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(54) **Shielding fabric against electromagnetic radiation**

(57) Shielding fabric against electromagnetic radiation, especially designed for the protecting clothes, is characterized by a weft threads. Maximum each 10th weft thread is a three - component bunch thread (11) that consists of electroconductive core thread (1) with a ferromagnetic. It is positioned in a rounding of electroconductive effect thread (2). This effect thread creates random accumulations (3) in a shape of solenoids on a core thread. The solenoids are fixed in a stable way on a core thread (1) by the means of binding thread (4). The warp thread and the rest of weft threads are made favorable of cotton threads. The threads of warp and weft are interlaced favorable with each other by the means of plain weave.

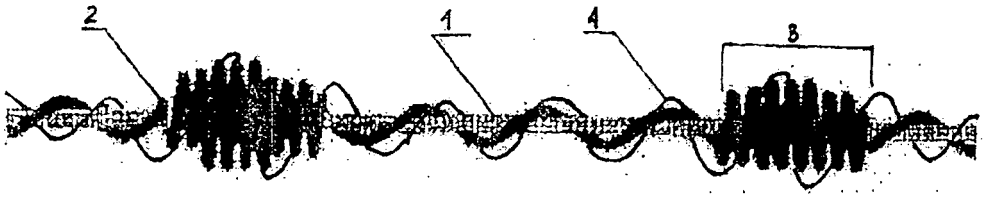

Fig.1

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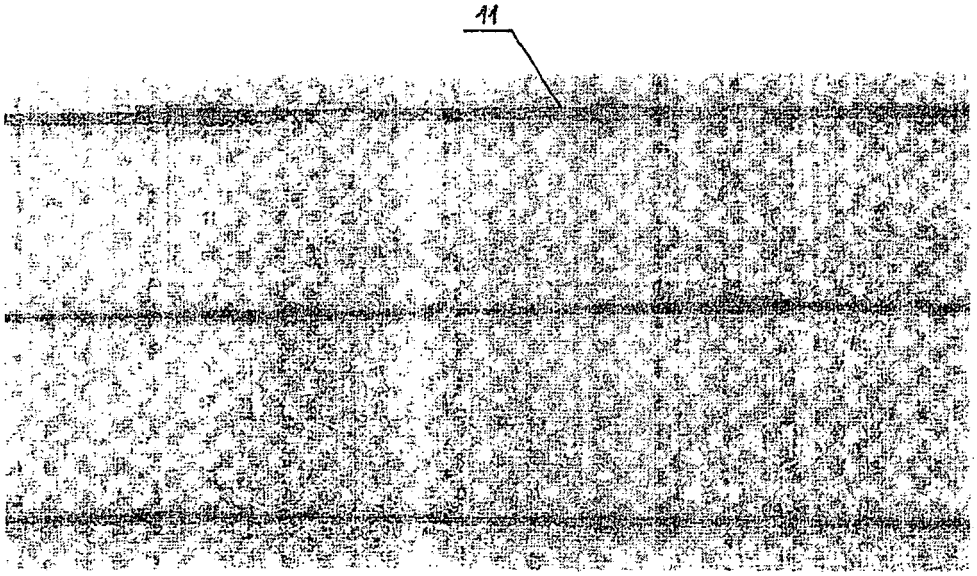

Fig.2

Description

[0001] The object of the invention is shielding fabric against electromagnetic radiation, especially designed for the protecting clothes against electromagnetic radiation.

[0002] The applied and produced by man devices can be a source of the artificial electromagnetic radiation (EMR) with considerable values of the intensity. The EMR sources are applied in the radio communication, industry, medicine and science. The EMR sources are, among all, a RTV antenna, a radar, mobile telephony installations, capacitive and microwave welders, apparatuses to the electrosurgery, micro and short-wave diathermy. It was concluded that there are the allegedly neurotic aggregates with superiority of the hypotonic attribute, which may impact the lowering activity of the sympathetic structure and the vagotonia. That was found after the clinical studies of the population professionally subject to EMR. The following affections are the consequences of exposition on EMR: pains of head, a general weakness, an easy fatigue, a sleepiness, a handicap of memory, an instability of pulse and a thrust of blood as well as a disorder of the autonomic nervous arrangement.

[0003] Both the obligatory European directive 2004/40/WE and the current Polish regulations relating safety and hygiene of the workers subject EMR, permit the acceptance of execution of the professional activities in the zone, which the very strong EMR crossing over the admissible intensities values. The worker is obliged to apply the suitable individual protection with an appropriate effectiveness and these individual personal protections against EMR have to simultaneously to assure the easiness of movement, elasticity, durability on tearing, the exchange of thermal energy as well as the mass.

[0004] The protective coveralls have been used so far as the individual protection. They are made of woven fabrics or nonwovens with good electrical conductivity metal nets introduced into textiles. The personal protections against EMR are also made of composite materials e.g. fibrous material including smooth electroconductive thread that creates the Faraday's cage. These materials are effective in the reference to the electric component of EMR, they do not muffle a magnetic component of EMR.

[0005] The paper of the Textile Industry Institute with its head office in Lodz, Poland was presented at the 4th International Symposium EL - TEX 2000- Lodz and informed about a textile material - a woven fabric with every fourth thread in warp direction made of the smooth electroconductive thread and a material - electroconductive nonwovens with a polyester monofilament pierced in a single direction manner by polyester monofilament. The paper also presents a material - nonwovens pierced in a single direction manner by a polyester monofilament, the monofilament was covered by finishing sub stance. Finally, the paper presents needled electroconductive nonwovens produced with two thicknesses of 2mm and 3.5mm. All of them might be use as an environmental protection against EMR.

[0006] The paper of The Nofer Institute of Occupational Medicine, Lodz, Poland, presented at the 4th International Symposium EL - TEX 2000- Lodz showed the results of research on EMR muffling effectiveness by electroconductive nonwovens. The factor that differed those nonwovens was the number of layers and their mutual arrangement. The final conclusions explains that both the muffling effectiveness of electroconductive nonwovens used as a electromagnetic screen and comfort use of such protection still require improvements.

[0007] The papers of the Institute of Telecommunication and Acoustics of the Technical University of Wroclaw that were prepared for the II International Symposium EL-TEX' 96 - Warsaw mentioned the screening of EMR by the means of products made of fibers covered by metal and other products made of chemically modified fibers.

[0008] Shielding fabric against electromagnetic radiation, especially designed for the protective clothes, contains an electroconductive thread, according to the invention, it comprises an electroconductive thread that is one of the wefts of the fabric, maximum every 10th weft thread. The electroconductive thread is a three - component bunch thread that contains electroconductive core thread being a good ferromagnetic. The core is covered by binding electroconductive effective thread. It creates a random accumulation of windings of effective thread on core thread. These accumulations take the shape of solenoids and are positioned, fixed on the core thread by winding thread. The electroconductive core thread being a part of three - component bunch thread is an iron or a nickel thread in polyester shield. A copper or a steel thread in a polyester shield plays a favorable role of the effect thread. The polyester thread plays a favorable role of binding thread. The warp threads and other weft threads are made of nonconductive threads, like cotton threads. The warp and weft threads are connected in a favorable way by the plain weave.

[0009] According to the invention, the fabric with a bunch thread implemented as a weft contains a series circuit arrangement of thicker places connected with each other. These thicker places have a solenoid shape and a ferromagnetic core that has a screening ability varying about 80%, which is more than in case of other, already existing solutions. The muffling of electromagnetic component in EMR is also higher than in case of the other, already existing solutions. The proposed fabric is characterized by muffling ability similar to that which characterizes metal screens. Proposed solutions give additionally a high comfort of use while a comfort of use of individual protection screens for humans equals almost zero. The personal protective clothes made of proposed fabric fulfill all protection requirements that are necessary in case of protection against EMR. Proposed fabric has a high comfort of use, it means, a good drape, a high elasticity and strength, a high aeration and the high wrinkle recovery in range of the durable deforma-

tions. The three - component thread applied into fabric according to invention as well as the fabric including this thread can be produced on already existing twisting machine and looms.

[0010] The object of the invention was presented on the figure 1 as an exemplary production case. A side view - figure 2 presents a piece of fabric with a three - component bunch thread as a weft. A perspective view - figure 3 presents a technological view of twisting machine, which was used for production of three - component bunch thread - a weft.

[0011] The fabric are two mutually perpendicular sets of threads - warp and weft, which are interlaced with each other by the plain weave. Each 10th weft thread is a three - component bunch thread (11), consisting of an electroconductive core thread (1) made of iron in polyester cover that was round by copper effect thread (2) in a polyester cover that created on a core thread (1) random accumulation (3) in a shape of solenoids. The solenoids are stabilized on a core thread (1) by the means of polyester binding thread (4). Warp threads and other weft threads of the fabric are made of cotton.

[0012] The three - component bunch thread was produced on the twisting machine with a hollow spindle intended for fancy yarns.

[0013] The core thread (1) was introduced to the interior of spinning spindle (5) at the twisting machine by the means of drawing apparatus (3). The effect component (2) of the three - component thread was introduced inside the hollow spindle (5) by the means of introductory roller (7), through the feeding rollers (8) and (9), with a higher speed than the introduction speed of the core thread (1). The third component of the three - component thread - a polyester binding thread (4) was introduced to the hollow spindle (5). The bobbin placed on a hollow spindle (5) with the third thread was unwinded. The twisting of three components (1), (2) and (4) took place inside the hollow spindle. The temporary decrease of a linear passing speed of a thread (1) or the temporary increase of a linear passing speed of the effect thread (2) caused a local accumulation of effect thread (2) on the core thread (1) and a formation of the solenoid shape (3) on a core thread (1). The number of solenoid coils (3) made of thread (2) on a thread (1) (the thickness of accumulation), the length and the shape of this accumulation was regulated by selection of a suitable twist, overfeed of the effect thread (2) as well as the frequency of feeding speed changes of one of the components (1) or (2) or (4). The false twist hook (6), placed in the bottom part of spindle (5) separated false twist zone from the real twist. The three - component thread (11) with the solenoid effect (3) was obtained by the means of receiving rollers (10) placed below spindle (5) and than it was twisted on a cylindrical bobbins (12) with usage of grooved underbobbin cylinders (13).

[0014] A produced three - component electroconductive bunch thread (11) was introduced in the continuous manner as every 10th weft thread in the weaving process of the fabric. The rest of the weft and warp threads of this fabric were made of cotton yarn.

[0015] The produced fabric had a screening ability varying about 80% and additionally a high comfort of use by humans working professionally in a danger of EMR zone.

Claims

1. Shielding fabric against electromagnetic radiation, designed especially for protective clothes, includes an electroconductive thread, is **characterized by** the fact that electroconductive thread being one of the weft threads, maximum each 10th weft thread, which is an electroconductive three - component bunch thread (11) that includes electroconductive core thread (1) with ferromagnetic covered by electroconductive effect thread (2) that creates on core thread (1) random accumulation (3) of winds in a solenoids shape which are fixed on a core thread (1) by binding thread (4), the other threads of warp and weft are favorable interlaced with each other in a form of plain weave.

2. The fabric, according to claim 1, is **characterized by** the fact that electroconductive core thread (1) being a component of three - component bunch thread (11) is favorable made of iron or nickel in a polyester cover.

3. The fabric, according to claim 1, is **characterized by** the fact that effect yarn (2) being a component of a three - component bunch thread (11) is favorable made of copper or steel in a polyester cover.

4. The fabric, according to claim 1, is **characterized by** the fact that binding thread (4) being a component of a three - component bunch thread (11) is favorable made of a polyester thread.

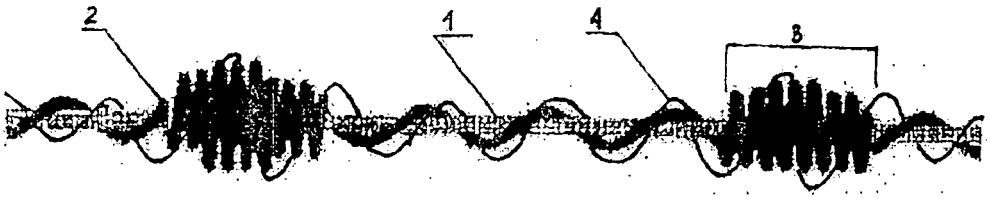

Fig.1

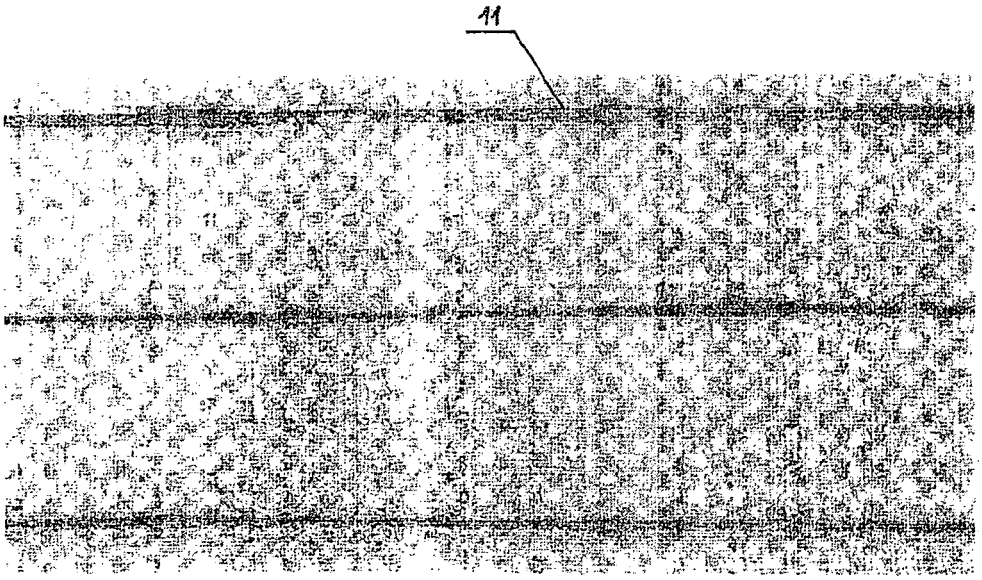

Fig.2

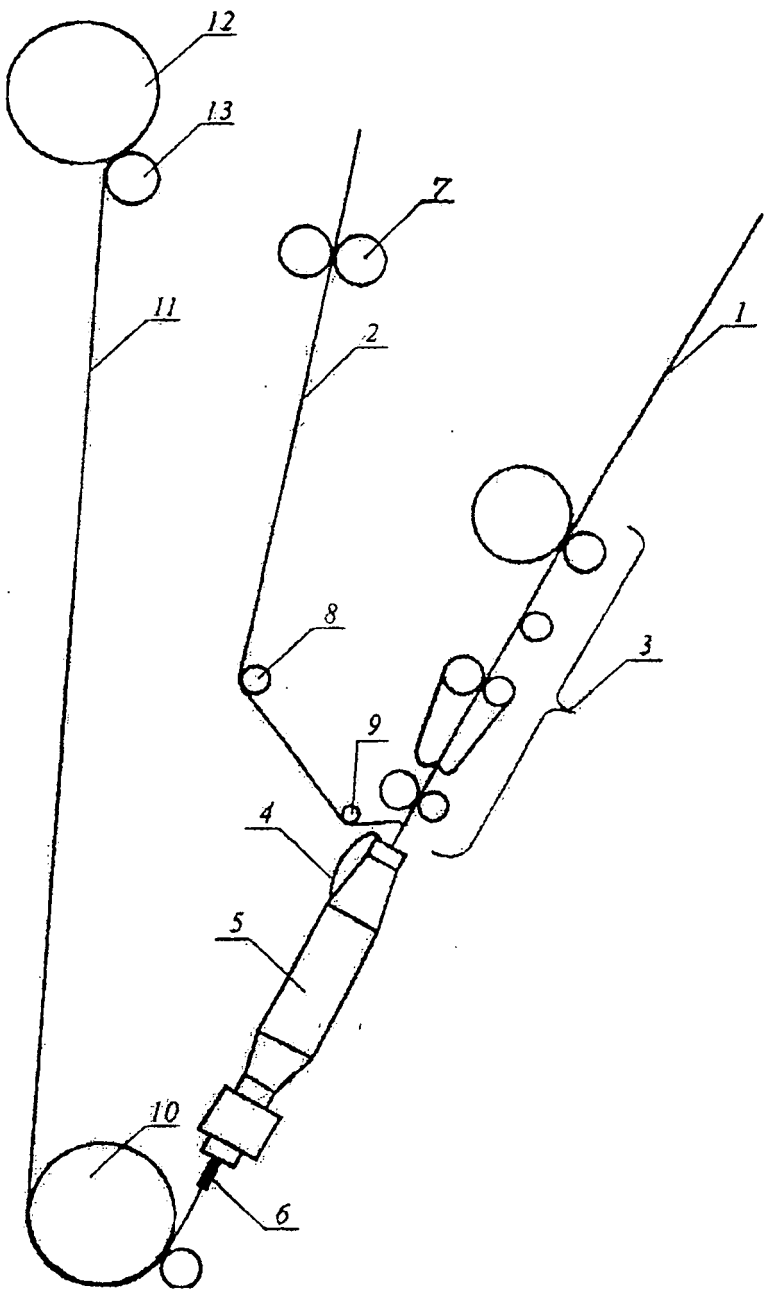

Fig.3