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PROCESS OF IMPREGNATING FABRIC.

No Drawing. Application filed February 6, 1924. Serial No. 691,010.

This invention relates to a process of impregnating fabrics with a water-proofing, strengthening and insulating material. More particularly, the invention relates to a process of impregnating fabrics braided or woven from yarns formed of mineral substance such as asbestos and usable in connection with brake linings and clutch surfaces where strong resistance to heat and frictional wear is essential.

In the methods heretofore employed in the impregnation of fabrics, it has been usual to apply the impregnating fluid or substance after the final fabrication of the material, subjecting the fabric to an immersion or saturation in the impregnating fluid and subsequently through the application of heat, diffusing the impregnator into the fabric. This process has in many ways been unsatisfactory particularly in that the impregnating fluid fails to penetrate thoroughly to the interior of the fabric, especially where the material entering into the yarn structure is of non-fibrous nature, as, for example, yarn formed of pulpy substance held together by an adhesive or outer sheath. Consequently, fabrics subjected to these prior processes have received impregnation only in the exterior layer of the substance and in use when the exterior layer is worn off, the unimpregnated interior is exposed which lacks the proper water-proofing and insulating characteristics of the exterior layer and the fabric thus becomes deficient in the purposes for which the material is used.

It is an object of the present invention, therefore, to utilize a process for impregnating fabrics by which all of the fabric from the exterior to the interior shall be thoroughly impregnated with a substance designed to water-proof or insulate the same. Another important object of the invention is the provision of a process in which it is possible to disseminate the impregnator thoroughly through the fabric material without hindering the various processes incident to the manufacture of the final fabric such as the formation of a material into yarn, and the subsequent making of the yarn into the final product. Another important object contemplated is the simplification of a means by which the impregnating substance is added to the body material of the fabric. An object also is the utilization of a process which is applicable to material either of a fibrous nature such as cellulose or a material which is thoroughly comminuted or ground so as to have very little if any fibrous structure and which, therefore, is relatively impervious to the action of liquids such as an impregnating fluid.

Additional objects are involved in the employment of a process which is applicable with equal facility to fabrics manufactured from mineral substances such as asbestos and fabrics manufactured from vegetable or other material; in the provision of suitable apparatus for carrying out the many steps of the process and in various features relative to the details of the process which will become apparent on consideration of the following detailed description of the invention.

Broadly stated, the invention consists in a process involving the application of an impregnating substance in the form of a powder to the elementary material going into the manufacture of the yarn by a thorough mixing of the impregnator with the yarn material and subsequently to the formation of a yarn and the manufacturing of the fabric, in the application of a solvent accompanied by the application of heat to loosen the impregnator and diffuse it throughout the fibres and interstices and open spaces throughout the fabric. A feature of the invention is the thorough dissemination of the impregnating substance by mixing or other means through the basic material of the fabric while in its elementary crude form so that the impregnating substance is present throughout the whole fabric structure when the same is finally fashioned into shape as a finished product.

The term "fabric" as employed in the present specification is intended to cover a manufactured product formed by the combination of various elementary materials. The fabric may be formed either from yarns which are of themselves made from substances more elementary or the fabric may be formed merely by the assembly of elementary substances which are held together by some binding substance, causing a cohesion of the composite particles of the materials of the fabric. The term "fabric" is

also intended to include a product as a yarn which may be employed in further processes such as weaving. The description, however, will be largely confined to the application of the impregnating substance to a fabric composed of material which is manipulated in pulp and formed into yarn and subsequently braided or woven into a fabric, such, for example, as fabrics manufactured from asbestos.

In carrying out the process as applied to asbestos fibre, the impregnator in the form of a dry powder normally insoluble in water is mixed with the fibrous abestos in a beater machine. The impregnator may consist of a natural asphaltum, such as gilsonite, or substances having similar characteristics.

The beater employed in the mixing of the impregnator and pulp may be similar in its essential features to that described in my co-pending application Serial No. 692,947 filed Feb. 15, 1924, Patent No. 1,642,495, and consists essentially in a vat in which the material is constantly moved beneath a rotating wheel having radial blades adapted to mix and distribute the pulp. The beater includes also pressure guide rolls through which the stream of pulp material is passed. After the beating process in which the gilsonite, for example, is thoroughly mixed with the pulp, the same is passed to a paper machine having the general characteristics described in my co-pending application, Serial No. 654,-117, filed July 27, 1923, Pat. No. 1,681,234 in which the pulp is mixed with a binder and deposited upon traveling belts and subjected to a series of compressions and heating operations, being finally formed into paper sheets and wound into rolls.

The paper rolls are then sliced and fabricated into yarns in accordance with the various steps indicated and claimed in my co-pending applications, Serial No. 654,118, filed July 27, 1923, Patent No. 1,585,622, Serial No. 684,325, filed January 4, 1924, Patent No. 1,585,614 and Serial No. 685,300, filed January 10, 1924, Patent No. 1,585,613 wherein the paper strip containing the powdered gilsonite is moulded, wrapped or twisted either on itself or with a reinforcing core to form a strand and subsequently where it is desirable, twisted or wrapped with one or more reinforcing filaments.

The yarns as completed according to the above indicated processes are then woven or fabricated by an approved means into a brake lining, friction belt or any other desired product. The material is now in condition for the various steps of the process necessary to make the gilsonite, present in the material, effective as a water-proofing material, frictioning agent, or as a toughening or insulating substance. In accordance with the process, the fabric is passed through a solvent bath such as a solution of carbon tetrachloride, benzine or benzol in order to partially or completely dissolve the asphaltum present in the fabric and make it more susceptible to the action of heat. Immediately after subjection to the solvent, the fabric is passed into a heating oven which is of the type well known in the art consisting in a tower-shaped oven having a plurality of rollers at the top and bottom over which the fabric is slowly and continuously moved up and down in the oven until the gilsonite is thoroughly diffused into all the openings and interstices of the fabric and then dried within the fabric. A passage interval of two or three hours and an oven temperature of about 300° Fahrenheit is ordinarily advantageous, where gilsonite is the impregnator, to accomplish the results desired. After emergence from the oven, the fabric is passed through pressure rolls to compact the material and bring it to size.

As a result of the impregnation, the fabric has improved properties, the gilsonite by filling up the spaces and openings of the fabric causing the same to become relatively stiffer and imparting complete water-proofing and insulating characteristics. The fabric is now ready for immediate application to the uses for which it is intended. Where this use is that of a brake lining, it is apparent that the substance is impervious to moisture; that it will prevent the passage of electric current; and that it will have appreciably higher resistance to disintegration from wear and friction induced by contact with exterior surfaces, as in brake mechanism.

As previously pointed out, the fabric is entirely completed and ready for application to the uses for which it is designed before it is subjected to the action of a solvent and the heating processes, since a prior treatment would make the yarn too stiff for easy working. This requirement is in fact advantageous as the dissolving and heating steps may both be carried out continuously and as a fabric is ordinarily a continuous structure, the same may be passed through the solvent vat and heating oven in a continuous movement. However, it is within the bounds of the invention to pass the yarn through the dissolving and heating processes prior to fabrication of the finished product where such fabrication does not involve serious manufacturing difficulties.

It should be noted that the invention is not limited to the employment of an asphaltum as gilsonite as an impregnator as it has been found that not only materials derived from hydrocarbons, but also dried vegetable oils such as linseed, cotton seed and China-wood oils and similar substances may be used as well as the mineral oils. In addition, while ordinarily advantageous in the carry-

ing out of the process, it is not essential that the impregnator be insoluble in water, the chief necessity of the process involving a thorough dissemination either by mechanical mixture or solution of the impregnated substance in the elementary material of the fabric prior to its composition as a yarn or as a fabric. Note should be made further that the employment of a solvent in the use of gilsonite is not obligatory as heat acting alone for a given period of time is sufficient to actuate or to liquefy the gilsonite or render it fluid and cause proper diffusion of the same through the fabric but this action is slower and possibly more inefficient than where the solvent is employed.

Various other modifications of the process will be apparent to those skilled in the art to which the invention relates, involving the use of equivalents having similar properties and it is desired therefore to cover the invention broadly as well as specifically as indicated by the claims hereto appended.

Having thus described my invention, what I desire to secure by Letters Patent of the United States and claim is:

1. A process of impregnating manufactured fabrics formed of yarns containing pulpy stock which consists in mixing an impregnator in the form of powder with the yarn pulp prior to the manufacturing process, subjecting the fabric to the action of a solvent to dissolve the impregnator, and finally subjecting the fabric to a high temperature to diffuse the impregnator through the fabric.

2. A process of impregnating fabrics manufactured from yarns formed of fibrous stock which consists in mixing the impregnator in the form of a powder with the stock prior to the making of the yarn, and subsequent to the manufacture of the fabric dissolving the impregnator, and finally subjecting it to the action of heat to diffuse the impregnator through the fabric.

3. A process of impregnating fabrics manufactured from yarns which consists in mixing the impregnator with the stock prior to the making of the yarn, and subsequent to the manufacture of the fabric subjecting the fabric to the action of heat to diffuse the impregnator through the fabric.

4. A process of impregnating fabrics which consists in mixing with the elementary fabric material, prior to fabrication, an impregnating substance, in the form of a powder insoluble in water, and after manufacture of the fabric subjecting the same to the action of a solvent and finally heating the fabric in an oven maintained at high and continuously maintained temperature until the impregnating substance is thoroughly disseminated and diffused through the fabric.

5. A process of impregnating a yarn formed of separate elementary materials held together by a binding agent which consists in mixing the materials prior to fabrication into yarn with an inactive impregnating substance and subsequent to the manufacture of the yarn subjecting the same to a continuous high temperature to activate and diffuse the impregnating substance through the yarn.

6. A process of impregnating fabrics containing undissolved powdered gilsonite disseminated through the fabric which consists in passing the fabric by a continuous movement through a solvent bath and then through a heating chamber maintained at a temperature sufficiently high to cause the gilsonite to flow and diffuse throughout the fabric.

7. A process of impregnating fabrics containing undissolved powdered gilsonite disseminated through the fabric which consists in passing the fabric by a continuous movement through a solvent bath such as carbon tetrachloride and then through a heating chamber maintained at a temperature sufficiently high to cause the gilsonite to flow and diffuse throughout the fabric.

8. A process of impregnating fabrics manufactured from yarns which comprises mixing the impregnator with the stock prior to the making of the yarn, and subsequent to the manufacture of the fabric diffusing the impregnator through the fabric.

9. A process of impregnating fabrics manufactured from strands which consists in incorporating an inactive impregnator into the strands before the completion thereof, manufacturing a woven fabric from the said strands and subsequent to the manufacture of the woven fabric activating the said impregnator to diffuse it through the fabric.

10. A process of impregnating fabrics manufactured from strands which consists in mixing an impregnator with the stock prior to the making of the strands, and subsequent to the manufacture of the fabric activating the said impregnator to diffuse it through the fabric.

11. A process of impregnating fabrics manufactured from strands which consists in mixing a pulpy stock with an impregnator insoluble in water prior to the manufacture of strands therefrom, manufacturing the yarns into a fabric and subsequently subjecting the woven fabric to the action of a solvent and heat to diffuse the impregnator through the fabric.

In testimony whereof, I affix my signature.

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