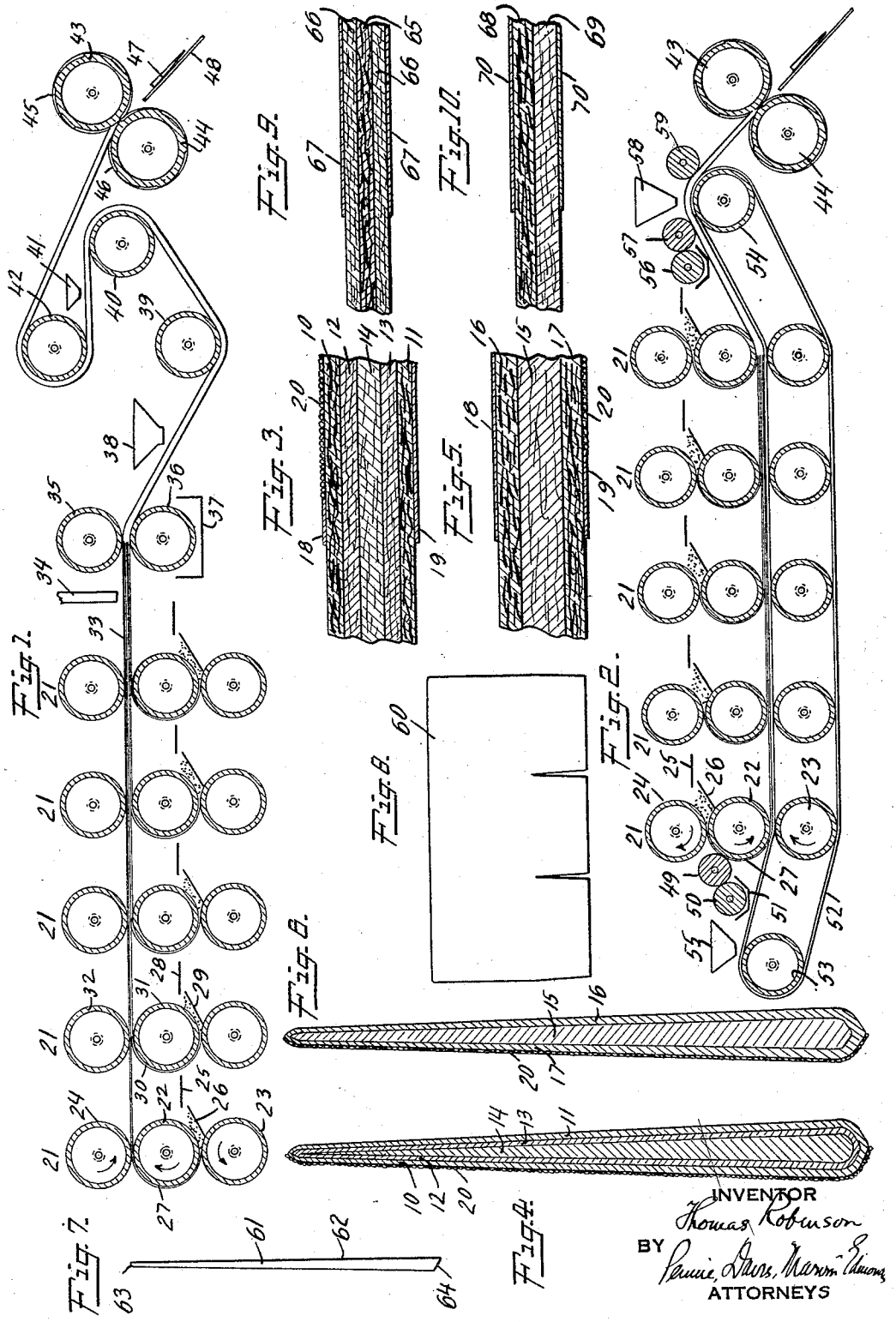
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APPARATUS FOR MAKING SHEET MATERIAL

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APPARATUS FOR MAKING SHEET MATERIAL

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This invention relates to the manufacture of building products and is concerned more particularly with apparatus for the manufacture of sheet material suitable for use as roll roofing, siding, and the like, the apparatus being capable of producing this material and also of converting it into individual roofing elements or shingles. The new apparatus is of simple inexpensive construction, and produces the new products at a high output rate and at low cost.

The sheet material produced by this apparatus is made up of fibrous material and a plastic binder, the fibrous material being of various kinds such as asbestos, vegetable fibre including chopped hay, cocoanut fibre and the like, wool felt scrap, bagasse, etc. with which in some instances may be mixed suitable amounts of a filler such as clay or finely divided solid material such as cinders. The plastic substance employed is preferably of the bituminous type such as asphalt of a suitable melt point.

In the new apparatus, plastic mixtures of fibre and asphalt are sheeted out to form webs and the webs, produced in successive parts of the machine, are combined into a single sheet or web which may then be given a coating of wear material such as crushed slate, etc. Such a sheet is suitable for numerous building purposes and may be employed as roll roofing, siding, partitions, etc. If desired, the sheet material may be converted into individual building elements or shingles in which event, it is delivered as rapidly as it is produced, to molding devices which shape and form portions thereof to the desired shape and then sever such portions from the sheet and discharge them in continuous succession.

Since the sheet material produced is made up of loose fibres and the plastic binder, and can be made in any desired thickness, roll roofing or shingles made from it are much cheaper and may be made much heavier than prepared roofing now commonly made of rag or asbestos felt impregnated with asphalt. The new products have a longer life than felt roofing since there is no felt to deteriorate and warp or curl and the shingles can be made of tapering thickness so that they have a heavy butt desirable for the shadow cast on the roof and at the same time may be laid flat without bulging or being bent.

The novel apparatus includes means for producing a plurality of sheets or webs of the plastic mixture and these means are disposed in a series with each web advancing to the next web-forming device and being there combined with the next web produced. A composite web of layers of varying thickness and physical characteristics is thus produced and this web may then be coated and surfaced without interruption in its advance. The surfaced web may then be wound into rolls of convenient size or may be at once converted into individual shingles. For the latter purpose, the apparatus is provided with molding devices of the rotary type receiving the sheet between them and shaping portions of it to the desired form and excising these portions from the sheet.

For a better understanding of the invention, reference may be had to the accompanying drawing, in which

Fig. 1 is a diagrammatic view in longitudinal section illustrating one embodiment of the invention;

Fig. 2 is a similar view showing a modification;

Fig. 3 is an enlarged sectional view of one type of sheet material produced;

Fig. 4 is a sectional view of a tapered shingle made of the sheet material illustrated in Fig. 3;

Figs. 5 and 6 are views similar to Figs. 3 and 4 respectively, but showing a different type of sheet material and shingle;

Fig. 7 is an edge view of a different form of shingle;

Fig. 8 is a face view of a strip shingle produced in the new apparatus; and

Figs. 9 and 10 are sectional views of other sheets produced on the apparatus.

Referring now to the drawing, 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 Fig. 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 mate-

rial, 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 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 in which it will be delivered to the molding drums 43 and 44 previously referred to.

The molding drums employed are similar to those illustrated and described in my Patent No. 1,698,242. These drums have cooperating mold cavities of a shape appropriate for the production of the desired units and the cavities are defined by knife edges so that coincident with the shaping and forming operations, the units are severed from the sheet. The drums may be constructed to produce individual rectangular shingle units of the tapering form illustrated in Figs. 4 and 6 or they may produce units of other forms such as the three unit strip shingle 60 shown in Fig. 8. An example of a shingle of another taper is illustrated in Fig. 7 and designated 61. This shingle has one flat face 62 and its end edges 63 and 64 are inclined to the plane of the face 62. These and numerous other shapes may be given the shingles by the use of appropriate molding devices.

In the molding operation, the core material 14, 17, being somewhat more fluent than the material in the outer layers, tends to flow while the more fibrous layers are not deformed to so great an extent and retain substantially their original thickness as indicated in Figs. 4 and 6.

In Figs. 9 and 10, there are illustrated other and cheaper forms of sheet material useful for various purposes. The material shown in Fig. 9 is of the three layer type with a central layer 65 containing a greater pro-

portion of fibre than the outer layers 66. Such a sheet coated with asphalt as at 67 makes a cheap roll roofing. It may be given the granular and talc surfaces, if desired. The sheet material in Fig. 10 is also cheap to produce and it is suitable for various purposes though not as desirable as the products previously described. This material has two layers 68 and 69, the first containing a greater proportion of fibre to asphalt than the second. This sheet material is given an asphalt coating 70 and may be surfaced with grit and talc, as described.

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 than 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.

This application is a division of my copending application Serial No. 291,638, filed July 10, 1928.

What I claim is:

1. An apparatus for the manufacture of sheet material which comprises the combination of a series of calenders for forming plastic material into a sheet, each calender receiving a sheet from the calender next before it in the series and combining that sheet with the one being produced in said calender, means for affixing a layer of surfacing material to one face of the sheet issuing from the last calender in the group, and means associated with the first calender of the series for affixing a layer of surfacing material to the other face of the sheet.

2. An apparatus for the manufacture of sheet material which comprises the combination of a series of calenders for forming plastic material into sheets, each calender receiving a plastic sheet from the calender next before it in series and combining that sheet with the one being produced in said calender, and means for supporting the plastic sheet as it passes from one calender to the next succeeding one of the series.

3. An apparatus for the manufacture of sheet material which comprises the combination of a series of calenders for forming plastic material into sheets, each calender receiving a sheet from the calender next before it in series and combining that sheet with the one being produced in said calenders, all the new sheets being applied to the same face of the sheet coming from the calender next earlier in the series, and means for affixing a layer of surfacing material to one face of the first sheet formed during its formation.

4. An apparatus for the manufacture of sheet material which comprises the combination of a series of similar stands of rolls, three rolls in a stand, with one roll of each stand rotating at a lower speed than the other two, means for supplying a plastic mixture to the bight of the rolls rotating at different speeds in each stand, the rotation of the rolls producing a sheet passing out between the rolls rotating at the same speed, means operatively associated with each stand for applying a plastic layer upon the sheet passing to the rolls thereof, and means for supporting this sheet and leading it to the bight of the rolls rotating at the same speed in the next stand to be combined with the sheet being formed in that stand.

5. An apparatus for the manufacture of sheet material which comprises the combination of a series of similar stands of rolls, three rolls in a stand, with one roll rotating at a lower speed than the other rolls, means for supplying a plastic mixture to the bight of the middle and one outer roll of each stand, the rotation of the rolls producing a sheet passing out between the middle roll and the other of the outer rolls, and means for supporting this sheet and leading it to the bight of the middle and outer rolls of the next stand to be combined with the sheet being formed in that stand, said supporting means being a continuous band.

6. Apparatus for the production of roofing elements and the like, which comprises the combination of a series of calenders for forming plastic material into a sheet, these calenders being arranged in line and each having a pair of pressing rolls adapted to rotate at the same speed and being operable to produce an individual sheet and combine that sheet with a sheet produced by the calender next prior in the series, means for varying the thickness of selected portions of the completed sheet, and means for cutting said shaped portions therefrom.

7. Apparatus for the production of roofing elements and the like, which comprises the combination of a series of calenders for forming plastic material into a sheet, these calenders being arranged in line and each being operable to produce an individual sheet and combine that sheet with a sheet produced by the calender next prior in the series thereby forming a composite plastic sheet, means

operatively connected with the calenders for cooling the sheet passing through the latter, rotary means adapted concurrently to shape selected portions of the composite sheet to a preselected form of variable thickness and to cut the formed portions from the sheet.

8. Apparatus for the production of roofing elements and the like, which comprises the combination of a series of calenders for forming plastic material into a sheet, these calenders being arranged in line and each being operable to produce an individual sheet and combine that sheet with a sheet produced by the calender next prior in the series, thereby forming a laminated sheet, and cooperating devices operable to form selected portions of the completed sheet to a selected shape of graduated thickness and to cut said shaped portions therefrom.

9. Apparatus for the manufacture of laminated plastic material in sheet form, which comprises the combination of a series of calenders, each adapted to form plastic material into a sheet, each calender having pressing rolls adapted to rotate at the same speed and being adapted to receive a sheet from the calender next before it in series and to combine that sheet by a pressure normally applied thereto with the one being formed in the said calender, thereby forming a laminated plastic sheet, and means for applying a coating of surfacing material to one face of the first sheet formed during its formation.

10. Apparatus for the manufacture of plastic material in sheet form which comprises the combination of a plurality of calenders each adapted to form plastic material into a sheet, the said calenders being arranged in line and driven at the same rate to form sheets, whereby the sheet formed in each calender is united as a skim coating to the sheet produced in the next preceding calender in the series during formation of the latter, such union being effected by pressure normally applied to the surface of the sheets.

11. Apparatus adapted for the manufacture of a laminated sheet from plastic material, which comprises a series of aligned calenders having pressing rolls and a feed roll and adapted to sheet out a plastic mass, means associated with each calender for feeding a heat-plastic mass to that calender, means for passing the sheet formed in each calender to the next calender in line and into pressing engagement with the sheet being formed by the last-named calender to form a skim coat of plastic upon the last-named sheet, and means for cooling the pressing rolls of each calender.

12. Apparatus adapted for the manufacture of a laminated sheet from plastic material which comprises a series of aligned calenders having pressing rolls and feed rolls and adapted to sheet out a plastic mass, means associated with each calender for feeding a heat-plastic means to that calender, means for passing the sheet formed in each calender to the next calender in line and into pressing engagement with the sheet being formed by the last-named calender to form a skim coat of plastic upon the last-named sheet, means for cooling the pressing rolls of each calender, means for disposing a coating of wear-resistant material on at least one surface of the composite plastic sheet, and means for concurrently forcing the wear-resistant material into the plastic surface of the sheet and for cooling the sheet to give it a surface set and for securely bonding thereto the wear-resistant material.

In testimony whereof I affix my signature.

THOMAS ROBINSON.