Aug. 19, 1947. F. P. HAUCK 2,426,020

METHOD OF COLORING GARNET

Filed Jan. 13, 1945

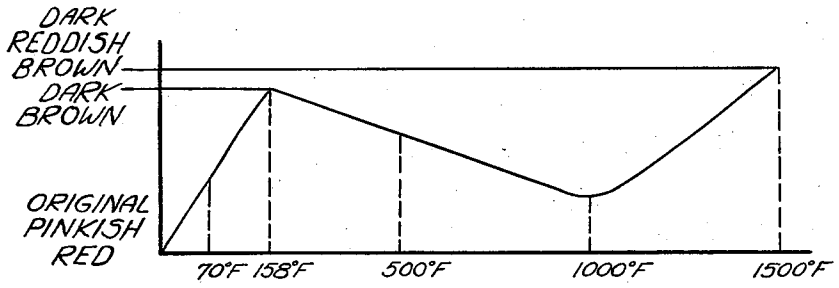


Fig. 1.

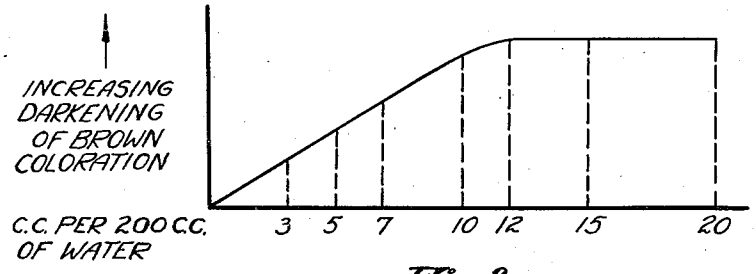


Fig. 2.

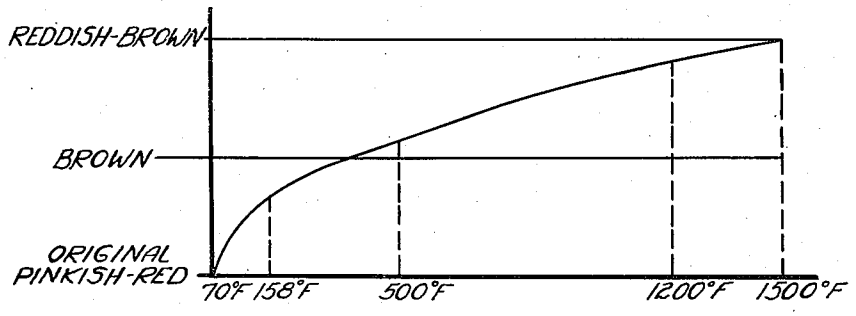


Fig. 3.

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Patented Aug. 19, 1947

2,426,020

UNITED STATES PATENT OFFICE

2,426,020

METHOD OF COLORING GARNET

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Application January 13, 1945, Serial No. 572,685

8 Claims. (Cl. 117—100)

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This invention relates to the coloring of crushed or granulated substances and particularly to garnet. Crushed or granulated garnet is used extensively for certain abrading operations for both metal and wood and is commonly employed as an abrasive applied to a suitable back, such as paper or cloth or other fabric, by means of a suitable binder.

Garnet, when crushed or divided into grains of suitable size, may also be used as a coating for building material, such as roofing strips or shingles. The granular material may be applied to and form the surface for a sheet of material containing such substances as asphalt, tar or pitch and, indeed, the sheet itself may include asbestos. The granulated garnet applied to such building strips provides a mineral surface which is to be employed as the exterior surface exposed to the elements and also visible.

From a general standpoint, the principal object of the invention is to provide an improved method for coloring the garnet. The coloring is of an extremely permanent nature and different shades of coloring can be provided throughout quite a wide range. This is advantageous for building materials. The coloring is also desirable when the garnet is used as an abrasive, as those who make use of the same, particularly in the furniture industry, prefer a relatively deep and uniform brownish or reddish brown color.

Among the further objects of the invention is the provision of an improved method of coloring the garnet wherein the coloring can be accurately controlled so that the desired coloring may be given any particular run or batch of the substance. Moreover, the invention has as an object the provision of a method by which the garnet can be colored more economically than it has been heretofore colored. This is accomplished particularly by two factors in the improved method. One of these factors is that the coloring can be effected by treating the garnet at temperatures much lower than those heretofore used, thus resulting in a considerable saving of energy and fuel. The other factor is the element of time in that no particular time period is required, it being only necessary, from a broad and general standpoint, to raise the temperature to the desired point to dry the batch and to obtain a given coloring. Heretofore, it has been necessary to maintain a high temperature on the garnet for quite a long period of time. This represents a large expenditure not only in fuel but also an expenditure of labor and an expenditure

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of plant space, all of which are factors in the cost of production.

The garnet, as originally mined, varies in its coloring but for the most part, it has a pinkish-red coloring. Heretofore, it has been proposed that garnet be colored by subjecting the same to a heat treatment wherein the temperatures ran as high, or higher than 1742° F., and the time period lasted for hours varying from a few hours to as high as sixteen hours. The Almandite variety of garnet includes as a constituent, ferrous oxide, and at least one example is as follows: $3FeO$, Al_2O_3, $3SiO_2$. The change in coloring was due to the change from the ferrous to ferric form.

In accordance with the present invention, an agent is employed in which the dispersion medium is water and, more particularly, the garnet is given a surface treatment of ferric oxide hydrosol. The preferred procedure is to employ dialyzed ferric oxide hydrosol since the dialyzed colloid is purged of what is believed to be a salt or salts which, in some instances, causes the formation of hydrogen sulphide in the process which is detrimental to the coloring procedure particularly through certain temperature ranges.

Fig. 1 is a diagram showing a color curve obtained with undialyzed ferric oxide hydrosol.

Fig. 2 is a diagram showing a color curve obtained by ferric oxide hydrosols of different strengths.

Fig. 3 is a diagram illustrating a color curve by the use of dialyzed oxide hydrosol.

One form of the invention is that of preparing a ferric oxide hydrosol by adding ferric chloride to boiling water. For example, 5 cc. of a 10% aqueous ferric chloride solution was slowly added to 500 cc. of boiling water. This resulted in a dark brown dispersion. This dispersion is ferric oxide hydrosol in substantially pure form being substantially free of adulterants of any kind. The quantities above given are exemplary only but are indicative of the relative proportions. Various sols were prepared from this iron oxide hydrosol with varying strength for use directly with the garnet. For example, the sols were prepared by adding to 200 cc. of boiling water various quantities of the ferric oxide hydrosol to-wit: 3 cc., 5 cc., 7 cc., 10 cc., 12 cc., 15 cc., and 20 cc.

Each of these sols have produced a satisfactory coloring thus indicating the relatively wide range of effectiveness of the iron oxide hydrosol. Any one of the sols is added to quantities of the desired grit size of garnet, and one example is 20 cc. of sol to 50 gram portions of ½ grit size of

garnet. In all of the above examples, the proportions of quantities are exemplary only.

The diagram in Fig. 1 illustrates the coloring function of sols prepared in accordance with the above example. As the temperature is elevated from about room temperature to 158° F. the color progressively changed from the original pinkish-red to a dark brown. If a coloring in this range or zone is desired the temperature to which the batch is elevated may be selected as desired. As the temperature is increased up to about 1000° F. the color curve receded as indicated. This was apparently due to the formation or generation of hydrogen sulphide which acts as a reducing agent and is detrimental, of course, to the progressive change in the degree of coloration. From about 1000° F. to 1500° F., the change in coloring again progressed to a point where the garnet became a dark reddish brown. The generation of hydrogen sulphide apparently ceased at about 1000° F. The production of the hydrogen sulphide can be prevented by first drying the batch and then subjecting it to the heat treatment in a dried condition. This, however, is thought not to be preferred, although it is within the invention to do so. Instead it is preferred to dialyze the ferric oxide hydrosol before use as will later appear.

The diagram in Fig. 2 illustrates the coloring effect obtained by the different strengths of the sol. It will be noted that the different strengths of solution of cc. per 200 cc. of boiling water, namely, 3, 5, 7 and 10 progressively resulted in an increased darkening of the coloration in a rather uniform manner and that the maximum darkening of coloration occurred with the solution of about 10 cc. to 12 cc. per 200 cc. of boiling water. Accordingly, it is within the invention to select the strength of the solution to thereby, in a measure, obtain the desired coloration and to control the coloration. Where the sol embodied more than about 12 cc. per 200 cc. of water, the coloration did not appear to be changed over that of 12 cc. per 200 cc. of water. Accordingly a maximum of 12 cc. to 200 cc. of water may be preferred. A second form of the invention may be disclosed by the following example: Preparing the ferric oxide hydrosol by adding a solution of ammonium hydroxide slowly to 2M ferric chloride solution. This addition can be made at the rate of about two drops per second. About 200 cc. of the ammonium hydroxide is the limit to which the same may be added to 100 cc. of the ferric chloride solution at which time the dispersion is very dark in coloring and the ferric oxide ceased to peptize. This sol is preferably filtered through a suitable plug of cotton or the like, to remove the larger particles and substance and is then dialyzed. The ferric oxide hydrosol may be dialyzed by placing the sol in a suitable sack subjected to water and the salt or salts is apparently diffused in the water and thus extracted from the sol. This sol in preparation for use, may be added to boiling water as, for example, in the ratios of 3 cc. to 20 cc. per 200 cc. of boiling water with about 12 cc. of sol preferred. And then a batch of garnet to be treated as, for example, 40 gram portions of the desired grit size of garnet is wetted with about 15 cc. of the sol.

The effect of heating the batch thus treated with the iron oxide hydrosol which has been dialyzed is illustrated in Fig. 3, where it will be noted that the coloration runs from the pinkish red through the browns to a reddish brown. It will be observed that the coloration curve progresses in a substantially uniform manner. There is no drop in the curve caused by the generation of the hydrogen sulphide and the material can be treated while in a wet condition.

No particular time period is required for maintaining the heat treatment. Good results have been obtained, for example, by raising the temperature of a batch up to 1000° F. with the consumed time being only ten minutes. The time depends upon the type of heating equipment and oven. Good results have been obtained by heating the batch to 1500° F. with about the same expenditure of time. The ferric oxide hydrosol is employed as a coloring agent and it is believed that the mineral is colored by the imposing or the applying of a coating of the ferric oxide to the particles. As to the different degrees of coloration, the best theory which can be offered at this time and which, however, is believed to be sound, is that as the heat treatment temperatures are increased more of the ferric oxide is deposited on the surfaces of the particles.

The coloring which is given to the granular particles in this treatment is superficial. Nevertheless the coloring is permanent in that the color will remain fast for an indefinite period. The material is treated preferably while it is in bulk form and the garnet of the desired coloring and grain size may later be used as desired, as by adhesively applying the same to a backing of cloth or paper to provide an abrasive element or applied to suitable backing materials, as above pointed out, for use as a building material, notably roofing. The treatment with the hydrosol also provides a cleaning or washing function, thus removing fine garnet dust and particles. This results in the obtaining of a better adhesive action when the colored garnet is applied to a backing.

I claim:

1. The method of coloring divided garnet which comprises, first wetting a batch of garnet with ferric oxide hydrosol which is substantially free of adulterants and then drying the batch to cause the ferric oxide to superficially color the particles.

2. The method of coloring divided garnet which comprises, first wetting a batch of garnet with dialyzed ferric oxide hydrosol and then drying the batch to cause the ferric oxide to superficially color the particles.

3. The method of coloring divided garnet which comprises, first wetting a batch of divided garnet with ferric oxide hydrosol,, which is substantially free of adulterants, drying the batch while heating the same to cause the ferric oxide to superficially color the particles, and selecting the maximum temperature given to the batch within the range from substantially room temperature to a temperature in the vicinity of 1500° to attain the desired coloration.

4. The method of coloring divided garnet which comprises, first wetting a batch of divided garnet with dialyzed ferric oxide hydrosol, drying the batch while heating the same to cause the ferric oxide to superficially color the particles, and selecting the maximum temperature given to the batch within the range from substantially room temperature to a temperature in the vicinity of 1500° to attain the desired coloration.

5. The method of coloring divided garnet which comprises, preparing a ferric oxide hydrosol which is substantially free of adulterants by adding substantially from one part to ten parts of aqueous ferric chloride solution to substantially one hun-

dred parts of boiling water, wetting a batch of divided garnet with the ferric oxide hydrosol and then drying the batch to cause the ferric oxide to superficially color the particles.

6. The method of coloring divided garnet which comprises, preparing a ferric oxide hydrosol by adding substantially from one part to ten parts of aqueous ferric chloride solution to substantially one hundred parts of boiling water, dialyzing the hydrosol, wetting a batch of divided garnet with the ferric oxide hydrosol and then drying the batch to cause the ferric oxide to superficially color the particles.

7. The method of coloring divided garnet which comprises, preparing a ferric oxide hydrosol by adding a solution of ammonium hydroxide to approximately 2M ferric chloride solution until the ferric hydroxide ceases to peptize, filtering the ferric oxide hydrosol to remove relatively large particles therefrom, dialyzing the ferric oxide hydrosol for the removal of salt, wetting a batch of divided garnet with the hydrosol and then drying the batch to cause the ferric oxide to superficially color the particles.

8. The method of coloring divided garnet which comprises, preparing a ferric oxide hydrosol by adding a solution of ammonium hydroxide to approximately 2M ferric chloride solution until the

ferric hydroxide ceases to peptize, filtering the ferric oxide hydrosol to remove relatively large particles therefrom, dialyzing the ferric oxide hydrosol for the removal of salt, wetting a batch of divided garnet with the hydrosol, drying the batch to cause the ferric oxide to superficially color the particles and heating the batch during the drying thereof and selecting the maximum temperature to which the batch is subjected within the range from substantially room temperature to a temperature in the vicinity of 1500° F. to obtain a substantially predetermined coloration.

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