

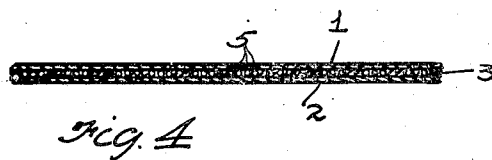
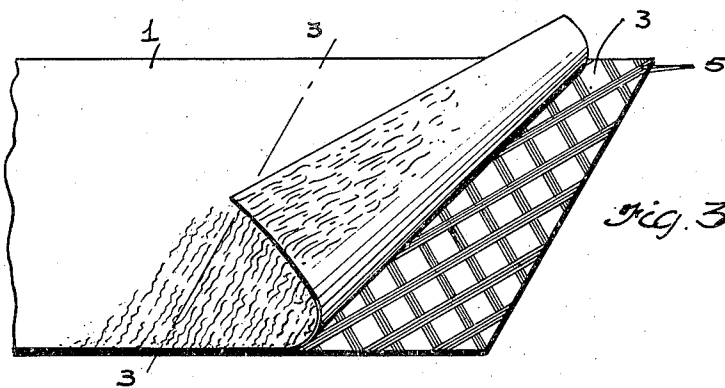
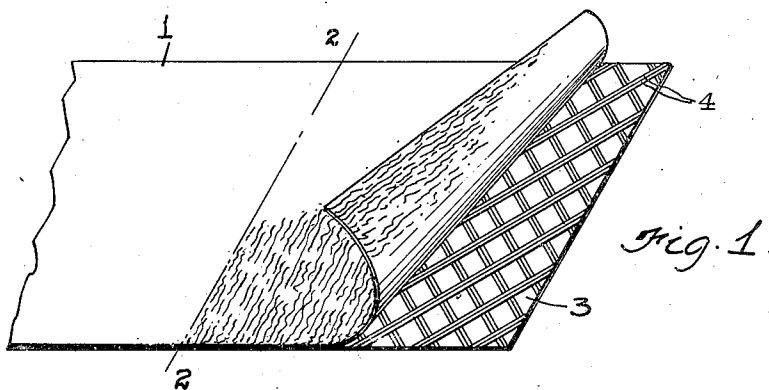
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ARTICLE OF MANUFACTURE

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ARTICLE OF MANUFACTURE

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The present invention is concerned with the production of a waterproof reinforced composite sheet which may be used for diverse purposes. For instance, when packaging products which are affected by moisture, while it is convenient to place such products in bags, the material of which such bags are made must necessarily be substantially water or moisture proof. Pitch constitutes one excellent waterproofing material for use in this connection, but the inclusion of such pitch in the wall of a bag or like container presents obvious difficulties. The interior of the bag must, of course, have a clean surface and it is equally objectionable for the pitch to be on the outer surface. At the same time the wall of the bag must be sufficiently stout to withstand rough handling where the bag is of the usual size and the packaged commodity a relatively heavy one, such, for example, as granular or flake calcium chloride.

One object of the present invention, accordingly, is the provision of a composite sheet which may be used for making moisture proof containers such as bags, which sheet will include a sufficiently heavy coating of waterproof adhesive to render the same substantially impervious to moisture. Another object is to provide a pliable reinforced waterproof paper that is stronger per unit of reinforcing material than has heretofore been thought possible. Other objects and advantages will be brought out as the description proceeds.

The term strength used in this connection is not to be confused with tensile strength which is commonly used to designate the transverse and longitudinal strength of a given paper. The term as used by us designates the property of resistance to tearing or rupture exhibited by a given sheet. For example a bag made from a sheet of kraft paper having a longitudinal tensile strength of 90 pounds per inch, when filled with 100 pounds of flaked calcium chloride, will with-

stand one to three drops of forty inches before rupture. In like manner a bag made from our improved type of sheet having reinforcing cords spaced at one inch centers and a strength of 50 pounds per inch width, will normally withstand 25 to 35 such drops.

To the accomplishment of the foregoing and related ends, the invention then consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawing and the following description setting forth but several of the various ways in which the principle of the invention may be utilized.

In said annexed drawing:—

Fig. 1 is a view of one form of our present improved composite sheet; Fig. 2 is a section of Fig. 1 taken along line A—A; Fig. 3 is another form of our improved composite sheet; Fig. 4 is a section of Fig. 3 taken along line B—B.

Referring first of all to the form of sheet illustrated in Figs. 1 and 2, we utilize two layers of stretchable paper 1 and 2, adhesively stuck together with a suitable material 3 such as asphalt having a low susceptibility factor. Imbedded in the adhesive between the paper plies is the reinforcing material consisting of two series of substantially parallel cords crossing each other at approximately right angles and laid diagonally with the edge at an angle of approximately 45°. Each of the cords in this case consists of two strands of spun yarn in substantially untwisted close parallel relation to each other. Figs. 3 and 4 illustrate a similar construction wherein each cord consists of three strands of spun yarn in substantially untwisted close parallel relation to each other.

Heretofore reinforced waterproof paper has ordinarily been made with a layer of woven fabric such as cheese cloth interposed between two layers of paper, as shown in U. S. Patent 1,301,605, or a layer of paper with a layer of burlap, U. S. Patent 798,680.

There have, however, been composite papers put on the market which contained cords running longitudinally and transversely of the composite sheet or even in some instances several plies of paper with cords interposed therebetween. Such forms of construction, however, we find in general do not produce a satisfactory paper for packaging relatively bulky materials, such packages being subsequently subject normally to rough handling.

Our work in this field has shown that a better adaptable and comparatively stronger paper for a number of uses can be produced by diagonally placing the cords with respect to the length of the sheet, these diagonal cords preferably being uniformly spaced and placed in two layers which cross each other in superimposed unwoven relation. While an angle of approximately 45° from the edge of the sheet would ordinarily be preferred for these cords, the invention is not limited to this angle since obviously other angles could be used in equivalent manner. It is further to be understood that the cords may be laid along curved lines and that the two plies of cords may be laid at different angles from the edge. If the cords in this construction were relatively bulky there would be a tendency for bridging and imperfect contact between the components of the sheet at the points where the cords cross each other, such condition being substantially the same as that encountered with a loosely woven coarse threaded fabric. In order to avoid this condition, instead of using single relatively bulky cords, we prefer to use at least two smaller ones, the combined strength of which is equal to the strength of the single cord, these cords being placed side by side in substantially untwisted relation when incorporated in the composite sheet. The multiple cords thus placed are not excessively bulky at the crossing points and thus aid in making a better contact between various components of the sheet.

The waterproof adhesive, if of the asphalt type, should be one that melts at a relatively high temperature and does not become excessively brittle under relatively low temperatures. Such a type of adhesive is said to have a low susceptibility factor. Some forms of asphalt satisfactorily meet this requirement as do a number of pitches, mixtures of asphalt and pitch, and like materials. In like manner some commercial glues have satisfactorily properties making them suitable for this use. The term adhesive as used herein will accordingly be understood to connote all of the various equivalent waterproof materials having suitable properties for the use described.

The paper used in this composite sheet may be relatively strong material in creped or other suitable form. We have found, however, that of these a stretchable or creped

paper is in general preferable. Of this type of paper, one having very fine or close crinkles appears to be the best. When such a paper is subjected to rough usage, or a blow, which would ordinarily tear a flat sheet between the reinforcing cords, the crinkles in the stretchable paper will partially or fully stretch out at the point receiving the blow and thus normally absorb it without tearing.

Cords to be incorporated in the composite sheet may be cotton, jute, hemp, sisal, New Zealand, or any such equivalent material. At the present time, of all these, jute is to be preferred as it costs less per unit strength without reaching the condition of excessive bulkiness. The size of cord or yarn to be used to obtain a given strength will, of course, be governed to a certain extent by the comparative price of different size yarns, as well as the conditions that the paper is to be subjected to in commercial usage. In other words, two 12 pound strands of yarn may possibly meet the requirements for reinforcing the sheet and still be satisfactory and cheaper than three 8 pound strands used for the same purpose.

Tests with composite sheets of this type show that even though the average reinforcement per unit area is the same with various spacings, sizes, and number of reinforcing cords, there is considerable difference in the performance of the ultimate product. Taking two 12 pounds strands of jute yarn spaced at one inch and incorporated in the composite sheet in manner heretofore described as standard, then six 12 pounds strands of jute yarn spaced at three inches will be equivalent in reinforcing strength per unit area. This spacing of the reinforcing cords, however, it will readily be seen leaves relatively large areas of unsupported paper between the reinforcing cords and is consequently subject to the danger of rupture if roughly handled. Paper having relatively wide spacing such as this, however, would make a satisfactory waterproof building paper. On the other hand if the reinforcing cords are reduced in strength and spaced closer together while maintaining the same unit area reinforcement, it becomes increasingly difficult to obtain proper contact between the various components of the sheet, with resultant loss of efficiency and strength. At the same time the decrease in strength of the cords makes the more vulnerable to breakage when subjected to rough usage as indicated by drop tests.

We have found that the preferred construction of such a sheet where it is to be used to make bags for holding relatively heavy materials, such as granular or flaked calcium chloride in standard size packages, is composed of two sheets of closely crinkled paper, adhesively fastened together with a layer of asphalt having a low susceptibility

factor and having incorporated in such adhesive two layers of double strands of substantially parallel 12 pound jute reinforcing cords crossing each other at approximately right angles and at an angle of approximately 45° from the edges, said cords being spaced from $\frac{1}{16}$ of an inch to an inch apart.

While this composite sheet is primarily designed for use in making strong waterproof bags, it will be obvious to those versed in the art that numerous other uses could be made of it. For instance, it may be used for wrapping or covering materials or articles which might be damaged by exposure to the elements. This paper may also be used satisfactorily as a waterproof building paper.

Other forms may be employed embodying the features of our invention instead of those explained, change being made in the form or construction, provided the elements stated by any of the following claims or the equivalent of such stated elements be employed.

We therefore particularly point out and distinctly claim as our invention:—

1. An elastic composite reinforced paper comprising two sheets of creped paper cementitiously united by a layer of adhesive therebetween and having embedded in such adhesive layer a plurality of substantially parallel diagonally laid strands of spun yarn in two plies crossing each other in unwoven relation.

2. An elastic composite reinforced paper comprising two sheets of creped paper cementitiously united by a layer of adhesive therebetween and having embedded in such adhesive layer a plurality of substantially parallel diagonally laid cords composed of untwisted strands of spun yarn, said cords being in two plies crossing each other in unwoven relation.

3. An elastic composite reinforced paper comprising two sheets of creped paper cementitiously united by a layer of asphalt therebetween and having embedded in such asphalt layer a plurality of substantially parallel diagonally laid cords composed of untwisted strands of spun yarn, said cords being in two plies crossing each other in unwoven relation.

4. An elastic composite reinforced paper comprising two sheets of creped paper cementitiously united by a layer of asphalt therebetween and having embedded in such asphalt layer a plurality of substantially parallel diagonally laid double strands of spun jute yarn spaced at 0.7 to 1.0 inch apart in two plies crossing each other in unwoven relation.

5. An elastic composite reinforced paper comprising two sheets of crinkled paper cementitiously united by a layer of adhesive of a low susceptibility factor and having embedded in such adhesive layer a plurality of strands of fibrous material laid crosswise

in diagonal relation to the edge of the sheet.

6. An elastic composite reinforced paper comprising two sheets of creped paper cementitiously united by a layer of asphalt of low susceptibility factor and having embedded in such asphalt layer a plurality of strands of fibrous material laid crosswise in diagonal relation to the edge of the sheet.

Signed by us this 27th day of February, 1929.

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