Patented Mar. 21, 1939 2,151,184

UNITED STATES PATENT OFFICE

2,151,184

MIXED PAINT

Elvin C. Burwell, Los Angeles, Calif., assignor, by mesne assignments, to The Evanston Company, a corporation of Nevada

No Drawing. Application June 1, 1936, Serial No. 82,933

2 Claims. (Cl. 134—39)

The object of my invention is to provide methods for independently controlling the brushing and levelling characteristics of mixed paints and for increasing the physical stability and permanence of such mixtures.

The purpose of a paint is to provide a covering which will hide, decorate and protect a solid surface over which it is applied. For this purpose it must have sufficient opacity to hide the surface beneath, a desired color and sheen, and such degree of resistance to oxidation and other destructive forces as is indicated by the use to which it is to be put. These requirements are met in the proper selection of vehicles and pigments and are aside from the purpose of my invention, other than incidentally.

Assuming that any given paint mixture fully meets the above requirements, it must also have certain physical characteristics to fit it for application to the surface to be protected and for storage in packages without depreciation in quality. These properties may be summarized as the brushing characteristic, the levelling characteristic, the physical stability of the mixture and the permanence of the initial body.

Paints are in most cases applied with a brush and for ease of application it is essential that the paint be readily spread on the surface to be covered. Free and ready brushing, coupled with the ability to spread a film of a desired thickness and hiding power, are properties so desirable as to be practically essential. Free brushing may always be produced by dilution of the paint with a nonviscous thinner, but in this manner only at the expense of hiding power and protective film thickness. My invention is directed to the maintenance of the brushing property entirely or substantially unimpaired while maintaining such body as to allow for any desired film thickness and covering power.

Levelling is a property which may or may not be desired in any specific case. When paint is applied in the usual manner, to form a protective covering film, it is desirable that the applied film should flow or level to such extent as to eliminate brush marks and produce a smooth surface. If the levelling tendency is exaggerated by reason of the paint being too free flowing it may be impossible to produce a film of desired thickness on vertical or sloping surfaces by reason of creeping or dripping. For some purposes, particularly for stippling and traffic paints, levelling is wholly undesirable and the film, of whatever thickness, should stay just where it is applied. My invention is specifically directed to control of the levelling tendency within the widest limits.

Physical stability of packaged goods is always desirable and is of considerable importance. The solid substances (pigments and extenders) which impart hiding power and body to the paint tend to settle out of the vehicle and form deposits on the bottoms of stored packages, and it is essential that this tendency be retarded and limited to the greatest possible extent. Further, the layer of sedimented solids which inevitably accumulates on long standing should be of such consistency as to be readily raised and dispersed in the supernatant layer of vehicle without too long or too vigorous stirring. The drying out of the settled layer: i. e., sedimentation carried to the point where the layer is solid and substantially free from vehicle, may practically destroy the salability of an otherwise excellent paint. My invention is directed toward increasing the time required for any given degree of sedimentation to take place, and toward causing the settled layer to be of a light and easily dispersed consistency.

Permanence of the initial body of the paint is always desirable. Mixed paints are made to such standards of consistency as fit them for specific uses. If the consistency changes materially after the goods are packaged and particularly if this change accumulates over a considerable period, the contents of packages taken from the shelves at various intervals may vary widely in body and be seriously depreciated for that reason. The paints made by the application of my improved methods preserve their initial body over long periods.

The above physical characteristics of any paint are determined, to a large extent, by its consistency, a somewhat vague term which includes with the true viscosity of the vehicle a further and unnamed resistance to flow which is occasioned by suspension in the vehicle of solid particles or particles which behave like solids so long as they are in suspension. The readings of the mobilometer, an instrument standard in the paint trade, are actually readings of consistency rather than of viscosity and will be so termed herein, viscosity being a measurement of fluid friction and properly applicable only to the vehicle portion of a paint. In very fluid paints the consistency may differ little from the viscosity, but in paints of heavy body the divergence is very wide and the use of the term viscosity as synonymous with consistence is misleading.

A paint consists of two ingredients or mixtures

of ingredients—the liquid portion or vehicle and the finely comminuted solid which is dispersed in the vehicle. Further, the vehicle consists of various drying oils, natural or synthetic resins and other bodies which provide the binding agent in the paint film, this mixture usually having a moderate to high viscosity, and one or more thinners, substances having a very low viscosity and used to modulate the viscosity of the binding agent. The solid portion includes always a pigment, providing color and hiding power, and usually includes also an extender or bodying agent.

The extenders commonly used include china clay, whiting and asbestine (a finely ground short fibre asbestos). They are typically chemically inert substances, white or whitish as dry powders but having neither tinctorial nor covering power when suspended in the vehicle, and used solely as bodying agents in the mixed paint. The use of these substances is not sophistication as they have their own function of providing body in the paint for its application as well as in the dried film in which they increase the wearing property. The proper use of true pigment is limited to the quantity required to provide the necessary hiding power and the desired color: beyond such quantity every purpose is served by the use of extenders, at a very much lower cost.

The above named extenders and others in conventional use are heavy, dense and substantially nonporous. When added to a vehicle-pigment mixture in such quantity as to materially increase the consistency they correspondingly depreciate the brushing characteristics. The mixture retains the character of an increasingly viscous liquid and will continue to flow long after the point at which it is possible to continue brush spreading is passed. On the other hand, the resistance to sedimentation is not increased, this being determined by the viscosity of the vehicle itself, and while the rapidity of settling and the density of the settled layer will vary with the specific weight of the extender, those above named are prone to form dense deposits which are difficult to disperse.

I have discovered: first, that the use in a mixed paint of a suitable grade of finely divided diatomaceous earth produces a more fluid paint than one obtained by the use of any of the conventional extenders in like quantity, thus obtaining superior brushing properties while maintaining the hardness and other qualities which are dependent on the proportion of solid mineral matter in the dried film; second, that by incorporating in such a mixture a small quantity of water the body of the paint may be very greatly increased without depreciating the brushing property. By these means the levelling or flowing property is controlled independently of the brushing property and a paint having these properties in any desired relation may be produced. This control may be carried so far that a paint readily spread with a brush may have no flowing characteristic whatever and be completely stable in the position in which it is placed, as for example in stippling. Further, the paints so prepared deposit their solids very slowly, give a light deposit which is readily redispersed in the vehicle, and suffer only a minute change in body on standing even for protracted periods.

Diatomaceous earth is an article of commerce under various trade names and is used for many purposes, the principal application being in the clarification of liquids by filtration. The filtering grades of this earth are less suited to my purpose than the grades known generically as "fillers", consisting of the finer particles separated from the filter-aids by air flotation. These diatomaceous earth fillers consist of extremely minute siliceous particles, usually almost pure silica and having a pronounced structure, being the casts of marine or lacustrine diatoms. The most desirable earths for this purpose are those in which the structure is preponderatingly spicular or needle-like. They occur in various shades from snow white to pale yellowish or pinkish, are practically transparent and colorless in suspension in the vehicle, and therefore have neither tinctorial or covering power. They are chemically inert except to strong alkalis and are very bulky, having also a bulking power in suspension exceeding that which would be indicated by their true specific gravity. They are highly porous and maintain their porosity in a drying or dried paint film, and are neutral or slightly alkaline to indicators, depending on their method of manufacture.

The substitution of diatomaceous earth filler for a conventional extender affects the initial body of the paint as indicated in the following experiment. A standard flat white paint was prepared containing zinc oxide and a lithopone (28% ZnS+72% $BaSO_4$) in a vehicle of varnish, drying oils and mineral spirit with a small proportion of aluminum stearate jelly. To one portion of this paint was added an extender consisting of china clay and asbestine in quantity equal to 16% of the weight of pigment+extender. To another portion was added a diatomaceous earth filler in equal weight proportion. The mixtures were suitably ground in each case to develop covering power and were then tested with the following results:

	Conventional extender	Diatomaceous earth extender
Volume yield, relative	1.00	1.05
Cryptometer reading	10x. 0007	9x. 0007
Hiding power, sq. ft.: gal	581	646
Mobilometer (150 gr. 51 hole)	35	12

In brief, with slight increases in yield and in hiding power, the substitution of diatomaceous earth filler for the customary extender reduced the initial body by approximately two-thirds.

The effect of the substitution on permanence is shown by the following experiment. The paints yielding the above results were sealed in tight cans and allowed to stand undisturbed for periods of 60 days and 120 days, after which they were again given mobilometer tests under the same conditions. The results were as follows:

	Conventional extender	Diatomaceous earth extender
Initial mobilometer	35	12
After 60 days	220	19
After 120 days	165	19

In brief, the paint with the standard extender increased to six times the original body in two months and thereafter diminished somewhat in consistency, while the paint with the diatomaceous earth extender increased to slightly over one and one half times its original body and did not change thereafter. Other experiments not recorded here indicate that the total change in the case of the diatomaceous earth extender takes

place within approximately one day after the final grinding, so that variations in body due to changes of variable magnitude may be corrected before the goods are packaged.

The influence on initial body and on permanence of the addition of water to paints made with diatomaceous earth extender is shown by two experiments in which water equal in weight to 1% of the total weight of pigment + extender was incorporated in a paint similar to the second example given above. The two samples tested were prepared separately, with identical weights and volumes except that in the second the small quantity of aluminum stearate was omitted in mixing the vehicle. The products were given the mobilometer test immediately after introducing the water, again after the lapse of 24 hours and finally after the lapse of 60 days, with the following results:

	Initial	24 hours	60 days
With stearate, no water	13		19
With stearate, 1% water	24	38	42
Without stearate, 1% water	50	52	54

It will be seen that in these tests the initial mobilometer reading was doubled by the addition of water to the formula containing aluminum stearate and multiplied by four when the stearate was omitted. In the first case (with stearate and water) the increase in body on standing was practically complete in one day, as has been noted in numerous other experiments. In the last experiment there was substantially no change from the initial body.

By this increase in consistency the settling rate was greatly retarded and, as in the case of diatomaceous earth mixtures containing no water, the deposit after even several months standing was light and readily raised and remixed by gentle stirring.

The increase in consistency produced in the ordinary manner, either by increasing the relation of total mineral matter (pigment + extender) to vehicle or by increasing the true viscosity of the vehicle, is of entirely different character from that produced in the manner just described, by incorporating water in a paint containing a material proportion of diatomaceous earth.

In the conventional practice, as already noted, the mixture which becomes progressively thicker with continued addition of solids retains the character of a progressively thickening liquid and becomes increasingly difficult to spread with a brush. In the practice herein disclosed the increase in body is due to the gradual acquisition of a salve-like consistency which progressively retards flow but has very little effect on brushing. A four-fold increase in body produced in this manner produces no appreciable increase in the resistance to brush spreading, and this characteristic of smoothness and lack of stickiness under the brush is maintained up to or even past the point where flow entirely ceases.

For example, a mixture containing 4 pounds lithopone and 4 pounds diatomaceous earth filler to one gallon of a varnish-linseed oil vehicle, in which was incorporated water to the extent of 2% of the weight of pigment + extender formed a buttery stippling paste too stiff to be picked up on a brush but which could be freely spread and stippled with a trowel. The stipple thus produced was heavy and sharp, looking like stippled plaster. On slightly thinning this paste with mineral spirits, to such consistency as just to permit its being picked up on a brush, it spread almost as freely as a low bodied paint but was devoid of any tendency to flow, even in thick films, and took a brush stipple which remained sharp until dried.

It should particularly be noted that paints thickened in this manner behave normally when progressively diluted by the addition of thinners. That is to say, they become progressively thinner and do not show any tendency to "break" or lose their body suddenly, a characteristic of paints thickened by the addition of large quantities of soap or alkali solutions.

It is generally known that paints containing conventional extenders are at times bodied up by using soaps or alkalies to form emulsions and that such paints continue to change in body on storage. Such methods of bodying are often detrimental to the film by reason of chemical reactions taking place and the large amounts of water solutions necessary.

The nature of the change in physical structure by which the salve-like structure is imparted to the paint by my process is not known to me. It occurs to an appreciable and useful extent only in the use of diatomaceous earth, to a very slight extent and only with a much larger proportion of water in the use of china clay, and not at all with any other extender known to me. The effect is not in any degree dependent on the acidity of the vehicle, experiments with vehicles ranging from 2 to 15 acid number giving identical results. Nor is it changed in any manner by rendering the earth distinctly acid or alkaline, though of course the addition of any large proportion of alkali is detrimental as attacking both the diatomaceous earth and the oily portion of the vehicle.

For uses in which the presence of the above minute quantities of water is objectionable, as for example in paste wood fillers in which water tends to raise the grain of the wood, alcohols may be substituted in the same proportions and with the same results. Thus, a paste wood filler having an ester gum varnish, linseed oil and mineral spirit vehicle and diatomaceous earth as a sole mineral ingredient, was blended with a four to one mixture of ethanol and butanol in the proportion of 1 volume mixed alcohols to 12 volumes finished paste. This mixture had the salve-like consistency characteristic of water mixtures, brushed freely and was free from any tendency to lift or drag out of the depressions in the wood when cross-brushed. This paste did not settle appreciably when allowed to stand for thirty days and was ready for use after gentle stirring.

In the use of diatomaceous earth to replace conventional extenders, care must be taken to avoid overgrinding. If the pigment requires more than a mild grinding in the vehicle, it should first be ground until covering power is fully developed. The diatomaceous earth should then be added and the mixture ground very lightly so as to avoid breaking down the structure of the diatoms. Diatomaceous earth is exceptionally wettable by commercial paint vehicles and the grades of earth used for this purpose are already in large part of suitable particle size. The final grinding required is merely that necessary to break up slight agglomerates of earth.

The addition of water or alcohol may be made during this final light grinding, but it is preferable to incorporate the liquid with the paint after the grinding operations are completed. In the

case of paints of ordinary consistency this addition may be made in any convenient or preferred stirring apparatus while the pasty products may be handled in a putty chaser or similar device. Stirring should be continued until the bodying-up action is completed, usually about fifteen minutes. When this point is reached neither water particles nor emulsion particles may be discerned under strong magnification, the only visible evidence of change in structure being a slight indication of flocculation of the suspended solids.

The water used in the above process should be free from suspended solids or organic matter but need not be otherwise pure. The water supplied to cities for domestic use and any water suitable for use in a steam boiler is of ample purity. Waters containing excessive quantities of salts or alkalis should be avoided, not because these impurities materially affect the bodying action but because of their detrimental action on the paint film after drying. The deliberate addition of alkalis or soaps to the water should be avoided for this reason.

I claim as my invention:

1. A mixed paint comprising a drying oil vehicle, a pigment, approximately 10 percent of finely comminuted diatomaceous earth, and from ½ percent to 2 percent of intimately incorporated water, said percentages being based on the total weight of finished paint.

2. A mixed paint comprising a drying oil vehicle, a pigment, an extender of which approximately 10 percent is diatomaceous earth, and from ½ percent to 2 percent of intimately incorporated water, said paint being substantially free from alkalis and soaps, said percentages being based on the total weight of finished paint.

ELVIN C. BURWELL.