April 23, 1940. C. L. JEWETT 2,197,803

METAL ROOFING SHINGLE

Filed Oct. 28, 1937

Fig. 1.

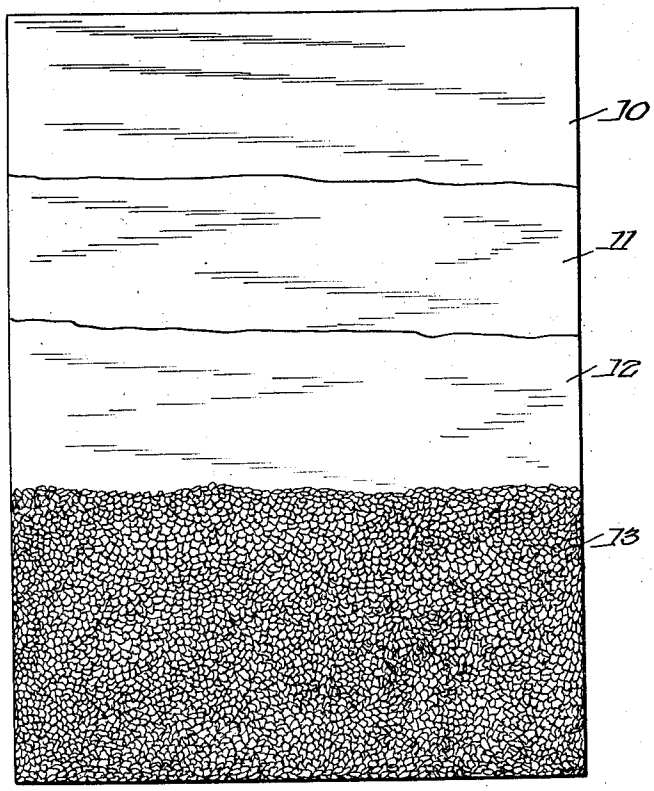


Fig. 2.

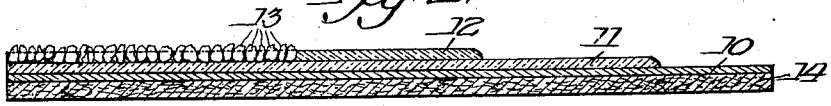


Fig. 3

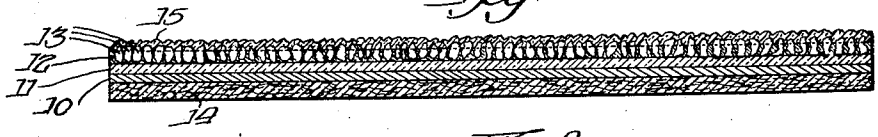
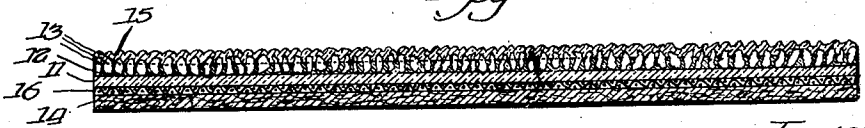


Fig. 4.



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UNITED STATES PATENT OFFICE

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METAL ROOFING SHINGLE

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7 Claims. (Cl. 91—73)

This invention relates to surfacing materials; more particularly to new and useful improvements in vitreous enameled sheet metal shingles and the like.

The invention contemplates the production of covering material having a metal base to be employed as roofing shingles or decorative covering for interior or exterior use, such as sidings and the like.

The invention further contemplates the provision of an improved method of coating metallic sheet material to produce a coated metallic product superior to somewhat similar products known to the art; the provision of a covering material which will adequately comply with the severe requirements of commercial roofing standards and usage. A particular fault with somewhat similar products known to the art lies in the weakness of the bond between the metallic base, the intermediate coating and the granular material. An object of the present invention, therefore, is the provision of a coated metallic product in which the granular material, intermediate enamel coating and metallic base are securely and permanently bonded together.

While it is to be understood that the process of my improvement may be used in producing surfacing materials for decorative and other purposes, I shall describe my improvement in coated granular coverings as applied to roofing shingles for producing an absolutely weather-proof and fire-proof covering material, which is more practical, lasts a great deal longer than asphaltic roofing, costs relatively less than types of rigid roofing materials at present commercially useable and known to the trade. A further feature of my improved shingle is its relative freedom from the collection of soot and dirt as well as a freedom from staining, blooming, blistering and granule loss so common to roofing material commercially available.

It is therefore a particular object of my improvement to provide a finshed product having the advantageous characteristics as above set forth as desirable features in a protective coating.

A further object of my improvement is to provide a process and product in which a sheet metal body, or the like, is covered with a coated granular material which not only assists in the utility of the sheet as a roofing shingle, but also assists in forming and maintaining the fused bond between the granules and the vitreous enamel.

Another material object of this improvement in roofing shingles is the production of an article of manufacture which may be furnished very cheaply in all ceramic colors from violet to red and from pastel shades to very intense colors, retaining a color permanent to outdoor exposure and giving diffused light by reflection.

Another object of my improvement is the attainment of a granular covered roofing article with the use of materials which will not be altered in their physical constituency by the application of sufficient heat for bonding.

Another object of my improvement is the production of a finished product very light in weight remaining clean and bright in appearance for a long period of time.

A further object of improvement is the provision of a covering material which is substantially formed of bonded materials and is considerably flexible without destruction of the bonded coating and subsequent loss of granular mineral.

For accomplishing the objects of my improvements in roofing shingles, a composite structure is formed of a base plate consisting of sheet metal such as iron, steel, copper, or the like, or the base may be a light screen or perforated sheet material of the same character instead of a plate material; and a surfacing material of a granular nature, having a ceramic or glazed coating, bonded to the sheet or plate material by means of the interfusion of vitrifiable coating substances. To the screen or perforated sheet material is preferably applied a water proofed felt backing of an asphalt saturated type or the like for the purpose of support, while with the plate material this backing may be omitted if desired.

The invention will be readily understood from the following description and the accompanying drawing wherein certain preferred embodiments of the invention are shown and in which:

Figure 1 is a plan view of the improved coated material with the plurality of coatings partially removed, showing the application of the coatings in an unfinished relation.

Figure 2, a vertical, sectional view of the embodiment of Figure 1.

Figure 3, a vertical sectional view of the embodiment of Figures 1 and 2 showing the covering material as a built-up whole in completed form, and

Figure 4, a vertical, sectional view of a modification of the invention.

Referring to the drawing, wherein is shown a composite coated material in sheet form comprising generally a metal base 10 having coated thereon a vitreous enamel layer 11, a colored coating of vitreous enamel 12, covered by a gran-

lar surface coating 13. These parts will hereinafter be described in detail.

In the embodiments shown and referred to above in addition to the elements 10, 11, 12 and 13, shown diagrammatically in step relation to illustrate the built-up layer as in Figures 1 and 2, the metal base 10 may have a backing member 14 of felt, cork, rubber or the like which will facilitate packing and sealing as well as serve as insulating and waterproofing means for metal shingles on a roof. This backing material 14, when applied to a sheet plate material, may be an ordinary roofing felt lending to cheapness of production which, if used, is unexposed and therefore does not affect the weather resistance of the roofing. It is preferably sealed to the metal base by means of a suitable cement or with heat as in the case of rubber, and is applied after all of the high temperature work has been completed.

In the embodiment as shown in Figure 3, the metal roofing shingle is in a completed form in which 10, 11, 12, 13 and 14 are as described in the Figures 1 and 2 with the addition of a sizing coat 15 applied over the surface of the granular material. Coating 15 overlying the granular material is preferably of the same vitreous coloring material as the cover coat 12 or the granular coating material; however, this coating may be of any character suitable for use as a surfacing material such as a ceramic or siliceous coating of a colored or clear and transparent nature so long as it is a vitrifiable material not subject to disintegration by the action of light or weather conditions.

The metal backing 10, may be either a sheet material of enameling iron, steel, copper, or the like, or it may be a light screen or perforated sheet material 16 as shown in Figure 4. I preferably use enameling iron with a carbon content of approximately .013%, enameling steel with carbon content between .05 to .14%, ordinary steel of carbon content approximating .2%, cast iron or copper.

The metal base material is preferably cleaned prior to an application of the enameling material 11. This cleaning process may be carried out in any one of a variety of ways. For example, if not cleaned electrolytically, the materials may be washed with a soap, then with an acid, followed by a neutralizing bath of a base solution as soda ash or caustic soda to remove the acid remaining on the surface. This is followed by a thorough washing and drying. The drying may be eliminated when it is desirable to apply the enamel coating 11 in dry form. More specifically, sheets of base material 10 may be cleaned by pickling in hot sulfuric acid of about 6% concentration or such acids of a mineral type as hydrochloric, nitric, and the like may be used. This pickling bath removes dirt and scale and leaves a clean surface for enameling.

Generally in enameling sheet iron or other metal, it is necessary to first apply an enamel frit by either dusting on the powdered frit or by dipping into a slurry of the frit or by spraying followed by subsequent suitable firing to produce an enamel surface on the metal. In order to secure a more stable bond between the enamel and the metal base, I preferably employ an enamel that contains an ingredient adapted to increase the affinity between the enameling coat and the base as, cobalt, nickel or the like, or I wash the metal in a solution of cobalt or nickel salts which leaves a fine deposit of the affinity increasing ingredient over the surface of the metal to which an enamel is to be applied. This use of an affinity increasing ingredient may be eliminated where cast iron or copper is being enameled.

To obtain good commercial adhesion to a base material of a character previously mentioned, from .1 of one percent to .8 of one percent of cobalt oxide is preferably used in the enamel batch to be smelted for procuring best results in fusing the enamel to a metal surface. As a substitute for the cobalt oxide, cobalt salts or nickel salts may be used.

The enameling coat 11 is first produced as frit, and while it may be of a character of enamel commercially available, an illustration of an enamel for use in coating the metal with which it is possible to obtain good results is as follows:

	Parts
Feldspar	30
Borax	32
Quartz	20
Soda ash	7
Sodium nitrate	5
Fluorspar	4
Cobalt oxide	0.5
Manganese dioxide	1.5

The mixture is heated to 2400° F. until all bubbling ceases. It is then poured into water to quench and shatter it. This product is called the frit, which is then ground up into a slip with clay, water and an electrolyte, as magnesium sulphate, zinc chloride, or the like in a ball mill until substantially 93% of the solids will pass a 200 mesh screen. In preparing the slip, the material is mixed in the approximate proportion of 100 parts frit, 6 parts clay, 60 parts water and 0.5 part electrolyte. The slip is applied to the metal base by dipping or spraying as previously mentioned. The frit is spread over the metal base with or without the addition of water and fused by heating.

The preparation of this coating is described as an enameling coat 11 with the use of cobalt oxide which tends to leave a dark color, however, if desired this cobalt may be eliminated and the frit applied as a cover or sizing coat either with or without the addition of a coloring agent.

The enamel cover coating 12 is applied to cover the dark bonding enamel 11 and consequently, is preferably of the same color as the coated granules. It is to be noted that I may apply one or more cover coats, as desired, of a light white or colored vitrifiable material before application of the granular material or I may omit the colored coating and apply the granules directly to the dark ground coat 11, preferably before it has been fused to the metal base. Preferably the coloring material contained in an enamel is of the nature of a ceramic pigment such as chrome oxide, red iron oxide, cobalt oxide, lead antimonate, and many others as are well known in the trade.

While the cover coat 12 may be of an enamel commercially available, I preferably use a formula of the following composition:

	Parts
Feldspar	30
Borax	15
Quartz	27
Soda ash	5
Sodium nitrate	5
Fluorspar	5
Cryolite	10
Zinc oxide	3

This mixture is likewise heated to 2400° F., for example, and treated as previously described in preparation of the ground coat frit. After fritting the cover coat, it is prepared for application to the enameled metal base by mixing in approximate proportion 100 parts of the prepared cover frit with 4 parts clay, 1 to 4 parts coloring material, 50 parts of water and 0.5 part electrolyte. The resulting slip is coated on the enameled metal base, either by dipping or spraying, and the coated granular material is then applied with the coating 12 preferably in a wet state.

As will be readily apparent, the coated granules 13 either uncolored or artificially colored may be embedded either in the colored or uncolored cover coat or, if desired, in the ground coat when no cover coat is used, either after or preferably before an initial setting or drying of either the cover coat or the ground coat has taken place.

In applying the granules to a metal base, the securing enamels may be either in a wet state as when the metal base material was dipped or sprayed with a slurry of the powdered enamel or the granules may be spread on a base covered with dry powdered enameling material, either of which applications are subsequently subjected to a firing operation which requires from approximately two to ten minutes heating at a temperature between 1450° to 1650° F. At this temperature the enamel fuses and adheres tightly to the metal and also to the granules. The vitreous granule coating softens and interfuses with the enamel bond, thereby greatly improving the adhesion of the granular material to the enamel.

The granular material 13 has a coating thereon of a vitrifiable nature as ceramic glaze, sodium silicate, or clay and sodium silicate type, or the like with or without a coloring agent and which will stand a temperature of 1550° to 1650° F. without breaking down or changing the character of the coated or coating materials. The glazed colored or uncolored granular materials which are preferably used are a quartz or quartzite base with a coating of the above mentioned character thereon. However, any granule coated with a vitrifiable material may be used. At the temperature used to fuse the vitreous enamel, e. g. 1450 to 1650° F., the coated granules, as for example those mentioned in application Serial No. 700,632 filed December 1, 1933, by Clifford L. Jewett on colored granuled material or Fisher Reissue Patent No. 20,295 issued March 16, 1937 and other numerous Fisher sodium silicate patents and Patent No. 2,033,656, March 10, 1936, to P. R. Smith and others mentioned therein have a coating thereon which will soften enough to interfuse with the enamel to form a solid ceramic or siliceous bond between the granule and the metal backing.

As a further means of securing the granules, a fusible sizing coat 15 may be applied over the surface of the granular coated article which sizing combines by interfusion with the granular coating and the coating 12 or covering enamel which is fused to the metal base, thereby holding the granules firmly in place. This sizing coat may be of the same character as the cover coat 12 or of the same composition and nature as the coating covering the granular material. In any event, it is preferably formed of a ceramic or vitreous glaze or other siliceous material which will soften and interfuse with the previously applied vitrifiable materials. The granular material, when covered by a sizing coat of a character herein described, may possibly be of an uncoated nature, as I have found an enameling sizing coat will secure it with substantially a firm and uniform adhesion.

In the coating of a roofing shingle with a sizing coat as above stated, this sizing material is applicable either prior or subsequent to a fusion of the other materials. In applying it over a fused coating, no particular care need be taken as to the manner of coating. However, when applied prior to the fusion of any of the coatings, care should be taken to properly dry, by a heat treatment or otherwise, the previously applied fusible materials so that there is no substantial disturbance of the coated granules. Whereupon, after application of the sizing, the vitrifiable materials are subjected to a heating temperature of sufficient degree to interfuse and bond the vitreous coatings as hereinbefore stated.

With the herein described coatings when applied particularly to a light metal screen or to a copper plate—I have secured a covering material of relatively unlimited flexibility without material enamel and granular loss and subsequent deterioration of the metal base, however, in general the degree of flexibility will depend a great deal upon the nature and rigidity of the base as for example, with a member formed of sheet iron, the coated sheet is characteristically resistant to pliancy.

With the above disclosure, I have obtained a surfacing material of a granular coated nature, wherein the respective coatings are securely bonded with a fused enamel. The finished sheet has a more brilliant, clean color which is more permanent in outdoor exposure, resulting in a material increase in advantages for its unlimited use as a decorative or covering material.

Having thus described my invention and illustrated its use, what I claim is new and desire to secure by Letters Patent, is—

1. As a new article of manufacture, a composite sheet element comprising a metal base and precoated granules, having vitrifiable ceramic coatings over surfaces of base granules, bonded to said metal base with an enamel coating which latter is interfused with the said ceramic coatings of said granules.

2. As a new article of manufacture, a weather-resistant composite sheet element having a desired colored appearance and adaptable for use as roofing material comprising a metal base and precoated colored glazed granules, having colored vitrifiable coatings firmly adhering to surfaces of refractory base granules, bonded to said metal with a vitrified enamel coating, said enamel coating being interfused to a sufficient degree with the said vitrifiable colored coatings on said granules so as to form a solid bond, thereby to provide an extremely strong bond between said granules and said metal base and at the same time economically give the composite sheet element the desired colored appearance due to the colored coating on surfaces of said granules.

3. As a new article of manufacture, a composite sheet element having a desired colored appearance comprising an apertured metal base and precoated colored granules (having colored vitrifiable ceramic coatings firmly adhering to the surfaces of refractory base granules) bonded to said metal base with a vitrifiable enamel coating interfused with the said ceramic coatings of said granules.

4. As a new article of manufacture, a weather-resistant and decorative composite sheet ele-

ment adapted for use as a building or roofing material comprising a metal base; precoated colored granules (having colored vitrifiable, firmly-adhering coatings over surfaces of refractory base granules) bonded to one surface of said metal base with a vitrified enamel coating which is interfused with the said vitrifiable coatings on said granules to provide a strong bond; and a backing material or coat of an insulating and waterproofing character adhering to the other or underneath surface of said metal base.

5. The method of making a weather-resistant composite sheet element adapted for use as a building or roofing material which comprises providing a metal sheet having a surface thereof prepared so that enamel will adhere thereto; coating granules at elevated temperatures with individual ceramic colored coatings of a vitrifiable character and then allowing said granules to cool to substantial extent; applying to the aforesaid surface of said metal sheet a layer of vitrifiable enamel and a layer of the aforesaid colored, coated granules; and then subjecting the latter to heat sufficient to make said enamel adhere to the said surface of said metal sheet and also to soften the said colored ceramic coatings on said granules enough so that the same interfuse substantially with the said enamel to form a strong bond.

6. The method of manufacturing roofing shingles which comprises coating refractory base granules with a vitrifiable colored glaze coating at elevated temperatures and then cooling the colored, coated granules; providing a metal sheet having a surface to which enamel will readily adhere; applying to said surface of said metal sheet a layer of vitrifiable enamel and a layer of the aforesaid colored, coated granules so that said granules are embedded to substantial extent in said layer of enamel; then heating to cause said enamel to fuse enough to provide a good bond with said surface of the metal sheet and to soften the said vitrifiable colored coatings on said granules to form a solid bond between said granules and said enamel; and then applying a second vitreous enamel coating over the aforesaid layer of enamel and over the said layer of colored, coated granules so as to substantially cover the latter and applying heat to the coated metal sheet to interfuse said second enamel coat with the first-mentioned layer of enamel.

7. As a new article of manufacture, a weather-resistant composite sheet element having a desired colored appearance comprising a metal base and precoated colored glazed granules, having colored vitrifiable coatings firmly adhering to surfaces of refractory base granules, bonded to said metal with a vitrified enamel coating, said enamel coating being interfused with the said vitrifiable colored coatings on said granules, thereby to provide an extremely strong bond between said granules and said metal base and at the same time economically give the composite sheet element the desired colored appearance due to the colored coating on surfaces of said granules.

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