

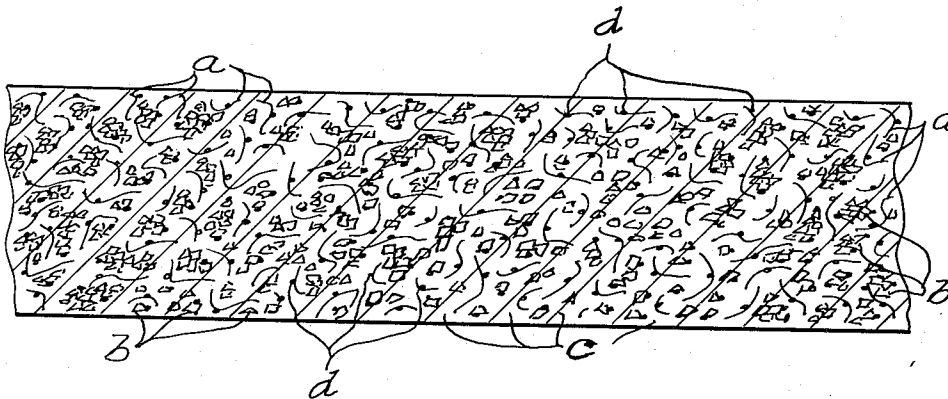
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METHOD OF MAKING SHEET MATERIAL

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METHOD OF MAKING SHEET MATERIAL

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This invention relates to an improved method of making flexible, fibrous, moisture resistant sheet material.

The mentioned type of sheet material may be useful for many purposes, as for example, as in-soles or mid-soles in shoes, as damping sheets for sound vibrations, as sheet gasket material for sealing or gasketing purposes in mechanical devices, and for various other purposes wherein a flexible sheet is desired which will not become weakened or distorted in shape or otherwise deteriorate in the presence of moisture.

Fibrous sheet material, to be useful for the mentioned purposes, must be strong enough to offer substantial resistance to tearing and to stretching while at the same time it should be quite flexible. Such sheet material has heretofore been made by first producing a web formed of suitable fibrous material and, preferably, some suitable binder material. Such a web, hereinafter sometimes conveniently referred to as "paper," then has been thoroughly impregnated with a mixture of animal glue, glycerine and water to give it sufficient strength for its intended purpose. Then, to render the paper useful in the presence of moisture, the web has again been processed to render the glue therein substantially insoluble by treating it with formaldehyde, or with certain chromium compounds or with combinations of the two.

The results of these prior practices, however, have been far from satisfactory. Such use of formaldehyde does not adequately insolubilize the glue; such use of chromium compounds substantially impairs the flexibility of the paper while insolubilization of the glue is not as fully accomplished as desired; and when chromium compounds, either alone or in combination with formaldehyde, are used as in the past, the control of the process is difficult and the final results are not satisfactory.

The principal object of the present invention is the provision of an improved method of making flexible, fibrous sheet material which is useful in the presence of moisture and which possesses the desired strength and flexibility.

According to the process of the present invention, in its broader aspects, a water soluble acid chromate or dichromate is thoroughly mixed with paper pulp, then paper is made from the chromated pulp after which the paper is saturated with a mixture of animal glue, glycerine and water. The glue, upon contact with the chromate in the paper, is rapidly rendered substantially insoluble while the glue-glycerine impregnated paper remains adequately flexible. Preferably, also, the surface of the impregnated web may be treated with formaldehyde to yield an even more complete insolubilization of the glue.

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In producing flexible fibrous sheet material according to a preferred manner of practicing this invention, a quantity of paper pulp is made by mixing suitable fibrous material with water and, preferably, with suitable binder material to produce a more or less plastic, slimy batch of pulp. The fibrous material used may preferably be of cellulosic fibres, although fibres of asbestos or glass or a combination of various kinds of the mentioned fibres may be employed. The paper pulp, if desired, may also include granular or pulverulent material such as particles of cork, wood flour or the like.

An aqueous chromate solution preferably is separately prepared by dissolving a quantity of a water soluble acid chromate such as potassium dichromate in water, this solution preferably being a saturated solution. Then the dichromate solution is thoroughly mixed into the paper pulp batch, the relative quantities of the original batch and of the dichromate solution being mixed at this stage being such as to assure that the dichromate solution will completely permeate the batch. It has been found that where potassium dichromate is the chromium compound used in the mentioned solution the preferred proportions to be admixed in forming the chromated batch are approximately 100 parts by weight of the dry fibres (and other solid material if the latter is used) in the initially formed paper pulp batch to .2 part by weight of the dry potassium dichromate.

The chromated paper pulp batch is passed through conventional paper making machinery by which it is formed into a web of a desired thickness after which the web is subjected to suitable drying means in accordance with conventional paper making procedure.

As a practical matter, the chromated paper web preferably is elongate and substantially continuous in form, enabling it to be rolled conveniently into a compact roll. The chromated paper may then be further treated, according to the process of this invention, either immediately upon emanating from the paper making machine or at some later time by being drawn from a roll. In such further treatment, the chromated paper is thoroughly impregnated with a mixture preferably of from two to four parts by weight of glycerine to one part of animal glue with sufficient water to give the mixture a relatively thin consistency. In order to impregnate the chromated paper, and assuming that the latter is in the form of an elongate web, the web, either as it emerges from the paper making machinery or as it is drawn from a roll, is passed, in a substantially horizontal attitude, through a long shallow bath of the mentioned glue-glycerine mixture.

As the web enters the bath it is inclined to

float, but as impregnation occurs it becomes submerged. The conditions surrounding the impregnation of the chromated paper with the glue-glycerine mixture should preferably be such that the consistency of the mixture, the length of the shallow bath, and the speed of travel of the web through the bath are all so determined or regulated that before the web emerges from the bath it becomes completely submerged therein, thereby indicating complete impregnation of the web. Upon emergence of the web from the bath, any excess of the glue-glycerine mixture may be removed by any suitable conventional wiping or squeezing means.

Upon the glue in the mentioned glue-glycerine mixture permeating the chromated paper and coming into intimate association with the chromate therein, a reaction sets in between the chromate and the glue whereby the latter is rapidly rendered substantially insoluble while, at the same time, the paper remains substantially flexible. The thorough impregnation of the paper with the glycerine and glue also very substantially strengthens the paper.

After the excess of the glue-glycerine mixture has been wiped or pressed from the web and the latter is dried, the web may be formed into a roll from which it may later be drawn for use for any of the mentioned purposes for which it may be suitable.

The accompanying drawing is a representation of sheet material resulting from the practice of the hereinbefore described process. It shows the sheet in cross-section in greatly enlarged form from which it may be seen that the sheet comprises fibrous material *a* extending throughout the sheet. The interstices in the fibrous material may or may not, as desired, be occupied by particles of granular and/or pulverulent material *b*. The sheet is permeated by chromate which is represented by dots *d* associated with the fibrous and granular and/or pulverulent material. The sheet material also includes substantially throughout its body the mentioned glue-glycerine mixture which cannot be conveniently shown in the drawing, but its presence therein is indicated generally by the reference character *c*.

The glue greatly strengthens the paper, and as the glue is substantially insolubilized, the paper is highly moisture resistant. Also, when the sheet material is made according to the present invention, it is substantially flexible.

Although the method hereinbefore described yields sheet material in which the glue is sufficiently insolubilized for many purposes, nevertheless, for some other purposes as, for example, for use as gasketing material, the impregnated sheet material preferably should be further treated by the application of formaldehyde thereto. This more completely insolubilizes the glue in the sheet material thus making it more suitable for use in the presence of extreme moisture conditions.

Preferably, but not necessarily, the finished sheet material, in roll form, is seasoned by allowing it to stand for approximately sixteen to twenty-four hours at approximately normal room temperature and humidity.

A process according to the present invention may also be practiced by using dichromates other than potassium dichromate. Among such other compounds are, for example, sodium dichromate and ammonium dichromate. In thus substituting other dichromate compounds for potassium dichromate in the described process, the number of

parts of the substituted dichromate compound to be used per 100 parts by weight of the dry paper pulp material should preferably be in the same proportion to .2 as the molecular weight of the substitute compound is to the molecular weight of potassium dichromate.

Although it is preferred to prepare the dichromate solution separately as hereinbefore described, the present invention, nevertheless, also comprehends forming the initial paper batch by mixing the dry dichromate with the dry pulp material and then mixing sufficient water therewith to yield a batch of the desired consistency in which the dichromate is substantially dissolved and thoroughly permeates the batch.

What I claim is:

1. A process of making sheet material which comprises converting into web form a wet batch of paper pulp comprising pulp material and dissolved dichromate, and impregnating the web with animal glue.

2. The process according to claim 1, wherein the dichromate used is potassium dichromate.

3. The process according to claim 1, wherein the dichromate used is sodium dichromate.

4. The process according to claim 1, wherein the dichromate used is ammonium dichromate.

5. A process of making flexible, fibrous, sheet material which comprises mixing an aqueous solution of dichromate into a wet batch of fibrous pulp material, converting the chromated batch to sheet form, and impregnating the sheet with animal glue.

6. A process of making flexible, fibrous, sheet material which comprises mixing a quantity of paper pulp material with water to form an initial batch, separately dissolving a quantity of water soluble dichromate material which is approximately 0.2% by weight as compared to the dry pulp material used in forming said initial batch, intermixing the latter solution with said initial batch, converting the resultant chromated batch to sheet form, and impregnating the sheet with animal glue.

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