Sept. 26, 1933. J. L. WETTLAUFER 1,928,274

METHOD OF MANUFACTURING ROOFING

Original Filed March 28, 1928 4 Sheets-Sheet 1

Fig. 1

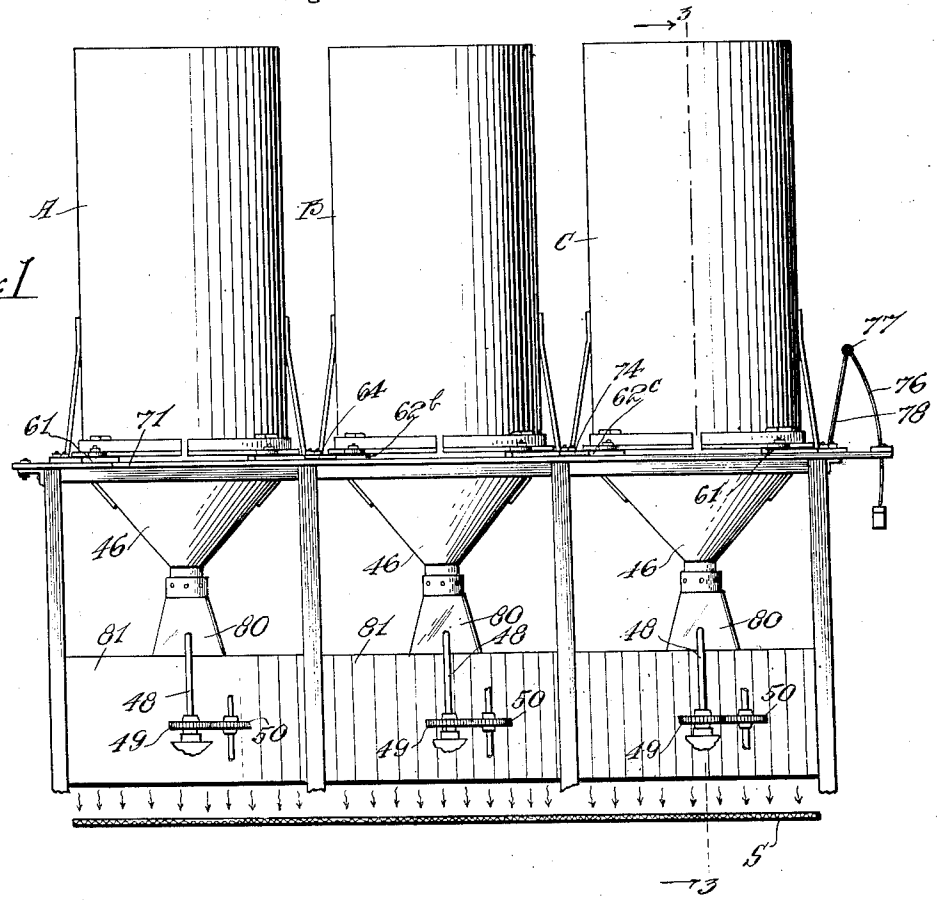
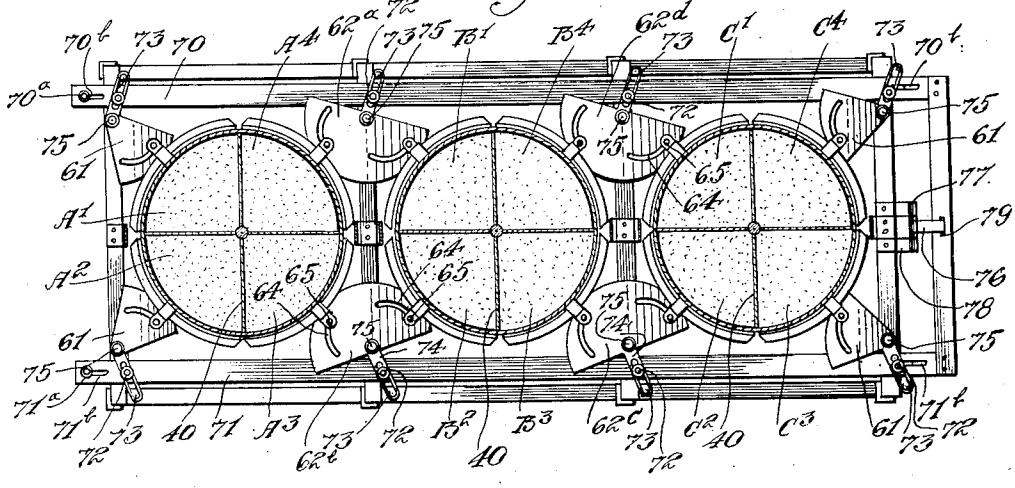


Fig. 2



INVENTOR
Jules L. Wettlaufer.
BY Samuel Stearman
ATTORNEY

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Fig. 3

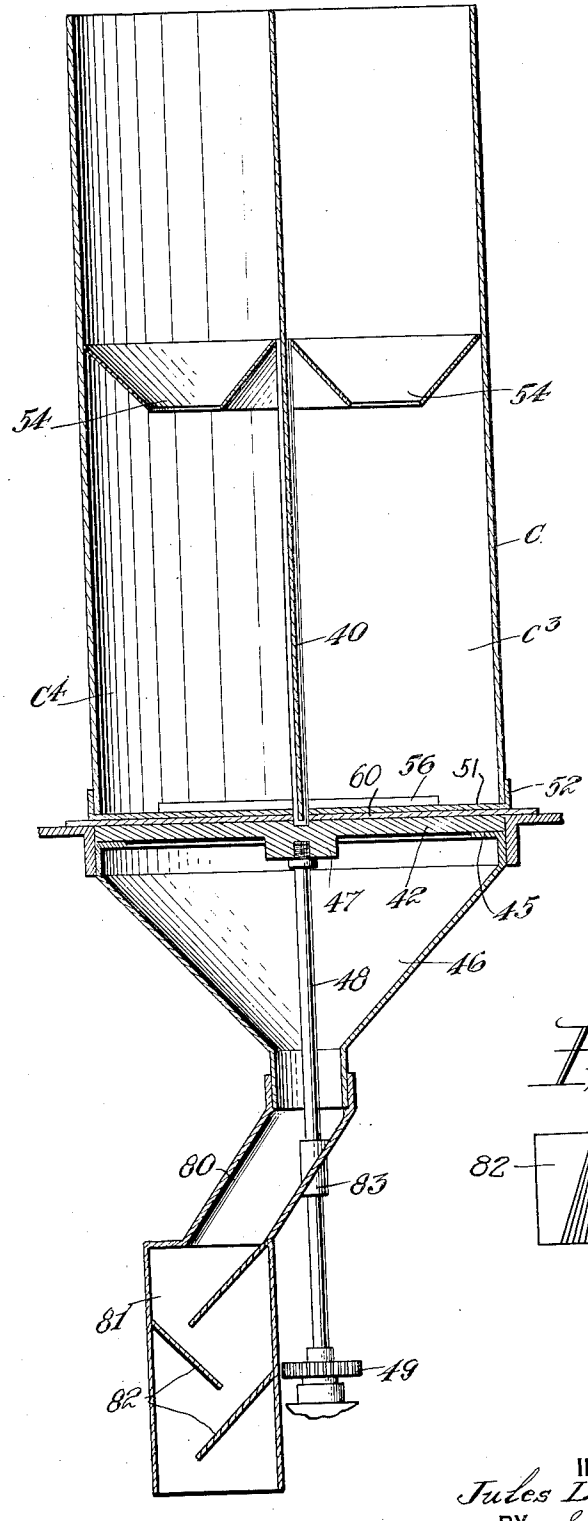
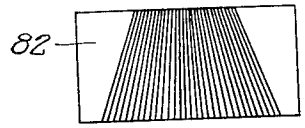


Fig. 11



INVENTOR
Jules L. Wettlaufer
BY Samuel Stearman

ATTORNEY

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METHOD OF MANUFACTURING ROOFING

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Fig. 4

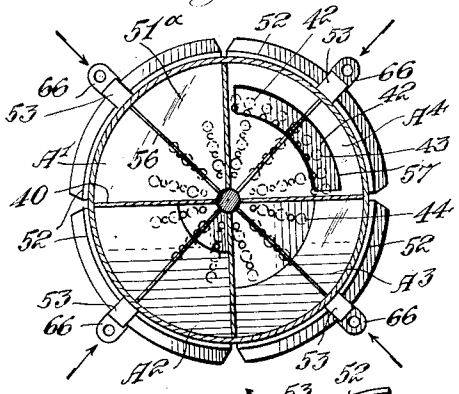


Fig. 5

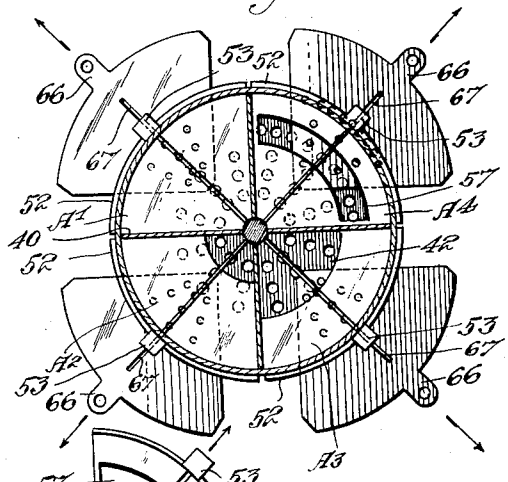


Fig. 6

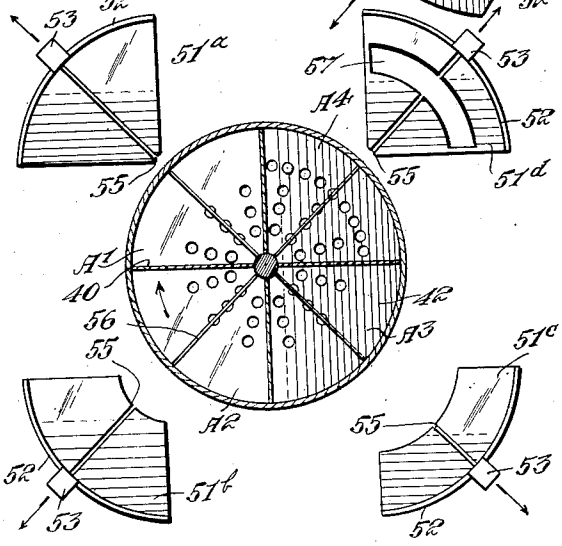
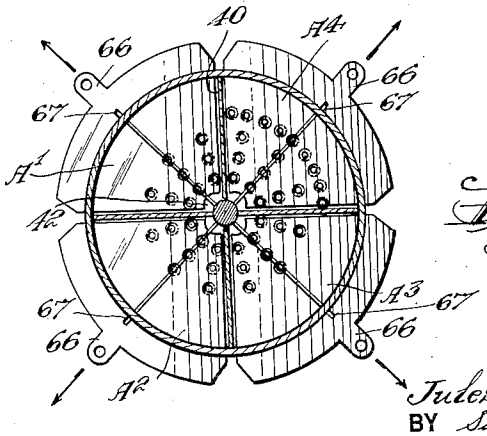


Fig. 7



INVENTOR
Jules L. Wettlaufer.
BY Samuel Stearman

ATTORNEY

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METHOD OF MANUFACTURING ROOFING

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Fig. 10

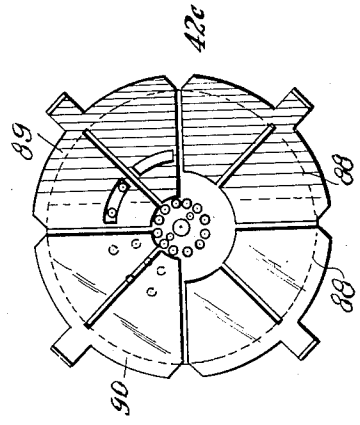


Fig. 9

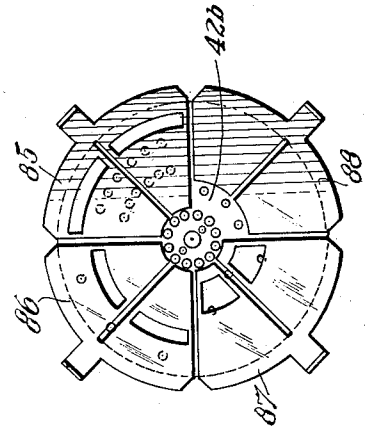
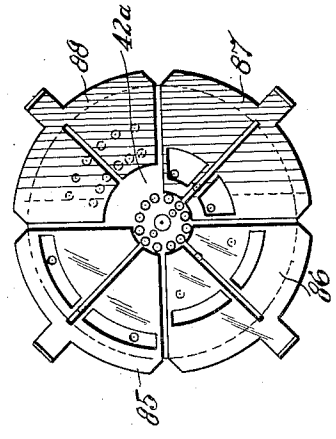


Fig. 8



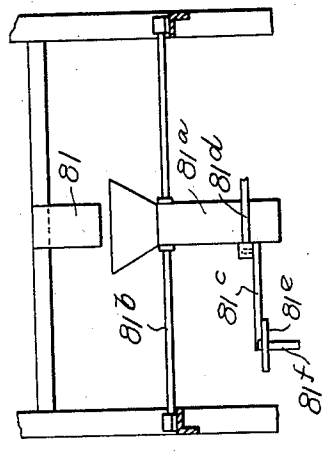


Fig. 12

INVENTOR
Jules L. Wettlaufer.
BY Samuel Stearman

ATTORNEY

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UNITED STATES PATENT OFFICE

1,928,274

METHOD OF MANUFACTURING ROOFING

Jules L. Wettlaufer, Belmont, Mass.

Application March 28, 1928, Serial No. 265,484
Renewed May 26, 1933

7 Claims. (Cl. 91—68)

This invention relates generally to mixing devices for producing various mixtures of solid granular or comminuted materials, and finds one particular adaptation in the prepared roofing industry wherein mineral materials are employed in the process of manufacture. Roofing prepared in this way generally comprises a foundation of felted fibrous material which is saturated in sheet form with waterproofing material of the character of asphalt, and is also provided with a waterproof and weatherproof coating of asphalt on one or both surfaces thereof, and in some instances on the edges thereof which are exposed to the weather when the roofing is applied on a roof. The waterproof coating on the surface of the sheet which is to form the exposed portion of the finished roofing product is usually provided with a wearing surface of grit, such as crushed slate or similar material, in order to protect the waterproof coating and to provide a finishing surface for the product.

Granular material which has been found suitable for this purpose lends itself very well to the production of roofing material of this character having a wide variety of colors or color arrangements on the exposed face thereof.

At the present time there is a considerable demand for this type of roofing finished in surfacing material of other than a solid color. Attempts have been made to produce roofing surfaced with various colors but the general result has been that when the roofing material is laid up on the roof the various colors appear to the eye of the observer either in mathematical regularity or they are otherwise distributed over the roof as to be displeasing to the eye, or in any event do not meet the demand which now prevails for a roof of a number of colors blended into one another or distributed over the roof in such haphazard and irregular fashion as to effect a harmonious and pleasing color arrangement with no patterning or striping of the colors at one or more places along the roof.

It will be understood that prepared roofing of the type here referred to may be either in the form of sheets or as individual shingles, or as the so-called strip shingles of commerce.

Strip shingles and individual shingles which can be laid so as to produce a finished roof meeting the requirements of a harmonious and artistic color arrangement as above noted, are being manufactured today, but in order to avoid the objections already described it is necessary to produce a series of separate stocks of the shingles, the color arrangement in the shingles of each stock being either wholly or partly different from that of the shingles of the other stocks, and the shingles of the separate stocks being thereafter assembled in accordance with a predetermined plan so that when they are taken by the workman laying the roof, from the package containing them, and laid up in regular order, the finished roof will have the desired haphazard arrangement of the colors. The necessity for making separate runs for producing the shingles of the different series, is open to objection, since it entails a large amount of storage space for the accumulation of the stocks which are to be mixed, and furthermore the assembling of the shingles of the various series requires additional labor and other expense.

The primary object of my invention resides in the provision of mechanism which can be very readily adopted in the manufacture of prepared roofing and by means of which colored mineral granules or other surfacing material may be combined and applied to the roofing sheet in such a way that successive shingles or strip shingles having varying arrangements of color thereon, may be cut from the sheet and immediately packaged without the necessity for assortment and re-assemblage.

With these and other objects in view, my invention consists in the organization, arrangement and combination of elements as will presently appear, and for a more complete understanding of the same and the advantages thereof, reference may be had to the following more detailed description and to the accompanying drawings, in which,

Figure 1 is a view in elevation of one form of apparatus in which the present invention may be embodied,

Figure 2 is a plan view of part of the mechanism shown in Figure 1,

Figure 3 is a vertical view in section taken along line 3—3 of Figure 1, through one of the hoppers for containing the mineral grit to be applied to the roofing sheet and the means for delivering the material from the hopper to the sheet,

Figure 4 is a detail view in plan of mechanism which may be employed in the hoppers in accordance with my invention,

Figure 5 is a view similar to Figure 4, but showing certain of the mechanism shown in Figure 4, partially removed from operative position,

Figure 6 is a collective view in detail, of certain of the devices appearing in Figures 4 and 5,

Figure 7 is a view similar to Figure 4, showing the parts in another position.

Figures 8, 9 and 10 are detail views in plan of various arrangements of certain of the parts that may be employed in carrying out my invention.

Figure 11 is a view showing a baffling plate that may be employed in conjunction with the invention,

Figure 12 shows an arrangement for securing certain ornamental effects in accordance with the invention.

It will be understood that the sheet of felt forming the foundation of the roofing material, saturated to the extent desired with waterproofing liquid such as molten asphalt and coated on one or both faces thereof with high melting point blown asphalt, is fed with the sticky asphalt on the surface thereof, continuously beneath the mechanism for applying the surfacing material to the surface of the sheet which is to form in the finished product the exposed face thereof. Generally the opposite surface of the sheet when provided with coating, is covered with some non-adherent material such as finely powdered mica or talc, although it is within the contemplation of my invention that after one surface of the sheet has been covered with the granular surfacing material the sheet may be reversed by any suitable mechanism so that in the further travel thereof it will present its opposite surface to a surfacing mechanism similar to that employed in the first instance so as to cover the opposite side with granular material which may be of a character similar to or different from that on the first side and with a color arrangement either duplicating that on the first side, or different therefrom.

It will also be understood that after the surfacing material has been applied to the sheet the latter is fed around suitable pressure rolls to cause the granular substance to be more firmly imbedded in the asphalt coating, whereafter the sheet may be formed into rolls of desired size or cut into individual or strip shingles of any suitable or desirable shape.

Referring in detail to the drawings, S indicates a section of asphalt saturated and coated roofing felt as it is proceeding beneath the surfacing mechanism. In the production of this type of roofing it is generally the common practice to deposit the granular mineral surfacing in such way as to form a plurality of ribbons of various colors or shades upon the sheet, which, in the case of strip shingles cut transversely from the sheet, correspond to tabs of the shingle strip. In the mechanism shown on the drawings, three distinct streams of color are deposited so as to produce three distinct ribbons extending longitudinally of the sheet, these ribbons or strips of color being of approximately equal width, but obviously, the number, as well as the relative widths of the stripes, may be varied as desired. Each of these streams is produced by one of the series of hoppers A, B, C, each of which is divided off into separate compartments or hoppers wherein a constant supply of mineral of the desired primary colors is maintained.

The individual hoppers are indicated in each series by the numerals 1, 2, 3 and 4, after the letter representing the respective series.

The hopper series are preferably formed as elongated cylindrical containers provided on the interior thereof with vertical partitions 40, extending at right angles to one another so as to form separate compartments within the hoppers, the lower end of the partitions being substantially in alignment with the lower end of the hoppers. Obviously, however, the containers may be divided into a greater or lesser number of compartments by the employment of partitions suitably positioned therein.

In accordance with my invention, the granular surfacing material in one of the compartments or hoppers in each series, may be combined and intermixed as will be more fully explained hereinafter, with granular material contained in one or more of the other compartments or hoppers in the same series. In one embodiment of my invention, I associate with each of the series of hoppers a rotatable blending disk 42 which is so constructed as to be capable of producing, when used in conjunction with certain control plates as will be more fully explained, various mixtures of mineral from the compartments composing each series. In the form shown, the blending disks 42 may be simply flat circular plates of metal or other suitable wear-resistant material, and, as illustrated in Figures 4 to 7, may be formed with an arcuate series of perforations 43 and a plurality of radial series of openings 44.

The blending disks 42 are each mounted for rotation upon an inwardly directed bearing flange 45 formed at the upper end of a funnel shaped chamber 46 which is adapted to receive the mineral withdrawn from the corresponding hopper series for delivery to the coated sheet.

In order to effect rotation of the blending disks 42, the latter are each provided with a hub portion 47 suitably connected to a rotatable shaft 48 so that upon rotation of the latter the disk 42 connected therewith will be caused to rotate. The shafts 48 may be journalled in suitable supports and connected in any convenient way with a source of power. As shown, the connections of the shafts with the source of power may be through the gears 49 fixed to the respective shafts and meshing with similar gears 50 which may be connected with a main drive shaft (not shown). The connection of the shafts 48 with the main drive shaft is preferably such that independent control may be exercised over the speed or direction of rotation of each of the shafts, so that any one or more of the shafts may either be disconnected at will or independently manipulated so as to increase or decrease the speed thereof in relation to the speed of rotation of the other shafts. Conveniently, and with advantage, in many instances, these connections may, if desired, include suitable variable speed devices.

For the purpose of producing various predetermined mixtures of material from the hoppers or compartments in each series, I employ in conjunction with the rotating discs 42, flat control plates 51, such as shown by way of example, in Figures 4 to 7, these plates being adapted for insertion below the compartments in each series, and when in position, fitting snugly against the lower ends thereof and being spaced slightly above the upper surfaces of the rotating discs 42, for a purpose to be more fully explained hereinafter.

Various styles of control plates are adapted for producing different effects. In the forms illustrated in Figures 4 to 7, these control plates may be of quadrant, and in some instances of segmental shape, with their side edges converging at approximately an angle of 90° so that each

plate will fit properly below the lower edge of the compartments or hoppers in each series. The outer edge of each of the control plates may be provided with an upwardly extending lip 52, adapted to fit against the exterior surface of the outer wall of the compartments and with a handle portion 53 to permit ready insertion and removal of the plates. In order to facilitate the insertion of the control plates in the compartments and their removal therefrom, they may be formed with radial open-ended slits 55 for co-operation with vertical guide-plate 56 fixed within each of the compartments adjacent the lower end thereof.

In order to relieve the disk and control plates from the bulk of the weight of material in each compartment, I may provide cone-shaped pans 54, fixed within each of the compartments at a suitable distance above the control plate therein.

As already indicated, the mineral of primary color in the various compartments in each series may be united and intermingled in such a way as to produce a stream of granules, the composition of which may be varied depending upon the relative arrangement of the perforations in the blending disk and upon the style of control plate used in conjunction therewith. Thus, one arrangement by way of example, is shown in Figure 4, wherein one of the series of hoppers, as for example series A, may have the separate compartments A1, A2, A3, A4 thereof, supplied with granules of different colors. the arrangement here being such as to produce a mixture of approximately three parts of the material in compartment A3 and approximately one part of the material in compartment A2, with a periodic addition to this mixture of the mineral in compartment A4, the mineral in compartment A1 being blocked out so as to form no part of the ultimate mixture delivered from this series of hoppers. In order to effectuate this result there is inserted in the compartment A1, a quadrant-shaped control plate 51*a* which blocks out entirely this hopper and prevents any of the mineral therein from dropping through any of the openings in the rotating disk 42 during the rotation thereof. In the compartment A2 there is inserted a segmental control plate 51*b*, adapted to block out approximately two-thirds of the area of the surface exposed in this compartment by the perforations in the disk 42, during the rotation thereof. The compartment A3 in this instance is provided with a control plate 51*c* of the same type as the plate 51*b*, but of lesser radial extent, the proportioning as shown, being such as to block out one-third of the area exposed in this compartment by the perforations in the disc 42 during the rotation thereof. In the compartment A—4 a control plate 51—*d* may be employed, this type of control plate being provided only with an arcuate slot 57 in the body thereof, so as to block out the radial series of perforations 44 in the rotating disk while the arcuate slot 57 registers periodically with the arcuate series of perforations 43 in the disk 42 during the rotation thereof. As will be apparent, during the rotation of the disk associated with this series of compartments or hoppers, there will be constantly formed a mixture of approximately 1 part of the material in compartment A—2 with about 3 parts of that in compartment A—3, and to this mixture there will be added periodically the material from compartment A—4, this addition occurring upon the registration of the perforations 43 in the disk 42 with the slot 57 in the control plate 51—*d* of this compartment. Manifestly the effects may be varied to suit the particular type of material to be produced by a judicious choice of control plates used in the various compartments.

In some instances, for example, it may be desirable to employ in each of the compartments in a series, control plates such as shown at 51—*d* so that the material in the compartments will be discharged therefrom only upon the registration of the perforations 43 in the rotating disk 42 with the slots 57 in the respective control plates. In this case, as will be obvious, there will be a substantially periodic variation in the composition of the granular mixture delivered from this series. Thus, assuming that the hopper A—1 contains a red mineral, the hopper A—2 a green mineral, the hopper A—3 a yellow mineral, and the hopper A—4 a brown mineral, each of these compartments being fitted with control plates of the type shown at 51—*d*, and the disk 42 rotating in a counter-clockwise direction, there will be delivered at one stage, for example, a solid red mineral, followed by a mixture of the green mineral with the red, the proportions of the green mineral constantly increasing and the proportions of the red mineral constantly decreasing until solid green mineral is delivered. Then, upon the entrance of the perforations 43 beneath the compartment A—3, the green mineral will be constantly varied by increasing proportions of the yellow mineral in compartment A—3 until a solid yellow mineral is delivered, whereupon during the further rotation of the disk the brown mineral from compartment A—4 becomes mixed in gradually increasing quantity with the yellow mineral from compartment A—3 while the proportion of yellow decreases until solid brown mineral is delivered, which is then varied by the increasing amounts of the red mineral in compartment A—1 as the disk continues to rotate, and so on, the series of colors repeating itself in this order. Obviously the sequence in which the colors are delivered may be varied by reversing the direction of rotation of the disk or by storing the primary colors in the compartments or series of hoppers in a different order. Furthermore, it will be apparent that the rapidity with which the change in the composition of the mixture delivered from the series of hoppers may be effected, will depend upon the speed of rotation of the disk 42 in relation to the rate of travel of the sheet of roofing material, the more rapid the rate of rotation of the disk for a constant linear speed of the sheet, the shorter will be the period of the change, and vice versa. Hence, by connecting the shafts carrying the gears 50 with suitable variable speed mechanism, the speed of rotation of the disk may be varied as desired so as to increase or decrease the periodic change in the composition of the mineral delivered from the series of hoppers. Where the mechanism is employed in the manufacture of strip shingles, the rate of rotation of the disk 42 may, if desired, be sufficiently rapid, in relation to the linear speed of the sheet of roofing base, to cause the mixtures of varying colors to be deposited on the sheet in successive areas corresponding substantially to the tabs of the finished shingle strip.

It will be understood of course, that the quantity of mineral delivered at any one time by a series of hoppers, is governed by the size and disposition of the perforations in the blending

disk relative to the openings in the co-operating control plates, and obviously, the parts must be so proportioned as to provide at all times a flow of mineral sufficient to cover the desired area of the sheet, and where, as shown, a plurality of series of hoppers are employed to surface a sheet of roofing base, substantially equal quantities are delivered from each series and the total quantity delivered from all the series should manifestly be ample to completely surface the entire width of the sheet during its progressive travel forwardly.

In actual practice, it frequently happens that the sheet of roofing slows down somewhat in its travel, due to delays at other points along the roofing machine, and not infrequently the travel of the sheet must be entirely stopped temporarily. It will be obvious of course, that under such circumstances, the perforations in the rotating disk 42 which are not covered or closed off by solid portions of the associated control plates, would continue to discharge mineral upon the surface of the retarded or halted sheet. The mineral thus accumulating while the sheet is not moving forwardly under normal speed would be wasted, for it would be very difficult to segregate the components thereof or thereafter distribute the same in the desired manner over the surface of the sheet. I provide means for taking care of such a contingency and for otherwise enabling the surfacing operation to be conducted under better control.

For this purpose, I provide mechanism including stop plates and means for moving the same to and from a position in which the flow of mineral produced by the associated rotating disk and control plates may be stopped entirely or diminished to any desired extent. In the form illustrated, this mechanism comprises stop plates 60 adapted to slidably fit within the space in each compartment between the upper surface of the rotating disk 42 and the lower face of the control plate therein. These stop plates are of quadrant shape and are provided with a plurality of radial and arcuate series of perforations 60—*a* similar to those in the disk 42, but staggered with relation thereto in respect to the axial center of the hopper series so that when the stop plates are moved to the position shown in Figure 4, the perforations therein will be out of register with those in the rotating disk and consequently no mineral will flow from this series of compartments. On the other hand, when the stop plates 60 are in the position shown in Figure 7, (the control plates being omitted in this figure for the sake of clearness), the perforations therein will coincide with the openings in the disk and hence permit the mineral to flow therethrough. Between the open position of Figure 7 and the closed position of Figure 4, the stop plates may be caused to rest at intermediate positions in which the openings in the disk 42, will be more or less partially shut off.

In any event, however, the movement of the plates 60 to and from their respective positions, is accomplished by a mechanism preferably designed to move all the plates simultaneously. As shown in Figure 2, the arrangement comprises plates 61 adapted for operative connection with the stop plates of the compartments A—1, A—2, C—3 and C—4, and semi-circular plates 62—*a* to 62—*d* adapted for connection with the stop plates of a pair of adjoining intervening compartments. Thus, as shown, plate 62—*a* is connected with the stop plates of compartments A—4 and B—1, plate 62—*b* is connected with those of compartments A—3 and B—2, plate 62—*c* with those of compartments B—3 and C—2, and plate 62—*d* with those of compartments B—4 and C—1. The plates 61 and 62—*a*—62—*d* are each provided with eccentric slots 64 within which are adapted to slide the pins 65 riveted or otherwise secured to ears 66 extending outwardly from the arcuate edge of each stop plate substantially at the mid-point thereof. The stop plates are also formed with radially extending open slits 67 adapted to embrace the guide plates 56 within the compartments so as to maintain the stop plates at all times in proper axial position. It will be seen that upon rotative movement of the plates 61 and 62—*a*, *b*, *c* and *d*, the pins 65 will slide within the eccentric slots 64 and cause the stop plates to be moved inwardly or outwardly depending upon the direction of rotation of the operating plates. The movement of the operating plates is effected by the sliding bars 70 and 71 mounted upon suitable supports and guided in their movement by the fixed pins 70—*a* and 71—*a* passing through elongated slots 70—*b* and 71—*b* formed in the bars near the ends thereof. Fixed at suitably spaced points along the bars 70 and 71 are a number of pins 72, adapted to slide, during rectilinear movement movement of the operating bars within closed slots 73 in the arms 74, projecting radially from the main body of the plates 61 and 62—*a*—62—*d*, the operating plates being pivoted as at 75 in any convenient manner. Movement of the bars 70 and 71 is effected manually by means of an operating lever 76 pivoted at 77 to a support 78 and passing through a slot 79 formed in the bar 80 connecting the bars 70 and 71 for unitary movement.

The operation of the foregoing mechanism will be obvious. Upon manipulation of the lever 76 the bars 70 and 71 may be caused to slide unitarily in one direction or the other, thereby effecting simultaneous rotation of all the operating plates and inward or outward movement of the stop plates connected therewith.

Hence, when the operator observes a slowing up in the speed of travel of the sheet being surfaced, the flow of mineral from all the series of hoppers may be diminished by moving the lever 76 in the proper direction to cause the stop plates to move toward the position shown in Figure 4, and upon resumption of the normal rate of travel of the sheet, the lever 76 may be manipulated in the opposite direction so as to bring the stop plates to the relative position shown in Figure 7. It will be understood of course, that either in the full or partially open position of the stop plates, the quantity of mineral flowing from each series of hoppers is substantially the same, while the sequence and relative proportion of mineral delivered from the respective hoppers of each series is substantially preserved.

I have heretofore set forth various ways in which different effects may be produced by the mineral delivered from the hoppers in one series, and obviously, by the employment of appropriate control plates in conjunction with the disks 42 rotating beneath the other series of hoppers, these latter may be similarly made to deliver a flow of mineral composed of any desired mixture, either of constant or of a continually varying composition of the various minerals maintained in the separate compartments of the respective series. While the character of the flow from the said other series of hoppers

may be identical with that produced from the one already described so as to deposit entirely across the surface of the sheet, surfacing material of the same composition, which may either be constant or may vary as the sheet progresses, it is preferred to make such a selection of colors in the hoppers of the various series and to associate the control plates therewith and operate the driving connections, all in such a way that the mixture delivered from each series will be more or less different from that delivered from any one of the other series, and the mixture from each series being either of constant or periodically varying composition, as desired. Thus, where three hopper series are employed, the sheet may be surfaced with three stripes or ribbons of different colors or shades, and where the composition of one or more of the streams is caused to vary continually, the corresponding bands or stripes on the sheet will vary more or less periodically in color. The color effects to be produced when laying up roofing shingles or strip shingles successively cut from a sheet of roofing material surfaced as described, will of course, govern the selection of the minerals fed to the various compartments, and the type of rotating blending disk and control plates to be used therein.

As one illustration of a particular color effect that might be produced in accordance herewith, I may employ in conjunction with each of the three series of hoppers, a rotating disk having suitably spaced openings therein and co-operating control plates formed with slots or perforations so related to the openings in the disk that in one position of the disk the charge of mineral delivered from each series will be composed of certain definite proportions of the mineral from certain of the compartments in said series, then at a later stage in the rotation of the disk, the stream will be composed of the same or different proportions of mineral from the same and/or other compartments of the series, followed then by a mixture composed of either the same or still different proportions of mineral from any one or more of the said and/or other compartments of the series, and then, if desired, by a still different mixture of desired composition from certain compartments in the series, the sequence in the composition of the charge thereupon repeating itself.

In Figures 8, 9 and 10 I show an arrangement of rotating disks and co-operating control plates that may be used in the various hopper series to secure charges of the aforesaid character. Referring to these figures, the blending disks 42—*a*, 42—*b* and 42—*c* are adapted to be mounted for rotation in the hopper series A, B, and C, respectively. Within the compartments A—1, B—3, there may be inserted control plates such as shown at 85; within the compartments A—2 and B—1 there may be placed control plates as shown at 86; within the compartments A—3 and B—2 there may be placed the control plates shown at 87; within the compartments A—4, B—3, C—2 and C—3, control plates as at 88; within the compartment C—4 control plates as at 89 and in the compartment C—1, a control plate as at 90. The rotating disks 42—*a*, 42—*b* and 42—*c* are formed as shown, with a plurality of series of circular openings arranged concentrically and located at various points circumferentially of the respective disks as shown. The control plates are formed with arcuate slots or perforations as indicated by the letter "*a*" following the numerals representing the respective plates, of greater or less radial dimension and at various radial distances from the axial center of the hopper series. Other of these plates, as for example those shown at 88 and 90, are not provided with slots as just described, but are segmental in shape and of greater or less radial dimension from the outer edge thereof. The foreshortening of the control plates 88 and 90 and the arrangement of the slots in the control plates 85, 86, and 87, is such that desired proportions of mineral will be delivered from selected compartments of each series during the continued rotation of the blending disk associated therewith, the mineral from the compartment or compartments of each series not desired in the mixture at any one stage during the rotation of the disk, being blocked off.

In the particular arrangement illustrated, and assuming that the compartments A—1, B—1 and C—1 contain red mineral, the compartments A—2, B—2 and C—2, black mineral, the compartments A—3, B—3 and C—3 green mineral, and the compartments A—4, B—4 and C—4 brown mineral, and referring more specifically to Figure 8, it will be seen that with the disk 42—*a* in the position shown in this figure, there will be exposed by the control plate 86 in the compartment A—2, six openings in the disk, and by the control plate 88 in compartment A—4, four openings in the disk, so that mineral will be discharged from these two compartments in the proportion of three parts of black to two parts of brown, the openings in the rotating disk underneath the other compartments of this series being blocked out, by virtue of the fact that in this position of the disk none of the openings therein are in registration with slots in the control plates in these compartments.

As the disk 42—*a* rotates in a counter-clockwise direction through an arc of 90° it reaches a position wherein mineral from compartments A—1 and A—2 is blocked off by the control plates therein, while the control plate 87 in compartment A—3 exposes six openings in the disk and control plate 88 in compartment A—4 exposes three openings in the disk, thus producing a mixture composed of two parts green and one part brown. When the disk has passed through another 90° in its rotation, the black mineral of compartment A—2 is blocked by the control plate 86, while control plates 87, 88 and 85 each expose three openings in the disk so as to form a mixture of equal parts of red, green and brown mineral. Then, as the disk rotates through another 90° it reaches a position where the control plate 87 in compartment A—3 exposes three openings in the disk and the control plate 88 in compartment A—4 exposes six openings in the disk, thus forming a mixture composed of one part green mineral, and two parts brown mineral. Thereafter, the return of the disk to the position initially referred to will effect repetition of the above described cycle. It will be seen that substantially the same number of holes in the disk are exposed at all times during the rotation thereof, and consequently the rate of feed of mineral from the hopper series is substantially uniform. It will be understood also, that as the disk continues in its rotation there will be a more or less slight blending of the successive mixtures produced at the various stages.

Similarly, rotation of the disk 42—*b* of the hopper series B, in co-operation with the arrangement of control plates shown in Figure 9,

will produce a stream, the composition of which is first one part green and two parts black, then equal parts of green, black and brown, followed by two parts green and one part black, and then by three parts red and two parts green. Likewise the stream from the hopper series C may be composed successively of two parts green and one part black, then equal parts of green, black and brown, followed by two parts black and one part green.

The period of change in the composition of the mixture in the several streams will depend, of course, upon the rate of rotation of the blending disks 42—*a*, 42—*b* and 42—*c*, and while in some instances the rate of rotation may be the same for the disks of all the hopper series, it is preferred, in order to produce a more harmonious effect on the roof, free from any appearance of patterning, to connect the shafts 48 for independent operation as heretofore described, so that while any of these streams may be composed of a mixture which changes and repeats itself relatively rapidly, any one or all of the other streams may be composed of a mixture in which the succession of the various mixtures repeats itself relatively slowly. Thus, the shaft of the hopper series A may rotate at 35 R.P.M., that of series B at 20 R.P.M., and that of series C at 28 R.P.M.

In this way, repetition in the arrangement of the colors transversely of the sheet is reduced to a minimum and the tendency towards splotchy or patterned effects on the roof laid with shingles cut from the sheet is thereby practically entirely eliminated.

The mineral discharged from each series of hoppers flows through the funnel-shaped chambers 46 to the downwardly inclined chutes 80 for conveying the mixtures to the mixing chambers 81, in which are arranged series of inclined baffle plates 82 adapted to effect an intimate commingling of the minerals contained in each stream, the final mixture from the lowermost baffle in each chamber being deposited upon the sheet of coated roofing base travelling therebeneath. If desired, each of the baffle plates may be provided, as shown in Figure 11, with shallow grooves or flutes extending transversely thereof and arranged to effect a lateral spreading of the stream of mineral so as to cause the components thereof to become more intimately mixed.

The rotating shafts 48 pass through stuffing boxes 83 in the walls of the chutes 80 and extend upwardly through the chutes and funnel chambers 46 for connection with the respective rotating disks 42. The funnels, together with their associated chutes, may be removably mounted so as to permit lowering of the shafts to enable the disks 42 to be exchanged, or other parts to be replaced.

I have heretofore referred to the minerals in each of the compartments in a series as being composed of mineral of a single primary color, but it should be understood that in certain instances the minerals in these separate hoppers may be composed of any desired mixture of minerals, which mixtures from the compartments in a series may then be combined as desired, by the use of appropriate control plates in association with the rotating disks.

Instead of depositing the mineral upon the sheet in steady streams so as to produce color bands substantially parallel to the longitudinal edges of the sheet, the streams as delivered from the mixing chambers 81 may be caused to oscillate to and fro by any suitable means, as for example by means of pipes or spouts 81*a* freely mounted for oscillation upon a shaft 81*b* and rocked upon the shaft by a rocker arm 81*c* carrying pins 81*d* on opposite sides of the spout and actuated by an eccentric disk 81*e* mounted on a shaft 81*f*. By thus oscillating the streams before they reach the sheet the minerals will be deposited in wavy or undulating bands instead of straight parallel bands, and by varying the amplitude of oscillation of the streams, various ornamental effects may be produced in addition to those which may be produced by the variation in colors as already described.

It will thus be seen that by my present invention I provide mechanism affording considerable latitude and flexibility of operation, and which is readily adapted to the production of composition roofing not only of any solid shade of mineral or predetermined mixture of minerals, but which is also adapted for surfacing a sheet with a plurality of stripes which may be of differently colored minerals, and the color of which may undergo more or less change as the operation continues so that successive roofing elements cut either lengthwise or crosswise of the sheet, may be packaged directly as they are delivered from the cutting operation without requiring them to be assorted and reassembled in order to produce when laid upon the roof, a harmonious association or blending of colors such as is now in great demand in the prepared roofing industry.

Having thus described several embodiments of my invention it will be evident to those skilled in the art that many and devious changes and modifications may be made therein without departing from its spirit or scope as defined by the claims hereunto appended.

I claim as my invention:

1. In the manufacture of granular surfaced roofing, the method of surfacing a sheet of roofing base which comprises maintaining separate supplies of differently colored granules, simultaneously discharging from several of said supplies, predetermined relative proportions of granules therefrom combining the simultaneously downwardly discharging minerals, to form a mixed stream of predetermined composition, periodically varying said proportions to vary the composition of the stream and depositing the granules of said stream upon a traveling sheet of roofing base.

2. In the manufacture of granular surfaced roofing, the method of surfacing a sheet of roofing base which comprises maintaining separate supplies of differently colored granules, simultaneously discharging from several of said supplies, predetermined relative proportions of granules therefrom combining the simultaneously downwardly discharging minerals, to form a mixed stream of predetermined composition, regulating the flow of granules from each of said several supplies while preserving the relative proportion thereof, and depositing the granules of said stream upon a traveling sheet of roofing base.

3. In the manufacture of granular surfaced roofing the method of surfacing a sheet of roofing base, which comprises maintaining a plurality of series of separate supplies of differently colored granules, simultaneously discharging from several supplies in each series predetermined proportions of granules therefrom and

combining the simultaneously discharged granules as they are flowing downwardly to form a plurality of streams, each stream being of predetermined composition and the composition of one of said streams differing at times from the composition of another of said streams, regulating the volume of different types of granules flowing in each stream while preserving the relative proportion of granules composing the same, and continuously depositing said streams upon a traveling sheet of roofing base.

4. In the manufacture of granular surfaced roofing the step which comprises maintaining a series of separate supplies of differently colored granules, continuously and simultaneously withdrawing predetermined relative quantities of granules from several of said supplies without substantially changing the rate of feed of the granules, and mixing the continuously and simultaneously discharged granules to form a stream composed of a homogeneous mixture thereof, and periodically modifying the composition of said stream with granules withdrawn from another of said supplies.

5. In the manufacture of granular surfaced roofing, the step of surfacing a sheet of roofing base which comprises maintaining a series of separate supplies of differently colored granules, withdrawing the granules from the supplies of said series in periodic succession, progressively decreasing the quantity withdrawn from one of said supplies and mixing the same with gradually increasing quantities of granules withdrawn from the succeeding supply in said series.

6. In the manufacture of granular surfaced roofing, the method of surfacing a sheet of roofing base, which comprises maintaining a series of separate supplies of differently colored granules, withdrawing granules from said supplies in predetermined sequence, the granules withdrawn from one of said supplies constantly decreasing while the granules withdrawn from the next sequential supply gradually increasing, whereby to form a continuous stream of periodically varying color, and depositing said stream upon a traveling sheet of roofing base.

7. In the manufacture of granular surface roofing the steps which comprise maintaining a series of separate supplies of differently colored granules, continuously and simultaneously withdrawing predetermined relative quantities of granules from several supplies, combining the simultaneously discharging granules as they are flowing downwardly from the supplies to form a stream composed of a homogeneous mixture, and periodically modifying the composition of said stream with granules withdrawn from another of said supplies without changing the aggregate quantity of the simultaneously discharged granules.

JULES L. WETTLAUFER.