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PROCESS FOR THE MANUFACTURE OF METALLIZED FIBROUS MATERIALS METALLIZED WITH A NOBLE METAL

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This invention relates to a process of metallizing fibrous materials, such as for instance fabrics of all kinds, laces or like materials, especially where the metal used is one of the noble metals.

It is already known to coat a fibrous material with metal such as the noble metals, gold, silver, etc., in order to impart the same with the appearance of a fabric consisting of metal-threads. However up to now a simple process which can be carried out at little expense has not been discovered by which a uniform firmly adhering coating of metallic appearance is produced and which yields an article in which the character of fabric and the softness of the fabric base is maintained.

The known galvanic process of metallizing call for rendering conducting the non-conducting surface of the fabric by means of graphite or like means. Already this intermediate layer impairs the final product. However in spite thereof a fabric metallized in the galvanic manner is provided with a considerable number of drawbacks. The strength of adhesion of the galvanic coating precipitated on the fabric fibres is too small compared with the strain to which a fabric is subjected during use. Further as in the case of the present bases the galvanic coating has to be of considerable thickness, the greatest part of the softness of the base is lost. This thick metal coating renders the galvanic process very expensive, because in most cases coatings of precious metal are called for. Thereby the strength of adhesion is not increased no matter how thick may be the galvanic metal coating. The difficulties are well known which are met with if it is desired to produce a really firmly adhering uniform galvanic coating, particularly on a non-conducting base, as the galvanic coating consists only of the conducting places of the surface of the base and spreads from these places only, without increasing the strength of adhesion in case of increasing the thickness of the precipitated metal.

Of course all these difficulties, which are a consequence of the character of the galvanically precipitated metal, are increased in the

event of the fine-threaded bases in question.

Many experiments have been made already to improve the galvanic process for the present object. For instance it has been proposed to precipitate a very thin galvanic metallic coating on the fabrics rendered conducting by means of graphite and to compress the said coating in mechanical manner and to apply on the compressed coating a second metallic coating also by a galvanic process. The first thin metallic coating, which is precipitated on the fabrics coated with graphite and compressed in mechanical manner, is quite useless and again has to be sufficiently treated in the galvanic bath. An essential improvement of the product is not attained by this process. Of course also in this case the conducting intermediate layer of graphite is troublesome, the thickness of the metallic coating is not reduced but still increased and the repeated galvanic treatment and the mechanical treatment render the carrying out of the process very complicated and expensive.

Another proposal aimed at improving the conductivity of the fabric-base for example U. S. Patent No. 675,413. This process consists in that the fabric is introduced into a metallic salt solution in which the metal is precipitated on the fabric in a powdery and porous condition by means of suitable reducing agents. Colloidal substances such as gelatine, collodion, glue and the like were added to the reducing metallic salt solution, in order to improve the strength of adhesion of the said conductive coating. The fabric metallized in this way is useless, because the metallic coating possesses a gray and poor appearance and a powdery and porous structure, but like a layer of graphite is adapted as conductive base for the subsequent galvanization. The galvanic coating applied to a base of this kind possesses, of course, the same drawbacks as all the other galvanic metal coatings. As all known processes of metallization are based on the galvanic methods for producing the metal coating, the difficulties connected therewith usually arise, so that heretofore it has not been possible to produce in a simple and

inexpensive manner perfect metallized fabrics in large pieces, whereby the character and softness of the fabrics are not altered in any way.

5 According to the present invention the galvanic process is entirely dispensed with and metallized fabrics with a uniform and firmly adhering metal-layer are produced, whereby very little metal is used up, the said
10 layer possessing the character of fabrics consisting of metal-threads and the softness of fabrics made of the common yarn threads. For rendering conducting the fabrics, the proposed method is of precipitating metal by
15 reduction from a metallic salt solution. As already mentioned the metal, precipitated on the fabric by reduction from a metallic salt solution and possessing a finely powdery structure, has a poor non-metallic appearance and small adhesive properties only, and
20 the fabrics metallized in this simple and inexpensive manner may just be suited for a subsequent galvanization, but they cannot be used or termed a final product.

25 Applicant has discovered the surprising fact that metallized fibrous material made in known fashion by means of noble metal salt solutions may be converted in an extremely simple manner into valuable end
30 products. Even if the adhesive property of the metallic powder precipitated by reduction in known manner is very small, this process possesses the advantage, that the individual small metal-parts not only are precipitated on the surface of the fabric but
35 also in the pores and spaces between the individual fibres of the fabrics. Now according to the present invention a fabric metallized in this way is subjected to a mechanical
40 treatment by pressure, beating, friction and the like and thereby the metallic powder precipitated on the fibres of the fabrics is compressed to a uniform, highly glossy metallic coating, which very firmly adheres
45 to the fabrics, because it is directly anchored in the latter.

In some cases, particularly in the case of a somewhat thicker metal coating, the surface of this metal coating shows the characteristic of a more or less coherent foil after
50 having been treated in the mechanical manner. However this partly surface-character disappears already in case of a very small mechanical influence to which the fabrics are
55 subjected, for instance on rolling up or off the finished goods. Thereby the original soft character of the fabrics is re-established without impairing in any way the metal coating by breaking, this being in consequence of the particular anchoring of the
60 metal-layer in the fabrics.

According to the present invention fabrics coated with noble metals may be made in a desirable manner by first precipitating noble
65 metal in powdery form upon the fibrous ma-

terial in known manner by the reduction of a metal salt solution therein and thereupon, and hereafter treating the fibrous material by mechanical treatment such as by pressure, impact, friction, etc., in order to produce a strongly adherent metallic covering having
70 a pure metallic sheen.

In carrying out the present invention, the metallic salt solution (for instance silver nitrate) together with colloidal members, such as glutin, gelatine and the like, are applied to the fibrous material, preferably in a hot condition, and subsequently the same is reduced in known manner by any convenient reducing agent, for instance formaldehyde, hydroxylamin, hydrazin. After the reducing action has been carried out the fibrous material is washed by means of a convenient solvent and subsequently dried. Now the fibrous material is treated in a
75 frictional calendering machine, lustring-device, beetle-machine or any other convenient textile machine used for producing a glossy appearance of fabrics, whereby the original gray and poor metallic precipitation is
80 transformed into a very firmly adhering, dense and highly glossy metal coating.

In case of a thicker metal coating it is of advantage to destroy the surface-character of the metal-layer by a separate additional
85 treatment. For this object the fibrous material is subjected, after the compression of the metal coating, to a mechanical treatment, such as stretching, extension or the like, in cracking machines, calender, mangle or like
90 machines, whereby the more or less coherent metal-layer is torn up and the soft character of the fabric base is reestablished. According to the present process the metal coating does not fly off even in case of a very
95 thick metal coating. However on treating in a cracking machine, calender, mangle or the like a fibrous material metallized in a galvanic way according to the known processes, particularly in the case of thick metal
100 coatings, the galvanic coating will crack and fly off and the result is a quite useless product.

By the process according to the present invention a very durable fabric possessing all
105 the features of a fabric consisting of metal threads, is produced in a most simple and inexpensive manner and at very little expenditure of metal. By employing suitable machines for compressing the metal coating, of course not only highly glossy but also dead metal surfaces of all desired shades may be produced, or the highly glossy compressed metal coating can be deadened subsequently.

Further it has been found, that it is possible to improve the quality and particularly the metallic appearance of the finished article by a suitable treatment of the powdery metal, precipitated from the metallic salt solution on the fibrous material. It has been
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found, that the reducing action does not proceed entirely quantitatively up to the metal. In part intermediate products are produced, which separate with the powdery metal on the fibrous material and cannot be simply removed from the latter by washing with water. These parts which are not reduced are the cause for the various difficulties during the subsequent mechanical treatment of the fibrous material. Particularly the colour and the metallic appearance of the finished article are considerably impaired by the residues which are not washed out.

According to the present invention these drawbacks are removed in that, after the precipitation of the powdery metal by the reducing action, the fibrous material is treated with solvents, which dissolve or remove the combination not reduced up to the metal.

Various solvents, such as for example ammonia, potassium cyanide, organic ammon-bases, amino- and amido-bases, sodium-thio-sulphate and so forth, can be employed for dissolving the combinations which are not entirely reduced, the choice of the solvent depending on the kind of metal and fibrous material as employed.

An essential improvement of the metallic lustre of the finished article is attained by treating the fibrous material with an acid-solvent after the precipitation of the reduced metals, the acidity of the said solvent being such, that the acid does not damage the already reduced metal or the fibres of the material. For instance formic acid, diluted sulphuric acid and the like may be employed as acid-solvent.

These after-treatments are performed in that, after reducing the metallic salt solution in usual manner in an alkaline way, the metallized fibrous material is at first washed in water, subsequently treated with one of the solvents above stated and hereafter again washed in water.

In case of a subsequent treatment with acidous solvents it is of advantage to treat the fibrous material, after washing with a diluted soda-solution in order to remove even the last traces of the acid which is detrimental to the fibres.

It is of advantage to add protecting colloids, such as gelatine, gluten and the like, to the solutions serving for the after-treatment of the metallized fibrous materials.

The adhesion and appearance of the metallized fibrous material is considerably improved by the processes above described. Particularly by the after-treatment with acid-solutions a metallic-lustre is attained, which is fully equivalent to the lustre of the pure metal.

The fabrics made according to the present invention have a very nice appearance and are very soft. Neither the strength nor the working up of the fabric is impaired in any

way as a consequence of the particular mode of manufacture. In most cases the strength and possibility of treating is increased or promoted, so that the process according to the present invention is adapted also for fibrous materials of inferior quality.

We claim:

A process for the manufacture of metallized fibrous material which comprises precipitating a noble metal in powder form in and upon said fibrous material in known manner by the reduction of a noble metal salt solution, treating said fibrous material thus coated with noble metal in powdery form with solvents which will dissolve out matter which has not been completely reduced to metallic form, the said solvent containing a protective colloid such as gelatine, glue and the like, and thereafter compressing by mechanical treatment (pressure, impact, friction) to produce a strongly adherent covering of pure metallic appearance on said fibrous material.

In testimony whereof we affix our signatures.

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