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[54] **METHOD OF ORNAMENTING ARTICLES BY MEANS OF MAGNETICALLY ORIENTED PARTICLES**

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[52] **U.S. Cl.** **117/238,** 117/239

[51] **Int. Cl.** **H01f 10/00**

[58] **Field of Search** 117/234–240; 252/62.54

[56] **References Cited**

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[57] **ABSTRACT**

A patterned effect can be produced in coatings applied to any surface by employing a preliminary coating which includes a liquid vehicle in which permanent magnet particles are suspended; the coating being applied and then hardened, after which the particles are magnetized under the influence of magnetic lines of force arranged in a predetermined pattern, and another coating containing magnetically orientable particles is applied, which particles become oriented by the magnetic field product by the particles first applied.

14 Claims, 3 Drawing Figures

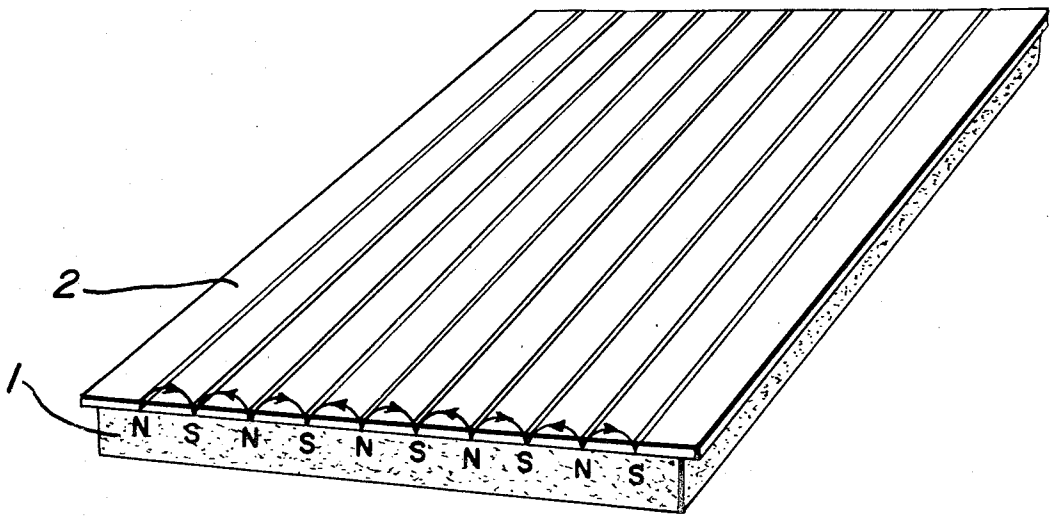


FIG. 1

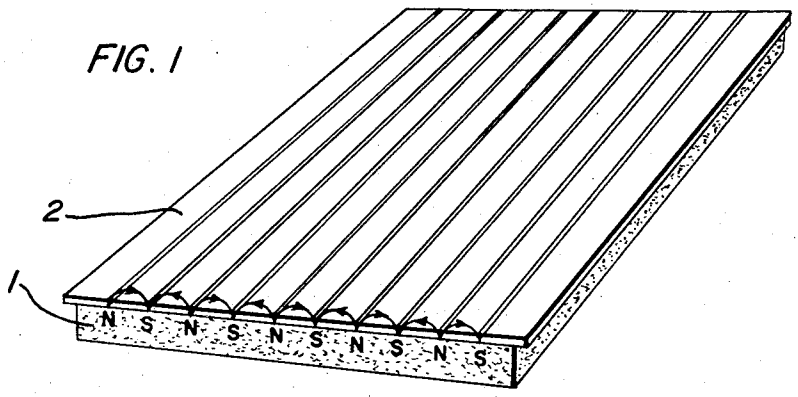


FIG. 2

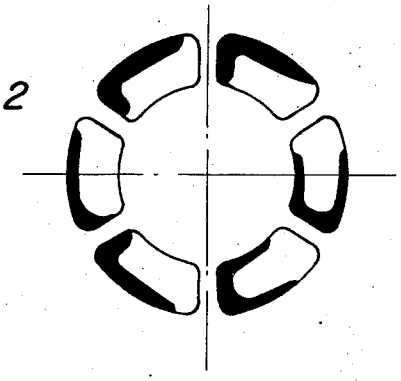
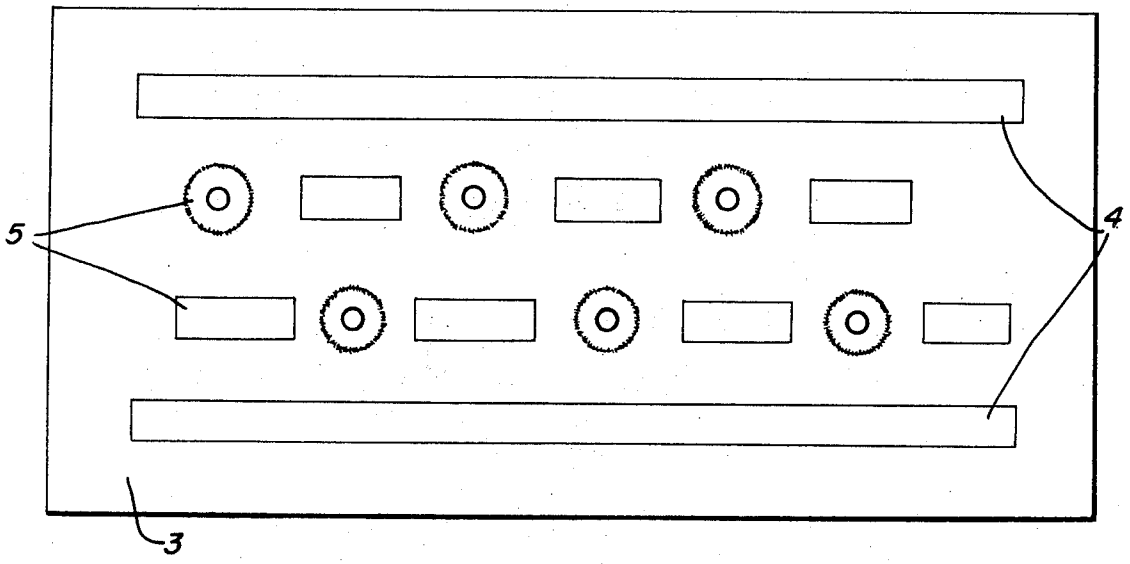


FIG. 3



METHOD OF ORNAMENTING ARTICLES BY MEANS OF MAGNETICALLY ORIENTED PARTICLES

The present invention relates to a method for producing a pattern on surfaces by applying a coating thereto, which contains magnetically orientable particles, and creating a pattern in this coating by means of magnetic fields.

It is already known to create nacre-like effects in plastic materials by admixing thereto lamellate or rod-shaped crystals with a high index of refraction. A known method of positioning the crystals in a desired way within the plastic material, for instance parallel to the surface of the object, consists in orienting the crystals by means of an electric or magnetic field. The basic idea of this method is derived from the fact that these crystals naturally possess a dipole moment of force, or else that such a moment of force can be induced in them under the effect of a magnetic field. Under the effect of such a field the crystals orient themselves parallel to the lines of flux. For example, a known process for manufacturing an abrasive utilizes this method.

Further, a method for producing transparent plastic materials is known, which can be used to manufacture objects or panels commercially in large amounts. According to this method, polytetrafluorethylene dispersions are used to manufacture decorated transparent plastic materials by admixing preferably lamellate particles with the plastic material, varying the positions of the particles by means of a magnetic field and subsequently drying the mixture.

Up to the present, however, there has always been the desire to also provide opaque objects with finishes having particular patterns, which could not be achieved with the methods hitherto known in the coating industry. Therefore, a method has been proposed for producing a pattern during the coating of surfaces, according to which a finish containing magnetic components is applied, under the effect of magnetic fields, onto the surfaces to be coated. For this purpose, the objects are placed on devices which product magnetic fields in accordance with the desired patterns. The lines of magnetic flux act through the surface to be coated and extend in arcuate paths from the north pole to the south pole, as is well known. The surface is then covered with a coating containing magnetic components. These magnetic particles orient themselves in the still unhardened coating according to the lines of magnetic flux. After hardening, the coating displays the desired pattern which reproduces the magnetic pattern used by virtue of differences in brightness and reflectivity.

Further, it has been proposed to create the patterns in a similar way in panels of ceramic material, enamel, pigment solutions with or without binders, pastes, varnishes, lacquers, and synthetic resins, etc. either colored or uncolored. For instance, according to this method, the powdery or pasty ceramic material is exposed to the effect of magnetic fields, then melted, and finally hardened.

According to the known and proposed methods the corresponding arrangement of the magnets, in front or in back of the respective surface to be coated or to be provided with the color patterns, has to be maintained during the whole coating and hardening process, to permit the lines of magnetic flux to act upon the still movable magnetically orientable particles in the coating. Further, if the magnets are arranged, according to both the known and proposed processes, above the recently coated, but unhardened, layer, there is the danger that the magnetically orientable particles will be drawn out of the coating if the magnetic fields are too strong. Moreover, the known methods are very time-consuming since the hardening of the coating has to be completed while the magnetic particles disposed therein are fixedly oriented.

The object of the present invention is therefore to provide a method which permits the application of patterns on surface coatings in any paint shop without requiring magnet arrangements from the outside.

This object can be accomplished, according to the invention, by applying a primer or other preliminary coating containing permanent magnetic particles to the desired surface, hardening said primer and magnetizing it according to the desired pattern, after which a liquid coating containing magnetically orientable particles can be applied to said primer and be hardened. The new method according to the invention offers the advantageous possibility that the untreated objects whose surfaces normally require a primer anyway, can be supplied to the industry, for their subsequent treatment, already provided with this layer of primer. Thus, only the desired finish coating needs to be applied in the usual manner, and the desired pattern automatically appears. The new method can further be advantageously applied to thick objects which cannot be magnetically influenced from the opposite side, generally the bottom side, such as for example thick steel plates and brickwork.

According to the invention the primer or first coating preferably contains magnetizable permanent magnetic particles with high coercivity and consisting of ferrite of the type $MO \times 6Fe_2O_3$, wherein M can be one or more of the elements Ba, Sr, Ca or Pb. The fluid coating containing the magnetically orientable particles can have a composition as disclosed in the German patent application No. P 20 06 848.8. A baking or vulcanizing or other form of hardening step can also be used instead of the above mentioned drying step.

The originally unmagnetized permanent magnetic particles are added to a conventional liquid vehicle, wuch as a primer and the mixture is applied to the surface. Whilst the particles are still movable in the primer which has not yet hardened, or even after the particles are already fixed due to the drying of the primer, the desired magnet arrangement, or a magnetization device having a similar effect, is applied to the surface, either at the front or at the back of it. The particles become magnetized and, as the result of their high coercivity, produce a magnetic field which corresponds to the magnet arrangement.

Generally, the primer consists of a pigmented layer in which the permanent magnetic particles are not visible. A plate or object which has been pre-treated in this way can thus be marketed. For example, the manufacturer can sell this object together with coatings containing magnetically orientable particles.

A particular feature of the invention consists in that the finish coating containing the magnetically orientable particles may either be directly applied to the primer or to further intermediate layers of varnish, plastic, resin or similar materials to said primer, since the lines of magnetic flux will act through these layers. The time required for the magnetization can be consid-

erably reduced by this new method, since the magnetization of the primer can be carried out in its dry condition, thus only requiring a fraction of a second. It is also possible to obtain particular patterns by applying the magnet several times, and in different directions, to the primer, without having to take into consideration the hardening time, since the primer is already hard and dry. The whole working cycle becomes more flexible, since the step of applying the primer, of magnetizing it and of applying the coating containing the magnetically orientable particles can be carried out completely independent from each other. The product of the first and second steps can be stored in large quantities, in order to be furnished to the second or third step, respectively, according to the demand.

According to the invention the magnetically orientable particles preferably consist of powdery lamellate or rod-shaped iron and the object or the surface to be treated may consist of a ferromagnetic base, particularly a steel plate. However, the new method is independent of the thickness of the steel plate and is also effective on wood, plastic, ceramics and similar materials.

A particularly suitable device to carry out the method of the invention to magnetize the permanent magnetic particles of the primer layer comprises an electric conductor which is shaped according to the desired magnetic field, which can be applied to the primer and through which a high electric current is sent. This can preferably be achieved by the use of a conventional circuit which utilizes the discharge from a condenser. Further, apparatus to carry out the method of the invention is characterized in that the electric conductor is insulated and is imbedded in recesses provided in the surface of an iron terminal.

According to a particular feature of the invention the permanent magnetic particles are made of a material having a $(B \cdot H)_{max}$ value of $1\text{–}4 \cdot 10^6$ gauss·oersted. The coercivity H_c has preferably a value which is higher than 2,000 oersted and the retentivity B_r has a value of 2,000 to 4,000 gauss.

Following is a description of a composition which is suitable for a primer according to the invention although it is not to be construed that other compositions are not equally suitable. The primer is hardened by baking and the desired pattern is afterwards applied to it by magnetization:

20 parts of ricinine alkyd
10 parts of urea or melamine resin
10 parts of titanium dioxide
10 parts of talc
15 parts of benzol hydrocarbon and
35 parts of OX 300, that is a powdery anisotropic ferrite of the type of $MO \cdot 6Fe_2O_3$, wherein M can be one or more of the elements Ba, Sr, Co or Pb.

The method according to the invention has particularly proved to be suitable for objects made of ferromagnetic material, particularly steel plate, and provided with a permanent magnetic primer of the type above described.

Other advantages, features and applications of the present invention will be apparent from the following detailed description with relation to the accompanied drawings, in which:

FIG. 1 shows a magnetic plate which has been provided with a striped pattern,

FIG. 2 shows a rose-like pattern provided on an iron surface, and

FIG. 3 shows a top view of another form of magnetic pattern plate.

To create the magnetic field a permanent magnetic plate can be used which is provided with a pattern defined by striped areas of alternating polarity. This pattern is produced by magnetization of the plate according to a known procedure which is similar to the one used in the manufacture of permanent magnets. Instead of the permanent magnetic plate an electromagnet can also be used in which insulated electric conductors are imbedded in parallel grooves provided in the surface of an iron plate **1**. When a strong electric current is sent through the conductors the pattern shown in FIG. **1** appears on the object or surface **2** provided with the primer containing the magnetic particles. The permanent magnetic particles can also be magnetized by the lines of flux in such a way that they invisibly carry the pattern **2** of FIG. **1** on the primed surface and with the result that lines of flux run from the permanent magnetic particles along lines N to the particles along the parallel lines S. This pattern can be immediately made visible by applying the finish coating containing particles which are sensitive to the magnetic fields of the magnetic particles in the primer defining said invisible pattern on plate **2**.

FIG. **2** shows a six-poled, frontal magnetization effect produced by a ring magnet made of barium ferrite. The shape and the range of the magnetic field can be very accurately determined therein.

FIG. **3** shows a magnetic plate to produce a particular pattern containing an arrangement of circles and rectangles. Such a pattern can also be obtained by combining electromagnets. For example, elongated strips **4** cut out of a flexible permanent magnet, or electromagnets corresponding in shape thereto and other forms of magnetic metal parts **5** can be located at various distances from said strips **4**, or correspondingly shaped electromagnets are fixedly arranged in a mounting support **3**.

The surfaces provided with such new and aesthetically arranged patterns of magnetic particles can be applied to household objects, to the panelling of safes and building walls generally, and can also be used in furniture and in the glass and ceramic industry, particularly for the manufacture of tiles.

The final coating, or coatings, of liquid material containing magnetically orientable particles can thus be applied after the treated surfaces, or panels, have been put in place.

I claim:

1. Method of producing a pattern in a coating applied to the surface of an object, comprising the steps of combining permanent magnetic ferrite particles having a coercivity H_c greater than 2,000 oersted in a fluid binder, applying said mixture of fluid binder and particles to the surface of an object, hardening said mixture to secure said magnetic particles to said object, magnetizing said magnetic particles to define a predetermined pattern, applying a fluid coating which includes magnetically orientable particles, and hardening the second coating so that the magnetically orientable particles adopt the pattern defined by the previously applied magnetic particles.

2. Method of claim **1**, wherein said magnetically orientable particles comprise lamellar iron.

3. Method of claim 1, wherein said binder is combined with magnetizable permanent magnetic particles having high coercivity and consisting of a ferrite of the type $MO \cdot 6Fe_2O_3$, wherein M is at least one of the elements Ba, Sr, Ca and Pb.

4. Method of claim 1, wherein said magnetically orientable particles comprise rod-shaped iron.

5. Method of claim 1, wherein said binder comprises a primer.

6. Method of claim 1, wherein said second coating produces a lustrous finish.

7. Method of claim 1, which includes the step of applying at least one intermediate coating after said binder and prior to the application of the coating including magnetically orientable particles.

8. Method of claim 1, wherein said magnetically orientable particles comprise powdered iron.

9. Method of claim 7, wherein said intermediate coating produces a lustrous finish.

10. Method of claim 7, wherein said intermediate coating comprises a synthetic plastic.

11. Method of claim 1, wherein said object comprises a steel plate.

12. Method of claim 1, which includes the step of subjecting said magnetic particles to the influence of magnetic lines of force to define said pattern.

13. Method of claim 12, which includes the step of utilizing a permanent magnet to supply said magnetic lines of force.

14. Method of claim 12, which includes the step of utilizing an electromagnet to supply said magnetic lines of force.

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