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FIRE RETARDING IMPREGNATING
COMPOSITION FOR WOODGrinnell Jones and Walter Juda, Cambridge,
Mass., assignors to Albi Chemical Corporation,
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5 Claims. (Cl. 167—38.5)

The present invention relates to wood fireproofing compositions and more particularly to such compositions suitable for fireproofing the wood of frame dwelling interiors.

Of paramount importance among the measures which should be taken to reduce the fire hazard in wood structures, particularly frame dwellings, is that of fireproofing the wood itself wherever possible, particularly in the attics of frame dwellings where the hazard of fire starting from fire bombs is greatest and the wood is usually in an unfinished state in which it may be readily subjected to fireproofing impregnation treatment. It is the object of this invention to provide a wood fireproofing impregnating composition particularly suitable for this purpose.

In order to fulfill this object satisfactorily, it is necessary that the composition provided should possess certain attributes. First and foremost, of course, it should have the property of greatly reducing the inflammability of wood and rendering it resistant to afterglow. It should have high penetrating power so that it may be applied to an exposed surface of the wood and penetrate deeply therein without application of vacuum-pressure treatments which are not feasible after wood has been embodied in construction. It should be easy, safe and not unpleasant to apply, as by merely painting or spraying on the wood surface without accompaniment by toxic, irritating, suffocating, explosive or inflammatory fumes or by bad odor. It should have an affinity for cellulose fibre but must not attack it in a manner to reduce its strength. It should reduce rather than promote the tendency of the wood to rot in the presence of moisture and should therefore be non-hygroscopic and fungicidal. It should not cause excessive rusting or corrosion of nails or other metal parts used in the building construction to an extent which would weaken the structure. Finally, it should be inexpensive and should comprise only readily available chemicals which are not difficult to obtain.

Our present invention provides compositions possessing all the foregoing attributes and which consist of stabilized water solutions of a fireproofing agent, a fungicide and a compatible wetting agent. A preferred composition contains, dissolved in water, the following ingredients in approximately the following proportions:

	Per cent
Monoammonium phosphate or diammonium phosphate	20-30
Copper sulphate	3-6
Ammonia (29.4% techn.)	5-20
Wetting agent	1-10

In this preferred formula, the phosphate, monoammonium or diammonium, is the fire retarding agent, and is not only exceedingly efficient as such, but is also an effective glow-preventing agent. It has also the advantage of low cost and is readily obtainable. Other low cost available fire retarding agents which may be used are sodium phosphates, boric acid, borax and other borates such as ammonium borate, and ammonium sulfamate. But we have found the ammonium phosphates to be preferable because they have afterglow preventing properties which the other agents mentioned do not possess and because they are more easily worked with in preparing the composition. We have found that the presence of 20% or over of the fire retarding agent is adequate for flame and afterglow proofing purposes and we prefer to keep the quantity of this agent between 20 and 30%, as greater proportions tend to make the compositions unstable.

Mono- and diammonium phosphate are readily soluble in water which facilitates their use in preparing the composition and does not detract from their suitability, as the composition of the invention is intended primarily for fireproofing of wood which is protected from exposure to weather, as in house interiors. They are, however, excellent plant foods and, if used alone, would promote the growth of fungi and, consequently, rotting of the wood. To avoid this, we include in the composition copper sulfate which has a fungicidal action. Other fungicides could be used, such as arsenates and other copper salts such as copper fluoride. But these are of a poisonous character and if used in substantial quantities, require protection of the worker as by a mask, gloves, etc. Copper sulfate does not involve this difficulty, its presence in the proportions mentioned renders the composition sufficiently fungicidal in character for most uses, it is non-hygroscopic and is inexpensive and available. In addition, copper sulfate imparts to the composition an affinity for the cellulose fibres but does not attack and weaken them and this is important in the effectiveness of the composition for its intended purpose.

The fungicidal character of the composition can be somewhat increased by the use of small amounts of sodium fluoride in addition to the copper sulfate. For example, we may add 0.8-2% of sodium fluoride dissolved in ammonia. When this is done, however, there is a tendency of the other ingredients of the composition to precipitate on standing which may be undesirable, particularly when it is desired to apply the composition with a spray gun.

The use of ammonia in the composition is for the purpose of stabilizing it, particularly to prevent the copper sulfate and ammonium phosphate from precipitating copper phosphate. It also co-operates with the copper sulfate in imparting to the composition an affinity for cellulose fibres, forming, with the copper sulfate, copper ammonia complex salts which have such affinity to a marked extent. When the other ingredients are diammonium phosphate and copper sulfate, the amount of ammonia used is determined as the amount necessary to prevent precipitation of copper phosphate, as the diammonium phosphate in water solution is substantially stable. In such case, we have found that the quantity of ammonia added should be about 60% in excess of the theoretical amount necessary to convert all the copper sulfate into copper ammonia sulfate. For example, when 3% of the composition is copper sulfate, 5% of the ammonia will ordinarily be sufficient. When monoammonium phosphate is used as the fire retarding ingredient, enough additional ammonia should be used to convert this to diammonium phosphate. Also, if sodium fluoride is used, additional ammonia is necessary to prevent precipitation of copper fluoride. As too much ammonia in the composition will produce fumes which make it somewhat unpleasant to use, it is well to use as small an amount of the copper sulfate as possible consistent with providing adequate fungicidal and cellulose affinity properties for the composition.

While a fireproofing composition containing the ingredients so far described has some penetrating power, particularly in the case of relatively porous woods such as pine and fir, it is important that this be substantially increased by the addition of a compatible wetting agent. We have found that certain wetting agents are suitable for this purpose and are compatible with the other ingredients. Those found most suitable are mixtures of soap or sulfonated castor oil with alcohol such as iso-propyl alcohol, and compounds chemically similar to an ester of a sulfonated bi-carboxylic acid such as the wetting agents sold under the trade name Aerosol, Aerosol MA (dihexyl sodium sulfosuccinate) and Aerosol IB (dibutyl sodium sulfosuccinate) have been found to be particularly effective. Suitable proportions of the wetting agent are 1% soap and 7% iso-propyl alcohol, 3-5% sulfonated castor oil and 5-7% iso-propyl alcohol, 0.5-1% Aerosol with or without 1-5% iso-propyl alcohol. Use of soap, while advantageous from the point of view of low cost and availability, has a tendency to cause precipitation when the composition is allowed to stand for any length of time and this tendency makes it somewhat difficult to use the composition in spray guns. Accordingly, it is somewhat preferable to use one of the other wetting agents mentioned.

In preparing compositions according to the

preferred formula, we preferably first dissolve the ammonium in the water, then stir in the copper sulfate until completely dissolved, then add the other ingredients, stirring until completely dissolved. The procedure is simple and inexpensive, requiring no complex equipment. In fact, the ingredients may be supplied to the user in a dry mixed state for dissolution by the user in an appropriate quantity of water or ammonia and water.

While we have described herein preferred ingredients and proportions, it will be understood that we do not intend the invention to be thereby limited but only as may be required by the appended claims.

We claim:

1. A composition for impregnating wood to reduce the inflammability thereof, comprising an aqueous mixture containing, to the extent of at least 20% of the composition, a compound selected from the group consisting of ammonium phosphate, ammonium borate and ammonium sulfamate, said composition also containing a water-soluble copper salt in amount not exceeding 6%, and ammonia.

2. A composition for impregnating wood to reduce the inflammability thereof, comprising an aqueous mixture containing the following ingredients in substantially the proportions specified:

	Per cent
Ammonium phosphate -----	20-30
Copper sulfate -----	3-6
Ammonia -----	5-20

3. A composition for impregnating wood to reduce the inflammability thereof, comprising an aqueous mixture containing ammonium phosphate to the extent of at least 20% of the composition, copper sulfate in amount not exceeding 6% of the composition, ammonia, and dihexyl sodium sulfosuccinate.

4. A composition for impregnating wood to reduce the inflammability thereof, comprising an aqueous mixture containing, to the extent of at least 20% of the composition, a compound selected from the group consisting of ammonium phosphate, ammonium borate and ammonium sulfamate, said composition also containing a substance selected from the group consisting of dihexyl sodium sulfosuccinate and dibutyl sodium sulfosuccinate.

5. A composition for impregnating wood to reduce the inflammability thereof, comprising an aqueous mixture containing ammonium phosphate to the extent of at least 20% of the composition, a water-soluble copper salt in amount not exceeding 6% of the composition, ammonia, and a substance selected from the group consisting of dihexyl sodium sulfosuccinate and dibutyl sodium sulfosuccinate.

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