United States Patent Office 3,247,059
Patented Apr. 19, 1966

3,247,059

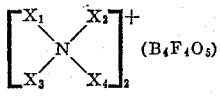
WOOD PROTECTION AGENTS

Dieter Bauer, Krefeld-Bockum, Germany, assignor to Farbenfabriken Bayer Aktiengesellschaft, Leverkusen, Germany, a German corporation

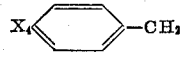
No Drawing. Filed Jan. 30, 1963, Ser. No. 255,093
Claims priority, application Germany, Feb. 6, 1962, F 35,944
4 Claims. (Cl. 167—38.6)

The object of the present invention is a new wood protection agent which consists of liquid, water-contaning ammonium fluoroborates with an atomic ratio of boron to fluorine of about 1:1.

The precise composition of these ammonium fluoroborates is not known but they may, perhaps, correspond to about the formula:



wherein X_1, X_2, X_3 and X_4 may be H, CH_3, C_2H_5 and C_2H_4OH, X_1, X_2 and X_3 may be H and X_4 may be OH, NH_2, CH_3, C_2H_5, C_3H_7 and C_2H_4OH, X_1 and X_2 may be H and X_3 and X_4 may be CH_3, C_2H_5, C_3H_7 and C_2H_4OH, X_1 may be H and X_2, X_3 and X_4 may be CH_3, C_2H_5, C_3H_7 and C_2H_4OH, and X_1, X_2 and X_3 may be CH_3 and



These compounds are obtained by the mixing of, for example, 1 mol of ammonium bifluoride with 2 mols of boric acid with the addition of some water and possibly some excess of ammonia and/or excess of ammonium compound, such as hydroxyl amine, hydrazine, methyl, dimethyl or trimethyl amine, ethyl, diethyl or triethyl amine, propyl, dipropyl or tripropyl amine, ethanol amine, diethanol amine or triethanol amine or diethyl benzyl amine. Instead of ammonium bifluoride, it is also possible to start from ammonium fluoride or from mixtures of hydrofluoric acid with ammonia or ammonium bases and, instead of from boric acid, from partially anhydrous boric acid or boric anhydride. If desired, some urea can also be added.

In comparison with the known wood protection agents, the ammonium fluoroborates are characterized by an exceptionally high solubility in water. At 20° C., about 900 parts (referred to the solid starting materials) dissolve in 100 parts of water.

This has the result that wood or wood-containing materials, such as wood shavings which are to be worked up to chip boards, take up so much wood protection agent by a single treatment with the wood protection agent, for example, by a single dipping or by painting or spraying, that they become difficultly inflammable. As a result of the fungicidal and insecticidal properties of the ammonium fluoroborates, the wood is also substantially protected against the attack by biological destructive agencies, such as fungi and insects.

The new wood protection agent also has the further advantage that it does not affect the ability to be glued of the wood treated therewith. A special drying of the wood or of the wood-containing materials before glueing is not necessary, because of the low water content of the new wood protection agent.

As a rule, a good protection of the wood is obtained when about 50–250 grams, and especially about 100*200 grams, of the wood protective agent (referred to the solid content of the agent) is applied to square meter of wood or with an addition of about 3–10 percent by weight of wood protective agent, referred to absolutely dry wood, in the case of wood materials.

If desired, other known flame-proofing materials and wood protecting agents, such as ammonium sulphate, can be added to the liquid, water-containing ammonium fluoroborates.

Admittedly, boron- and fluorine-containing wood protection agents are known which correspond to the general formula:

$$Me(I)(BF_{2-4}(OH)_{0-2})$$

in which, consequently, the atomic ratio boron to fluorine amounts to 1:2 to 1:4 and wherein Me(I) signifies a monovalent cation. However, boron fluorides of this type are less soluble than the ammonium fluoroborates. Therefore, their concentration in the wood is, as a rule, much too low to be able to make the wood difficultly inflammable. Their importance lies, on the contrary, in the protection of the wood against biological destructive agencies, especially when they are used together with chromates and/or arsenates so that, by a suitable choice of the additional materials, well-fixed precipitates are formed in the wood.

The ammonium fluoroborates are, with regard to their solubility in water, also significantly superior to the known "phosphate combination" flame-proofing agents, which are mainly ammonium phosphates with an addition of fluorides or borates or boric acid. The "phosphate combinations" dissolve in water at 20° C. only to an extent of about 50–70 parts in about 100 parts of water. In order to achieve a sufficiently difficult inflammability of the wood with them, it is, consequently, necessary to apply several treatments of the wood with these agents. Furthermore, the wood treated with such "phosphate combinations" must be dried before glueing which, as mentioned, is not necessary in the case of the use of the ammonium fluoroborates according to the present invention.

The following examples are given for the purpose of illustrating the present invention:

Example 1

570 grams of ammonium bifluoride are mixed with 1260 grams of boric acid, with the addition of 255 grams of a 25 percent ammonia solution, to give a solution which contains 925 parts by weight, referred to the solid starting materials, in 100 parts by weight of water.

Rough sawn pine planks of 20 millimeters thickness are impregnated with the solution by painting once with an amount of about 170 grams/m.^{2}. After drying, the so treated wood is difficultly inflammable and also protected against-wood-destroying fungi, such as *Poria vaporaris*, and against wood-destroying insects, such as the larvae of the death watch beetle.

Example 2

To a mixture of 6 mols of boric acid and 3 mols of ethanol amine there are dropped under cooling 6 mols of hydrofluoric acid as a 40 percent aqueous solution. There is obtained a highly concentrated aqueous solution of the wood protection agent which is ready to be used for impregnating wood. For the production of laminated wooden plates, for instance, chip boards, the aforesaid fluoroborate solution is mixed with an adhesive, for instance, an urea formaldehyde resin. The working up of the wood shavings with said adhesive and protection composition to the chip board is carried out as known in the art. An interim drying of the shavings is not necessary.

I claim:

1. A method for protecting wood against insects, fungus and fire which comprises treating wood with an effective amount of a wood protecting agent comprising ammonium fluoroborates containing nitrogen, fluorine and boron in an atomic ratio of about 1:2:2, obtained by mixing corresponding proportions of a fluoro compound

selected from the group consisting of hydrofluoric acid, ammonium bifluoride, and ammonium fluoride, a boron compound selected from the group consisting of boric acid and boric acid anhydride, and a nitrogen base selected from the group consisting of ammonia, hydroxyl amine, hydrazine, amino alkane having up to 3 carbon atoms, amino toluene, and amino ethanol, in the presence of water.

2. The method of claim **1** wherein the wood protecting agent is used in an amount of from 50 to 250 grams per square meter of wood.

3. Wood protected against insects, fungus and fire containing an effective amount of a wood protecting agent comprising ammonium fluoroborates containing nitrogen, fluorine and boron in an atomic ratio of about 1:2:2, obtained by mixing corresponding proportions of a fluoro compound selected from the group consisting of hydrofluoric acid, ammonium bifluoride, and ammonium fluoride, a boron compound selected from the group consisting of boric acid and boric acid anhydride, and a nitrogen base selected from the group consisting of ammonia, hydroxyl amine, hydrazine, amino alkane having up to 3 carbon atoms, amino toluene, and amino ethanol, in the presence of water.

4. Wood protected against insects, fungus and fire according to claim **3** wherein the wood protecting agent is used in an amount of from 50 to 250 grams per square meter of wood.

References Cited by the Examiner

UNITED STATES PATENTS

2,395,311	2/1946	Woodhouse et al.	117—147
2,726,189	12/1955	Cook	167—38.6
2,757,121	7/1956	Fahlstrom	167—38.6
2,799,556	7/1957	Sullivan et al.	23—59
2,948,641	8/1960	McCluer	106—15
3,071,618	1/1963	Pinson	260—567.6
3,076,835	2/1963	Kay et al.	260—462
3,119,654	1/1964	Cunningham	23—59
3,169,983	2/1965	Hunter	260—462

JULIAN S. LEVITT, *Primary Examiner.*