Aug. 14, 1962 H. D. STEWART ET AL 3,049,436

APPARATUS AND METHOD FOR APPLICATION OF PARTICULATE MATERIAL TO SHEET PRODUCTS

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FIG.1.

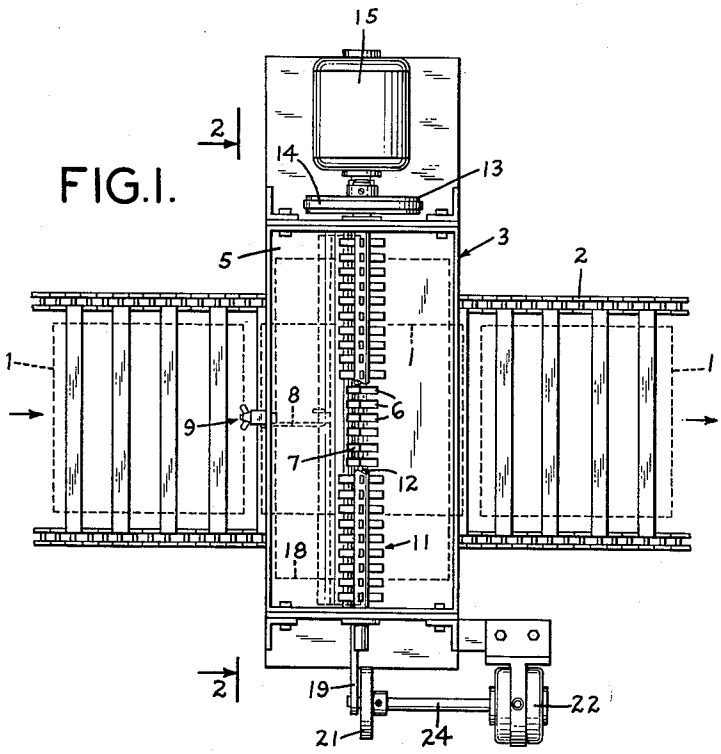

FIG.2.

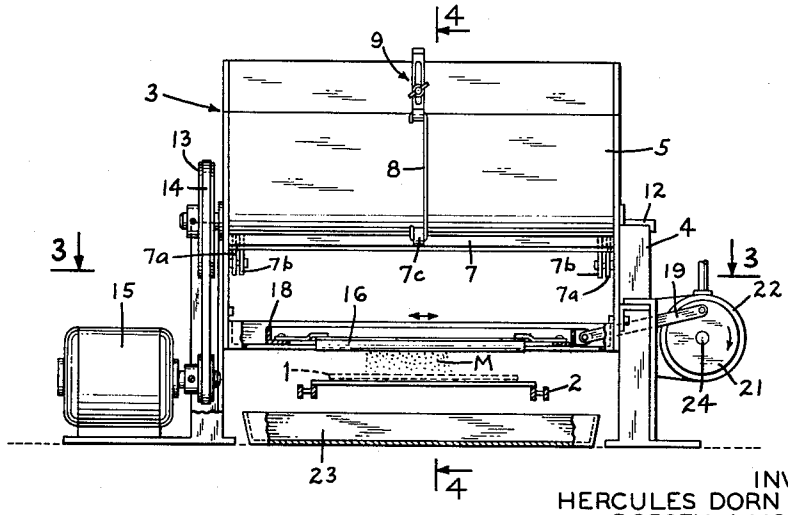

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FIG. 3.

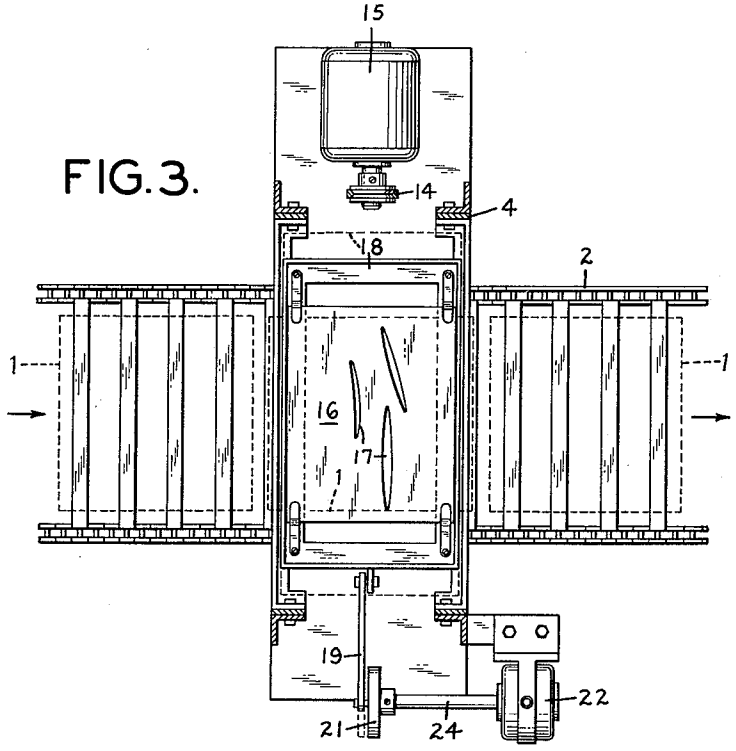
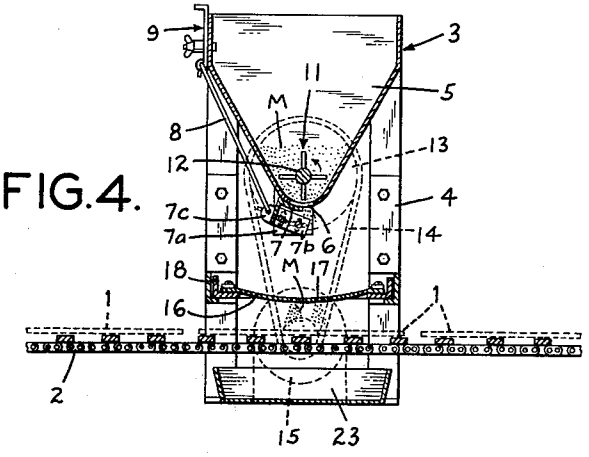


FIG. 4.



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APPARATUS AND METHOD FOR APPLICATION OF PARTICULATE MATERIAL TO SHEET PRODUCTS

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5 Claims. (Cl. 117—25)

This invention relates to apparatus and method for applying solid particulate material to sheet surfaces to be coated therewith. More particularly, the invention relates to apparatus and method which permit application of particulate material to said surfaces in random pattern distribution.

Many unsuccessful attempts have been made to obtain random pattern distribution of solid particulate material on sheet products such as ceiling tile and wallboard. For example, when a conventional air-controlled flocking gun was used in spraying particulate material through a slotted shield onto a sheet product, uniform distribution of the particulate material resulted. Using the flocking gun, particles were blown against a "bang-board" and the material was allowed to bounce back onto the product. Uniform distribution of the particulate material still resulted.

Accordingly,. it is the object of this invention to provide apparatus and method for applying solid particulate material to sheet surfaces to be coated therewith, whereby a random pattern distribution is obtained.

Other objects and advantages of the invention will appear hereinafter.

According to one aspect of the invention, a method of applying solid particulate material to a moving adhesive-coated sheet product in random pattern distribution includes the steps of moving the adhesive-coated sheet in a substantially horizontal plane, placing a shield above the moving sheet, said shield being provided with elongated slots and being sloped slightly from its ends which extend in the same general direction as the slots downwardly toward the middle of the shield, oscillating the shield in a substantially horizontal plane, and dropping the particulate material onto the oscillating shield, whereby the material is shaken through the slots in the shield onto the moving sheet product in random pattern distribution.

According to another aspect of the invention, random pattern distribution of solid particulate material onto a substantially horizontally moving adhesive-coated sheet product may be obtained by use of an apparatus comprising a hopper for discharge of the particulate material thereto, said hopper being provided with a bottom wall having discharge openings, means for keeping said openings from being plugged with particulate material, a shield below the openings, said shield being provided with elongated slots and being sloped slightly from its ends which extend in the same general direction as the slots downwardly toward the middle of the shield, and means for oscillating the shield in a substantially horizontal plane.

In operation, the sheet product to be coated with solid particulate material is given a precoat of wet adhesive such as paint and, while the adhesive is wet, particulate material is deposited thereon. The particulate material is first introduced into the hopper of the distributing apparatus and discharged through the openings in the bottom wall of the hopper. As the particulate material descends through the openings onto the slotted oscillating shield, material falls constantly through the slots onto the sheet product. Part of the material, however, collects on the solid section of the shield and is shaken through the slots. As a result, the sheet product contains a random pattern distribution of irregular heavy coated areas in contrast to areas lightly coated. The product is finally dried to set the adhesive retaining the particulate material.

The sheet products to be surfaced may be insulating articles such as ceiling tiles and wallboards composed of either cellulosic or mineral, e.g. gypsum or glass, material. Either perforate or imperforate products may be used. The precoat adhesive applied to the products may be paint. Other suitable adhesives include acrylic latices, styrene-butadiene latices, alkyd and hydrocarbon emulsions, polyvinyl chloride and polyvinyl acetate.

Solid particulate material which may be employed includes granules or aggregate of size in the range of about 1/64" to 1/8" in maximum dimension. The particles of the material are preferably made up of light-reflecting material such as metallic foil bits. The metallic foil bits may be composed of aluminum, gold, silver, copper or the like and, if desired, may be coated with plastic such as lacquers of nitrocellulose, ethyl cellulose or acetate butyrate types or vinyl plastisols. The metallic foil bits are preferably colored aluminum flakes, e.g. gold or silver colored aluminum flakes. Other particulate material comprising natural or synthetic beads, plastic foil, etc., may also be used.

The shield is preferably composed of a pliable material such as cardboard, asbestos, rubber, plastic material or the like. As indicated above, the shield contains elongated slots and is sloped slightly from its ends which extend in the same general direction as the slots downwardly toward the middle of the shield. Although not required, the shield may also be sloped slightly from its other two ends downwardly toward the middle thereof. Thus the shield may be formed into a shallow trough extending longitudinally of the slots or may be slightly dished. The configuration and distribution of the slots may be varied widely as long as particulate material passes through the slots at all times.

If desired, before or after drying the adhesive, the coated sheet may be treated with a suitable protective coating such as polyvinyl chloride, polystyrene, lacquers of nitrocellulose, ethyl cellulose or acetate butyrate types, alkyd or hydrocarbon resins, vinyl plastisols or organosols or the like dissolved in inert solvents such as hydrocarbons, esters and ketones. This coating may be applied by conventional roller, spray or air- or trailing-knife techniques.

The present invention is described in greater detail in the accompanying drawings in which:

FIGURE 1 is a plan view of the apparatus for applying solid particulate material to sheets, with part broken away to show the openings in the bottom wall of the hopper;

FIGURE 2 is a transverse elevational view taken gener-

ally along line 2, 2 of FIGURE 1, with part broken away to show details of internal structure of the apparatus;

FIGURE 3 is a plan view taken generally along line 3, 3 of FIGURE 2, and

FIGURE 4 is a vertical section taken generally along line 4, 4 of FIGURE 2.

Referring to the drawings, there is shown ceiling tiles 1 composed, for example, of cellulosic material which have been precoated with a suitable wet adhesive such as paint applying by spraying or by any other suitable means. The tiles are moved in a substantially horizontal plane by means of a conventional continuous conveyor 2. The precoated tiles pass via the conveyor beneath particle distributing apparatus 3.

Apparatus 3 is provided with a suitable framework 4 for support of the apparatus. At the top of the apparatus is a hopper 5 for discharge of the particulate material, e.g. metallic foil bits, thereto. Hopper 5 has a bottom wall with a series of adjustable discharge openings 6 extending across the width of the hopper. Adjustment of the size of the openings controls the feed rate of the particulate material. The size of the openings is adjusted by means of a slide plate 7 which swings arcuately in rotating action under the openings to various adjustments. The slide plate is pivotally mounted on hopper 5 by brackets 7*a* at each end of the plate. Each of the brackets is adjustably fastened by bolts to a flange 7*b* of the respective ends of the plate. The position of the slide plate is determined through a rod 8 attached to a flange 7*c* on the plate. The rod is controlled by an adjustable slide plate setting means 9 mounted on the hopper. A toothed rotor 11 adjacent the bottom wall of the hopper extends along discharge openings 6 and serves as an agitator and wiper to insure a steady, continuous flow of particulate matter through the openings. The rotor is positioned on a shaft 12 and is driven through a wheel 13 and belt 14 by a conventional motor 15. Beneath the bottom wall of hopper 5 is provided a shield 16 containing elongated slots 17 and being formed into a shallow trough extending longitudinally of the slots to provide for movement of the particles toward the middle of the shield and the slots. The shield is fastened to a frame 18. Frame 18 is connected by a link 19 to an eccentric cam 21 which is driven through a shaft 24 by a conventional variable speed motor 22. By operation of the cam, the shield is oscillated in a substantially horizontal plane generally in the direction of elongation of the slots and substantially perpendicular to the movement of the tiles.

The particulate material may be distributed by hand or any other suitable means across the length of the hopper. As indicated above, the rotor assures continuous flow of the material through the openings in the bottom wall of the hopper onto the oscillating shield. Particulate material falls constantly through the slots in the shield while some of it collects on the solid section of the shield and is thrown through the slots in the shield to give areas of heavy and light concentration of particulate material on the tiles passing beneath.

Particulate material not falling onto or retained by the tiles collects in an overflow pan 23 fitted to the framework of the conveyor, and may be simply scooped up and refed to the hopper. Alternatively, any suitable automatic system may be used for removing the excess particulate material and recycling it to the hopper.

The tiles having particulate material arranged on their faces in random pattern distribution pass through a conventional drying zone where the paint is dried and the particulate material is set into the dried paint, for example, through a zone provided with burners for heating the tiles and fans for keeping the hot air in circulation.

The nature of the random pattern is dependent upon many operating conditions, including (1) speed of the tile being treated, (2) feed rate of the particulate material, (3) size of openings for distribution of the particulate material, (4) oscillation and throw rates of the shield, and (5) configuration and distribution of the elongated slots in the shield. These conditions may be correlated by simple experimentation to obtain any desired random pattern.

The particulate material may be fed to the hopper at any desired rate consistent with the degree of coating desired. In typical operation, the feed rate varies from about 1 to 1½ pounds per 1000 pieces of 12" square tile. The speed of the tile on the conveyor usually ranges from about 50 to 300 pieces per minute. The holes of the spreader may be, for instance, about 1/32" to 1/8" wide and about 1/16" to 1/4" long. The slotted shield is generally oscillated at a speed of at least about 60 cycles per minute. The throw of the shield, determined by the configuration of the eccentric cam, usually varies from about 1/2" to 2".

In a specific example, pieces of 12" cellulosic ceiling tile, precoated with wet paint, are moved on conveyor 2 in a substantially horizontal plane. About 1.3 pounds of a mixture comprising acetate coated gold colored aluminum square flakes (1/64") and acetate coated gold colored aluminum hexagon flakes (1/16"), in the weight ratio of about 7:1, are distributed through hopper 5 and the discharge openings 6 in the bottom wall thereof onto oscillating shield 16. The speed of the tiles passing beneath the distributing apparatus is about 105 to 115 pieces per minute. The discharge openings in the bottom wall of the hopper are maintained about 1/16" wide and about 3/32" long. The shield is about 9¾" wide, 16" long and 1/32" thick. It is provided with elongated slots having the configuration and distribution shown in the drawings and is sloped slightly from its ends which extend in the same general direction as the slots downwardly toward the middle of the shield. The oscillating speed of the shield is about 120 to 150 cycles per minute, and its throw is about 2". The shield is oscillated in a substantially horizontal plane generally in the direction of elongation of the slots and substantially perpendicular to the movement of the tiles. Under these operating conditions, the aluminum flakes are applied in random pattern distribution to the tiles. Some areas of the tile are heavily coated while other areas are lightly coated with the flakes.

The apparatus of this invention may be readily incorporated in an existing commercial installation for continuous manufacture of sheet products, including tile and wallboard insulating products, and applied or not applied, as desired. Distribution of the particulate material may, therefore, be either continuous or intermittent. The random pattern distribution of particulate material on the resultant products has an extremely attractive appearance and provides the trade with new and decorative products which are in great demand by owners of homes and commercial establishments.

The invention as hereinabove set forth is embodied in particular form and manner but may be variously embodied within the scope of the appended claims.

We claim:

1. A method of applying solid particulate material onto a moving adhesive-coated sheet product in random pattern distribution which includes the steps of moving the adhesive-coated sheet in a substantially horizontal plane, placing a shield above the moving sheet, said shield being provided with elongated slots and being sloped slightly from its ends which extend in the same general direction as the slots downwardly toward the middle of the shield, oscillating the shield in a substantially horizontal plane, and dropping the particulate material onto the oscillating shield, whereby the material is shaken through the slots in the shield onto the moving sheet product in random pattern distribution.

2. The method of claim 1 wherein the shield is composed of a pliable material.

3. The method of claim 2 wherein the shield is oscillated generally in the direction of elongation of the

slots and substantially perpendicular to the movement of the sheet product.

4. Apparatus for applying solid particulate material to a substantially horizontally moving adhesive-coated sheet product in random pattern distribution comprising a hopper for discharge of the particulate material thereto, said hopper being provided with a bottom wall having discharge openings, means for keeping said openings from being plugged with particulate material, a shield below the openings, said shield being provided with elongated slots and being sloped slightly from its ends which extend

in the same general direction as the slots downwardly toward the middle of the shield, and means for oscillating the shield in a substantially horizontal plane.

5. The apparatus of claim 4 wherein the shield is composed of a pliable material.

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