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ROOFING AND PROCESS OF MANUFACTURING SAME

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This invention relates to roofing and to processes of manufacturing roofing.

At the present time the better grades of fireproof roofings are relatively expensive while the cheaper grades of roofing, with the exception of metal roofing, are not fireproof. Metal roofing is not suitable as a rule for use on residential buildings, although it finds a very wide and important use in industrial buildings, farm buildings, and the like. Its chief disadvantages for these uses are in its tendency to corrode and its lack of mechanical strength except in heavy gauges.

The present invention aims to devise a roofing which can be manufactured at a sufficiently low cost to compete successfully with the cheaper grades of roofings, but which will be superior to them and will have a much wider range of usefulness.

In building certain types of structures, such as sheds and a great variety of the buildings used in warmer climates, it is desirable to erect a frame and then nail the roofing directly to the frame timbers without boarding the roof. To satisfy these requirements a roofing must be very strong mechanically in addition to being waterproof and substantially fireproof. It is, therefore, a further object of this invention to devise a roofing which will be more satisfactory for this purpose than the roofings heretofore available.

It is contemplated that the product provided by this invention can be used either in the form of sheet roofing, whether corrugated or flat, shingles, or for siding, and all of these articles therefore will be included in this specification and in the appended claims in the term "roofing".

Price considerations make it essential to use relatively inexpensive material for the body of the roofing. For this reason I prefer to use some inexpensive form of fibre such as wood pulp, pulp screenings, or equivalent materials. With this fibrous stock I prefer to mix a substantial proportion of some powdered or granular non-combustible substance, such as gypsum, clay and sand, or the like. These and similar ingredients constitute the body forming materials for the roofing. With them is mixed a non-combustible binder such as Portland cement, or more preferably, potassium or sodium silicate.

The desired degree of resistance to combustion may be imparted to the product partly by the use of the non-combustible ingredients above mentioned and partly, also, by the use of fireproofing salts, such as borax, ammonium chloride, ammonium sulphate, ammonium phosphate, aluminum sulphate, and even common salt in small proportions. Preferably a mixture of ammonium chloride, or ammonium sulphate and borax is used since a mixture of these salts appears to neutralize the objectionable characteristics of the ammonium salts, while at the same time producing a combination which has good fireproofing properties and is relatively inexpensive. Ammonium chloride or ammonium sulphate if used alone are objectionable because of their tendency to corrode the metals with which they come in contact including the nails driven through the roofing to hold it in place. If borax is used either with ammonium chloride or ammonium sulphate it seems to substantially neutralize this tendency and certainly greatly minimizes the corrosive action of te ammonium salts.

It is necessary to work these materials into the form of a sheet or board and this may conveniently be done by mixing the salts with the body forming materials and rolling or molding and pressing the mass to form a sheet or board. A method of procedure, however, which I consider preferable is to place the body forming materials and the binder in a beater, such as that used in the paper industry, and to beat them in a solution of the fireproofing salts. This results in suspending the fibrous and granular constituents in the solution, and the beaten mixture can then be delivered to a board forming machine, such, for example, as the so-called cylinder machines used in making binder's board, fibre board, and paper boards of various kinds. The solution can be reused, additional salts being added to keep the concentration substantially uniform.

The proportions of the ingredients used necessarily will vary somewhat with the composition of the mixture, the nature of the ingredients used, and the results desired. If a very high percentage of wood fibre or pulp of a combustible nature is used, it may be advisable to use such a concentration of salts in the solution that approximately 20% of the weight of the board when dry will consist of salts. This percentage, however, is rather higher than ordinarily is required. In a typical case the weight of the dry board may consist approximately of 35% to 40%, by weight, of fibrous constituents, about 15% of fireproofing salts, and approximately 50% of non-combustible ma-

terials, such as gypsum, clay, and sodium silicate. The percentage of dry silicate on the final product need be only about one-half to 5% of the weight of the board.

After the board has been formed it is dried and is then impregnated with some waterproofing agent. While a wax such as montan wax may be used for this purpose and would be very satisfactory in some cases, for general purposes I prefer to use a synthetic resin. Almost any of the synthetic resins will work successfully, but price considerations make it advisable, at least for many purposes, to use one of the cresol base resins, such for example, as that known commercially as catalin. The resin may be applied by spraying or dipping, the resin being dissolved in a solvent, such for example, as denatured alcohol. Preferably the dry board is dipped in a solution of the resin, the solution penetrating rapidly because of the relatively porous nature of the board. It is not usually essential that a through and through impregnation be produced, but the strata of the board for a substantial depth should be impregnated. If catalin varnish is used it will be found to penetrate very rapidly so that a very brief dipping produces an entirely satisfactory impregnation. This and the other synthetic resins make excellent binders and could be used exclusively for this purpose if it were not for considerations of price. At the present time, however, even the cheapest of these resins is too expensive to use alone as a binder, and it is for this reason that sodium silicate is preferred as a binder, this material producing a very strong board and having desirable fireproofing properties, while at the same time being of valuable assistance in reducing the quantity of synthetic resin which will penetrate the board.

The resin at this time is in an intermediate phase, that is, in the so-called A or B stages, preferably the latter. The next step in the process, therefore, is to heat the impregnated body to convert the synthetic resin into its C stage where it is insoluble in water and is substantially infusible. In performing this operation it is preferable to keep the heat at a relatively low point, at least for a time, in order to avoid breaking down the fireproofing salts and driving them off. Assuming that the catalin varnish is used as the waterproofing agent, it is preferable not to raise the temperature above 180° F. In fact, the entire conversion of the resin can be accomplished at lower temperatures within three or four hours. Only a relatively small percentage, say 5%, of resin is required, such percentage being based on the weight of the final product. To convert this small percentage of resin the temperature can well be started at, say, 130° F. and later raised to 180° F. after the resin in the outer strata of the board has been converted and the fireproofing salts consequently have been sealed in.

The synthetic resin makes the board highly waterproof, gives it excellent wearing qualities, and, if a penetration of the resin for a substantial depth is permitted, it adds materially to the mechanical strength of the board.

Prior to either the impregnating or heating operations, the board may be pressed, cut, or otherwise shaped. Preferably this operation is performed before the impregnating step so that the scrap or refuse can be returned to the beater and utilized. Roofing and siding of any desired form can be made by this process. It may take the form of shingles or shingle strips in any desired shapes and either plain or tapered butt shingles may be made this way. Any of the usual types of sidings also can be manufactured by this process.

In making sheet roofings for many purposes, particularly those intended to be nailed directly to the frame timbers of a building, it is preferable to corrugate the board in much the manner that metal roofings are corrugated in order to give additional strength to the sheets. Preferably the corrugations are two and one-half or three inches between centers and about five-eighths of an inch deep, and such shaping of the material produces an exceptionally strong roofing. It also has the advantage of being very resilient. This is particularly true when sodium silicate is used as a binder, this being the material preferred for this purpose. It makes a board of great mechanical strength and the corrugating of the board adds materially to its strength and rigidity.

An especially important advantage of the roofing provided by this invention is its relatively high degree of fireproofness. As above indicated, this result is obtained partly by the granular materials used in its composition, partly, also, by the nature of the fireproofing salts which it includes, and in addition, both the sodium silicate binder and the synthetic resin waterproofing agent contribute to this result.

It should also be noted that the salts have toxic properties and that the binding and waterproofing materials are of such a nature that the roofing is rendered practically immune from the attacks of insects or of fungi which would produce decay. Both these are particularly important advantages where the roofing is to be used in tropical countries. Decay proceeds very rapidly in such climates and certain insects, more particularly ants, would attack the roofing and destroy it in a very short time if it were not for the protection afforded by these substances.

The roofing produced by this invention is stronger mechanically than sheet metal roofings of the ordinary gages, is lighter in weight, easier to handle, more resilient, and has a longer life. It is also superior to them in that it does not require painting. If desired pigments can be mixed with the fibre in the beater to produce the desired colors. The roofing thus can be manufactured to meet a great variety of uses and the manufacturing cost can be held within entirely reasonable limits.

Having thus described my invention, what I desire to claim as new is:

1. A roofing of the character described, comprising a body containing a high proportion of combustible fibrous material united by a fireproofing binder and coated with an additional waterproofing substance which is relatively brittle at high atmospheric temperatures.

2. That improvement in processes of manufacturing a roofing which consists in suspending body forming materials in a solution of fireproofing substances, working said materials into the form of a board, impregnating said board with a synthetic resin in one of its lower phases, and heating the board so impregnated to convert the resin into substantially an insoluble and infusible condition.

3. That improvement in processes of manufacturing roofing which consists in producing a sheeted fibrous body containing substantial proportions of fireproofing salts and a synthetic resin in one of its lower phases, said resin being present in sufficient proportions to render said body substantially waterproof, heating the body so produced at a relatively low temperature to convert the resin in the outer strata of the body into an insoluble condition and thereby to seal said salts into the body, subsequently raising the temperature of said body and thereby producing a conversion of said resin in the deeper strata of the body into an insoluble condition, and continuing such heating until all of said resin for a substantial depth in the body has been so converted.

4. A roofing of the character described comprising combustible fibrous materials mixed with granular non-combustible materials associated with a sufficient proportion of a fireproofing binder to unite said materials and a suitable proportion of synthetic resin in the outer layers only to render the roofing substantially waterproof, said roofing also containing a substantial proportion of fireproofing salts associated with said materials and serving to render the entire product highly resistant to combustion.

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