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(54) Method of manufacturing a non-woven felt for use in cue sports and gaming tables and a non-woven felt thus obtained

(57) A method of manufacturing a non-woven felt for use as a covering cloth for cue sports or gaming tables which comprises the following steps:

a) providing a non-woven web of fibres, the web including feltable fibres;
b) needlefelting the web of fibres to produce a non-woven felt; and
c) milling the non-woven felt.

The invention further relates to a non-woven felt obtained according to the above method and to the use of such non-woven felt in the manufacture of cue sports or gaming tables.

EP 1 008 684 A1

Description

Field of the Invention

[0001] The invention relates to a method of manufacturing a non-woven felt suitable for covering cue sports (such as billiards, pool and snooker) and gaming tables. The invention further relates to non-woven felt thus obtained and its use in covering of cue sports and gaming tables.

Description of the prior art

[0002] Traditionally table coverings for the games of billiards, snooker and pool or for quality gambling table layouts have been produced from woven woollen materials, usually dyed in green and called "baize".

[0003] Some attempts have been made to produce pool table covering materials using synthetic fibres but to date, these have been restricted to specific end uses, for example water-resistant cloths for outdoor pool tables, and are known to be of low performance and poor tactile characteristics. US Patent No. 3,889,945 (Ellis) describes an inexpensive billiard table where the cloth is replaced by a sheet of plastic. US Patent No. 3,876,202 (Allison) and US Patent NO. 3,489,410 (Stillman et al.) both relate to weather resistant pool tables where plastic or synthetic felts are used as table coverings.

[0004] The use of woven, felted, woollen materials for the game of billiards can be traced back at least as far as the middle of the 17th century. It would be reasonable to assume that this material has played an integral part in the evolution of the modern games of billiards, snooker, pool and their derivatives. The performance and play characteristics of the felt have become central to the game. In recent years some cue sports particularly some pool games, have utilised other table coverings, for example, woven worsted materials, but the predominant covering material remains a felted, woven, woollen product.

[0005] Standard quality baize is made of a 100% wool woven felted fabric. The play characteristics of such a table covering material are mainly generated during the finishing processes of the woven felt, and in particular during the milling process where the fibres in the threads of the woollen yarn are felted together to form a matt surface. Both the 100% wool nature and the woven structure of the woollen material used for covering cue sports and gaming tables have been considered to be the prerequisites for generating a felt having good play characteristics.

Summary of the invention

[0006] Surprisingly, it has been found that a non-woven felt comprised predominately of wool can demonstrate performance and tactile characteristics comparable to those of a high quality woven woollen felt whilst being made by an easier, quicker and less expensive manufacturing process.

[0007] One object of the invention is the production of a wool rich non-woven felt having performance and tactile characteristics comparable to those of a high quality woven woollen felt so that it can be used as a competitive replacement for woven woollen felt as a covering material for cue sports and gaming tables.

[0008] This invention utilises the application of current needling technology followed by finishing techniques that, to date, are usually only applied to woven felts.

[0009] One object of the invention is a method of manufacturing a non-woven felt for use as a covering cloth for cue sports or gaming tables which comprises the following steps:

a) providing a non-woven web of fibres, said web including feltable fibres;
b) needlefelting the web of fibres to produce a non-woven felt; and
c) milling the non-woven felt.

[0010] Preferably the feltable fibres are wool fibres and preferably also the feltable fibres form more than 50 % by weight of the web and preferably more than 60%.

[0011] The blend of fibres may include a proportion of synthetic fibres such as polyamide fibres. Preferably such proportion does not exceed 40% in weight of the total fibres weight.

[0012] It is preferred that the blend of fibres comprises at least 90% of wool fibres and up to 10% of polyamide fibres. For example, such polyamide fibres are staple fibres having an average thickness ranging between 3.3 decitex and an average fibre length of about 50mm. Advantageously the wool fibres have an average thickness ranging from 20 to 24 microns and an average length ranging between 35 to 40mm.

[0013] Advantageously prior to step b) the web of fibres is carded and crosslapped to form a multi-layered batt of fibres. The number of layers of said multi-layered batt is advantageously superior to 10, and desirably 14 or above.

[0014] The needlefelting step b) of the invention may further comprise the steps of :

i) pre-needling the web of fibres;
ii) providing said web of fibres with a scrim; and
iii) finish needling using needle boards, at least one of said needleboards punching down and at least one of said needleboards punching up.

[0015] The finishing step iii) is advantageously performed by a single needling machine and each board used in step iii) may typically contain an average of around 5000 needles per square metre.

[0016] Preferably the method of the invention com-

prises the additional step(s) of dyeing and/or brushing the felt and in some cases submitting it to a heat-fixing process. Preferably the felt can be submitted to further dry finishing processes.

[0017] The invention also relates to a non-woven felt obtained by such a method and to the use of such non-woven felt as a covering cloth for tables for the cue sports such as billiards, snooker, pool, and for gambling tables.

[0018] Other objects and advantages of the present invention will be apparent from the following description of a preferred embodiment of the invention.

Description of the preferred embodiment of the invention.

Raw Materials

[0019] The fibres used in the method of the invention can be solely wool fibres. However a blend of fibres can be used but to achieve an acceptable product it has been found necessary to keep a high proportion of fine wool fibres in the fibre blend. Preferably the percentage of wool fibre should exceed 60% in weight of the total fibres. Preferably the wool is of Merino type with a thickness of 20-24 microns and a length of 35-40mm. It is advantageous to treat the wool fibres (preferably by carbonising) to remove spurious vegetable matter.

[0020] When the felt is not made solely out of wool fibres it is preferred that the non-wool fibres of the blend are entirely or at least predominantly synthetic, for example polyamide fibres. Preferably these are staple fibres of 3.3 decitex thickness and cut to 50mm fibre length.

[0021] Various non-woven felts have been produced following the method of the invention described hereinbelow. Good results have been obtained using 100% wool fibres and also blends composed of 90% wool and 10% nylon (polyamide) fibres. As the proportion of nylon fibres in the blend is increased there is an increased risk of the finished product exhibiting "pills" (small surface balls of fibre) during use. For example, felt produced from a blend of 75% wool fibres and 25% nylon fibres exhibited a slight degree of pilling during field testing.

[0022] Non-woven felts of the invention have been made according to the following method which is a preferred embodiment of the invention:

Web Formation

[0023] The selected fibres above described were blended together using an appropriate opening and blending system. For this particular embodiment the Tatham Fearnaught opener and the blending system sold under the trade name Mix Master by the company TEMAFA has been used. The fibre blend was then transported to a feed hopper of an appropriate carding system of a type known in the art and capable of producing a commercially acceptable web of fibres from the selected blend. Better results are obtained employing a card with a double doffer. Advantageously an antistatic additive (sold by Steve and Thompson Textile under the trade name Dispertat-IP) was applied during blending to facilitate carding and web forming.

Cross Lapping

[0024] According to known techniques the fibre web formed by the carding machine was then fed to a cross-folding machine to produce a multi-layered batt of fibres for needlepunching. It has been preferred to use a cross folding machine having a "profiling" capability to minimise any cross width weight variation in the fibre batt. Such a machine is the Profile 400 sold by the company ASSELIN. The number of layers of web that are needed to is dependent on the weight consistency of the web produced by the carding machine and determines the required weight of the end product. The number of layers used for the preferred embodiment was 14 and preferably the number of layers of web should not be less than 10 and preferably 14 or more. The width of the multi-layered batt depends on the required product width taking into account the drafting and shrinkage which occurs during subsequent processing.

Needle Punching

[0025] Needlefelting techniques are known techniques for producing a non-woven fabric. An appropriate blend of fibres, either dyed or undyed, was carded and cross-lapped to form a substantially horizontal fibre web. The fibres of the web were provided in a generally planar configuration and were superimposed according to successive horizontal patterns. This fibre web was then passed through a needlefelting machine having at least one panel of barbed needles (or needleboard). Advantageously the machine has needleboards arranged on opposite sides of the fabric which may be arranged successively. As the fibre web was passed horizontally through the machine, barbed needles of each needleboard were punched through the fabric web and then removed. The passage of the barbed needles through the fibre web provoked an entanglement of the fibres as the barbs of the needles carried some portion of the fibres along their pathway.

Pre-needling

[0026] The cross folded multi-layered batt of fibres was fed into a pre-needling machine of the kind sold by the Austrian Company Textiles Maschinenfabrik Dr E. Fehrer AG. It was advantageous to use a pre-needling machine which incorporates an angled needling system such as the system known as "Fehrer H1 Technology" which is described in US patent No 5,699,596. Such

machine is provided with curved needleboards allowing the needles to penetrates the batt at various angles and not only at a 90° angle. The fibres in the batt are thus entangled more efficiently.

[0027] Settings for pre-needling varied depending on the weight of the batt and the end product required. Drafting of the batt took place during needling in order to reduce the difference between width-wise and length-wise tensile properties.

[0028] Needle punch density depends on the machine used and needle board configuration. It is preferable to set a needle punch density that minimises any potential patterning effect from the needle board configuration. The machine used in the preferred embodiment of the invention was the Fehrer H1 needlepunching machine with an average of 5000 needles per square metre with a curved needleboard. The punch density was about 170 punches per square centimetre with a needle penetration of 10 mm. The use of Fehrer's H1 needling machine is advantageous but not essential.

[0029] The needles used were 42 gauge 3 inch length with regular barbs.

Needlefelting

[0030] Following pre-needling, the pre-needled batt of fibres, together with an appropriate scrim material, was processed through a finish needling machine or series of finish needling machines. The scrim material allowed adequate support and strength (see paragraph below).

[0031] It was preferred to carry out the finish needling operation using a single needling machine set with two needle boards, one punching down and one punching up, each board containing an average of 5000 needles per metre of width. Conveniently the first board was of up punch configuration and the second board of down punch configuration. With this configuration, the scrim material was fed into the finish needling machine from above the fibre batt. Thus the first (up punch) needle board of the finish needling machine needled the fibres from the fibre batt through the scrim material and the second (down punch) needle board needled fibres back through the scrim material into the fibre batt. Again, the Fehrer's H1 needling machine previously mentioned was used with good result as a finish needling machine.

[0032] The needles used for finish needling were 3 inches 42 gauge needles with regular barbs but their characteristic could vary depending on the specific results required. Draft, needle penetration depth and penetration density also varied according to product requirements and, by varying these parameters, it was possible to alter the surface appearance and wear characteristics of the product. In the preferred embodiment good results were achieved punching at densities of 180 punches per square centimetre on both needle boards with the first board at 13mm penetration depth and the second board at 6mm penetration depth.

Scrim

[0033] A variety of scrim designs could be used as support material for the felt. Scrim selection ensured that adequate support and strength was given to the material during the dyeing and finishing processes together with appropriate strength and extension during table fitting and in use. Although a variety of scrims were appropriate, in practice a warp knitted product was preferred. The scrim used for the preferred embodiment was made of a polyamide filament yarn such as the polyamide blend which was used when the blend of fibres was not 100% wool. This enabled the product to be dyed compatibly with the felt producing a more pleasing aesthetic appearance. The scrim weight was kept as low as possible once performance characteristics were met. In the preferred embodiment the scrim constituted less than 25% of the total product weight.

Felt Finishing

[0034] If spurious vegetable matter was not removed from the wool fibres prior to the formation of the fibre blend then it was advantageous to carbonise the needled felt at this point. This involved soaking the material in a dilute solution of sulphuric acid and then drying and baking it. During the baking process the sulphuric acid converted the cellulosic vegetable material to friable carbon which was easy to remove. Carbonising techniques are well known in the art.

Milling

[0035] To produce a felt which meets the required aesthetic and performance characteristics desired to be used for cue sports and gaming tables, it was important to the finishing of the felt to perform a woollen fulling or milling step.

[0036] This process utilised the felting characteristics of the wool fibres which constituted a major proportion of the fibre blend. Without the milling process the felt remained soft and relatively bulky and would fail to perform satisfactorily in use. Alternative fibre bonding techniques such as calendering or chemical bonding which are frequently used on needlefelted synthetic fibres failed to produce the required combination of handle and wear characteristics.

[0037] The fulling or milling process could be carried out using either traditional woollen rotary milling machine or the flat roller hardening machine used in the woollen felt industry. Typically a common rotary milling machine was used.

[0038] In this machine the felt in rope form was subjected to moisture heat and pressure facilitating, due to the wool fibre's scale structure, increasing fibre entanglement and felt consolidation. During the rotary milling

process the felt integrity was advantageously supported and maintained by the scrim material. The rotary milling machine shrunk the felt in all three dimensions, the shrinkage in each dimension being varied and controlled by the machine settings and process time. However, due to the nature of the needled felt and the drag of the rotary milling machine, shrinkage of the material lengthways was minimal. The exact degree of shrinkage and consolidation required from the milling process depended on the density and character needed for the finished product. Typically dimensional reductions ranging from 10 to 35% were achieved.

Dying

[0039] Following milling, the material was dyed. The dyeing process could be carried out using one of a number of conventional machines appropriate for woollen goods. For the preferred embodiment a Winch Beck machine was used but jet dyeing, jig dyeing and beam dyeing were all practical. Alternatively, the fibres constituting the blend could be dyed as loose fibre stock before processing. However, this method reduced the potential for colour flexibility and was less commercially viable. During piece dyeing, depending on the preferred process, the scrim helped to support the felt and maintain its dimensional stability. With appropriate dyestuff selection the use of a polyamide scrim enabled the scrim to be dyed to the same colour as the felt as wool and polyamide fibres can be dyed with the same class of dyestuffs.

Brushing

[0040] After dyeing a laid or brushed surface was applied to the face side of the material. In this known process the surface of the material was subjected to a brushing or teasing action using a machine containing wire covered rollers or teasels. Fibres were raised from the surface of the material to create a laid or vertical "nap" which could be cropped short if appropriate. Repeated passages through the machine were performed in order to lift additional fibres increasing the density of the surface nap. The laid effect of this nap could be increased by additional brushing. The process was more effective if applied to the material in a damp state. The process could be carried out before dyeing but, depending on the dyeing method, the dyeing could disturb the nap necessitating an additional brushing operation after dyeing.

[0041] Advantageously if the felt had received a brushed nap, the material was then subjected to a heat setting process to "fix" the surface appearance. Traditional "potting", "crabbing" or "decating equipment" could be used. Continuous crabbing or decating machines were used and were particularly effective. These techniques are well known in the art and do not need to be described. As with the face finishing process outlined above this process could be applied to the material before dyeing.

[0042] Drying of the material was carried out using a single or multi-layer stenter or tenter. The stage at which drying took place varied depending on the required finish and selected process route.

[0043] The dried material was cropped on the face side and optionally the back side. This process was carried out using a traditional textile shearing or cropping machine having one or more shearing heads. The length of fibre left after shearing was controlled by altering the machine settings and depended on the requirements for the end product.

[0044] The non-woven felts obtained according to this preferred method demonstrated all the desirable characteristics of standard woven felts while being less expensive. The addition of a small proportion of synthetic fibres is believed to have enhanced the durability of the material.

[0045] It should be noted that the material could be subjected to further dry finishing processes. Depending on the end use these can include steaming, brushing, decating or blowing and pressing. These processes, individually or in combination, can enhance the appearance and handle of the material leading to a more pleasing aesthetic appearance and feel.

Claims

1. A method of manufacturing a non-woven felt for use as a covering cloth for cue sports or gaming tables which comprises the following steps:

   a) providing a non-woven web of fibres, said web including a proportion of feltable fibres;
   b) needlefelting said web of fibres to produce a non-woven felt; and
   c) milling said non-woven felt.

2. The method of Claim 1, wherein said feltable fibres are wool fibres.

3. The method of Claim 1 or 2, wherein said feltable fibres form more than 50% by weight of the web.

4. The method of Claim 3, wherein said feltable fibres form more than 90% by weight of the web.

5. The method of any one of Claims 1 to 4, wherein said web of fibres includes a proportion of synthetic fibres.

6. The method of Claim 5, wherein said synthetic fibres are polyamide fibres.

7. The method of Claim 2, wherein said blend of fibres comprises at least 90% of wool fibres and up to 10% of polyamide fibres.

8. The method of any one of Claims 6 to 7, wherein said polyamide fibres are staple fibres having an average thickness ranging between 3.3 decitex and an average fibre length of about 50mm.

9. The method of any one of Claims 1 to 8, wherein said feltable fibres have an average thickness ranging from 20 to 24 microns and an average length ranging between 35 to 40mm.

10. The method of any one of Claims 1 to 6, wherein prior to step b) said web of fibres is carded and crosslapped to form a multi-layered batt of fibres.

11. The method of Claim 10, wherein the number of layers of said multi-layered batt is at least 14.

12. The method of any one Claims 1 to 11, wherein the needlefelting step b) comprises the steps of :

i) pre-needling the web of fibres;
ii) providing said web of fibres with a scrim; and
iii) finish needling using needle boards, at least one of said needleboards punching down and at least one of said needleboards punching up.

13. The method of Claim 12, wherein each of said needleboards contains an average of about 5000 needles per square metre.

14. The method of any one of Claims 1 to 13, wherein said method further comprises the additional step(s) of dyeing and/or brushing said non-woven felt.

15. A non-woven felt obtained according to the method of any one of Claims 1 to 14.

16. Use of the felt of Claim 15 in the manufacture of cue sport or gaming tables.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 9756

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.7)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 April 2000	Seabra, L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
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L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 30 9756

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82