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WOOD FILLER COMPOSITION

Leo Roon, Southold, N. Y., and William T. Smith, Rahway, N. J., assignors to Interchemical Corporation, New York, N. Y., a corporation of Ohio

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This invention relates to the art of filling pores of wood prior to the application thereto of suitable finishes.

The filler compositions which have long been used for this general purpose embody inert solid filler particles (which may be generally termed pigments) in an appropriate binder. These have generally been mixed in the form of a paste. To prepare the paste for use there is added thereto a suitable solvent for the binder and the entire composition and solvent is stirred to produce a creamy homogeneous filler in which the binder is completely dissolved in the solvent diluent. The mixture is then ready to be applied to the wood.

The resulting diluted filler is applied by brush or in any other convenient way to the surface of the wood to be filled, and after it has been allowed to stand for a while, during which time considerable diluent evaporates and the filler coating on the wood becomes dull in appearance, it is subjected to a "padding" operation which consists in rubbing the thus deposited filler with a pad for the purpose of packing the filler into the pores of the wood, and removing the excess from the surface.

In prior fillers the pigments employed have generally been silicon dioxide, the function of which is to produce a mechanical interlocking with the wood structure, a suitable extender such as gypsum or kaolin to increase the bulk, and an appropriate porous material, such as magnesium silicate, which is well adapted to act as a bulky suspension aid for the other inerts.

In all prior fillers of the character described it has been the universal practice to employ as binder an oxidizing oil which is soluble in the solvent diluent subsequently added to the paste to prepare it for use. Linseed oil has been commonly used in this connection, as well as so-called long oil varnishes, so that when the "padding" or cleaning up operations of filling the wood are carried out, the filler composition would remain soft and workable for a considerable period of time in order to permit the workmen to wipe off the excess deposited filler from the surface of the wood, leaving the top surface of the wood entirely clean but with the filler thoroughly deposited in the pores of the wood. It is obvious that filler compositions of this type require a lengthy drying period, depending upon the rate of oxidation and polymerization of the oil or the long oil varnish. Some attempts have been made to use quick drying binders in lieu of the drying oil or the long oil varnish binder,

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but the setting of the filler deposited on the wood came so quickly and nonuniformly (the thinner deposits dried first and the thicker deposits dried later) that it became impossible and impractical for a workman to clean reasonably large surfaces of wood, such as are found in radio cabinets, furniture, etc., and to produce uniform results. This practice left streaks where the filler had dried and these streaks could not be removed unless the surfaces were again wetted with a solvent, in which case the filler was pulled out of the pores. On the other hand, if the work were to be cleaned without partial wetting, the "padding" had to be done so quickly that very little of the filler composition was actually padded or brushed into the pores of the wood. In addition, such quick drying binders require relatively high priced reducers or diluents, such as high boiling alcohols or esters, as against the more economical aliphatic hydrocarbons which are commonly used as thinners.

For these reasons it has been heretofore considered impractical to employ quick drying binders and the art has had to be content, all things considered, to continue the use of the relatively slow drying binders of the type to which we have referred.

The conventional fillers to which reference has been made, give a satisfactory end product insofar as the filling of the pores and the conditioning of the wood for a subsequent finish is concerned, but they all require a long time to dry, or to set to a point where, for instance, a lacquer coating can be applied to the wood. Usually overnight drying is best, but four hours has been considered the minimum period to condition prior fillers to take a lacquer finish. If lacquer or other similar coatings are applied over a filler which is not sufficiently dry or set, there is a marked tendency toward grayness of the pores and a shrinking of the filler in the pores as it continues to set under the coating, causing blisters or pinholes in the coating. For an occasional operation, the time required for the conventional filler may not be critical, but where large production is desired, the time of waiting for this type of filler to set results in a serious "bottleneck" and materially slows down the production output. Furthermore, the binder of conventional fillers, even if thoroughly dry, is easily attacked by the solvents of subsequent lacquer coatings and it is one of the difficulties well known to the trade that such fillers often puff and swell under a lacquer coating, to shrink back finally to a point below the surface level.

One object of the present invention, which is a continuation in part of our application Serial No. 616,970, filed September 17, 1945, now abandoned, is to accomplish a satisfactory filling of the pores of the wood by means of a filler which sets in a fraction of the conventional drying time, and yet permits the mechanical filling operation to be done as easily and quickly without streaking the surface of the wood or pulling the filler out of the pores.

Another object is to provide a quick drying wood filler which does permit the use of the relatively inexpensive conventional aliphatic hydrocarbon reducers.

Our experimentation and research have resulted in the accomplishments of these objects and others by a revolutionary departure from prior practice. The invention which we have made is based on an entirely new principle which enables us to replace the slow drying oxidizing oil binders of prior art and to successfully employ quick drying binders in exerting a retarding effect upon the drying of them so that they are kept at a state of proper working consistency for at least such a length of time as is required for padding, wiping and cleaning of a relatively larger surface area in order that the filler may be applied at once to such an area without difficulties.

Our filler composition consists, in principle, of (*a*) a solvent soluble, quick drying binding material which substantially dries by evaporation of the solvent rather than by oxidation, (*b*) a solvent for the said binder, (*c*) pigments incorporated in the binder solution to produce a filler paste, and (*d*) an incompatible diluent which causes the binder to separate from the solution. We found that upon addition of the incompatible diluent a flocculent precipitate occurs which adsorbs or rather envelops the pigment particles and forms agglomerates with them which remain well suspended after addition of so much of the incompatible diluent as is required to reduce the filler paste to working consistency. When we apply a filler of this composition upon the wood and permit the vehicle to partly evaporate to the proper point of "padding," we find that we are able to fill the pores of the wood with great ease and without stickiness or drag on the "pad" and without streaking or premature drying and that we are able to obtain perfectly clear wood surfaces with pores completely filled. The mechanical working ability of this filler is at least the equal of the slow drying oil types of fillers of the prior art.

The principal difficulty encountered in prior attempts to use quick drying binders in wood filling compositions was due to the fact that the binders were in colloidal solution in a solvent. Upon partial evaporation of the solvent, just at the time of padding, the filler became sticky and unworkable. In adding a non-solvent to the binder solution, the resin exists, after partial evaporation of the vehicle at the time of padding, in a friable, flocculent and non-sticky form which lends itself well to be packed into the pores of the wood without pull-out or drag on the pad.

Having succeeded in preparing a usable wood filler in the indicated manner, it seemed reasonable to try preparing an equally useful filler composition by what appeared to be a more practical way, namely, reducing the resin first to minute particle size by any suitable means and dispersing it then in the non-solvent without the presence of a solvent for the resin. However, a

usable filler composition could not be prepared in this manner. It appears that not all of the resin is thrown out of solution upon the addition of non-solvent to the pigmented resin solution in amounts as herein disclosed. Some of the resin remains in solution and by virtue thereof, acts as a self-plasticizer for the precipitated portion of the resin and as such performs several vital functions; first, it aids in the formation of the agglomerates between the resin particles and the pigments, second, it acts as a suspending aid for these agglomerates, and third, it substantially increases the homogeneity and cohesiveness of the applied filler. Our belief in the stated principle is supported by the observation that thinning beyond the indicated limits results in an irreversible breakdown of the flocculents, causing the binder and pigments to collect at the bottom of the solution.

By means of this principle we have been able to introduce extremely quick drying binders at low costs and to ameliorate to a great extent the difficulties and disadvantages which have been previously described.

For the filler composition of this invention we may embody the appropriate inert solid filler particles which have been heretofore employed, such as silicon dioxide, kaolin, and magnesium silicate. In connection therewith we use binders in solvent solution which are thrown out of solution in the above described manner when a volatile, incompatible solvent is added to the binder solution with the pigments evenly dispersed therein. In general, any water-insoluble, quick drying material may be used as the binder, provided it is soluble in an easily volatilized solvent and separates from the solvent solution upon addition of another, incompatible solvent. We have had excellent results when employing certain natural resins, such as shellac and gum accroides, or various synthetic resins, such as oil modified phenol-formaldehyde resins, saturated oil fatty acid-modified glycerol phthalates, or the conjoint polymerization products of a drying oil acid modified alkyd with styrene, and others.

The diluent used in connection with binders of the character described must be one which is at least partially non-compatible with the dissolved binder so that part thereof is thrown out of solution upon addition of the diluent and forms the aforesaid flocculents. For this we have used mineral spirits with highly satisfactory results. Other suitable diluents or combinations of diluents may also be used, such as a combination of mineral spirits, viz., aliphatic hydrocarbons, with an aromatic hydrocarbon. Hydrogenated and/or aromaticized aliphatic solvents may also be employed as the diluent but, obviously, they must be at least partially incompatible with the binder resin.

The mixture of the filler paste and the diluent should be of creamy consistency, having substantially the same appearance as prior conventional fillers when ready for use. This consistency may be obtained through the use of approximately one part by volume of paste to one and one-quarter parts by volume of thinner, which, in the average, corresponds to 8.25 parts by weight of thinner to 13.5–14 parts by weight of filler paste, providing a composition, ready for use, of about 11 lbs. per gallon. In the filler, the amount of binder used may correspond to conventional proportions between inert solid particles and binder if so desired, but it is one of our

outstanding advantages that the amount of binder may be greatly reduced without impairing the results. Therefore, in practicing our invention we keep the binder ratio very low, down to about one-half of the conventional.

When applied to the wood by brush or otherwise, the filler composition settles readily in the pores and, since it does not form a tenacious coating or layer, any excess thereof may easily be removed from the surface. After standing at room temperature for a period substantially the same as usual for conventional filler treatment, the filler composition will assume the mealy consistency and appearance of conventional fillers at that stage. By this time, the agglomerates may be packed firmly into the pores of the wood by a "padding" operation which cuts the filler level with the wood surface. Inasmuch as these fillers set or harden sufficiently to permit a subsequent coating with lacquers and the like without difficulties in but a fraction of the time required for the drying of the conventional drying oil or long oil alkyd base fillers, the present invention aids materially in manufacturing output and eliminates the "bottleneck" to which we have referred.

As it is desirable in the filling of wood for most finishes to have the pores of the wood clearly visible, it is the practice to incorporate in the fillers appropriate coloring matter. We accomplish this result by adding to the filler mixture, while in the form of a paste and before the addition of the diluent, appropriate earth pigments and bone black and the like. These serve, when the filler is used, to keep the pores quite dark, while the background color on the flake of the wood gives the desired color match. In gilsonite we found a material especially valuable for this purpose.

It will be apparent from the foregoing that this invention is not restricted to specific ingredients. However, the following paste formulations are illustrative:

Example I

Into 20 lbs. of a xylol solution containing 35 per cent of the conjoint polymerization product of 4.5 lbs. of a drying oil acid modified alkyd resin (38% phthalic anhydride, 22% glycerol, 40% unsaturated oil fatty acids) and 2.5 lbs. of monomeric styrene, and having a Gardner reading D, there is thoroughly mixed:

41 lbs.	8 oz.	silicon dioxide
11 lbs.	8 oz.	kaolin
13 lbs.		magnesium silicate
3 lbs.	8 oz.	raw umber
4 lbs.		of an 82% solution of gilsonite in mineral spirits
	8 oz.	bone black
6 lbs.		mineral spirits
100 lbs.		

In order to attain the proper consistency for application, the filler paste of the above and the subsequent examples is to be cut, with mineral spirits or any other suitable volatile non-solvent for the resin as diluent, in case of mineral spirits, preferably as a ratio of one part by volume of the paste to not more than one and one-quarter parts by volume of the thinner.

Example II

To a solution of 7.35 lbs. of a saturated fatty acid modified glycerol phthalate (phthalic anhydride 46%, glycerol 28%, stearic and cocoanut oil fatty acids 13% each) dissolved in 13.65 lbs. xylol, there is added, while agitating:

41 lbs.	8 oz.	silicon dioxide
11 lbs.	8 oz.	kaolin
13 lbs.	5 oz.	magnesium silicate
3 lbs.	8 oz.	raw umber
3 lbs.	8 oz.	of an 82% solution of gilsonite in mineral spirits
	9½ oz.	bone black
5 lbs.	1½ oz.	mineral spirits
100 lbs.		

Example III

Into 20 lbs. of the 35% xylol solution of the conjoint polymer of styrene-drying oil modified alkyd resin of Example I, there is mixed:

39 lbs.	8 oz.	silicon dioxide
11 lbs.	8 oz.	kaolin
13 lbs.		magnesium silicate
4 lbs.	8 oz.	burnt umber
2 lbs.		bone black
2 lbs.		yellow lake pigment
3 lbs.	8 oz.	of an 82% solution of gilsonite in mineral spirits
4 lbs.		mineral spirits
100 lbs.		

Example IV

To a solution of 9 lbs. gum accroides, dissolved in 11 lbs. ethyl alcohol, there is added, while mixing:

41 lbs. silicon dioxide
12 lbs. kaolin
14 lbs. magnesium silicate
7 lbs. burnt umber or Van Dyk brown
6 lbs. toluol

100 lbs. paste

Example V

To 20 lbs. of a 60% toluol solution of a tung oil modified phenolic resin of the heat reactive type, made by heating the condensation product of about two mols of phenol and one mol of formaldehyde with tung oil at a weight ratio of about one to one, there is added, under agitation:

41 lbs. silicon dioxide
12 lbs. kaolin
14 lbs. magnesium silicate
7 lbs. burnt umber
6 lbs. mineral spirits

100 lbs. paste

Due to the nature and purpose of the herein exemplified compositions, quantitative changes of constituents are permissible within a considerable range. We obtain useful filler pastes having from 7 to 12 parts binder resin. While 7 parts appear to be the practical minimum to obtain a proper sealing of the pores of the wood, the workability of the filler is adversely affected if the paste contains more than 12 parts of the binder.

The ratio of inert pigments is preferably kept at 55–68 parts. We like to add them in such proportions that about four-sixths of the total pigments is silicon dioxide while kaolin and magnesium silicate roughly represent one-sixth each.

The addition of more than 7 parts of gilsonite causes stickiness. At a ratio of 2 to 4 parts, gilsonite aids materially in darkening the pores, while 4 to 7 parts specifically tend to brighten the yellow undertone of the wood.

It is obvious that other changes may be made

without departing from the scope of the invention.

We claim:

1. A composition according to claim 10, in which the resin is the conjoint polymerization product of 4.5 parts of a 40% drying oil acid modified alkyd and 2.5 parts monomeric styrene.

2. A composition according to claim 1, in which the solvent for the resin is xylol and the non-solvent for the resin is mineral spirits.

3. A composition according to claim 2, which comprises about 13 parts by weight of xylol and about 7.5 parts by weight of mineral spirits per 7 parts by weight of the resin.

4. A composition according to claim 3 comprising about 65 parts by weight of wood filler pigments per 7 parts by weight of resin.

5. A composition according to claim 10, in which the resin is a modified alkyd, prepared from 28 parts glycerol, 46 parts phthalic anhydride and 13 parts of each stearic acid and cocoanut oil fatty acids, and in which the volatile organic solvent for the resin is xylol and the volatile organic non-solvent for the resin is mineral spirits.

6. A composition according to claim 5, comprising about 65 parts by weight of wood filler pigments, 21 parts by weight of a 35% solution in xylol of the resin and about 5 parts by weight of mineral spirits.

7. A composition according to claim 10, comprising agglomerates of 41 parts by weight silicon dioxide, 12 parts by weight kaolin, and 14 parts by weight magnesium silicate with 9 parts per weight gum accroides, dispersed in a mixture of 11 parts by weight ethyl alcohol, and 6 parts by weight toluol.

8. A wood filler composition characterized by having a binder constituent taken from the group of natural resins, oil modified phenol formaldehyde resins, saturated oil fatty acid-modified glycerol phthalates and conjoint polymerization products of a drying oil acid-modified alkyd with styrene, said composition comprising a continuous phase consisting of one portion of the resin dissolved in a mixture of a volatile organic solvent for the resin and a volatile organic non-solvent for the resin, and a flocculently dispersed phase consisting of aggregates between pigments, the remaining portion of the resin and part of the said solvent for the resin.

9. A wood filler composition characterized by having a binder constituent taken from the group of natural resins, oil modified phenol formaldehyde resins, saturated oil fatty acid-modified glycerol phthalates and conjoint polymerization products of a drying oil acid-modified alkyd with styrene, said composition comprising a continuous phase consisting of one portion of 7 to 12 parts of the resin dissolved in a mixture of a volatile organic solvent for the resin and a volatile organic non-solvent for the resin, and a flocculently dispersed phase consisting of aggregates between 55 to 68 parts of pigments, the remaining portion of the resin and part of the said solvent for the resin.

10. A wood filler composition characterized by having a binder constituent taken from the group of natural resins, oil modified phenol formaldehyde resins, saturated oil fatty acid-modified glycerol phthalates and conjoint polymerization products of a drying oil acid-modified alkyd with styrene, said composition comprising a continuous phase consisting of one portion of 7 to 12 parts of the resin dissolved in a mixture of a volatile organic solvent for the resin and a volatile organic non-solvent for the resin, and a flocculently dispersed phase consisting of aggregates between 55 to 68 parts of pigments consisting to about four-sixths of silicon dioxide and to about one-sixth of each kaolin and magnesium silicate, the remaining portion of the resin and part of the said solvent for the resin.

LEO ROON.
WILLIAM T. SMITH.

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