Jan. 1, 1957 W. ROWE 2,775,994

METHOD AND APPARATUS FOR PRODUCING A DECORATIVE SURFACE COVERING SHEET

Filed Feb. 19, 1954 4 Sheets-Sheet 1

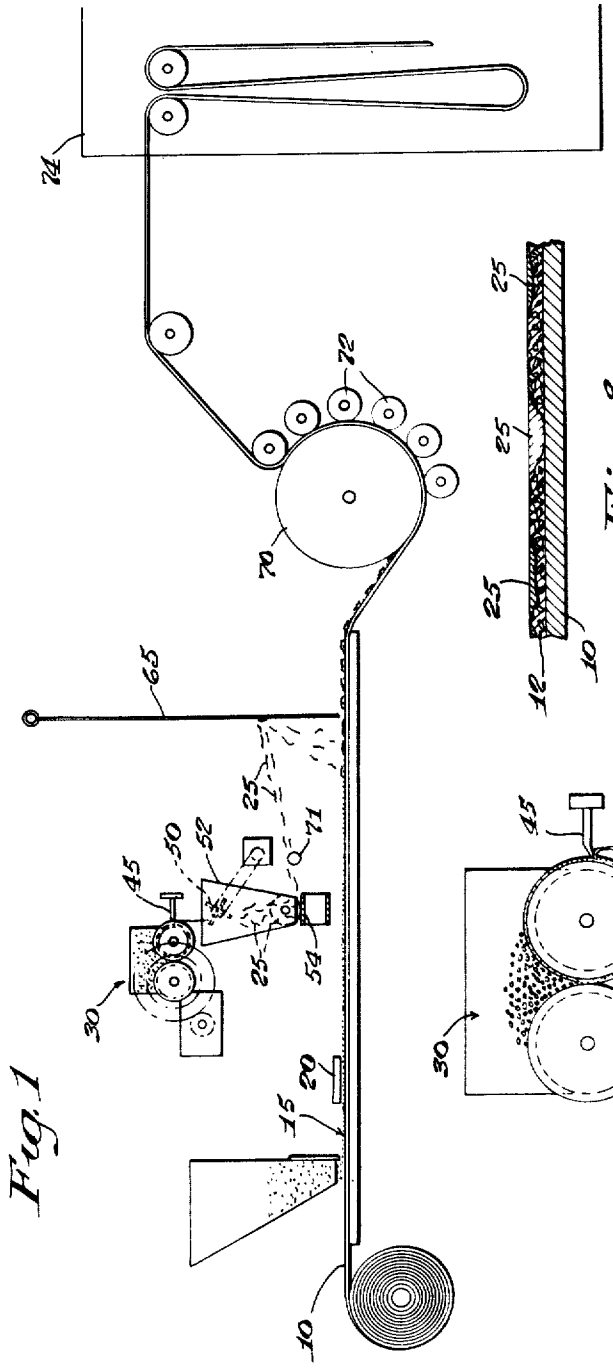


Fig. 1

Fig. 3

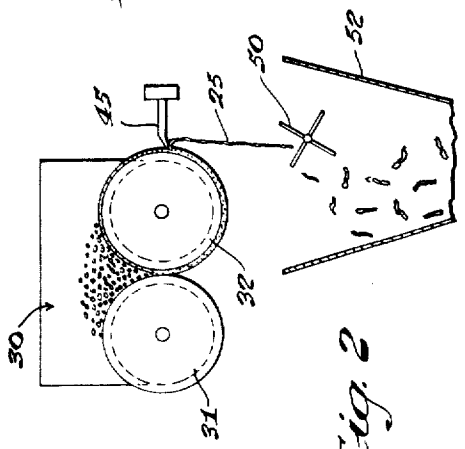


Fig. 2

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METHOD AND APPARATUS FOR PRODUCING A DECORATIVE SURFACE COVERING SHEET

Filed Feb. 19, 1954 4 Sheets-Sheet 2

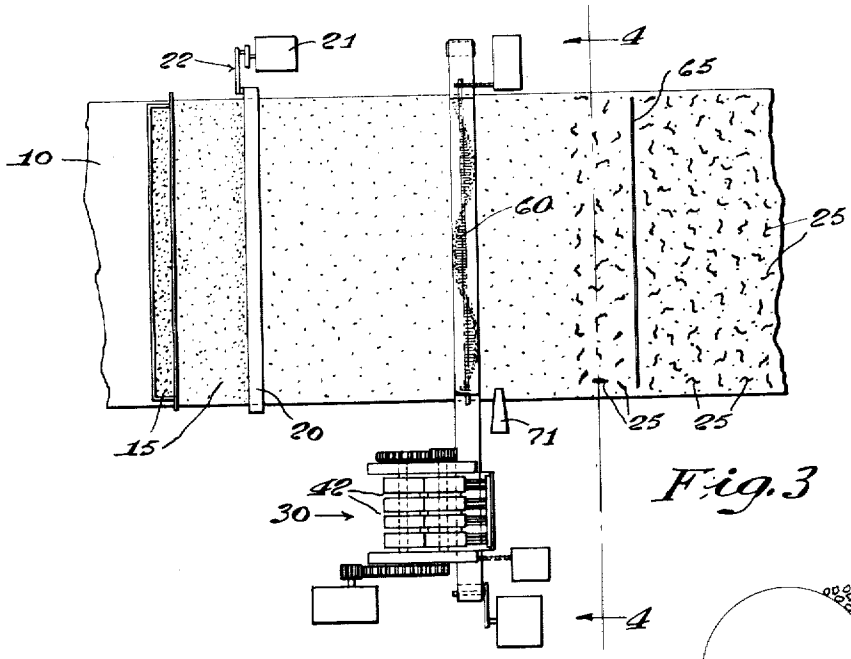


Fig. 3

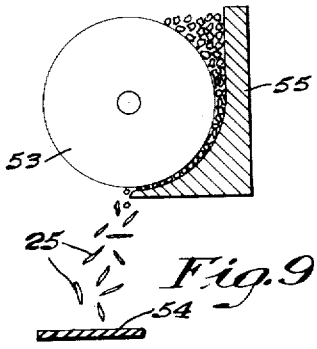
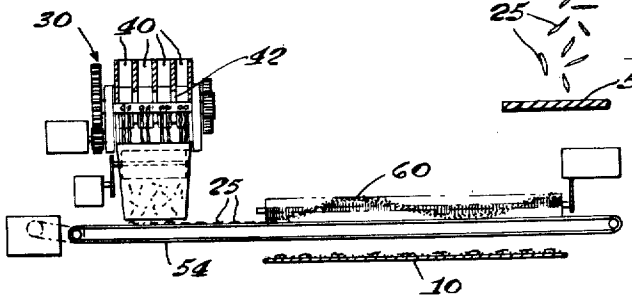


Fig. 9

Fig. 4



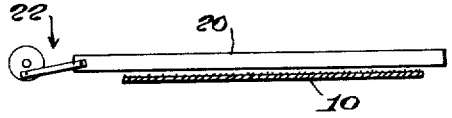


Fig. 5

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METHOD AND APPARATUS FOR PRODUCING A DECORATIVE SURFACE COVERING SHEET

Filed Feb. 19, 1954 4 Sheets-Sheet 3

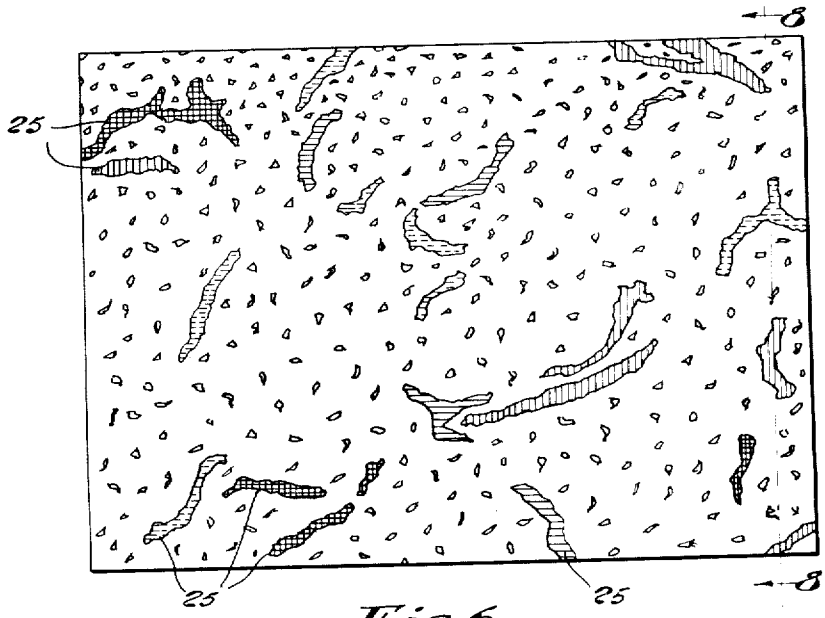


Fig. 6

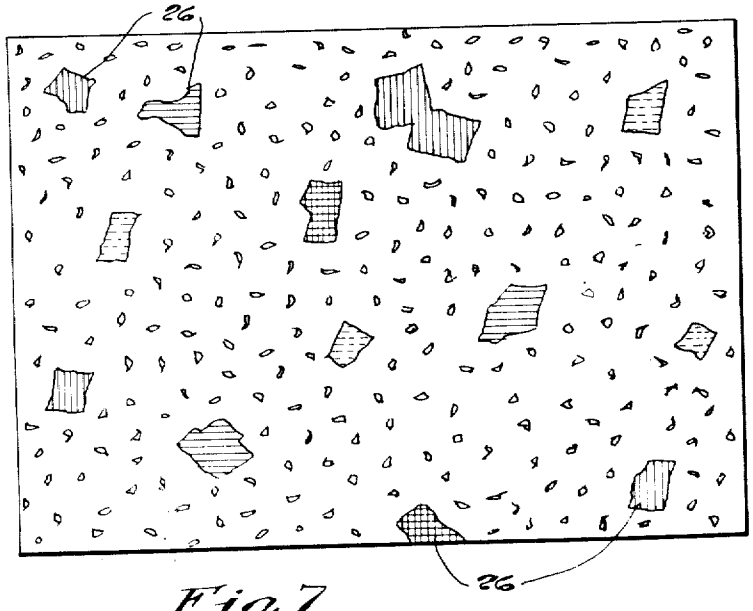


Fig. 7

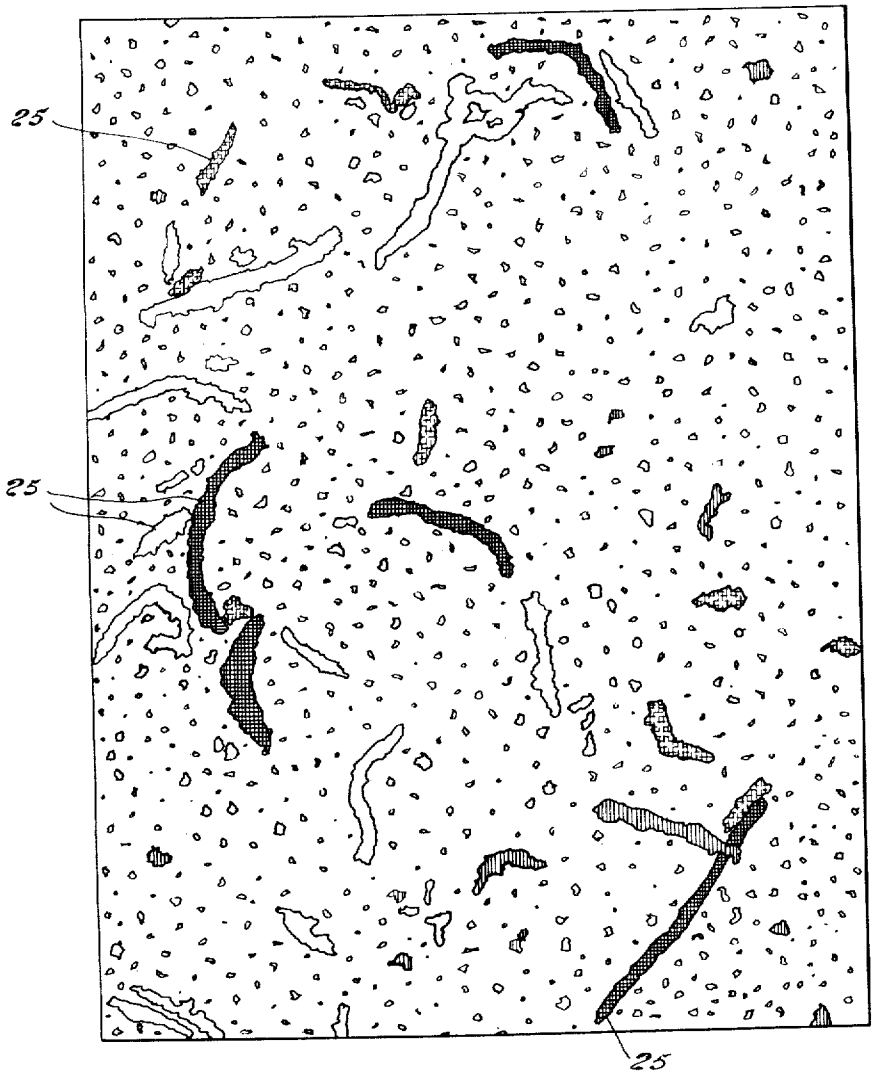
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METHOD AND APPARATUS FOR PRODUCING A DECORATIVE SURFACE COVERING SHEET

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Fig. 10



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United States Patent Office 2,775,994 Patented Jan. 1, 1957

2,775,994

METHOD AND APPARATUS FOR PRODUCING A DECORATIVE SURFACE COVERING SHEET

William Rowe, Lewiston, Maine, assignor to Bonafide Mills, Inc., Lisbon, Maine, a corporation of Maine

Application February 19, 1954, Serial No. 411,475

5 Claims. (Cl. 154—20)

This invention relates to a novel decorative sheet and particularly to a novel decorative surface covering sheet and to methods and apparatus for producing the same.

One object of the invention is to produce a novel decorative sheet embodying a foundation member and a surface covering layer bonded to the foundation member and constructed to provide a novel decorative pattern on the surface thereof.

A further object of the invention is to provide a novel decorative sheet which may be plain, jaspé, marbelized, or otherwise decorated with or without figures laid lengthwise and/or cross directional, which may be used as a floor or wall covering.

A still further object of the invention is to provide novel, highly efficient and practical methods by which the present decorative sheets may be made.

A still further object of the invention is to provide novel apparatus for the commercial and efficient manufacture of the present decorative sheets.

In the drawings illustrating more or less diagrammatically the preferred apparatus for producing the present sheet for practicing the present method:

Fig. 1 is a side elevation of the essential elements of the present apparatus;

Fig. 2 is an enlarged sectional detail of a portion of the apparatus shown in Fig. 1;

Fig. 3 is a plan view of a portion of the apparatus shown in Fig. 1;

Fig. 4 is a section on the line 4—4 of Fig. 3;

Fig. 5 is an end elevation of the strickler bar;

Fig. 6 is a plan showing the preferred form of the surface design of a surface covering sheet embodying the invention;

Fig. 7 is a similar view showing a modified form of a sheet embodying the invention;

Fig. 8 is a cross section of the line 8—8 of Fig. 6;

Fig. 9 is a side elevation of alternative mechanism which may be used to form the elongated flakes; and

Fig. 10 is a plan showing a different design of surface covering sheet embodying the invention.

In general in its broader aspects the invention contemplates a foundation layer of a thermoresponsive material to which flakes of a pigmented thermoresponsive material are applied in a random manner and bonded thereto, preferably by heat and pressure to impart a decorative appearance to the foundation layer and without repeats.

In its preferred form the invention contemplates a decorative sheet comprising a suitable backing sheet to which a wear-resisting layer is bonded and which covers the backing sheet. The wear-resisting layer preferably results from the application to the backing sheet of granules of a pigmented composition and preferably from the application of a mixture of a plurality of differently colored granules of pigmented compositions imparting a background color and preferably a colored and speckled appearance to the surface of the wear-resisting layer. The surface layer preferably has embedded therein and

bonded thereto a plurality of and relatively few differently and brightly colored flakes, and preferably a plurality of and relatively few differently and brightly colored elongated ribbon-like flakes, of a pigmented composition and whose length may vary from a fraction of to about one to several inches in length and extend in random directions and in random spaced relation, and may by proper color combinations stand out in strong contrast to the background imparting an unusual and highly attractive appearance to the sheet.

The invention in other aspects involves novel methods of producing the present decorative and surface covering sheets as well as novel and highly efficient apparatus for economically producing the same.

For purposes of illustration the invention will be described in connection with the production of a decorative surface covering sheet in the nature of linoleum and other flooring materials of the granulated type. The present sheet includes a base or backing member which may comprise paper, treated or untreated felt and textile fabrics, such as cotton or burlap, plastic, rubber or rubber-like sheet materials and any other suitable backing to which a wear-resisting composition may be bonded. The treated felt may be saturated with any one of a number of saturants including asphalts and natural or synthetic resin vehicles. If desired to improve the appearance, a smoothing coat consisting of an oleoresinous binder or synthetic resin combined with a latex, such as butadiene styrene copolymer and the like, with fillers may be applied over the saturated felt. This smoothing coat may be sensitive to heat and pressure to improve the bond of the composition to the saturated felt. A sticky coat without filler may also be applied as a face coat over a suitable backing to obtain better bond of the composition to the felt. A sticky coat which is unaffected at room temperature but sensitive to heat and pressure may be used. Acrylonitrile butadiene copolymers or coumarone indene resins or a combination of both and the like may be used. Such a backing layer is provided with a surface covering layer, preferably of the granulated type, such as is now commonly used in the production of linoleum or in the production of any of the other granulated types of floor and surface coverings now on the market. Preferably, the wear-resisting layer may be produced by the application to the surface of the backing sheet of a layer of granules each consisting of a pigmented thermoresponsive composition comprising a binder, pigment and filler. The granules may be of one color or a mixture of colors so that when applied to the sheet and subsequently calendered or pressed under heat and pressure or otherwise formed into a smooth wear-resisting layer of one or more colors or of speckled appearance of one or many colors is produced.

In accordance with the present invention provision is made for greatly enhancing the decorative appearance of the covering sheet thus far described by embedding in and bonding to the same in a scattered pattern and in random spaced relation a series of brightly colored flakes and preferably a series of flakes in brightly colored elongated narrow ribbon-like form. These may be of varying lengths producing a scatter pattern, such as is illustrated in Figs. 6 and 10. These narrow elongated ribbon-like flakes may be produced and applied to the aforesaid surface covering layer in a novel manner in accordance with the present invention and prior to the calendering or pressing thereof so that when the sheet is calendered or subjected to the pressing operation such flakes are embedded in and bonded thereto and form an integral part of the final product, imparting thereto a novel and highly decorative appearance. Provision is also made in accordance with the present invention for controlling the production and application of the ribbon-like flakes in such a manner

that flakes of different size and in different patterns may be applied to the sheet, as will be described.

Referring now to the drawings, **10** represents the base or foundation sheet upon which the granulated thermoresponsive layer **12**, which will be hereinafter referred to as the background layer, may be produced as will be described. In producing the individual granules a plastic binder is combined with the required color pigments, preferably together with fillers, such as wood flour and whiting, and a typical formula for producing the granulated plastic composition is as follows:

	Pounds
Binder	200–400
Wood flour	200–500
Whiting	300–0
Pigments (white and colored pigments)	20–100

A preferred formula is as follows:

	Pounds
Binder	335
Wood Flour	400
Whiting	100
Pigment	40

The binder, which as will be hereinafter pointed out, may be of any usual or preferred composition, such as an oleroesinous binder or a gelled linseed oil or other siccative oil gels produced by oxidizing the siccative oil to a gel in any usual or preferred form of kettle, such as in a modified Bedford kettle, and after the binder has been produced it is preferably placed in a mixing apparatus of any usual or preferred form, such as in a Banbury mixer, where it is combined with the fillers and pigments and worked into a uniform mass by the operation of the mixers. After having been formed, the binder composition is then preferably fed into a disintegrator (not shown) of any usual or preferred form, and in practice one form of suitable disintegrator may consist of two cages, one driven inside the other, and which are rotated in opposite directions at a high rate of speed. The pigmented binder composition is fed into the inner cage, and the high speed shatters the composition into very small granules.

In practice it is preferred to produce the different colored granules separately and to subsequently blend them if desired to produce the desired color blend so that the background layer, indicated at **12**, of the surface covering sheet may have a predetermined color and appearance. This background layer may be of one color or may be of a blend of a series of different colored individual granules, imparting to the background a speckled appearance similar in some degree to the apperance which might be produced by the application of fine different colored confetti. The effect produced by the use of a plurality of colored particles in producing the background surface may be a foundation color, such for example as red, green, yellow or blue, and also may be black or white, over which extremely small particles **15** of one or more colors are distributed in a more or less uniform manner over the surface of the sheet.

In producing the foundation layer instead of using the conventional stencilling equipment or stencil openings or screens used in conventional machines for producing inlaid linoleum to apply the plurality of colors on the sheet, in accordance with the present invention the particles are fed behind one or more oscillating bars **20** which will be hereinafter referred to as stricklers. The strickler bars **20** may be driven from a motor **21** through an eccentric connection **22**. The oscillating strickler bars may and preferably will be provided with micrometer adjustments (not shown) at each side of the sheet to enable accurate adjustment of the height of the undersurface of the bar from the sheet so that the desired thickness of granular layer may be produced over the surface of the sheet as the sheet travels under the bar and the bar is reciprocated.

In order to prevent the colored particles from sticking

together and permit free flow (similar to dry sand) a small percentage of talc or similar material is added to the blended colored granules. It has been found that approximately 1 to 5% talc based on the compound is desirable. It is also desirable to add the talc to the blended color granules as shortly before they are applied to the base sheet as practical.

After the sheet with the granulated surface constituting the foundation or background layer has been applied, the base sheet now moves forward toward the press, and the next step in the operation involves the production of and the application of the flakes **25**, preferably of form indicated in Fig. 6, but which for some purposes may take the form indicated at **26** in Fig. 7.

As the base sheet containing the loose fluffy particles from which the background layer is produced moves forward toward the press the flakes **25** are applied to the surface. This is accomplished by feeding the disintegrated pigmented composition or if desired a scratch pigmented composition without disintegration into a two-roll mill **30**. The rolls **31**, **32** of the mill operate at differential speeds, and it is preferred to use different temperatures on these rolls **31**, **32** in order to have the composition stick to the colder roll **32**. Even speed rolls may be used and the difference in temperature alone utilized to cause the composition to stick to the colder roll. Preferably, the rolls **31**, **32** are divided into a plurality of sections **40** by grooves **42**, and granular compositions of different colors are preferably fed into these sections utilizing a divided hopper and cheek plates (not shown) to obtain the different and preferably desired colored compositions on each section **40** of the roll **32**. The cheek plates fit into the depressions in the rolls to avoid overlapping of colors and blending of the colors and the production of half-tones. The application of pressure between the rolls causes the composition to form as a uniform layer on the roll **32** as described, and provision is then made for shaving off the composition at each section of the roll by a series of small cutters **45**. These cutters **45** may take various forms, and in effect operate to shave off a predetermined thickness of material from each section of the roll **32** in the form of an elongated ribbon-like flake or strip. This shaving operation imparts irregular conformation to the ribbon-like flakes giving the appearance of a worm. As these elongated strips or flakes **25** descend they are subjected to the action of a rapidly moving revolving cutter member **50** which severs the strips to the desired length. These worm-like flakes **25** may be varied in width, thickness and length according to the decoration or design which it is ultimately desired to produce on the surface of the sheet. After the short flakes or strips **25** have been produced they are permitted to fall through a hopper **52** onto a transversely travelling belt **54** by which they are moved across and above the surface of the base sheet **10** which is advancing thereunder.

Alternate apparatus is illustrated in Fig. 9 which may be used in producing suitable elongated ribbon-like flakes and essentially, such apparatus may comprise a rotated roll **53** having a fixed shoe **55** extended around a portion of the same. The face of the shoe gradually tapers downwardly so that when granules of the pigmented composition are fed as illustrated between the shoe and the roll, the granules are rolled out into elongated pencil-like elements which preferably drop on the transverse conveyer or belt **54** to be moved across and above the base sheet **10** in a manner similar to that illustrated in Fig. 4. The size of the granules fed into the apparatus may be used to control the length and thickness of the pencil-like flakes.

Provision is preferably made for projecting the ribbon-like flakes **25** from the surface of the belt and moving them in the direction of the advance of the base sheet **10**, and as herein shown, a helical or sinuous form of brush **60** is utilized to brush off these shot ribbon-like flakes **25** at a rapid rate and to project them through the

air forwardly, preferably against a curtain or stop member 65 by which the forward movement of the flakes 25 is ended, and the flakes are permitted to fall by gravity onto the surface of the granulated layer of the base sheet 10. Other methods may be used if found desirable in controlling the application of the flakes to the surface of the base sheet. The effect of the brush is to throw the flakes forward, and control of the uniformity of the pattern of the flakes on the sheet may be obtained by using compressed air which is applied from one or more nozzles 71 in the same general direction as the conveyer belt moves. The curtain 65 is placed several feet in front of the sine curve brush and operates to stop the flakes as they fly through the air. The flakes hit the sheet and drop to the surface of the moving base sheet 10.

After the flakes 25 have been applied to the granular layer upon the base sheet as above described, the composite sheet in this condition is conducted around a heated press or calender roll 70, heated to a degree sufficient to amalgamate the granules to one another, with the simultaneous application of pressure by the presser rolls 72. Any suitable form of pressing apparatus may be used, including for example, rotary presses, hydraulic presses and pressure calenders. The pressure serves to embed the flakes 25 into the granular layer, and the combined effect of heat and pressure bonds the granules to one another and to the backing sheet and bonds the flakes to the granular layer so that a satisfactory unitary wear-resisting decorative layer is produced on the backing sheet. Thereafter, depending on the character of the composition used in the production of the granules and flakes, the composite sheet may be led from the press or calender to a curing or drying oven 74 following the usual practice employed in the floor covering art.

Instead of the flat thin ribbon-like elongated flakes, flat particles or irregular shapes which are normally larger than the disintegrated fluffy particles used for the base are produced by permitting the two rolls on the roll mill to come to a closer clearance. The shavers and rapidly revolving cutters are removed. As the thin sheets of different colors leave the rolls, they may be fed into a breaker and screen (not shown) to form flat irregular shaped particles or flakes 26 and fed to the belt conveyer and brushed off by the sine curve brush as described above.

An alternative method for producing the flakes 25 may be two belts travelling in the same direction with a differential speed; in other words, one belt is travelling faster than the other. The granulated composition is fed in between the belts to form the elongated ribbon-like flakes 25 which are dropped through a funnel on top of the conveyer belt and applied on the granulated base sheet by means of a sine curve brush, as above.

As above described, the composition and a granulated surface are finally pressed and hung into festoons in a stove and cured (except vinyl and rubber compositions) after which the material may be coated with lacquer or an equivalent clear coat applied in any known or preferred manner, waxed if desired, and trimmed to the desired width and rolled for shipment and use. The finished goods may also be cut into tile of various sizes. It may be desirous in some cases, such as vinyl flooring or rubber flooring, to eliminate the use of lacquer or equivalent clear coat or wax.

If desired the foundation layer may be produced as one operation and the flakes produced and applied as a separate operation. A pressing operation may be utilized in the production of the foundation layer and/or in the application of the flakes. Thereafter the product is led to the drying oven and cured.

In producing a binder suitable for the production of the individual granules of which the background surface of the present decorative sheet may be produced as above described, I may utilize a linoleum cement having as its base an oxidized linseed oil processed in accordance with the methods well known in the art in the production of linoleum, and in addition fossil or other resins or rosin or an equivalent oxidized oleoresinous binder may be used. A binder which may be used and which is more resistant to acids, alkalies, soaps, household greases, and oils is that described in United States Patent No. 2,630,319.

The binder may also contain a gelled linseed oil, other siccative gelled oils, such as safflower, soya, hempseed, perilla, cottonseed pitch, stearine pitch, Tall pitch, and the like, produced by oxidizing the siccative oil to a gel in a modified Bedford kettle.

The binder may also contain a plasticized vinyl resin. For example, binders which are of the preferred type consisting of gelled linseed oil, plasticized vinyl resin and a binder as shown in United States Patent No. 2,630,319 are as follows:

	Pounds
Siccative oil gel	0 to 100
Plasticized vinyl resin	0 to 150
Binder U. S. Patent No. 2,630,319	350 to 150

Other binders may include the following:

I

	Pounds
Siccative oil	80
Plasticized vinyl resin	55
Binder	200

II

	Pounds
Vinyl resin	55
Binder	280

III

	Pounds
Siccative oil gel	80
Plasticized vinyl resin	90
Binder	165

IV

	Pounds
Paracoumarone indene resin	21
Cottonseed pitch	14
Asbestos medium fiber	45
Asbestine	10
Floated silica	5
Color pigment	5

V

Tile formula

18 lbs. paracoumarone indene—light grade
15 lbs. stearine pitch M. P. approximately 100–140° F.
4 lbs. blown castor oil
30 lbs. limestone
66 lbs. short asbestos fibers
Pigment as required.

The foregoing are representative formulas for asphalt tile. The formulas shown above are examples only and can be varied in composition. Stearine pitch may be replaced partially or entirely with cottonseed pitch, soya bean pitch, linseed pitch and the like. For darker colors gilsonite synthetic or natural may be used, or asphalt processed by oxidation or steam refining. Blown castor oil may be replaced with other blown oils, such as blown linseed, blown soya, softer pitches, high molecular weight polymers produced from hydrocarbons of predominately aromatic structure, or various chemical plasticizers, such as dioctyl phthalate, tricresyl phosphate and the like.

These compositions are thermoplastic in nature and

are non-oxidizing and do not require curing. After the material is pressed it is ready for the market.

The fillers instead of being limestone, may be replaced with silica, barytes, blanc fixe, magnesium silicate, aluminum silicate, asbestine and the like.

If grease resistant tile is desired the paracoumarone indene resin may be replaced with thermoplastic hydrocarbon resins produced from styrene type materials which also contain homologues of styrene and substituted styrene. Piccolastic resins produced by Pennsylvania Industrial Chemical Corporation with a melting point of approximately 125° F. are most desirable. A low molecular weight polystyrene may be added with the paracoumarone indene resin if desired to obtain grease resistance.

A good example of the polystyrene that can be used is produced by Koppers Company, Inc. with the following properties:

Ball and ring softening point	144–148° C.
Viscosity 30% solution in toluene (Brookfield viscometer)	69–69 cps.
Volatile matter (110° C. for 3 hrs.)	Less than 2%
Monomer content	Less than 1%

The plasticized vinyl resin may be prepared as follows:

I

	Pounds
Vinyl chloride vinylidene copolymer	100–200
Dioctyl phthalate	50– 25
Dibasic lead phosphite	8– 4
Dibasic lead stearate	2– 1

II

	Pounds
Polyvinyl chloride	100–200
Dioctyl phthalate	50– 25
Dibasic lead phosphite	8– 4
Dibasic lead stearate	2– 1

III

	Pounds
Vinyl chloride-vinyl acetate copolymer	100–200
Dioctyl phthalate	50– 25
Dibasic lead phosphite	8– 4
Dibasic lead stearate	2– 1

Other vinyl resins may be used, such as polyvinyl acetate, polyvinyl butyral, blends of vinyl chloride and butadiene acrylonitrile. Various polystyrene resins including resins produced from styrene type materials containing homologues of styrene and substituted styrene may be used as a partial replacement of the vinyl resins.

Plasticizers other than dioctyl phthalate may be used, such as dibutyl phthalate, butyl benzyl phthalate, tricresyl phosphate, triphenyl phosphate, alkyd aryl phosphate, di-iso-octyl phthalate, dibutoxyethyl phthalate, polyester plasticizers of the oil modified alkyd type and resin types based on sebacic acid and related materials and the like may be used.

Other stabilizers for both heat and light may be used, such as barium cadmium laurate, barium cadmium ricinoleate, cadmium 2 hexyl hexoate or other lead compounds may be used. Organic tin compounds or stabilizers with epoxide type resins may be used.

The amount of plasticizer used may be varied as shown above as well as the amount of stabilizer used.

The fillers may also be varied. Instead of calcium carbonate, calcium sulphate, barytes, blanc fixe, magnesium silicate, mica, clay and asbestine may be used.

The wood flour used may be either soft wood or hard wood. A fibrous chemically purified wood cellulose with a high alpha cellulose content may be used. Some semi-chemically purified wood fiber, such as the type produced in an Asplund defibrator, may be used. Other sources of organic fibers include cork, ground walnut shells, ground almond shells, and others.

Inorganic fibers, such as asbestos, glass fiber or glass

wool, may be used as a partial or complete replacement of the organic filler.

Although I show a preferred granulated composition for the base or the flakes, other formulas may be used, such as vinyl asbestos compositions. Typical formulas which may be used are as follows:

I

	Pounds
Vinyl chloride-vinyl acetate copolymer	84
Dioctyl phthalate	40
Calcium carbonate	100
Asbestos	147
TiO_2	20
Stabilizer	8
Stearic Acid	1

II

	Pounds
Vinyl chloride vinyl vinylidene copolymer	100
Asbestos	125
Calcium carbonate	120
TiO_2	10
Dibutyl phthalate	10
Butylbenzyl phthalate	15
Stabilizer	10
Stearic acid	1

III

	Pounds
Polyvinyl chloride	100
Tricresyl phosphate	25
Butylbenzyl phthalate	23
Asbestos	100
Calcium carbonate	250
TiO_2	20
Stabilizer	5
Stearic acid	.5

IV

	Pounds
Neolyn resin (a rosin derived alkyd material)	15
Polyvinyl chloride	60
Tricresyl phosphate	25
Stabilizer	5
Calcium carbonate	80
Asbestos	10
TiO_2	10

V

	Pounds
Neolyn (a rosin derived alkyd material)	30
Vinyl chloride vinyl vinylidene copolymer	60
Tricresyl phosphate	10
Stabilizer	5
Calcium carbonate	80
Asbestos	10
TiO_2	10

VI

	Pounds
Neolyn resin	43
Vinyl chloride vinyl acetate copolymer	43
Di-iso-octyl phthalate	14
Stabilizer	4
Calcium carbonate	80
Asbestos	10
TiO_2	10

Although Neolyn resin is shown in Formulas IV, V, and VI, other resins may be used, such as paracoumarone indene resins, polystyrene, thermosplastic hydrocarbon resins produced from styrene type materials which also contain homologues of styrene and substituted styrene, styrene butadiene copolymers, butadiene acrylonitrile copolymers and the like.

No curing in the stove is required for the vinyl compositions. The formulas may be modified especially in the amount of plasticizer or the type of plasticizer used to obtain the quality desired.

Rubber compounds such as have been used for floor-

ing or paneling or wall covering sheet may be used of which the following are illustrative formulas:

	I Pounds	II Pounds	III Pounds
Rubber (synthetic or natural)	100	100	80
Reclaimed			40
Reogen (oil soluble sulfonic acid of high molecular weight with parafine oil)	2	2	2
Stearic Acid	.5	.5	.5
Coumarone Indene Resin	2	2	2
Agerite White (anti-oxidant)	.5	.5	.5
Zinc Oxide	3	3	3
Filler and Pigments	30	100	75
Sulphur	2.5	2.5	2.5
Altax (benzothiazyl disulfide)	.6	.6	.6
Captax (mercaptobenzothiazole)	.6	.6	.6
Methyl Zimate	0.12	0.12	0.12

Material is compounded, scratched and processed, as indicated in the above write-up. However, the final sheet after the application of the decorative flakes is normally vulcanized for cure.

For some purposes I may prefer to produce the granulated composition for the production of the base or foundation sheet or for the production of the flakes which are applied thereto, in accordance with the present invention, of a binder of a fire-resistant nature. Accordingly, any known or preferred fire-retardant thermoresponsive compositions which possess suitable characteristics may be used for this purpose.

I

	Pounds
Gelled linseed oil	66.0
70% chlorinated paraffin	46.4
42% chlorinated paraffin	19.7
Antimony trioxide	104.0
Asbestos	116.0
Magnesium silicate	122.5
Coloring matter	45.0
Dibasic lead phosphite	3.3
Zinc oxide	0.5
Manganese resinate (6% min.)	0.04

II

	Pounds
Gelled linseed oil	66.0
70% chlorinated paraffin	46.4
42% chlorinated paraffin	19.7
Antimony trioxide	130.0
Asbestos	116.0
Magnesium silicate	96.5
Coloring matter	45.0
Dibasic lead phosphite	3.3
Zinc oxide	0.5
Manganese resinate (6% min.)	0.04

III

	Pounds
Gelled linseed oil	66.4
70% chlorinated paraffin	46.4
42% chlorinated paraffin	19.7
Antimony trioxide	104.0
Asbestos	116.0
Aluminum silicate	122.5
Coloring matter	45.0
Dibasic lead phosphite	3.3
Zinc oxide	0.5
Manganese resinate (6% min.)	0.04

IV

	Pounds
Gelled linseed oil	66.4
70% chlorinated paraffin	46.4
42% chlorinated paraffin	19.7
Antimony trioxide	130.0
Asbestos	116.0
Aluminum silicate	96.5
Coloring matter	45.0
Dibasic lead phosphite	3.3
Zinc oxide	0.5
Manganese resinate (6% min.)	0.04

V

	Pounds
Vinyl resin-siccative oil gel (1 to 1)	114.5
Antimony oxide	52–156
Asbestos	55
Aluminum silicate	268.5–164.5
Coloring pigment	30.0
Zinc oxide	0.4
Manganese resinate	0.03
Lead phosphite	3.0

VI

	Pounds
Vinyl resin-siccative oil gel (1 to 1)	131.3
Aroclor 1262 (Chlorinated biphenyl)	18.7
Asbestos	117.5
Magnesium silicate	250.0
TiO_2 (titanium dioxide)	29.0
Lead phosphite	4.0

VII

	Pounds
Linseed gel	45.0
70% chlorinated paraffin	48.0
Vinyl chloride-vinyl acetate copolymer	40.0
Tricresyl phosphate	40.0
Lead phosphite	5.0
Antimony oxide	54.0
Magnesium silicate	214.0
Coloring matter	27.0
Zinc oxide	1.35
Manganese resinate	0.03

VIII

	Pounds
Linseed gel	37.0
70% chlorinated paraffin	48.0
Antimony oxide	54.0
Magnesium silicate	150.0
Barium sulphate	54.0
Vinyl chloride-vinyl acetate copolymer	40
Di-octyl phthalate	60
Coloring matter	27
Lead phosphite	4.5
Zinc oxide	1.12
Manganese resinate	0.03

IX

	Pounds
Linseed gel	66.0
70% chlorinated paraffin	46.4
42% chlorinated paraffin	19.7
Antimony oxide	157.0– 52.2
Asbestos	116
Magnesium silicate	69.5–174.3
Color pigment	45.0
Lead phosphite	3.5
Manganese resinate	0.04
Zinc oxide	0.5

Various modifications of the illustrated apparatus may in practice be utilized in producing the present products.

Thus, if desired any of the known or preferred designs may be produced on the foundation layer prior to the application of the flakes in accordance with the present invention, as by the use of stencils or screens following prior art method. Thereafter the flakes may be applied and bonded to the foundation layer as above described. The stencils may embody divided sections to permit the application of plain or different colored granules, or granules of a plurality of colors, in the different sections according to the background effect that it may be desired to produce on the foundation layer, and thereafter the flakes may be applied as above described.

Instead of the strickler unit shown a divided strickler unit may be used wherein provision is made for applying one or more bands, either plain or colored, and of any desired width, and thereafter the flakes may be applied as above described.

In order to form flakes of varying colors a plurality of

sets of rolls 30 without subdivisions may be used in tandem with each roll supplied with its own colored material.

An alternative method which may be used in the production of the flakes and particularly the elongated ribbon-like flakes may include the use of any known or preferred form of extrusion apparatus similar to that extensively used in producing flat and round plastic shapes, and a breaker mechanism for reducing the extruded shapes to smaller flakes.

Also, instead of the sine curve brush which is in the illustrated apparatus, other means may be employed for projecting the flakes onto the foundation or base sheet, as for example the flakes may be blown or caused to drop onto an oscillating or vibrating screen and to then fall at random onto the base sheet.

In some instances I may prefer to utilize a thermoresponsive carrier sheet or web without any backing, such as a web or sheet of the composition used in the production of the various tiles, such as asphalt and vinyl tiles, and the flakes may be applied directly thereto or to a layer of thermoresponsive granules applied to the carrier sheet. Following application of the flakes, the composite sheet may be subjected to a pressing operation, or if desired a series of sheeter rolls may be used to gradually decrease the thickness and embed the flakes, preferably utilizing heat to combine the components into a unitary product. When the flakes are applied to a thermoresponsive carrier sheet, such as the asphalt or vinyl tile sheet, the latter may have a plain or mottled surface, or bands simulating the appearance of hardwood floors, borders or any other desired designs may be provided on the base sheet, preferably followed by the application of the flakes in accordance with the procedures outlined above.

In some instances I may prefer to apply to a thermoresponsive carrier sheet, color in the form of pigmented granules of a thermoresponsive composition which is capable of bonding with the thermoresponsive carrier sheet, such as a sheet from which any of the commercial forms of asphalt or vinyl tiles are formed, and the colored granules may and preferably will be applied by either a sectional type of reciprocating strickler bar or by a series of individual smaller strickler bars disposed to apply the colored granules in the form of bands over the surface of the thermoresponsive carrier sheet, and in this manner effects, such as borders and appearances simulating hardwood floors, may be produced, and in addition, such banded products in the form of tiles may be laid to simulate parquet floors.

From the description thus far it will be observed that the pigmented composition, of which the wear-resisting surface layer and the flakes are made may be of any color and may be black or white. It will also be observed that the following types of compositions may be used for these purposes, namely, an oxidizable composition, such as a linoleum composition; a vulcanizable composition, such as a rubber or rubber-like composition; a thermoplastic composition of which the vinyl resins and asphalt tiles are typical; a two-stage thermosetting composition which is characterized by a softness when heated to moderate temperatures and which may be converted or set up into a hard mass when subjected to substantially higher temperatures. Typical of such materials are the two-stage Bakelite resins and Epon resins now on the market. In addition, combinations of oxidizable and thermosetting compositions may be used. It will also be observed by reference to Figs. 6 and 10 that the elongated ribbon-like flakes may be aptly described as "twigs" or "twig-like." It will also be observed that by reason of the random application of the flakes in accordance with the preferred and illustrated method, no repeats are produced in the decorative design produced by the flakes.

Having thus described the invention, what is claimed is:

1. In the method of producing a decorative sheet of the character described, which consists in feeding a plurality of different colored masses of the pigmented composition onto successive portions of a set of calender rolls whereby to produce on one of the rolls a plurality of different colored sheets of plastic composition disposed along the surface of the roll, and then holding a plurality of narrow cutters adjacent each of said portions of the roll and substantially in a horizontal plane passing through the axis of the roll whereby to shave from each a plurality of different colored elongated strips thus permitting said strips to fall by gravity out of contact with the roll and without coalescence with other strips, and during their descent subjecting the strips to a cutter to cut the strips into shorter ribbon-like flakes, collecting the descending flakes on the surface of a belt, advancing a foundation sheet having a granulated surface under said belt, then projecting said flakes from the surface of the belt through the air and onto the surface of the granulated sheet to produce a scattered pattern of different colored worm-like plastic strips on the surface thereof, and then subsequently subjecting the composite covered sheet to heat and pressure to embed the worm-like strips in the surface and to consolidate the whole into a unitary layer.

2. The method as defined in claim 1 wherein the flakes are projected longitudinally of the advancing sheet in the direction of travel thereof against a curtain, and then permitted to drop onto the surface of the granular layer to form a scattered pattern.

3. In the method of making a decorative sheet, the steps comprising advancing a backing sheet covered with a granular composition, feeding a plurality of different colored masses of pigmented composition onto successive portions of a rotating roll whereby to produce on the roll a plurality of different colored sheets of plastic composition spaced axially along said roll, then holding a plurality of narrow cutters adjacent each of said portions of the roll and substantially in a horizontal plane passing through the axis of the roll whereby to shave from each a plurality of different colored elongated strips thus permitting said strips to fall by gravity out of contact with the roll and without coalescence with other strips, and during their descent subjecting the strips to a cutter to cut the strips into shorter ribbon-like flakes, collecting the descending flakes on the surface of the belt, advancing a foundation sheet having a granular surface under said belt, and then projecting said flakes through the air onto the surface of the granular covered sheet to produce a scattered pattern, and then subsequently subjecting the composite sheet to pressure to embed the ribbon-like flakes into the surface and to consolidate the whole into a unitary sheet.

4. Apparatus for producing a decorative sheet of the character described, comprising means for supporting and continuously advancing a backing web, means for depositing a pigmented composition in granular form upon the backing web as it advances, a reciprocable strickler bar extending transversely of the backing sheet for operating on the granular mass to spread it to a uniform thickness evenly over the backing sheet, means for pressing the granulated surface into a unitary layer and for bonding it to the backing sheet, means for forming and applying flakes of pigmented composition in a scattered pattern over said granular layer prior to its passage to said pressing means, said flake forming means comprising a pair of cooperating rolls, means for feeding a plurality of different colored masses of a pigmented plastic composition between said rolls whereby to produce on one of the rolls a plurality of different colored sheets of plastic composition disposed along the surface of the roll, a plurality of narrow cutters, means for supporting the cutters whereby to dispose the same adjacent each of said colored sheets of plastic on the surface of the roll and with the cutters lying substantially in a horizontal plane passing through the axis of the roll whereby to enable a plurality of different colored elongated strips to be shaved from the roll and to be permitted

to fall freely without coalescence with other strips, a cutter below said narrow cutters and in the path of the descending plastic strips for cutting the strips into shorter ribbon-like flakes, a belt disposed below said cutters and in a position to collect the descending flakes on the surface of the belt, a brush for projecting said flakes on the surface of said belt through the air and onto the surface of the granulated sheet to produce a scattered pateern of different colored worm-like plastic strips on the surface thereof, and means for subsequently subjecting the composite sheet to heat and pressure to embed the worm-like strips in the surface and to consolidate the whole into a unitary layer.

5. Apparatus as defined in claim 4 wherein a curtain is disposed in the path of the flakes being projected through the air to be engaged by said flakes and permit the flakes to fall freely on the granular surface of the foundation sheet.

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