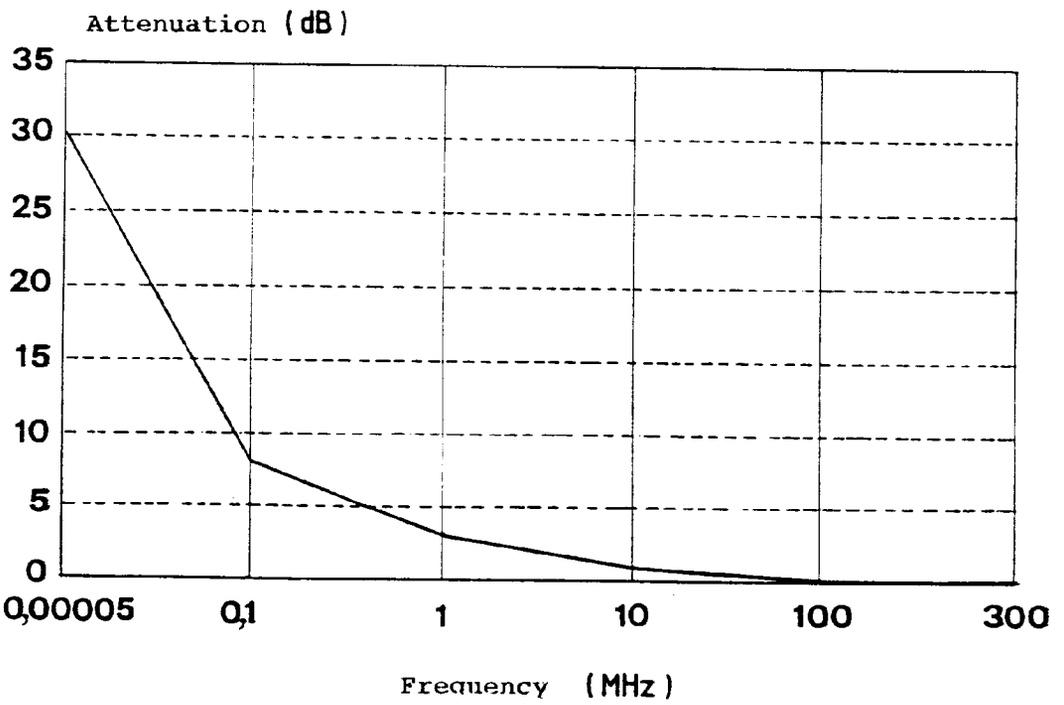

Attenuation (dB)
35
30
25
20
15
10
5
0
0,00005
0,1
1
10
100
300
Frequency (MHz)

Fig.2

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EUROPEAN SEARCH REPORT

Application Number

EP 93 83 0007

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	WO-A-8 603 050 (RAYCHEM CORP.) * page 6, line 24 - line 27; claims 1,3,10,18,21; figures * ---	1,4,5	D02G3/44 D02G3/04 D04B21/20 H05K9/00
A	DATABASE WPIL Section Ch, Week 9122, Derwent Publications Ltd., London, GB; Class F01, AN 91-161262 & JP-A-3 097 932 (TOYOBO) 23 April 1991 * abstract * & PATENT ABSTRACTS OF JAPAN vol. 015, no. 282 (C-850)17 July 1991 & JP-A-30 97 932 (TOYOBO) 23 April 1991 ---	1,5	
A	DATABASE WPIL Section Ch, Week 8649, Derwent Publications Ltd., London, GB; Class F07, AN 86-322449 & JP-A-61 239 044 (ASAHI CHEMICAL IND.) 24 October 1986 * abstract * ---	1,4,5	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	DATABASE WPIL Section Ch, Week 9132, Derwent Publications Ltd., London, GB; Class F02, AN 91-234188 & JP-A-3 152 229 (KOWABOSEKI ET AL.) 28 June 1991 * abstract * & PATENT ABSTRACTS OF JAPAN vol. 015, no. 377 (C-870)24 September 1991 & JP-A-31 52 229 (MIE PREF GOV ET AL.) 28 June 1991 * abstract * --- -/--	1,4,5	D02G H05K D04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 APRIL 1993	RAYBOULD B.D.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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EPO FORM 1503 03.82 (P0401)

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DOCUMENTS CONSIDERED TO BE RELEVANT

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A	DATABASE WPIL Section Ch, Week 9117, Derwent Publications Ltd., London, GB; Class F02, AN 91-120699 & JP-A-3 059 129 (NAKATUSHIKO) 14 March 1991 * abstract * & PATENT ABSTRACTS OF JAPAN vol. 015, no. 206 (C-835)27 May 1991 & JP-A-30 59 129 (NAKATSU SHIKO) 14 March 1991 * abstract * -----	1,4	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

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