United States Patent [19]

Thaning

[11] **3,761,190**

[45] **Sept. 25, 1973**

[54] **UNITARY PARTICULATE MATERIAL SURFACE STRUCTURE AND METHOD AND MATERIAL FOR PREPARING THE SAME**

[75] Inventor: **Alva G. Thaning,** Hemet, Calif.

[73] Assignee: **Sta-Rock, Inc.,** San Jacinto, Calif.

[22] Filed: **Oct. 8, 1969**

[21] Appl. No.: **864,714**

[52] **U.S. Cl.** **404/82**

[51] **Int. Cl.** **E01c 7/35**

[58] **Field of Search** 94/7, 4, 3, 22, 23; 404/82, 72

[56] **References Cited**

UNITED STATES PATENTS

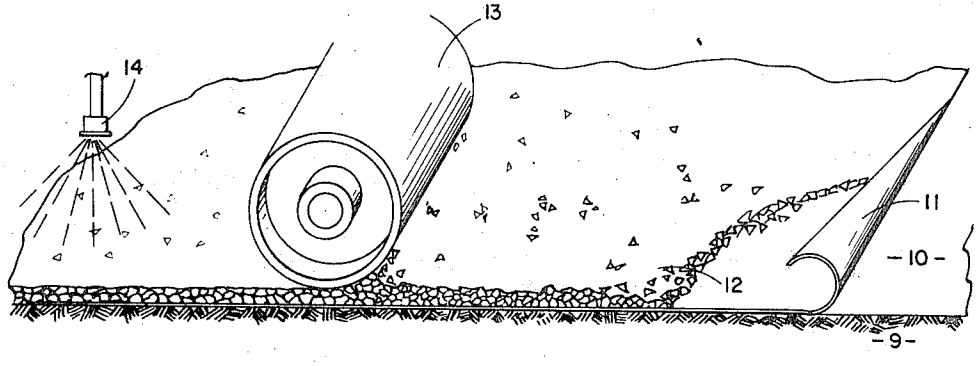
1,623,417	4/1927	Lanham	94/7 X
2,147,195	2/1939	Finley	94/23
2,187,877	1/1940	Ferris	260/85
2,752,275	6/1956	Raskin	154/45.9
3,000,276	9/1961	Foulger	94/22 X
3,103,860	9/1963	Piquette	94/23
3,112,681	12/1963	Gessler	94/3 X
3,171,335	3/1965	Pincon	94/23 X
3,346,219	10/1967	Salyer	94/22 X
3,400,644	9/1968	Baskin	94/7
3,459,108	8/1969	Patterson	94/22

Primary Examiner—Nile C. Byers, Jr.
Attorney—Gausewitz, Carr & Rothenberg

[57] **ABSTRACT**

A unitary particulate material strucure for use in yards around buildings or in roofing, for example, is produced by placing a flexible sheet, such as a polyvinyl plastic sheet, upon the ground or other support material or base. A thin layer of particulate material, such as gravel, crushed rock, stones, pebbles or the like, is placed over the exposed surface of the sheet and rolled level. The structure is completed by applying a binder to the layer of particulate material so that the binder penetrates the interstices of the particulate material. The binder is applied in a dispersion of plastic material, such as synthetic resins, and filler material, such as powdered silica, dispersed in an aqueous medium. Pigments, thickening and drying agents and the like may also be included in the binder dispersion for various applications of the unitary structure produced upon drying of the applied binder dispersion.

2 Claims, 4 Drawing Figures



PATENTED SEP 25 1973

3,761,190

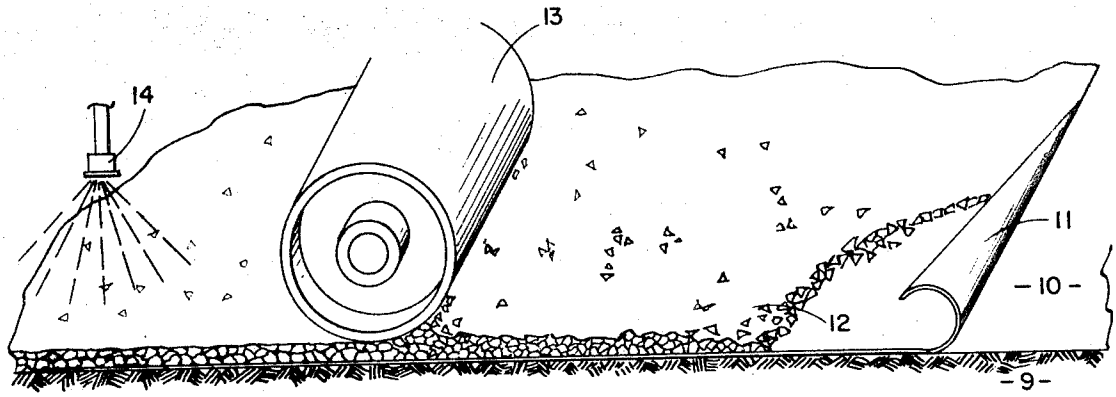


FIG. 1

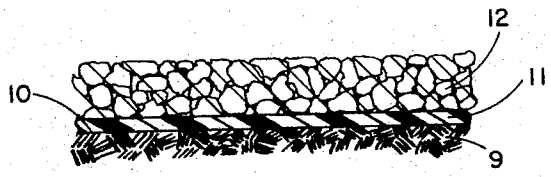


FIG. 2

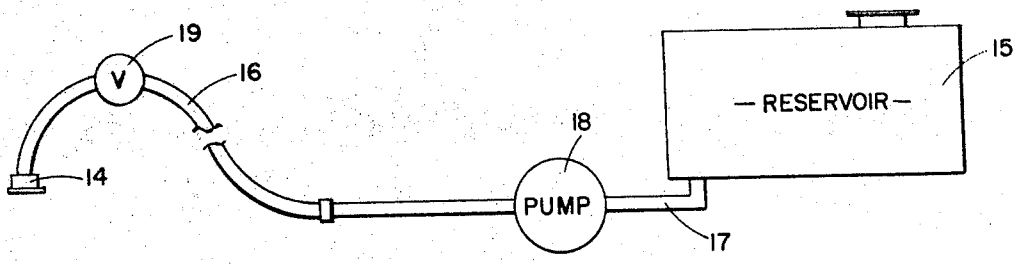


FIG. 3

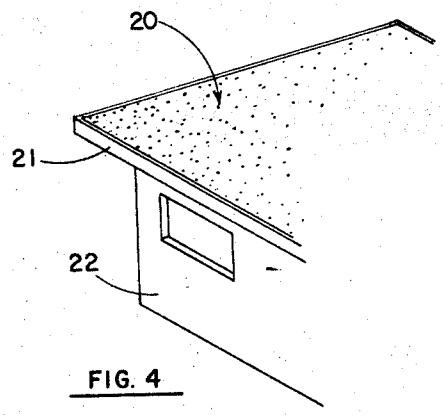


FIG. 4

INVENTOR.
ALVA G. THANING

BY

Jansenty & Carr

ATTORNEYS

UNITARY PARTICULATE MATERIAL SURFACE STRUCTURE AND METHOD AND MATERIAL FOR PREPARING THE SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention provides a unitary particulate material structure, method and means for securing gravel, crushed rock, pebbles, etc., in a cohesive mass for use in yards around buildings, roofing material and the like.

2. The Prior Art

To reduce the amount of gardening care and watering of lawns, yards and strips around houses and buildings and adjacent to curbs and walks, it has become the practice to apply a thick layer of crushed rock, gravel, pebbles, crushed bark, peat moss, etc., directly over the soil or over a plastic, paper or other type of sheet first placed over the soil of the area to be covered. The loose layer of particulate material thus placed is subject to being washed, kicked and otherwise dislodged and dispersed from its original placement. An untidy condition results which necessitates continual maintenance. If such conditions are not rectified, in time unsightly bare spots result. Weeds frequently grow within the particulate material so that the original aim of reducing the amount of gardening care is defeated.

Similarly, the gravel in a conventional gravel roof is blown and washed from the roofing paper so that in time more and more of the surface of the roofing paper becomes exposed directly to rays of the sun. The direct radiation of the sun and the increased temperatures during the daytime, plus the lower nighttime temperatures, result in more intense chemical and physical weathering of the roofing material and a shorter service life.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of this invention to provide a unitary particulate material structure for use in lawns, yards and strips around buildings and adjacent to curbs and walks which overcomes the disadvantages of prior-art practices.

Another object is the provision of a unitary particulate roofing structure which is more resistant to weathering than prior-art gravel roofing.

These and other objects of the invention are attained by providing a unitary particulate material structure comprising a flexible or impervious sheet placed upon the surface to be covered, a layer of particulate material covering the sheet and binding material in the interstices of the particulate material binding its particles together.

The particulate material structure of the invention is produced by first placing the sheet material upon soil, a roof or other area to be covered. A generally uniform, thin layer of particulate material then is spread over the exposed surface of the sheet material. The structure is completed by applying a dispersion of binding material to the layer of particulate material in a manner so that the dispersion penetrates the interstices of the particulate material sufficiently to bind the particles thereof to each other upon drying of the dispersion and setting of the binding material.

The binding material dispersion comprises primarily plastic material, such as synthetic resins, and filler material, such as finely divided silica, powdered silica or silica powder, dispersed in an aqueous medium. Secondary components of the dispersion include pigments, thickening agents, drying agents, and the like in addition to a dispersing agent.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a partial isometric view, partially in vertical section, showing the placement of sheet material upon a level area of soil, and indicating the rolling of a layer of particulate material to produce a level surface thereof and the spraying of binding material into the interstices of the leveled particulate material;

FIG. 2 is a partial enlarged vertical sectional view showing the unitary particulate material surface structure produced according to the showing of FIG. 1;

FIG. 3 is a schematic view showing an embodiment of spraying apparatus used to apply binding material to leveled particulate material according to FIG. 1; and

FIG. 4 is a partial isometric view showing the unitary particulate material surface structure of the invention applied to the roof of a building.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIG. 1, initially an area of soil or ground 9 is given a relatively smooth upper surface 10, and a suitable substance is applied to prevent plant growth. An approximately sized fluid-impervious sheet 11 then is placed over the surface 10. The sheet material 11 may be a flexible polyvinyl plastic having a thickness that depends upon the character of the surface 10 and the characteristics of the particulate material to be placed on the sheet 11. Thus, sharp stones in the surface 10 or sharp particles in the particulate material, or both conditions, call for a thicker sheet 11, whereas the relative absence of such characteristics permits the use of a thinner gage sheet 11.

Other lower cost synthetic resin or plastic sheet materials can be used, such as polyethylene plastic sheets for example. For some installations, impregnated paper, such as asphalt-impregnated paper, resin-impregnated paper and the like, can be used. The sheet material preferably should be waterproof to prevent softening of the soil or ground 9 forming the surface 10, and it should resist weather conditions, including chemical and physical action as well as bacterial action, termite action and rotting action.

The particulate material 12, such as gravel for example, is spread in a layer over the exposed surface of sheet material 11, as shown in FIG. 1. The layer of gravel 12 is raked to a generally uniform thickness and then gone over by a roller 13, as indicated in FIG. 1. The rolling assures that the gravel 12 is compacted and presents a relatively smooth upper surface. The layer of gravel 12 may be relatively thin, one to two inches being appropriate in most circumstances.

The binding material is applied to the layer of particulate material 12 in the form of a liquid, preferably a liquid dispersion of the binding material. The liquid binding material is conveniently applied to the gravel by being sprayed into the particles through a sprayer head 14, so that the liquid binding material penetrates into the interstices between the particles of particulate material. More than one spraying application usually is used to saturate the layer of particulate material 12 and thus bind all of the particles to each other upon drying and setting of the binding material, and to form a unitary particulate material structure of particles and

binding material as shown in FIG. 2. Usually, two applications suffice, filling all the open spaces in the layer of gravel 12. The fluid-impervious sheet 11 retains the liquid in the gravel layer so that it does not soak into the ground 9 beneath it.

As indicated in FIG. 3, the liquid binding material is conveniently applied to the layer of particulate material 12 through a sprayer head 14 connected to a reservoir or supply tank 15 by a hose section 16 connected to a conduit 17 which leads from the reservoir. An auger and stator type pump 18 forces the liquid through the conduit 17 and hose 16 so that a spraying pressure of about 70 pounds per square inch can be maintained while applying the binding material to the layer of gravel 12, as indicated in FIG. 1. A valve 19 controls the flow of the liquid to the sprayer head 14. No air is introduced into the liquid binding material and the apparatus does not unduly agitate the binding material and thus avoids mixing air with the liquid.

The liquid binding material preferably is a dispersion of plastic material, such as synthetic resins or polymers, and filler material dispersed in an aqueous medium. A dispersion of polyvinyl acetate homopolymer in water has been found to produce very satisfactory results in producing the unitary particulate material surface structure of this invention when applied to a thin layer of gravel supported on a sheet of polyvinyl plastic. In such an example, the binding material dispersion contained about 45% polyvinyl acetete homopolymer, 18% powdered silica filler (800 fine) and about 37% water (including a small amount of nonionic dispersing agent) by weight based upon the mixture.

Other low-cost natural resins, synthetic resins, polymers, plastics and elastomers can be used as the binding material. Examples of such binding materials are polyvinyl chloride polymers, acrylic ester polymers, polyurethane polymers and elastomers, phenolic resins, natural gums, natural and synthetic rubbers and the like.

Similarly, various filler materials can be used, such as organic fillers, inorganic fillers, amorphous silica, powdered silica or silica powder, powdered sea sand, powdered pumice, powdered mica, powdered gypsum, powdered iron oxide, powdered titanium oxide and the like. Colored fillers can be used to produce a variety of colors in the final unitary particulate material surface structure of the invention. The amount of filler used can range from about 2 percent, or less, to about 25 percent, or more, by weight of the mixture.

Many different dispersing agents can be used to produce the desired binding material dispersion, as is well known in the art. These include plant materials such as tannin, natural proteins such as blood, rosin soaps, synthetic detergents and others.

During cool, damp weather and during high relative humidity conditions, it is desirable to reduce the amount of water in the binding material dispersion to hasten drying and setting of the binding material. In such case, some of the water can be replaced by a more rapidly drying water-soluble material. The material marketed under the trademark "Texanol" by Central Solvents & Chemicals Co., Santa Fe Springs, California, can be used for such purpose in the range of about 1.0 percent to about 25 percent by weight based on the mixture. This is an ester-alcohol (2,2,4-trimethylpentanediol-1,3-monoisobutyrate) manufactured by Texas Eastman Company and distributed by Eastman Chemical Products, Inc., Kingsport, Tennessee.

Conversely, during warm, dry, quick-drying weather conditions, more water can be used in the binding material dispersion to permit the applied dispersion to sufficiently penetrate the layer of particulate material to which it has been applied. The dispersion may be thickened when needed by adding any one of many suitable thickening agents. Methylcellulose is an example of a group of such thickening agents available commercially.

In actual practice, the binding material dispersion is prepared for application to the prepared particulate material layer by utilizing any one of several commercially available synthetic resin, plastic or polymer dispersions. An example of a preferred dispersion of such type is sold on the market by The Borden Company under the trademark designation "Polyco 773" and is described as a fine particle size polyvinyl acetate homopolymer emulsion having the following composition and properties:

Solids Content	55% ± 0.5%
Emulsion Type	Nonionic
Viscosity (Brookfield LVF at 25°C)	800–1200 cps
Viscosity Index (12 RPM/60 RPM)	1.8–2.1
pH at 25°C	4.0–5.0
Particle Size (approximately)	1–5 microns
Surface Tension	40–46 Dynes/cm
Free Monomer (maximum)	0.5%
Specific Gravity of Emulsion at 25°C	1.10
Weight per U.S. Gallon at 25°C	9.2 pounds
Film Description	Slightly Hazy, Continuous

A batch of the binding material dispersion can be prepared for actual application by starting with 25 gallons of the Polyco 773 and diluting it with water from about 5 percent to about 50% in accordance with weather conditions, as described hereinabove. Normally, the Polyco 773 will be diluted about 40% to 50 percent. The filler, such as powdered silica or silica powder, then is added to the diluted Polyco 773 in amounts varying from about 1 pound to about 10 pounds, preferably in the form of a slurry or paste. A pigment, such as a permanent green paste, then can be added to the resulting mixture in the amount of from about 1 pound to about 50 pounds, preferably about 3 pounds, to impart a green color to the final structure adjacent areas of lawn. Titanium oxide or other powdered oxide coloring, in an amount of around 50 pounds to the diluted Polyco 773, may be included.

If it is desired to add Texanol, it is diluted about 50 percent with water and added to the resulting mixture in amounts of about 1 gallon to about 20 gallons of diluted solution, preferably about 5 gallons, to speed the drying and setting of the applied binding dispersion. The Texanol should be diluted with water at least 24 hours before its use.

In addition, if desired, about 5 to 10 pounds of methylcellulose and about 1 ounce to 16 ounces aqueous ammonia mixed with about 1 gallon to 10 gallons of water are added to produce the finally prepared batch of binding material dispersion for application to the prepared layer of particulate material. Preferably, around 1 pound of methylcellulose, 3 ounces aqueous ammonia and 1 gallon of water are used.

A suitable dispersing agent, if desired for the batch, is premixed to provide a mixture of 1 gallon of 50 percent diluted Texanol, 2 pounds methylcellulose, 2 pounds silica powder, 1 gallon of tannin and 3 gallons

of water. The resulting mixture is added to the mixture of Polyco 773 in the range of 1 pint to 10 quarts to 50 gallons of the Polyco 773 mixture, preferably 1 quart to 50 gallons of the Polyco 773 mixture.

As shown in FIG. 4, the unitary particulate material surface structure 20 of the invention can be applied to the roof 21 of a building 22, as well as on soil, ground or other earthen base. The manner and means employed to apply the surface structure 20 to the roof 21 are very similar to those described hereinabove with reference to FIGS. 1, 2 and 3 for application of the surface structure to the surface 10 of soil or ground 9. In the case of the roof 21, the sheet material 11 is placed upon the surface of the roof and affixed thereto appropriately with nails, pitch, tar, asphalt and/or the like, as is well known in the roofing art.

The particulate material 12, such as gravel, for example, is applied to the affixed sheet material 11 and leveled by any suitable means, such as by raking, to produce a layer of particulate material 12 of substantially uniform thickness. The binding material dispersion can be sprayed upon the particulate material 12 as before, with enough applications being made to fill all the interstices in the particulate without running off while the binding material dispersion is in liquid form.

The spraying apparatus employed can be the kind described hereinabove with reference to FIG. 3. Reservoir 15 can be stationed on the ground adjacent the binding 22, or be located on the roof, if desired. Any suitable motor or engine can be used to drive pump 18. The material of sheet 11, the type of particulate material 12 and the components of the binding material dispersion are, of course, chosen to resist the chemical and physical action of weathering conditions, such as the action of rain, snow, sun radiation, heat, cold and frost.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. Various particulates may be formed into a unitary structure in accordance with this invention, which is not limited to the production of roofing or yard coverings.

I claim:

1. A method of forming a stable ground cover of particulate material comprising the steps of:

a. placing a sheet of flexible synthetic plastic base material upon a supporting ground surface;

b. spreading a layer of particulate aggregate selected from the group consisting of gravel, rock, stones and pebbles, over the exposed surface of the base material sheet;

c. compacting the said layer of particulate material by rolling;

d. spraying at about 70 psig upon said compacted layer an aqueous dispersion of about 40 to 50 weight percent of a polyvinyl acetate homopolymer in an amount sufficient to penetrate the interstices among the particles of the particulate material and substantially fill the volume defined by said interstices; and thereafter

e. drying said aqueous dispersion to bind the said particulate material.

2. The method of claim 1 wherein said spraying is conducted in at least two separate coats to facilitate penetration.

2. The method of claim 1 wherein said sprayIng is conducted in at leAst two seParate coats to fa,i'itaJe penPtration.

* * * * *