RESERVE COPY.

PATENT SPECIFICATION

777,855

Date of filing Complete Specification: April 14, 1955.

Application Date: Sept. 20, 1954. No. 27200/54.

Complete Specification Published: June 26 1957.

Index at Acceptance:—Class 140, P3(B:F2:G5).

International Classification :—B27k.

COMPLETE SPECIFICATION

Improvements in or relating to Wood Preservative Compositions.

I, VENKATA RAMANIAH SONTI, c/o Ascu Wood Products, 6, Mango Lane, Calcutta, India, of Indian Nationality, do hereby declare the invention, for which I pray that a Patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to wood preservative compositions. More particularly, this invention relates to wood preservative compositions of the kind in which the elements chromium, arsenic and copper are present in sufficient amounts to exert a substantially toxic action on wood-destroying organisms.

In wood preservative compositions of the kind described, the chromium component has hitherto been present only as potassium dichromate. Although for purposes of various chemical reactions sodium dichromate is well known as an equivalent of potassium dichromate, and although it is well known that sodium dichromate is less costly than potassium dichromate, and therefore a substance which from the standpoint of cost is more tempting for use than potassium dichromate, it has not hitherto been employed as an ingredient of wood preservative compositions of the kind described. This prejudice against the use of sodium dichromate has been due to the well known fact that sodium dichromate is a highly hygroscopic salt which is very corrosive to metals. It has been taken for granted that due to its hygroscopic nature, a wood preservative composition of which it is a substantial ingredient, would raise the moisture content of the timber on which it is used and that where the conductivity of electricity becomes an important factor, it would thereby render the treated timber useless, by raising its liability to short circuiting.

Also, due to the corrosive nature of sodium dichromate, it has also been taken for granted that a wood preservative composition having sodium dichromate as a substantial ingredient thereof, would eat its way through the drums in which it might be packed, and would therefore be difficult to pack.

It has also been taken for granted that such a composition would be inferior to one in which the chromium is present as potassium dichromate, from various other desirable aspects as well, such as penetrability and resistance to leachability.

This invention is based on actual tests carried out with preservative compositions of the kind described wherein sodium dichromate was used in place of potassium dichromate, for the fixation of copper and arsenic in the wood, the said tests being carried out side by side with similar tests carried out under comparable conditions using compositions in which the chromium is present as potassium dichromate.

These tests have resulted in the surprising discovery that, in the presence of arsenic pentoxide and copper sulphate in the proportions hereinafter mentioned, sodium dichromate has, contrary to prevailing prejudices, not only no detrimental effect as apprehended, but, on the contrary, that it has also a positive beneficial effect, particularly as regards its non-leachable property.

For instance, it has been found that the wood treated with this invention has markedly higher electrical resistance, is less corrosive, is more or less non-leachable, and has a higher penetration than wood treated similarly with compositions in which the chromium is present as potassium dichromate, and that it could be used for poles of power transmission and like purposes.

It is not proposed to give herein any theoretical explanation of the surprising results set forth, but they are probably due to the complete fixation of the sodium dichromate brought about by the complete reduction of the chromate ions by the cellulosic and other substances usually present in the

wood.

Based on the foregoing discovery this invention consists of a wood preservative composition of the kind described characterised in that its chromium component is provided in the form of sodium dichromate and its arsenic and copper contents are in the form of arsenic pentoxide and copper sulphate respectively in the proportions indicated below.

In general it may be stated that in the preferred wood preservative composition of this invention each of the elements, chromium, arsenic and copper, is present in sufficient amount to exert a substantial toxic action on wood-destroying organisms.

The following data gives the preferred compositions of this invention and indicates in parts by weight the amount of each compound which is advantageous to employ, approximate upper and lower limits being given for each compound:—

	Preferred.	*Permissible Variation.*
Arsenic Pentoxide (As_2O_5. $2H_2O$) ...	1.	.7—1.3
Copper Sulphate ($CuSO_4$. $5H_2O$) ...	3.	2.5—3.5
Sodium Dichromate ($Na_2Cr_2O_7$) ...	4.3	4. —5.

An aqueous solution of the preservative composition according to this invention may be injected into wood, or brushed or sprayed on to it, or the wood may be dipped into open vessels containing baths of the preservative compositions.

The following Examples illustrate how a wood preservative composition according to this invention gives better results than those in which the chromium content is provided by potassium dichromate.

In the said Examples, the tests were carried out with a mixture which has a pH value of 4-5 which is sufficiently toxic to preserve wood against wood-eating insects and wood-destroying fungi.

The abbreviation "S" is used for compositions containing sodium dichromate and "P" is used for compositions containing potassium dichromate.

EXAMPLE 1.

LEACHABILITY:—Various samples of timber, in a size big enough to make practical tests, were taken. The dimensions of test-samples were about 4" diameter 12" long. These samples were brought down to 20% moisture content and impregnated with "S" solutions and "P" solutions, and the quantity retained in each case calculated. Later these samples were put in running water and leachability tested by chemical analysis. The process was carried out as follows:—

Sample pieces of 20% moisture content were impregnated in a small laboratory pressure plant. The empty cell process was followed. The samples were weighed for initial weights. They were then impregnated at a standing pressure of 100 lbs. per square inch, keeping a pressure cycle of 30 minutes and drawing a final vacuum of 20" for 10 minutes. The sample pieces were then weighed again. From the difference of weights and knowing that the solutions in each case were 10% strong, the net calculated amount of chemical left in each sample was recorded.

In the table below three species of timber are given as examples.

"S" solution, 10% strength.

Species of timber.	*Initial weight retention in lbs./cwt.*	*Final weight retention in lbs./cwt.*	*Percentage Loss.*
(i)	.683	.669	2.07%
(ii)	.823	.814	1.11%
(iii)	.568	.558	1.84%

"P" solution, 10% strength.

Species of timber.	*Initial weight retention in lbs./cwt.*	*Final weight retention in lbs./cwt.*	*Percentage Loss.*
(i)	.734	.717	2.31%
(ii)	.643	.631	1.92%
(iii)	.814	.797	2.11%

It will be seen that in all the cases the "S" solution showed about 10% more resistance to leaching than the "P" solution.

EXAMPLE 2.

CORROSION TEST:—

Though, as a salt, sodium dichromate is

very corrosive, yet in combination with copper sulphate and arsenic pentoxide in the proportion mentioned, there is practically no corrosion. This may be due to the complete inter-reaction of ions being neutralised due to the very hygroscopic and therefore homogeneous solution.

Tests were conducted with various samples of mild steel and brass screws, which were allowed to soak in 20% solution of both compositions for 90 days. The following are some of the results recorded.

	Original Wt.	*Final Wt.*	*Percentage Loss*
"S" solution.			
Nail (wrought iron) ...	3.2 gms.	3.11 gm.	.01%
Screw (Brass) ...	4.5 gms.	4.46 gm.	.04%
Mild Steel ...	15.4 gms.	15.369 gm.	.031%
"P" solution.			
Nail (wrought iron) ...	2.79 gm.	2.773 gm.	.06%
Screw (Brass) ...	4.84 gm.	4.863 gm.	.086%
Mild Steel ...	17.38 gm.	17.370 gm.	.057%

The "P" solution was distinctively more corrosive than the "S" solution.

EXAMPLE 3.

PENETRABILITY TEST:—

In wood preservation, penetrability is a very important factor, as the protection afforded by the preservative depends upon the depth to which the preservative enters from the surface of the timber.

Tests were conducted by soaking timber specimens in equal strength solutions. At the end of 12 hours the specimens were taken out and dried to equal moisture contents. They were then sawn in the middle, in half. The depth of the absorbed solution was measured and compared.

15% *Strength Solution.*

	"S" *Depth in inches.*	"P" *Depth in inches.*
Mango	0.334".	0.305".
Chir	0.347".	0.312"
Sal	0.198".	0.114".

It was found that the "S" solution was drawn deeper into the timber, in most cases. The hygroscopic nature of the salt, which in proportion is about half in weight, is drawn into the cells easily by osmosis.

EXAMPLE 4.

SOLUBILITY TEST:—

The compositon was dissolved in each case in 100 gallons of water maintained between 55°/60°F. The mixture was stirred continuously with a mechanical agitator which kept the solution fairly well agitated under the same conditions throughout the experiment. Care was taken to see that no undissolved particles remained in the solution.

The strength and homogeneity of the solution at various points in the containing vessel should be the same. Such containing vessels in some cases store about 2,500 gallons of solution at a time. Various samples of each of the solutions were taken and tested with standard sodium carbonate solution and the precipitate measured to keep a check on the concentration.

Quantity in lbs.	*Time taken to dissolve (in minutes).* "S" *Solution.*	"P" *Solution.*
1 lb.	1.23	1.9
25 lbs.	8.50	12.0
112 lbs.	15.00	25.0

Although it was noticed that the solution strengths remain constant in both cases, a very appreciable discrepancy in actual dissolving time was noted. When large quantities of salt mixtures have to be dissolved daily, in the range of a ton and more, the importance of time saving will be appreciated.

INSULATION RESISTANCE.

To measure the resistance, 3 planks of similar species of timber (mangifera indica) 4' ft. long and 2" square were pressure treated using the standard method as outlined above in Example 1 to get a retention of 0.75 lbs. per c.ft. of salt of both p and s each and 8 lbs. per c.ft. 50:50 Creosote/crude oil mixture in the third case for Creosote. These retentions were chosen as they represent normal standard outdoor requirements.

After treatment the timber pieces were oven dried to bring their moisture content in each case to 15%. Two 2" mild steel nails, along the middle line of the planks and 1' apart (1' ft. apart also from the left edge) were driven, to a depth of 1" into the timber. A second set of two similar nails but staggered at a distance of 3" from the first set, were also driven into the same piece of timber. These nails were used as terminals. Two sets of readings to measure the insulation resistance was taken with a sensitive "Megger" (Registered Trade Mark), using the alternate nails as terminal points. The



1½"

average readings (after summing and dividing by 2) were taken to be the correct insulation resistance for each sample.

Specimens of timber were impregnated with "S" solution and "P" solution and it was found that the "S" solution gives higher insulation resistance.

	Insulation resistance measured in megohms per ft.
Solution "S'	1.6334.
Solution "P"	0.4247.
Standard Creosote treatment.	0.6782.

This shows that contrary to expectations the "S" solution has given a very much higher megohm resistance per ft. than the other two.

It must be noted that in addition to the beneficial effects of an improved wood preserving composition as illustrated by the foregoing Examples, there is also the economic aspect: The "S" salt costs about 75% of the "P" salt, and therefore the mixture itself is proportionately less costly. This 25% saving is large when the nett cost is calculated.

What I claim is:—

1. A wood preservative composition of the kind described characterised in that its chromium component consists of sodium dichromate and its arsenic and copper contents are in the form of arsenic pentoxide and copper sulphate respectively in the proportions by weight mentioned below:—

Arsenic Pentoxide (As_2O_5. $2H_2O$)	.7—1.3
Copper Sulphate ($CuSO_4$. $5H_2O$)	2.5—3.5
Sodium Dichromate ($Na_2CR_2O_7$)	4. —5.

2. A wood preservative composition according to Claim 1 having the undermentioned components in the proportion by weight given below.

Arsenic Pentoxide (As_2O_5. $2H_2O$) ...	1.
Copper Sulphate ($CuSO_4$. $5H_2O$) ...	3.
Sodium Dichromate ($Na_2Cr_2O_7$) ...	4.3

3. A wood preservative composition substantially as described and illustrated with reference to the Examples given herein.

GEE & CO.,
Chartered Patent Agents,
51-52, Chancery Lane, London, W.C.2.,
and 22, Whitefriargate, Hull.
Agents for the Applicant.

SC 3

PROVISIONAL SPECIFICATION

Improvements in or relating to Wood Preservative Compositions.

I, VENKATA RAMANIAH SONTI, c/o Ascu Wood Products, 6, Mango Lane, Calcutta, India, of Indian Nationality, do hereby declare this invention to be described in the following statement:—

This invention relates to wood preservative compositions. More particularly, this invention relates to wood preservative compositions of the kind in which the elements chromium, arsenic and copper are present in sufficient amounts to exert a substantially toxic action on wood-destroying organisms.

In wood preservative compositions of the kind described, the chromium component has hitherto been present only as potassium dichromate. Although for purposes of various chemical reactions sodium dichromate is well known as an equivalent of potassium dichromate, and although it is well known that sodium dichromate is less costly than potassium dichromate, and therefore a substance which from the standpoint of cost is more tempting for use than potassium dichromate, it has not hitherto been employed as an ingredient of wood preservative compositions of the kind described. This prejudice against the use of sodium dichromate has been due to the well known fact that sodium dichromate is a highly hygroscopic salt which is very corrosive to metals. It has been taken for granted that due to its hygroscopic nature, a wood preservative composition of which it is a substantial ingredient, would raise the moisture content of the timber on which it is used and that where the conductivity of electricity becomes an important factor, it would thereby render the treated timber useless, by raising its liability to short circuiting.

Also, due to the corrosive nature of sodium dichromate, it has also been taken for granted that a wood preservative composition having sodium dichromate as a substantial ingredient thereof, would eat its way through the drums in which it might be packed, and would therefore be difficult to pack.

It has also been taken for granted that such a composition would be inferior to one in which the chromium is present as potassium dichromate, from various other desirable aspects as well, such as penetrability and resistance to leachability.

This invention is based on actual tests carried out with preservative compositions of the kind described wherein sodium dichromate

average readings (after summing and dividing by 2) were taken to be the correct insulation resistance for each sample.

Specimens of timber were impregnated with "S" solution and "P" solution and it was found that the "S" solution gives higher insulation resistance.

	Insulation resistance measured in megohms per ft.
Solution "S'	1.6334.
Solution "P"	0.4247.
Standard Creosote treatment.	0.6782.

This shows that contrary to expectations the "S" solution has given a very much higher megohm resistance per ft. than the other two.

It must be noted that in addition to the beneficial effects of an improved wood preserving composition as illustrated by the foregoing Examples, there is also the economic aspect: The "S" salt costs about 75% of the "P" salt, and therefore the mixture itself is proportionately less costly. This 25% saving is large when the nett cost is calculated.

What I claim is:—

1. A wood preservative composition of the kind described characterised in that its chromium component consists of sodium dichromate and its arsenic and copper contents are in the form of arsenic pentoxide and copper sulphate respectively in the proportions by weight mentioned below:—

Arsenic Pentoxide (As_2O_5. $2H_2O$)	.7—1.3
Copper Sulphate ($CuSO_4$. $5H_2O$)	2.5—3.5
Sodium Dichromate ($Na_2CR_2O_7$)	4. —5.

2. A wood preservative composition according to Claim 1 having the undermentioned components in the proportion by weight given below.

Arsenic Pentoxide (As_2O_5. $2H_2O$) ...	1.
Copper Sulphate ($CuSO_4$. $5H_2O$) ...	3.
Sodium Dichromate ($Na_2Cr_2O_7$) ...	4.3

3. A wood preservative composition substantially as described and illustrated with reference to the Examples given herein.

GEE & CO.,
Chartered Patent Agents,
51-52, Chancery Lane, London, W.C.2.,
and 22, Whitefriargate, Hull.
Agents for the Applicant.

SC 3

PROVISIONAL SPECIFICATION

Improvements in or relating to Wood Preservative Compositions.

I, VENKATA RAMANIAH SONTI, c/o Ascu Wood Products, 6, Mango Lane, Calcutta, India, of Indian Nationality, do hereby declare this invention to be described in the following statement:—

This invention relates to wood preservative compositions. More particularly, this invention relates to wood preservative compositions of the kind in which the elements chromium, arsenic and copper are present in sufficient amounts to exert a substantially toxic action on wood-destroying organisms.

In wood preservative compositions of the kind described, the chromium component has hitherto been present only as potassium dichromate. Although for purposes of various chemical reactions sodium dichromate is well known as an equivalent of potassium dichromate, and although it is well known that sodium dichromate is less costly than potassium dichromate, and therefore a substance which from the standpoint of cost is more tempting for use than potassium dichromate, it has not hitherto been employed as an ingredient of wood preservative compositions of the kind described. This prejudice against the use of sodium dichromate has been due to the well known fact that sodium dichromate is a highly hygroscopic salt which is very corrosive to metals. It has been taken for granted that due to its hygroscopic nature, a wood preservative composition of which it is a substantial ingredient, would raise the moisture content of the timber on which it is used and that where the conductivity of electricity becomes an important factor, it would thereby render the treated timber useless, by raising its liability to short circuiting.

Also, due to the corrosive nature of sodium dichromate, it has also been taken for granted that a wood preservative composition having sodium dichromate as a substantial ingredient thereof, would eat its way through the drums in which it might be packed, and would therefore be difficult to pack.

It has also been taken for granted that such a composition would be inferior to one in which the chromium is present as potassium dichromate, from various other desirable aspects as well, such as penetrability and resistance to leachability.

This invention is based on actual tests carried out with preservative compositions of the kind described wherein sodium dichromate

was used in place of potassium dichromate, for the fixation of copper and arsenic in the wood, the said tests being carried out side by side with similar tests carried out under comparable conditions using compositions in which the chromium is present as potassium dichromate.

These tests have resulted in the surprising discovery not only that, contrary to prevailing prejudices, sodium dichromate has, as compared with potassium dichromate, no detrimental effect as apprehended, but that it has, on the contrary, a positively beneficial effect from the standpoint of the desirable characteristics of wood preservative compositions.

For instance, it has been found that the wood treated with this invention has markedly higher electrical resistance, is less corrosive, is more or less non-leachable, and has a higher penetration than wood treated similarly with compositions in which the chromium is present as potassium dichromate, and that it could be used for poles of power transmission and like purposes.

It is not proposed to give herein any theoretical explanation of the surprising results set forth, but they are probably due to the complete fixation of the sodium dichromate brought about by the complete reduction of the chromate ions by the cellulosic and other substances usually present in the wood.

Based on the foregoing discovery this invention consists of a wood preservative composition of the kind described characterised in that its chromium component is provided in the form of sodium dichromate.

In general it may be stated that in the preferred wood preservative composition of this invention each of the elements, chromium, arsenic and copper, is present in sufficient amount to exert a substantial toxic action on wood-destroying organisms.

The following data gives the preferred compositions of this invention and indicates in parts by weight the amount of each compound which is advantageous to employ, approximate upper and lower limits being given for each compound:—

	Preferred.	*Permissible Variation.*
Arsenic Pentoxide (As_2O_5. $2H_2O$) ...	1.	.7—1.3
Copper Sulphate ($CuSO_4$. $5H_2O$) ...	3	2.5—3.5
Sodium Dichromate ($Na_2Cr_2O_7$) ...	4.	4.3—5.

The preservative according to this invention may be injected into wood, or brushed or sprayed on to it, or the wood may be dipped into open vessels containing baths of the preservative compositions.

The following Examples illustrate how a wood preservative composition according to this invention gives better results than those in which the chromium content is provided by potassium dichromate.

In the said Examples, the tests were carried out with a mixture which has a pH value of 4—5 which is sufficiently toxic to preserve wood against wood-eating insects and wood-destroying fungi.

The abbreviation "S" is used for compositions containing sodium dichromate and "P" is used for compositions containing potassium dichromate.

EXAMPLE 1.

LEACHABILITY:—Various samples of timber, in a size big enough to make practical tests, were taken. The dimensions of test-samples were about 4" diameter 12" long. These samples were brought down to 20% moisture content and impregnated with "S" solutions and "P" solutions, and the quantity retained in each case calculated. Later these samples were put in running water and leachability tested by chemical analysis. In the table below three species of timber are given as examples.

"S" solution, 10% strength.

Species of timber.	*Initial weight retention in lbs./cwt.*	*Final weight retention in lbs./cwt.*	*Percentage Loss.*
(i)	.383	.669	2.07%
(ii)	.823	.814	1.11%
(iii)	.568	.558	1.84%

"P" solution, 10% strength.

Species of timber.	*Initial weight retention in lbs./cwt.*	*Final weight retention in lbs./cwt.*	*Percentage Loss.*
(i)	.734	.717	2.31%
(ii)	.643	.631	1.92%
(iii)	.814	.797	2.11%

It will be seen that in all the cases the "S" solution showed about 10% more resistance to leaching than the "P" solution.

EXAMPLE 2.

CORROSION TEST:—

Though, as a salt, sodium dichromate is very corrosive, yet in combination with copper sulphate and arsenic pentoxide in the proportion mentioned, there is practically no corrosion. This may be due to the complete inter-reaction of ions being neutralised due to the very hygroscopic and therefore homogeneous solution.

Tests were conducted with various samples of mild steel and brass screws, which were allowed to soak in 20% solution of both compositions for 90 days. The following are some of the results recorded.

		Original Wt.	*Final Wt.*	*Percentage Loss*
"S" solution.				
	Nail (wrought iron) ...	3.2 gms.	3.11 gm.	.01%
	Screw (Brass) ...	4.5 gms.	4.46 gm.	.04%
	Mild Steel ...	15.4 gms.	15.369 gm.	.031%
"P" solution.				
	Nail (wrought iron) ...	2.79 gm.	2.773 gm.	.06%
	Screw (Brass) ...	4.84 gm.	4.863 gm.	.086%
	Mild Steel ...	17.38 gm.	17.370 gm.	.057%

The "P" solution was distinctively more corrosive than the "S" solution.

EXAMPLE 3.

PENETRABILITY TEST:—

In wood preservation, penetrability is a very important factor, as the protection afforded by the preservative depends upon the depth to which the preservative enters from the surface of the timber.

Tests were conducted by soaking timber specimens in equal strength solutions. At the end of 12 hours the specimens were taken out and dried to equal moisture content. They were then sawn in the middle, in half. The depth of the absorbed solution was measured and compared.

15% *Strength Solution.*

	Depth in inches. "S"	*Depth in inches. "P"*
Mango	0.334".	0.305".
Chir	0.347".	0.312".
Sal	0.198".	0.114".

It was found that the "S" solution was drawn deeper into the timber, in most cases. The hygroscopic nature of the salt, which in proportion is about half in weight, is drawn into the cells easily by osmosis.

EXAMPLE 4.

SOLUBILITY TEST:—

The compositions are dissolved in water, in varying strengths, before being used. The strength and homogeneity of the solution at various points in the containing vessel should be the same. Such containing vessels in some cases store about 2,500 gallons of solution at a time. Various samples of each of the solutions were taken and tested with standard sodium carbonate solution and the precipitate measured to keep a check on the concentration.

Quantity in lbs.	*Time taken to dissolve (in minutes).* "S" *Solution.*	"P" *Solution.*
1 lb.	1.23.	1.9.
25 lbs.	8.50.	12.0.
112 lbs.	15.00	25.0.

Although it was noticed that the solution strengths remain constant in both cases, a very appreciable discrepancy in actual dissolving time was noted. When large quantities of salt mixtures have to be dissolved daily, in the range of a ton and more, the importance of time saving will be appreciated.

INSULATION RESISTANCE.

Specimens of timber were impregnated with "S" solution and "P" solution and it was found that the "S" solution gives higher insulation resistance. Experiments were performed after all the specimens were thoroughly air-dried.

	Insulation resistance measured in megohms per ft.
Solution "S'	1.6334.
Solution "P"	0.4247.
Standard Creosote treatment.	0.6782.

This shows that contrary to expectations the "S" solution has given a very much higher megohm resistance per ft. than the other two.

It must be noted that in addition to the beneficial effects of an improved wood preserving composition as illustrated by the foregoing Examples, there is also the economic aspect. The "S" salt costs about 75% of the "P" salt, and therefore the mixture itself is proportionately less costly. This 25% saving is large when the nett cost is calculated.

GEE & CO.,
Chartered Patent Agents,
51-52 Chancery Lane, London, W.C.2.,
and 4, Silver Street, Hull.
Agents for the Applicant.

Printed for Her Majesty's Stationery Office by Kingston Printers Ltd., Portsmouth. 335/3.—1956.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.