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# UNITED STATES PATENT OFFICE.

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## PAPERLIKE PRODUCT AND PROCESS OF MAKING THE SAME.

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*To all whom it may concern:*

Be it known that I, KIRKE L. MOSES, a citizen of the United States, and resident of Brookline, county of Norfolk, State of Massachusetts, have invented an Improvement in Paperlike Products and Processes of Making the Same, of which the following description is a specification.

This invention relates to a paper-like product and a process of making the same.

One of the objects of the invention is to provide an improved product manufactured from paper material, which has high tear-resisting qualities compared with paper made in the ordinary way, which is very flexible, which presents a high folding number, which has a surface that will resist strongly abrasion by a blunt instrument, which will hold stitches as well as some fabrics, which is capable of being put to a great variety of uses by subjecting it to various kinds of surface treatments, which will retain its tough qualities even when saturated with water and which has various other novel and advantageous features.

In making this improved product I employ as a base a material having somewhat the nature of paper in that it is the product of a paper-making machine, but which is formed of loosely-matted relatively-long fibres producing a highly porous web which of itself has no very great strength. The character of the fibres from which this base product is formed may vary within wide limits without departing from my invention. I find good results can be secured by using hemp fibre, jute fibre, ramie fibre or any other similar fibrous material wherein the individual fibres are relatively long, but I wish it distinctly understood that the invention is not limited to the above-mentioned fibrous material but is intended to include any fibrous material capable of producing the results hereinafter described.

The base material is made in sheet form in a manner somewhat similar to that in which paper is made, except that the structure of the sheet material is very porous and shows a loosely-matted condition of the fibres. In fact it is important that the porosity and looseness of the fibrous structure be carried to such an extreme that great weakness and tenderness will result in the final web as it comes from the paper-making machine whether in a wet, damp, or dry condition. This sheet material having the relatively-long fibres is then subjected to a rubberizing process by which the individual fibres are coated with rubber without, however, necessarily having the interstices between the fibres filled with rubber. For thus rubberizing the product the latter is either immersed in or has its faces coated with a rubber, gutta percha or balata solution, which solution may be a hydrocarbon solution or a solution in the nature of an emulsion or a "suspendoid." Such emulsion or "suspendoid" may be either in the form of latex, or an artificially-produced emulsion or "suspendoid" of the above-named gums.

In this description and in the claims I have for the sake of simplicity used the terms "rubber" or "rubber solution" or "rubber emulsion" in a generic sense, meaning thereby to include any rubber-like product such as is derived from rubber, balata, gutta percha and similar trees. The terms "emulsion", "suspendoid" or "dispersion" are commonly used in the trade as descriptive of rubber compound in the nature of latex and my invention comprehends the use of such rubber compound whether described by any of the above terms or similar terms. I may add any desirable compounding ingredients to the rubber solution or emulsion and in the use of the term "rubber" or a "rubber compound" I intend to cover a solution or emulsion either with or without such compounding ingredients.

Where a solution or mixture of rubber in hydrocarbon is used it may be applied to each surface of the paper-like material in any suitable way, such as by a spreading or an immersing operation. To work the rubber solution into the material and thoroughly impregnate it with the solution the web or sheet may be passed between rolls which force the rubber into the fibrous body of the web, thus causing the rubber to thoroughly impregnate the web and coat the individual fibres. Good results are obtained by employing a rubbing pressure during this impregnating step, such for instance as would result if the pressure rolls were re-

volving at a surface speed considerably faster than that at which the web of paper moves between them.

Experiments show that it is advantageous to have one or both of such rolls formed with a soft or yielding body as the use of soft rolls facilitates the impregnation without, however, having any destructive effect on the paper base.

As stated above the rubberizing process may also be carried out by using latex or a rubber emulsion or "suspendoid" artificially formed and having the nature of latex. A rubber emulsion or "suspendoid" in the nature of latex has the distinctive quality that it readily penetrates fibrous material and in some cases even to the extent of entering the pores or canals of the individual fibres and, therefore, when a base material such as above described is immersed in or has latex applied to it, this solution will thoroughly saturate the material and provide a coating for every individual fibre and partially or substantially fill the interstices between the fibres. Since a rubber emulsion or "suspendoid" in the nature of latex has greater penetrating qualities than a solution of rubber in a hydrocarbon solvent, it is possible to successfully use the latex solution with fibrous material which is less porous and has less absorbent qualities than required when the hydrocarbon solution is used. After the material is thus saturated with this rubber emulsion the excess surface emulsion will be removed in some suitable way, such for instance as passing the web between rollers which apply a slight pressure thereto.

Where the rubberizing process is carried out by using an emulsion in the nature of latex it is not absolutely necessary to subject the web or sheet to any rubbing action or pressure to cause the rubber emulsion to penetrate the interstices of the web as is the case where a hydrocarbon rubber solution is employed, because the latex emulsion has the property of readily impregnating the base material without the aid of any pressure or force although this operation may be facilitated by the use of some force.

After the web or sheet has thus been subjected to the rubber solution so as to provide a coating for the individual fibres, it is then dried in some suitable way. Where the rubber coating is a hydrocarbon solution the drying is effected by evaporating the volatile solvent and where the latex emulsion is employed the drying is effected by evaporating the moisture in the emulsion. In both cases the drying operation can be facilitated by the use of heat.

The evaporation of the volatile constituents of the solution leaves the rubber and other non-vaporizable content, as a deposit on the fibres. Even though the interstices of the paper-like material may be filled with the solution before the drying operation yet the evaporation of the volatile constituent of the rubber solution may result in a more or less porous web or sheet depending somewhat on the percent of volatile constituent in the rubber solution.

After the material is dried it may be subjected to a condensing process to render it more compact and to condense somewhat the loosely-matted fibres. This condensing operation may be accomplished in various ways, such for instance as passing the web between heavy calender rolls.

A product made in this way has somewhat the appearance of paper but is highly resistant to any tearing strain or surface abrasion. Owing to the peculiar nature of the fibrous material it will absorb more or less water even after having been subjected to the condensing operation. It will also retain its tough flexible nature even when wet.

The uses to which the product can be put are wide and varied. Said product is of such a nature that it can be subjected to a variety of surface treatments and processes of manufacture which are now conceived to be applicable only to a fabric. In fact my improved product is of such a nature that it can be used for many of the purposes for which woven or knitted fabric is now commonly employed.

I desire to again state that although the base from which my improved product is made is the product of a paper-making machine, yet it differs very materially from any ordinary paper product, in that in the product employed in my invention the fibres are relatively long and loosely matted thus yielding an extremely porous sheet or web having of itself no apparent commercial value other than its use in the process above described to produce my improved paper-like product.

The toughness of the final product depends on the quantity of rubber which the web takes up as well as on the character of the fibre from which the web is made and the greater the porosity of web the heavier the deposit of such solution will be on the fibres and in the interstices. Hence the advantage resulting from the use of a web of high porosity.

I claim:

1. As an article of manufacture, a sheet or web formed by a paper-making process with high porosity and composed of loosely-matted relatively-long fibres which are bound together by a rubber compound.

2. As an article of manufacture, a sheet or web formed by a paper-making process with high porosity and composed of loosely-matted relatively-long fibres substantially all of which are coated with a rubber compound.

3. The process of making a paper product

which consists in forming by a paper-making process a sheet or web of high porosity and composed of loosely-matted relatively-long fibres, and then impregnating the sheet with a rubber compound.

4. The process of making a paper product which consists in forming by a paper-making process a sheet or web of high porosity and formed of loosely-matted relatively-long fibres, coating the individual fibres with a rubber compound and subsequently condensing the sheet or web by subjecting it to pressure.

In testimony whereof, I have signed my name to this specification.

KIRKE L. MOSES.