Jan. 2, 1934. T. ROBINSON 1,941,491

BUILDING PRODUCT AND METHOD OF MAKING SAME

Filed July 10, 1928 2 Sheets-Sheet 1

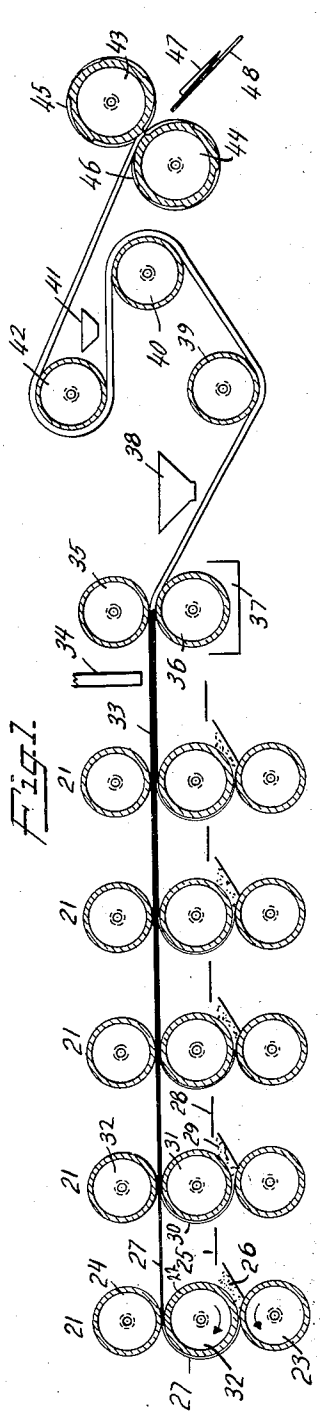


Fig. 1.

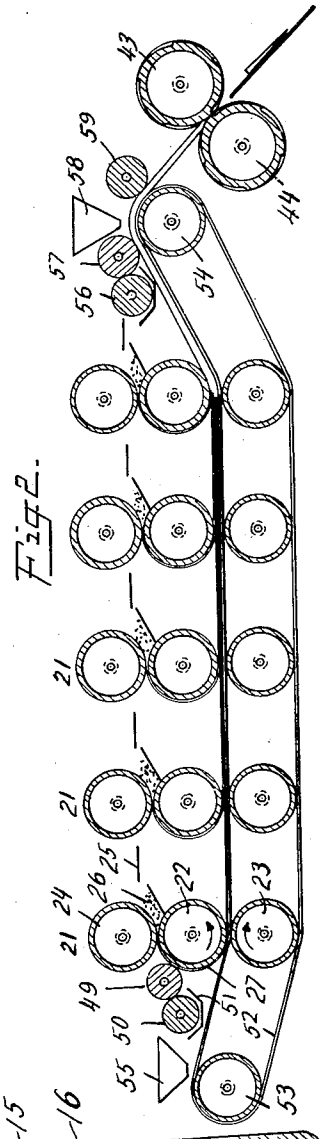


Fig. 2.

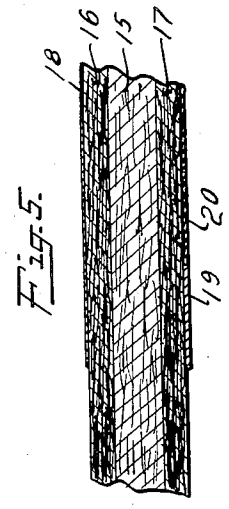


Fig. 5.

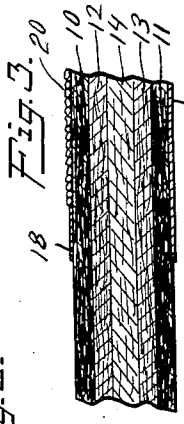


Fig. 3.

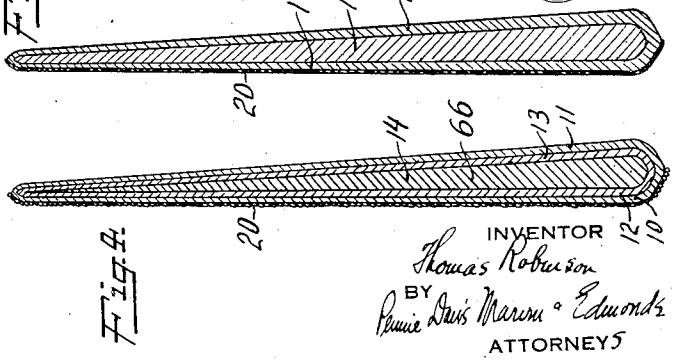


Fig. 6.

Fig. 4.

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BUILDING PRODUCT AND METHOD OF MAKING SAME

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Fig. 7.

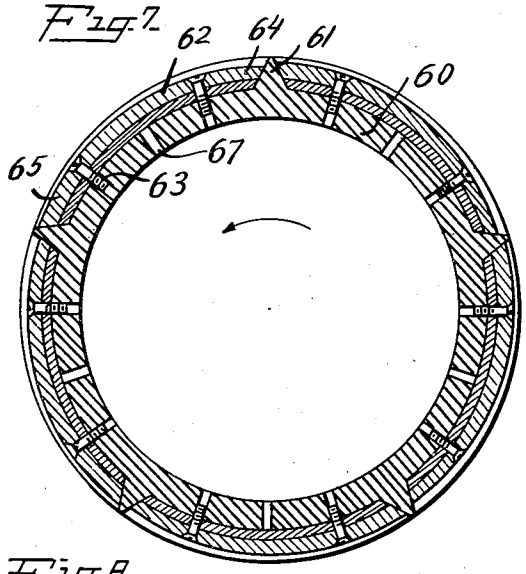


Fig. 8.

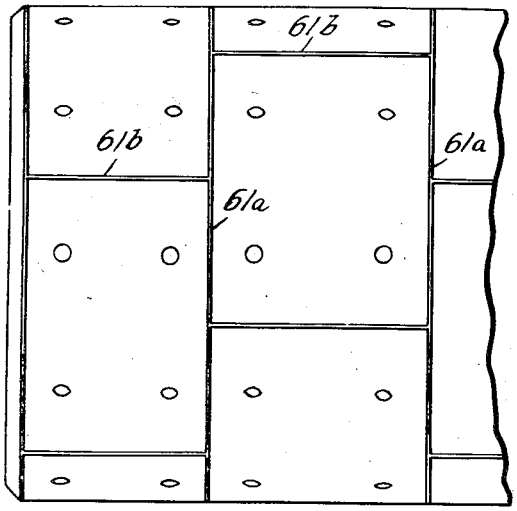


Fig. 9.

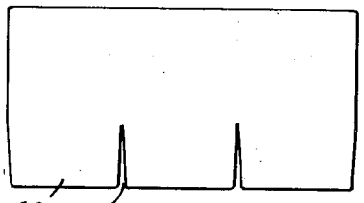


Fig. 10.

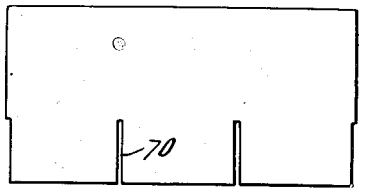


Fig. 11.

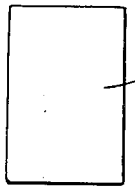


Fig. 12.

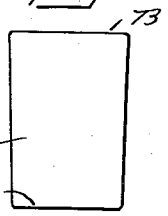


Fig. 13. Fig. 14. Fig. 15.

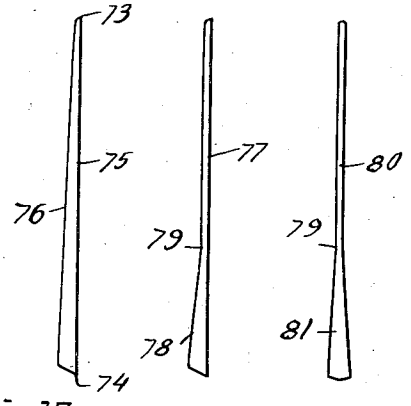


Fig. 16.

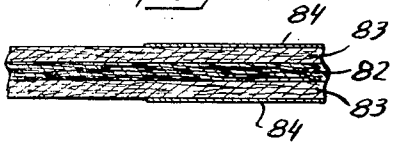
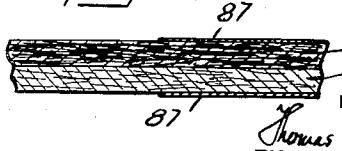


Fig. 17.



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Patented Jan. 2, 1934 1,941,491

UNITED STATES PATENT OFFICE

1,941,491

BUILDING PRODUCT AND METHOD OF MAKING SAME

Thomas Robinson, New York, N. Y., assignor to Lancaster Asphalt, Inc., New York, N. Y., a corporation of Delaware

Application July 10, 1928. Serial No. 291,638

18 Claims. (Cl. 154—2)

This invention relates to a sheet material of great durability and resistance to the action of the elements, and therefore of utility for building and construction purposes, being employed in sheet form as roll roofing, and in slightly modified forms, as individual and strip shingles. More particularly, this invention is concerned with the new material and a method and apparatus by which it can be made rapidly and at low cost, and also comprehends the roofing elements or shingles into which this material may readily be converted.

The material of this invention is composed primarily of fibrous material bound together by a plastic substance capable of hardening, and it may consist of a single layer or web or a plurality of such layers, differing among themselves in the relative proportions of fibre and plastic present but produced in such manner that the layers while distinguishable in a cross-section of the product are still joined to form a unitary structure. These layers differ not only in the proportions of ingredients present but also, because of the varying amounts of fibre, in physical characteristics and I take advantage of these differences in preparing products for different uses.

The new material is preferably composed of fibrous substances, such as asbestos, cocoanut fibre, wool felt scrap, bagasse and the like, with which in some instances, may be mixed suitable amounts of a filler such as clay. Waste paper, and wood fibre may also be used. The plastic I prefer to employ is one capable or resisting the action of the weather, and I have found that a bituminous product, such as asphalt of a suitable melt point to withstand solar heat, is satisfactory both for the above reason, and because it can be easily worked, and is cheap. For some purposes, it may be useful to mix with the fibre and plastic amounts of finely divided solid material such as cinders and the like, to reduce the cost.

In the production of this material, I employ a plurality of sheet forming devices, arranged in a line, with each one delivering a sheet to the one next succeeding. To the first of these devices, there is supplied a mixture of fibre and plastic in proper proportions to produce a layer of the desired physical characteristics to form one face of the finished product, and a web of this mixture is formed in the first device and delivered to the one next to it. A mixture of fibre and plastic is delivered to the second device, sheeted out by it and applied and united to one face of the web first produced, the sheeting operations being performed while the plastic material is relatively fluent so that these operations and the union of the two sheets may be carried out without difficulty. These steps are repeated to build up a sheet of as many layers as desired, though it is preferable for many purposes to make a sheet of an uneven number of layers, the center layer or core containing a relatively small amount of fibre, which is replaced by cheaper products such as waste paper, cinders, clay, wood fibre and the like.

When the new material is to be used in sheet form, it is preferably finished by receiving a coating of asphalt or the like on both faces, and if desired, a layer of wear material such as crushed slate, crushed rock, sand, and the like may be applied to one face and non-stick material such as talc applied to the other. These coating materials may be applied after the sheet is built up to the desired thickness or a coating may be applied to the first layer as soon as it is produced, and the coating on the opposite face applied when the last layer has been added.

In producing roofing elements or shingles, a sheet of the desired thickness is built up and then led to rotary molding drums which receive the sheet between them and cooperate to vary the thickness of selected portions thereof by the application of pressure and then excise these portions from the sheet to form the finished product. These drums have cooperating mold cavities in their faces by which the shaping operations are performed, and by properly forming these cavities, products of any desired shape and size may be readily formed from the sheet.

The roofing elements made in this manner are preferably produced from a sheet having three or five layers, the central layer or core being relatively more fluent than the outer layers either by reason of including less fibre or solid material and more plastic, or plastic having a lower melt point. The outer layers include increased proportions of fibre to plastic, and the outer layers include the greatest amount so that they are firmer and more rigid than the layers between them. Then when granular wear material is applied by pressure in the usual way, the application of pressure will not cause the granular material to be submerged as might otherwise be the case.

The new sheet material is capable of production in various forms in accordance with the principles of this invention and shingles of many different shapes and forms may be made there-

from. For a better understanding of these principles and products, and the methods and apparatus used, reference may be made to the accompanying drawings in which:

Figure 1 is a view in side elevation diagrammatically illustrating apparatus for producing the new sheet material and converting it into roofing elements;

Figure 2 is a similar view illustrating a modified form of apparatus for the same purpose;

Figures 3 and 4 are sectional views of a sheet of the new material and a roofing element prepared therefrom;

Figures 5 and 6 are sectional views of a modified type of sheet material and a roofing element prepared therefrom;

Figures 7 and 8 are sectional and elevational views respectively of a molding drum used for producing roofing elements;

Figures 9 and 10 are plan views of two different forms of strip shingles produced in accordance with the new process;

Figures 11 and 12 are similar views of individual shingles;

Figures 13, 14 and 15 are side views showing different forms of roofing elements which may be made by the new process; and

Figures 16 and 17 are sectional views of two different forms of sheet material which may be produced by the new process.

Referring now to the drawings, the sheet material illustrated in Figures 3 and 5 is shown to consist of a plurality of layers united face to face. The sheet shown in the first of these figures consists of five such layers, while the other sheet is made up of three layers. In each instance the sheet is coated on both faces and on one of these faces wear material such as crushed slate or the like is shown partially embedded in the coating.

The materials of which the layers of this sheet material are made consist of fibre, and a plastic substance capable of hardening. Fibrous materials suitable for the purpose include asbestos, cocoanut fibre, wood fibre, bagasse, wool felt scrap and other similar products of that character. Various plastic substances may be used but I prefer to use those of a bituminous character, such as asphalt. The type of asphalt that will be employed will depend on the use to which the product is to be put. For example, if the product is to be used for roofing or in a place where it will be exposed to solar heat the asphalt used should have a melting point which will be high enough to prevent solar heat from softening the plastic to the extent that would permit this substance to run. The sheet material may be made up of these ingredients in varying proportions and I prefer to build up a sheet material by joining together layers sheeted out of the mixtures of fibre and plastic, the proportions of these ingredients varying in the different layers which form a single sheet. In some instances it may be desirable to add filling material, such as clay and waste paper, and for some purposes it is satisfactory to incorporate finely divided solid material, such as asbestos sand, infusorial earth, cinders, crushed rock, crushed slate and the like.

In preparing the sheet material, I prefer to employ a central layer or layers in which there is a considerably lower amount of fibre present than in the outer layers which form the facings of the sheet, and a typical sheet such as that illustrated in Figure 3 may consist of five of these layers in which those designated 10 and 11 constituting the outer facing layers will contain up to about 50% of fibre and the remainder asphalt, while those designated 12 and 13 contain about 25% of fibre with the remainder asphalt, while the central layer or core 14 contains less and cheaper fibre, a filler, and the remainder asphalt. Preferably the outer layers or facings are relatively thinner than the central layer or core, and these outer layers have a high fibre content to form what amounts to a protective jacket over the material which lies between them. In some instances, and particularly when the sheet material is to be converted into roofing elements by a shaping and cutting process, it may be desirable to use an asphalt of lower melting point, which will therefore retain its fluidity longer, in the core or central layer.

As an example of a mixture which is suitable for use in the central layer or core, I may employ asphalt, cinders and paper, a suitable mixture including 80 pounds of paper, 90 pounds of cinders and 150 pounds of asphalt. The paper is first steamed and pulped in a mixer, then mixed with the proper proportion of dry cinders and the mass ground in a suitable mill until the cinders are fairly fine and graded. This mixture is then put through a dryer, preferably of the rotary steam-heated type, to remove moisture and then conveyed to a pug mixer where the proper amount of asphalt is added.

This mixture of paper, cinders, and asphalt affords numerous advantages when used as the central layer or core of a sheet to be converted into shingles, because the ingredients are of low cost, available in large quantities everywhere, and a shingle produced from them is semi-rigid, due to the presence of the cinders, is practically non-absorbent, fairly light in weight, and a good insulator. In addition, such a shingle is resistant to fire and nails can be driven through it without the necessity of preforming holes. This mixture when used as the core or central layer is capable of being molded to give the shingle the desired final shape and when so used the fibrous outer layers may be relatively thin.

In the sheet illustrated in Figure 5, the central layer 15 contains the relatively lower proportion of fibre and the two facing layers 16 and 17 contain higher amounts of fibre and preferably up to about 50%. On both sheets coatings designated 18 and 19 are applied, these coatings being a waterproof substance, preferably asphalt of the desired melt point. In the coating 18 in Figure 3 there is partially embedded a layer of granules 20 which may be crushed slate, crushed rock and other similar products ordinarily used to provide wear surfaces, while the opposite face of this sheet may have a coating of a non-stick material such as talc or the like applied over the coating. In the product shown in Figure 5, the granular material 20 is applied to the coating 19 and partially submerged therein, the granular material shown in these two figures being applied in different manners whereby in one instance the granular material projects beyond the coating, while in the other the surfaces of the granules lie substantially flush with the coating. The method by which the granular materials is applied to produce these different effects will be made clear hereafter.

In the production of the new sheet material, the plastic mixtures are preferably made up in advance of actual use, as for instance, by pulverizing the solid asphalt to the desired fineness and then mixing this asphalt powder with the

desired amount of fibre. The mixture is then heated to render the asphalt fluent and this mixture conveyed to a device by which it may be formed into a sheet. To build up a finished sheet, I utilize either the apparatus illustrated in Figure 1 or Figure 2.

In the apparatus shown in Figure 1 there are a plurality of stands 21 of rolls arranged preferably three high in a stand. These rolls are hollow so that they may be steam heated or cooled and thus maintained at the desired temperature. The rolls are power driven and the central and top rolls 22 and 24 preferably are cooled and operate at a higher speed of rotation than the bottom roll 23 which is heated. The rolls are spaced apart a distance which is dependent upon the thickness of the sheet to be formed thereby. The plastic mixture is delivered to the stand by a conveyor generally designated 25 and of any suitable construction. This plastic mixture is discharged into a feeding trough 26 which maintains a supply of the mixture in contact with the middle roll 22 and the bottom roll 23. These rolls rotate in the direction shown by the arrows and the action of the rolls is to draw plastic mixture from the supply through the space between the roll faces. The roll 22 carries with it a layer of the mixture designated 27, and this layer is carried around the face of the roll and passes between that roll and the upper roll 24. By reason of the rolls 22 and 24 being rotated at a higher speed than the roll 23, the action of the stand is to discharge the sheet 27 having a thickness determined by the spacing between the rolls 22 and 24, and this sheet which constitutes one of the outside layers of the finished product, is then led to the next stand.

In this stand there are central and top cooled rolls moving at one speed of rotation and a bottom heated roll moving at a slower speed. A mixture of the desired proportions is delivered by the conveyor 28 to the trough 29 and a sheet 30 is formed, which is carried around the middle roll 31 and applied to the under face of the sheet 27 as the two sheets pass between the middle roll 31 and the upper roll 32. This formation of a sheet and its application to the lower face of a built-up sheet previously formed is continued throughout the apparatus until in the apparatus as shown in Figure 1 there is produced a final sheet 33 made up of five layers and similar to that shown in Figure 3. The character of the sheet will, of course, depend upon the proportions of the fibre and plastic material occurring in the several layers thereon, but preferably the sheet will consist of central layers in which there is a relatively small amount of fibre and two outer layers on each face in which the proportion of fibre to asphalt is relatively high. Also, it is preferable to form such a sheet with a core 14 somewhat thicker than the other layers and having a lower amount of fibre, while the two outer layers 10 and 11 are relatively thin and contain a much larger amount of fibre.

This sheet is capable of use for many purposes just as it emerges from the final stand of rolls but for roofing and other construction purposes, it is preferable to coat its opposite faces with a thin layer of asphalt. To apply this coating, there is provided any suitable mechanism, such as a discharge nozzle 34 delivering asphalt in fluent condition upon the upper face of the sheet, the nozzle 34 having a plurality of orifices to insure that the entire face of the sheet will be covered. Beyond the nozzle 34 are placed rolls 35 and 36 preferably maintained at a suitable temperature to work the asphalt properly. The lower roll 36 enters a trough or vat 37 in which asphalt is maintained in fluent condition and this roll picks up asphalt and delivers it to the under face of the sheet 33. The two rolls 35 and 36 thus apply an asphaltic coating to the sheet emerging from the last stand of rolls.

If the sheet is also to receive a facing of wear material, this can be accomplished by discharging granular material on the upper face thereof from the discharge mechanism 38, which may be of any ordinary type. The sheet with this granular layer thereon then passes beneath a hollow roll 39 through which cooling water may flow, this roll serving to embed the granular material partially in the coating and also to give the coating an initial set. The sheet then passes around another roll 40 of similar construction, so arranged that the sheet reverses direction and moves with that surface uppermost which is coated but carries no granular material. To this stretch of material a non-stick material, such as talc may be applied, a suitable distributing mechanism 41 of any ordinary type being employed for that purpose. The sheet now passes around a cooling roll 42 which forces the talc into the coating to complete the application of the talc and give the coating an initial set, and from the roll 42 the sheet passes to molding drums 43 and 44 if the sheet is to be converted into shingles.

These drums have cooperating mold cavities 45 and 46 in their faces, arranged if desired, so as to vary the thickness of the sheet at different points and to shape and consolidate the layers. These molding cavities are also defined by cutting edges of appropriate form which cooperate to cut the shaped portions from the sheet so that as the sheet passes through the molding drums individual roofing elements 47 are discharged therefrom upon a sloping platform 48.

In the apparatus as shown in Figure 2, the same principles of operation are employed, but the apparatus is modified in certain respects to vary the type of coating that would be produced. In this apparatus, there are a plurality of stands of rolls 21 similar to those used in the type of apparatus previously described, and the plastic material is delivered to the first stand of rolls by a conveyor 25 discharging into a trough 26 which maintains a supply of material in contact with the middle roll 22 and the upper roll 24. This plastic material is sheeted out by the action of the rolls and travels around the face of the middle roll in a manner previously described. Contacting with the outer surface of the sheet as it moves around the surface of the middle roll is a coating roll 49 resting lightly in contact with the sheet, and also contacting with a roll 50 which lies partially in a trough or vat 51 containing the coating material. The roll 50 picks up coating material from the vat 51 and transfers it to the surface of the roll 49 which in turn applies it to the surface of the sheet being carried around the surface of the roll 22.

Extending from end to end of the stands of rolls is an endless conveyor belt 52, which passes around guide rolls 53 and 54 at its ends. This conveyor belt may be a canvas webbing or a fine wire mesh and its upper stretch passes between the middle and lower rolls 22 and 23 of the several stands. As the first layer 27 is formed by

the rolls of the first stand, this layer is carried along on the surface of the belt to the next stand, where another layer sheeted out of plastic and fibrous material is applied to its upper face. The sheet is built up in the manner previously described through the successive action of the stands of rolls and between each pair of rolls the sheet produced therein is supported on the surface of the endless belt. As previously described, a layer of coating material is applied to one surface of the sheet formed in the first stand of rolls by the roll 49 and this sheet, which is to form one of the faces of the final product, preferably includes a relatively high amount of fibre with respect to the plastic present. Immediately after the coating is applied, the granular wear material is also applied and for this purpose granular material may be discharged from a distributing mechanism 55 upon the upper surface of the conveyor belt 52 before that belt contacts with the sheet 27. This layer of granular material is carried along by the conveyor to a point where the sheet and the conveyor move between the rolls 22 and 23 and at that point the granular material is partially embedded in the coating by the action of the rolls. The coated layer with its outer facing of granular material passes through successive stands of rolls to receive and be united to the successive plastic layers formed by these devices. In this form of the apparatus, the top roll of each stand is preferably slow and heated while the two bottom rolls are preferably cooler and driven at a higher speed.

The sheet emerging from the last stand of rolls shown in Figure 2 consists of five layers made up of plastic and fibre and it has a coating of asphalt on its under surface together with a layer of granular wear surfacing. The upper face of the sheet may now be finished by the application of a layer of coating material and for this purpose a pair of rolls 56, 57 are provided, the roll 56 running partially in a vat of coating material and delivering that material to the surface of the roll 57, which lies lightly in contact with the upper surface of the sheet. Beyond the roll 57 a finishing material may be applied if desired as, for example, talc, which may be delivered on the outer surface of the coating by a suitable distributing mechanism of any well-known type generally indicated at 58. Beyond this distributing mechanism, the sheet passes under a roll 59 which smooths out the coating and embeds the talc or similar material therein, and the sheet may then be used for ordinary roofing purposes such as roll roofing, or it may be converted into shingle units by being delivered to the molding drums 43 and 44 previously referred to.

One of these molding drums is illustrated on an enlarged scale in Figure 7, this drum being appropriate for the formation of single shingles which have a tapering thickness from one end to the other, such shingles being illustrated in Figures 4 and 6. This molding drum consists of a hollow cylinder 60 of steel which is formed with a plurality of knife edges 61 projecting from its periphery. These knife edges are preferably of triangular section and may be formed as an integral part of the drum itself. The knife edges define cavities in which the roofing elements will be given their final shape and the knife edges of the two drums cooperate to cut the sheet into such elements. In the drum as illustrated in Figure 8, there are circumferential knife edges 61*a* and axial knife edges 61*b*, and there are a plurality of the circumferential knife edges so arranged that a sheet of a width equal to the width of a plurality of shingles may be sub-divided into such shingles. The axial knife edges 61*b* lead between adjacent circumferential knife edges 61*a*, thus forming rows which extend around the face of the drum. Preferably the knife edges 61*b* in adjacent rows are offset as illustrated in Figure 8 to reduce the strain on the drum and also on the sheet in the cutting action.

Each mold cavity defined by a pair of knife edges 61*a* and 61*b* has a bottom which is defined by a mold plate 62 held in place by bolts 63, which pass through the plates and into the threaded openings in the drum wall. These plates have a shape which determines the shape of the final product and as illustrated in Figure 7, the plates have a thin end 64 and a thick end 65, so that when the sheet is acted on by a pair of such cavities cooperating, the sheet will be reduced in thickness between the thick ends 65 of the plates and increased in thickness when acted on by the thin ends 64 of the plates. In converting the sheet into roofing elements by the action of these molding drums, the sheet is delivered to the drums with its plastic ingredient still sufficiently fluent to permit the drums to vary the thickness in the manner described and when any substantial shaping action occurs, a relatively low melting point plastic substance may be employed in the core so that during the action of the drums, the core can be shaped as illustrated in Figure 4. Here, the core or inner layer 66 has been reformed so that it no longer has the uniform thickness shown in Figure 3, but is thin at the thin end of the shingle and thick at the thick end, the other layers 10, 11, 12 and 13 retaining their substantially uniform thickness. The molding action is, therefore, largely confined to the core.

The mold plates 62 which determine the shape of the final product may be removed and replaced by others of different contour so as to produce elements of different types and in order to protect these plates and to add to their life, a cushioning layer of metal is introduced between each plate and the face of the drum beneath it. For this purpose, the drum is provided with a plurality of openings 67 extending therethrough and when each plate is in place in the cavity defined by the knife edges, its under surface is slightly spaced from the face of the drum. Into this space is introduced a quantity of molten zinc, lead, or the like, through the openings 67 and when this metal solidifies, the plate is supported from beneath by a softer metal which will insure that the plate is supported evenly and thus relieved of strains due to improper seating.

As shown in Figures 7, 8, the molding drums are arranged to produce a plurality of single elements or shingles at each operation and the sheet which is acted on has a width equivalent to that of a plurality of such shingles. These drums are arranged to rotate in the direction of the arrow, Figure 7, so that as the sheet passes between the drums, the thin ends of the elements are first produced. The action of the molding cavities of the drums causes the more fluent portions of the sheet to be displaced rearwardly of the direction of movement of the sheet through the drums, so that the elements are discharged thin end first and this action of the drum insures that the displacement of the more fluent material in the sheet will take place properly. Due to this dis-

placement of the more fluent material, it will be observed that in the product illustrated in Figures 4 and 5, there is a greater proportion of the fibrous material at the thin end than at the thick, a cross-section of the product at the thick end including a larger portion of plastic due to the increased amount of core material at that end. Also it will be observed that in this product there is an increasingly greater amount of fibre present from the center toward either of the outer faces, the greatest amount of fibre being present in the two facing sheets.

A pair of molding drums of the type illustrated in Figure 7 will produce shingles similar to those illustrated in Figures 4 and 5, but by properly forming the drums, it is possible to produce strip shingles of the type shown in Figures 9 and 10. In Figure 9, the shingle consists of a rectangular body 67', the length of which is substantially equal to the width of the sheet from which it is made, and along one edge portions have been cut out to form notches 68 defining tabs 69. The cut-out portions may be of generally triangular section as illustrated so that the edges of the tabs converge toward the center of the shingle, or if desired, the cut-outs may have parallel sides as illustrated at 70. Similarly, the individual shingles may be generally rectangular as shown at 71, or their side edges 72 may converge from the thin end 73 toward the thick end 74. All of these forms may be readily produced by a proper formation of the molding drums.

In Figure 13, 14, and 15, there are shown three types of shingles having different cross-sectional forms. In the shingle shown in Figure 13, the body has a flat side 75 and its other side 76 diverges therefrom from the thin end 73 to a point near the thick end 74, where the two faces meet at nearly a right angle. Any of the shingles, either strip or multiple, illustrated may be given this cross-sectional shape or they may have that shown in Figure 14, where the main body of the shingle 77 is of substantially uniform thickness, while one end is of increased thickness as illustrated at 78. Preferably, this portion of increased thickness begins at a point 79 which defines the line of normal exposure of the shingle. In the form illustrated in Figure 15, the single has a portion 80 of substantially uniform thickness and then beginning at the exposure line 79, both faces diverge to provide a portion 81 of increased thickness. Any of the shingles produced by the new method may have the shapes illustrated in these figures or they may have a substantially uniform thickness from one end to the other. The cross-sectional contour of the finished product will depend upon the character of the mold cavities and the plates 62 which form the bottom thereof. The outlines of the shingles will depend upon the arrangement of the cutting edges 61 of the molding drums, and shingles of what may be termed regular shape illustrated in Figures 9 to 12 may be produced as well as shingles having irregular shapes and tabs of irregular outline.

Where the shingles have a tapering thickness, this is accomplished by varying the thickness of the sheet from which they are cut, by displacement of the more fluent layers thereof by the molding drums. In any of these shingles, however, the action of the cutting edges causes the outer layers to be forced into the central layers and to meet along the extreme edges of the shingles. As these outer layers are highly fibrous, the finished product is one in which the more fluent inner layers are protected by the outer fibrous layers both along the faces of the shingles and along at least a pair of opposite edges thereof. Where the shingle is cut along all side edges from a sheet by the action of cooperating knife edges, the more fluent inner material will be completely enclosed over both faces and along all edges by the more fibrous outer layers, and these layers thus add strength to the shingle and prevent displacement of the core layers under pressure. The shingle therefore has what amounts to an encasing jacket in which a high proportion of fibre is present, but this is accomplished without using felt, paper, or similar felted fibrous material which is preformed prior to its use in the present apparatus.

In the shingle shown in Figure 3, the granular material 20 has been applied by the apparatus shown in Figure 1. The sheet has first been formed and then coated and a layer of granular material applied to the surface thereof. Since this granular material is not subjected to severe pressure after its application other than that applied by the molding drums, the granular material is only partially submerged in the coating and projects from the surface thereof. In the product shown in Figure 5, the granular material has been applied, in accordance with the method shown in Figure 2, to the surface of the first layer produced during the formation thereof and this granular substance has therefore been acted on by the rolls of a plurality of stands. This layer is consequently submerged to a somewhat greater extent that that shown in Figure 3, but the granules will not be completely submerged, although their upper surfaces lie substantially flush with the layer of coating material over which they have been applied.

While I have described sheet material which may be employed as roll roofing to be converted into shingle units in which the sheet is built up of a plurality of layers with the outer layers containing more fibre than inner, for some purposes, it may be desirable to produce a sheet in which the greater amount of fibre occupies the core. Such a product is shown in Figure 16 in a three-layer sheet in which the central layer 82 contains more fibre than the outer layers 83. Such a product when coated with waterproof substance such as asphalt, as indicated at 84, may be used without further treatment as a roll roofing, although in some instances it may be desirable to apply the granular wear material and talc as previously described.

Such a material would not be as suitable for conversion into shingles as those illustrated in Figures 3 and 5, but would be suitable for roll roofing and would be cheaper because less fibrous material is utilized. For a very cheap roll roofing a product such as that illustrated in Figure 17 can be produced, this material consisting of two layers 85 and 86, the first of which contains a relatively high proportion of fibre to asphalt and the other a lower proportion. Such material would be coated as indicated at 87 and would be used with the layer 85 containing the greater amount of fibre uppermost. If desired, granular material could be applied to this sheet by being partially embedded in the coating layer 87 over the layer 85.

While I have described this sheet material as made up of a plurality of layers, which are illustrated in the drawings as distinct from one another, it is to be understood that in the finished product, these layers do not have any separate existence but are united into a unitary sheet

in which there is no well defined lines of demarkation. The plastic material used in the different layers is preferably of the same melting point, except in some instances a lower melt point may be used in the core or central layer, but in any event these sheets are united face to face in the apparatus while the plastic material is still somewhat fluent, so that a perfect union between layers is accomplished. In the drawings, these layers have been shown as separate and distinct for purposes of illustration, but in the finished product they merge together so that the layers can be distinguished only by the varying amounts of fibre present therein, and by somewhat different physical characteristics of these different layers resulting from such differences in fibre content. To produce a sheet material suitable for formation into shingles, I prefer to employ a sheet made up of an odd number of layers, with the outer layers relatively thin and containing the higher proportions of fibre, but for a sheet material to be used without further treatment as a roll roofing or siding material, various distribution of fibre and plastic may be employed, of which examples have been given.

This novel sheet material is of greatest utility for building purposes to be used as roofing, siding and for conversion into shingles, but it will be apparent that it may be used for numerous other purposes, as for instance, it may be cut into strips suitable for fillers used in concrete pavements and for many other purposes in which a water-resistant product which can be cheaply and quickly produced is desirable. It will be apparent further that this product is much more desirable when used as a roofing than the ordinary prepared roofings of commerce in which the foundation is customarily of felt. That is so because the felt is highly expensive and is the weakest part of the roofing, because it is the part which deteriorates and rots. In the present product, the use of felt is avoided and the roll roofing and shingles of unusual thickness may be produced at a low cost. Thick butt shingles of the type shown in Figures 4 and 6 would be of prohibitive cost when made of felt by reason of the cost of felt of such thickness. The new product is also superior to felt in that it is impossible to secure complete saturation of felt by any of the methods now employed, whereas in the present product the plastic and fibrous materials may be used in proportions sufficient to secure the desired impregnation or saturation and complete coating of the fibre by the plastic, and this is accomplished during the preparation of the plastic mixture when this mixture may be agitated to secure the desired result.

I claim:

1. A sheet material comprising a hardened plastic substance and unfelted fibre, the proportions of the fibre and plastic substance varying through the sheet, the proportions of the fibre and plastic material varying in different parts of the sheet with the greatest amount of fibre lying near the faces of the sheet and the least amount near the centre of the sheet, the portion of the sheet near the faces containing at least fifty per cent of the said hardened plastic substance.

2. A sheet material comprising a dry, intimate mixture of a hardened plastic substance and unfelted fibre, the sheet being made up of layers forming a unitary web but distinguishable by reason of the varying proportions of fibre and plastic substance therein, the layers constituting the faces of the sheet containing at least 50 per cent of the hardened plastic substance.

3. A sheet material comprising asphalt of a melting point sufficient to withstand solar heat without running, and unfelted fibre, the said asphalt and fibre being permanently sealed together in the dry state during formation of the sheet, the proportions of the asphalt and fibre being regulatably varied in different parts of the sheet.

4. A method of producing sheet material which comprises forming a sheet of non-aqueous plastic material capable of hardening and unfelted fibre, and building up the sheet by forming and applying thereto, a dry layer of plastic material and unfelted fibre, said layer having different proportions of plastic material and fibre from those present in said sheet, and sealing the layer to the sheet during building up of the sheet.

5. A method of producing sheet material which comprises sheeting out a dry mass of plastic material capable of hardening and unfelted fibre, and while the said material remains in plastic condition, sheeting out a dry mass containing plastic material and a different proportion of fibre from that present in the first mass and simultaneously uniting said sheets face to face.

6. A method of producing sheet material which comprises forming a sheet of a dry mixture of unfelted fibre and plastic material capable of hardening, uniting to one face of the sheet a compact layer including a dry mixture of fibre and plastic material capable of hardening, the proportions of the mixture in the second sheet differing from that in the first, and uniting to the exposed face of the second sheet a second layer made of similar compacted materials but differing in the proportions of said materials present, and sealing each of the respective layers to the sheet concurrently with its union therewith.

7. A method of producing sheet material which comprises sheeting out serially a plurality of non-aqueous mixtures of unfelted fibre and plastic material capable of hardening, differing among themselves in the proportions of fibre and plastic material present, and permanently uniting under pressure each sheet as it is formed to one face of a previously formed sheet.

8. A method of producing sheet material which comprises forming a sheet of a non-aqueous mixture of unfelted fibre and plastic material capable of hardening, moving the sheet as it is formed and supporting it during such movement, and forming a second sheet of a non-aqueous mixture of unfelted fibre and plastic material capable of hardening, and simultaneously uniting and sealing it to one face of the first sheet as the latter moves.

9. In a method of producing roofing elements, the steps of passing a non-aqueous mixture of plastic material and unfelted fibre through successive roll passes to sheet out the mixture, sheeting out other non-aqueous mixtures of plastic material and unfelted fibre, permanently uniting one of such sheets with the first-mentioned sheeted mixture at each of the respective roll passes, while cooling the sheeted mixtures, and distributing wear-resistant surfacing material over one face of the sheet as it moves from one roll pass to the second.

10. A sheet material comprising a central core of asphalt, cinders and paper pulp, and outer facing layers on the core formed of unfelted fibrous material saturated with asphalt and sealed to the core during formation of the sheet.

11. A sheet building material comprising unfelted fibres saturated and coated with a hardened plastic substance, the proportions of the unfelted fibre and the plastic substance varying from top to bottom of the sheet, said materials being permanently bonded together concurrent with the formation of the sheet.

12. A sheet material comprising unfelted fibres saturated and coated with a hardened plastic substance, the proportions of the fibre and plastic substance varying in different parts of the sheet, with the greatest proportion of the fibre being present in that part of the sheet near a face, and the mid-portion of the sheet between the faces containing an inorganic filler.

13. A sheet building material comprising unfelted fibres intimately mixed with a hardened plastic substance, the proportions of the fibre and plastic substance varying through the sheet with the lesser amount of fibre near the centre of the sheet, and the portion at its face containing at least 50 per cent of the said hardened plastic substance.

14. A sheet material comprising a plurality of sealed superposed layers containing unfelted fibres and a hardened plastic material, the percentage of plastic material being different in the respective layers and being at least fifty per cent of that mixture forming the facing layers of the sheet, another of the said layers containing a substantial proportion of an inorganic filler, all of the said layers being permanently sealed together in the absence of moisture and coincident with their formation.

15. A sheet material comprising a plurality of sealed superposed layers containing unfelted fibre and a hardened plastic material, the percentage of plastic material being different in the respective layers and being at least fifty per cent of the mixture forming the facing layers of the sheet, another of the said layers containing a substantial proportion of an inorganic filler, all of the said layers being permanently sealed together in the absence of moisture and coincident with their formation, and a coating of water-resistant material on at least one face of the sheet.

16. A sheet material comprising a plurality of sealed superposed layers containing unfelted fibre and a hardened plastic material, the percentage of plastic material being different in the respective layers and being at least fifty per cent of the mixture forming the facing layers of the sheet, another of the said layers containing a substantial proportion of an inorganic filler, the said layers being permanently sealed together in the absence of moisture and coincident with their formation, a coating of water-resistant material on at least one face of the sheet, and a layer of wear-resistant material superposed upon and partially embedded in the said coating.

17. A fire-resistant sheet material comprising a mixture of unfelted fibres and inorganic filler impregnated and coated with a hardened plastic substance, the proportions of the fibres and plastic substances varying in preselected degree between the faces of the sheet, with the greatest proportion of fibres being in the material at the sheet faces.

18. In a method of producing roofing elements, the steps of passing a non-aqueous mixture of plastic material and unfelted fibres through successive roll passes to sheet out the said mixture, and distributing wear-resistant surfacing material upon one face of the sheet as it moves from one roll pass to the second in the process of sheet formation.

THOMAS ROBINSON.