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SHEET MATERIAL

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This invention relates to sheet materials and is concerned more particularly with a novel felt-like material which is soft, porous, and absorbent. The new product is strong and pliable and may be readily impregnated with bituminous compounds, such as are commonly used for that purpose in the manufacture of roofing and floor coverings. An embodiment of the invention, which may be employed to special advantage in the production of roofing, will, accordingly, be described in detail for purposes of explanation, but it is understood and will be readily apparent, that the utility of the new product is not limited to that particular use.

In the manufacture of prepared roofing in the form of sheets or strip shingles, it is the common practice to employ a porous sheet material known in the art as "roofing felt" and to impregnate this felt with bituminous or hydrocarbon compounds, which are capable of withstanding solar heat and the action of the elements when exposed to the weather. The felt used for the purpose consists largely of rag fibres and it is produced by well known methods from rag stock. In the impregnation operation, the sheet material is passed through the hot compound and the compound penetrates the pores of the material and gives it strength, stiffness, and weight. Following the impregnation, the saturated sheet is coated with a compound, usually of a higher melting point than that employed as the saturant, and, thereafter, the material is finished by the application of a layer of granular surfacing material, such as crushed slate.

Although it has been common practice in the roofing industry for many years to employ felt made of rag fibres and consisting largely of cotton with a minor proportion of wool, it has long been recognized that such stock adds greatly to the cost of manufacture and the price fluctuates widely. Accordingly, various other ingredients have been employed with the rag fibres to reduce the total cost and to add desirable qualities. The characteristics of the felt have thus been modified, for example, by the use of a proportion of fibres derived from waste papers, such fibres adding stiffness to the sheet. While the expedients employed have increased the rate at which the saturation can be carried on, and have to some extent reduced the cost of the sheet material, the felt still remains an expensive element in the manufacture of roofing, and, more recently, has increased in cost with an increase in the cost of the rags from which it is prepared.

The present invention is directed to the provision of a novel porous absorbent sheet material, which offers special advantages when used in the manufacture of roofing, because it may be produced rapidly and at low cost, takes up saturants freely, and has good tensile strength. The new material includes a less proportion of rags than has been though feasible heretofore, and waste paper fibres may be used, if desired, the balance of the material being made up of wood fibres disintegrated to the form substantially of elementary fibres and small fibre bundles. The fibrated wood consists of fibres of substantial length having fibrillae thereon in large amount, and these wood fibres not only render the sheet more porous, but, in addition, felt together so as to impart strength to it. In the new sheet, therefore, the use of sawdust to make the sheet saturate more freely is avoided and that function is served by fibres which felt, rather than by small particles which have no such tendency. The incorporation of the wood fibres in the sheet thus permits a substantial reduction in the quantity of rag fibres required, and since the wood fibres may be produced at relatively little cost, the replacement of the rag fibres by the wood effects a substantial reduction in cost.

In the manufacture of the new sheet, the rags and paper stock are treated in water in a beater in the usual way, and after they have been worked and are ready for discharge, the wood fibres are introduced into the beater and the beating operation continued until the wood fibres have been thoroughly distributed through the mass undergoing treatment and have become partially hydrated. Thereafter, the pulp is sheeted out and dewatered on a cylinder or Fourdrinier machine of the conventional type. The sheet is then dried by means of the usual drier and is then ready for saturation.

Wood fibres suitable for use in the production of the new sheet material may be produced by the process described in the copending application of Banbury and Comes, Serial No. 101,014, filed September 16, 1936. According to this process, pieces of wood of small size are introduced into the chamber of an internal mixer, and are there subjected to rolling, rubbing, and crushing operations, and are also smeared against the inner walls of the mixer chamber by the agitating elements of the apparatus. During the operation the mass undergoing treatment is subjected to pressure so that the pieces of wood are not only acted on by the mechanism, but are also rubbed and crushed against one another so that the wood is reduced to the form of elementary

fibres or small fibre bundles. These fibres have substantial elongation relative to their diameter and they have fibrillae thereon in large amount.

The wood used in this defibering operation may be any desired wood in its natural state, and the wood is treated in the presence of moisture which, to some extent, softens the fibres and facilitates the disintegration. Following the production of the fibrated wood, it may be used without further treatment in the production of the sheet material, but I have found that if the wood employed is of the resinous type, it is advantageous to recover the rosin and turpentine and other volatile substances before the fibre is used in the production of the sheet material. For this recovery, the material may be first treated by means of steam to remove the volatile substances, following which, the rosin and similar substances may be extracted by means of a solvent. The process may be that described in my copending application, Serial No. 54,644, filed December 16, 1935. By thus recovering the resinous and volatile materials, a substantial saving is effected, and, in addition, the wood fibres thus treated are found to become saturated more readily with the bituminous compounds which are employed in the manufacture of roofing.

If wood fibre is used, from which the resinous and volatile substances have not been removed, the sheet material produced is satisfactory, but the saturation with the bituminous material may not be so complete and the material will not take up quite so much of the saturant, nor will it become saturated quite so readily. However, in the case of soft woods such as poplar, balsam, and the like, the defibering operation produces a good fibre which is quite satisfactory even though the fibres are not subjected to treatment with steam and solvents.

Instead of employing wood fibre produced by the Banbury and Comes process, such fibre may be produced by other methods. Thus, spent chips from which the resinous and volatile substances have been extracted, may be introduced into a beater with the rag stock and waste paper, if the latter is used. By a prolonged beating operation, the chips will be disintegrated substantially to the form of the fibres produced by the Banbury and Comes process. The production of the fibre by such a beating operation is somewhat expensive because of the prolonged beating necessary, and the use of the Banbury and Comes process for the purpose is accordingly preferred.

In the production of roofing felt by one method now commonly employed, the proportions used are by weight, about 73 per cent rag fibre, about 17 per cent waste paper, and about 10 per cent sawdust. In the manufacture of the new material, I have found it possible to obtain a sheet, which is equally satisfactory with that described, which contains by weight, about 50 per cent rag fibre, about 20 per cent waste paper fibre, and about 30 per cent of the fibrated wood. As the fibrated wood is much less expensive than the rag fibre, the saving in cost afforded by its use will be apparent.

Instead of using approximately 50 per cent rags, 30 per cent fibrated wood, and 20 per cent waste paper, I find that advantages are obtained even though the fibrated wood amounts to as little as 10 per cent by weight, in that the wood fibre helps to open the felt so that the sheeted out pulp dewaters better and saturates more freely. Also, the proportion of wood fibre may be increased up to 50 per cent, where extreme low cost is desired. The use of so large a proportion of wood fibre somewhat reduces the tensile strength of the felt and it will be used, therefore, only when low cost is more important than strength. Generally, the new product will contain between 10 per cent and 50 per cent of wood fibre, between 5 per cent and 20 per cent waste paper, when such stock is used, with the remainder rag fibres, the proportions being by weight. I prefer to use not in excess of 30 per cent of the wood fibre, however, and also find that best results are obtained when the wood fibre has been treated to remove the resinous and volatile substances in advance of its being mixed with the rag fibre and waste paper.

In some instances it may be desired to produce a sheet material which is extraordinarily open and porous so that it will take up saturants readily. For that purpose, the waste paper may be omitted entirely or used in very small proportions. In a sheet material in which waste paper is not used, the rag fibre content may vary from about 40 per cent to about 95 per cent, with the remainder the wood fibre referred to.

I claim:

1. A porous absorbent felted sheet which comprises rag fibres, waste-paper fibres, and from 10% to 50% by weight of mechanically disintegrated wood which has been defibered by subjecting a mass of small pieces of the wood, while under pressure and in the presence of not more than a relatively small amount of water, to mechanical action which will cause the individual pieces of the wood of the mass to be rubbed one against another until said pieces are broken down into a state of elementary fibres and small bundles of fibres.

2. A porous absorbent felted sheet which comprises rag fibres, waste-paper fibres, and from 10% to 50% by weight of mechanically disintegrated wood which is substantially free of resinous and volatile substances naturally occurring in the wood, and which has been defibered by subjecting a mass of small pieces of the wood, while under pressure and in the presence of not more than a relatively small amount of water, to mechanical action which will cause the individual pieces of the wood of the mass to be rubbed one against another until said pieces are broken down into a state of elementary fibres and small bundles of fibres.

3. A porous absorbent felted sheet which comprises from 5% to 20% by weight of waste-paper fibres, 10% to 50% by weight of mechanically disintegrated wood which has been defibered by subjecting a mass of small pieces of the wood, while under pressure and in the presence of not more than a relatively small amount of water, to mechanical action which will cause the individual pieces of the wood of the mass to be rubbed one against another until said pieces are broken down into a state of elementary fibres and small bundles of fibers, substantially the remainder of the fibrous material of the sheet being rag fibres.

4. A porous absorbent felted sheet which comprises about 50% by weight of rag fibres, about 20% by weight of waste-paper fibres, and about 30% by weight of mechanically disintegrated wood which has been defibered by subjecting a mass of small pieces of the wood, while under pressure and in the presence of not more than a relatively small amount of water, to mechanical action which will cause the individual pieces of the wood of the mass to be rubbed one against another until said pieces are broken down into

a state of elementary fibres and small bundles of fibres.

5. A porous absorbent felted sheet which comprises about 40% to 95% of rag fibres, with substantially the remainder of the fibrous material of the sheet being disintegrated wood which has been defibered by subjecting a mass of small pieces of the wood, while under pressure and in the presence of not more than a relatively small amount of water, to mechanical action which will cause the individual pieces of the wood of the mass to be rubbed one against another until said pieces are broken down into a state of elementary fibres and small bundles of fibres.

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