GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, LOWER CIRCULAR ROAD, CALCUTTA-17.

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PROVISIONAL SPECIFICATION.

IMPROVEMENTS IN OR RELATING TO LACQUERS FOR CORROSION PREVENTION.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, Rafi Marg New Delhi-1, India an Indian registered body incorporated under the Registration of Societies Act (Act XXI of 1860)

The following specification describes the nature of this invention

This is an invention by MEYYAPPA SUNDARAM Scientific Assistant NARAYANASWAMI SUBRAMANYAN, Scientist KUMMATTITHIDAL SANTHANAM RAJAGOPALAN, Scientist, and KADARUNDALIGE SITARAMA DOSS GURURAJA DOSS, Director, all of the Central Electrochemical Research Institute, Karaikudi-3, India all Indian citizens

This invention relates to improvements in or relating to lacquers for corrosion prevention

The materials used for the prevention of corrosion during storage and transit of corrodible metal stores and which can be easily removed with the help of solvents are known as 'temporary protectives' One class of temporary protectives known is the hard film solvent—deposited type Hard film solvent—deposited protectives are commonly known as 'lacquers and consist of solutions of plasticised resins in volatile solvents On evaporation of the solvent, a thin hard film of protective remains The film is not removed during handling The protective is applied by dipping, spraying or brushing This type of preservative is suitable for long term storage and for the use of simple metal assemblies, *e g* crank shafts, hand tools, light steel sections etc This type of temporary protective is required for use under a wide variety of conditions, *e g*, to protect parts made in one part of the country and transported for assembly in another, for spare parts to be kept in storage, for machines between manufacture and so on

Vapour phase inhibitors are widely used in anti corrosion packaging of metallic stores where it is inconvenient to apply a coating as in the case of inaccessible or complicated parts and items to be protected can be kept completely enclosed inside the package

The above methods of protection during storage and transit have the following drawbacks

It has been generally found that such protectives do not give satisfactory protection at places where the protective has been removed during handling (Table 1) Further it has also been observed that acidic constituents liberated by degradation of the resin base sometimes promote corrosion Protection by the use of vapour phase inhibitor alone is found to be (i) costly (ii) inhibition is dependent on proper packaging and (iii) degree or protection is very sensitively dependant on atmospheric pollution inside the package and, lastly it cannot be used safely on composite items consisting of both ferrous and non ferrous parts In regard to a large number of operations, such as inter process waiting periods dismantling and assembly, handling of he item for inspection and so on, it appears to be more beneficial and feasible to give protection by film formation The object of this invention is to obviate these disadvantages

The present invention consists in the following

(i) the rusting of exposed portions of items protected by the hard film solvent deposited type of temporary protective can be largely overcome by incorporation of a vapour phase corrosion inhibitor as an integral part of the hard film solvent deposited coating

(ii) not all types of vapour phase inhibitors can be advantageously used for incorporation in film-forming materials for various reasons (a) incompatibility of the vapour phase inhibitor with the film forming material (ii) rapid removal of vapour phase inhibitor from the film forming material and (iii) loss of vapour phase inhibitor by reaction with the film forming material and so on (Table 2)

(iii) a film forming material which can give continued protection at scratches and other exposed parts can be produced by taking into account a well-known property of the materials used as hard film deposited type of protective A small proportion of acidic constituents is often present in film forming materials used to formulate this type of temporary protective This amount is carefully controlled in order that corrosion does not take place in their presence However, it is observed in practice that, even if initially the amount of acidic constituent present is smaller than what may be required to cause corrosion, during ageing and exposure to light and moist air, acidic constituents are produced and accelerated corrosion takes place Considerable improvement in protection given by solvent deposited films can be brought about by taking into account the presence of a small proportion of acidic constituent A vapour phase inhibitor can be produced as an integral part of solvent deposited film if the acidic constituent can be reacted upon by addition of a suitable basic constituent, *e g*, morpholine, methylene diamine etc, leading to the formation of salt which has the valuable property of vapour phase inhibition

(iv) by producing the inhibitive constituent *in situ* the properties of the film forming material remain unchanged

(v) when the inhibitive constituent is produced *in situ* it acts as a deterrant to corrosion by acidic constituents

(vi) when inhibitive constituent is produced *in situ* very effective inhibition of corrosion of exposed parts is observed (Table 3)

(vii) the vapour phase inhibition of damaged portions of the solvent deposited films can be improved by adjustment of the proportion of the basic constituents

and

(viii) in the production of vapour phase inhibitor *in situ* in the above manner the formation of transparent films is in no way affected (Table 3)

The following are among the main advantages of this invention

(i) more satisfactory protection can be obtained from solvent deposited temporary protectives by production of a vapour phase inhibitor in the film forming material than by the film forming material plus a known vapour phase inhibitor

(ii) complete protection is given to metal surfaces exposed at scratches by production *in situ* of a vapour phase inhibitor in the film forming material

and

(iii) by a correct adjustment of the basic constituent in the film forming material harmful effects on composite items can be avoided

Price : TWO RUPEES.

TABLE 1

CORROSION OF STEEL IN THE PRESENCE OF RESINS

Test Method Immersion coated steel specimen is suspended inside a bottle containing distilled water and bottle placed in thermostat such that the lower half is maintained 10°C above room temperature Continuous condensation takes place on the specimen surface Observations made after 24 hours are given

No.	Type of the film forming material used	Clarity of the dissolved lacquer	Appearance of the coated surface	Observations: Protection given to unscratched portions	Observations: Protection given to scratched portions
1	Drying Oil Modified short oil . .	Clear	Clear	Rusting at the edges	Rusted
2	Butylated Urea Formaldehyde Resin .	,,	,,	,,	,,
3	Rosin Modified Phenolic Resin . .	,,	,,	No rusting	,,

It may be seen from the above table that the resin cannot give protection at scratches and may also permit corrosion at other places.

TABLE 2

PROTECTION GIVEN TO STEEL BY FILM FORMING MATERIAL—A KNOWN VAPOUR PHASE INHIBITOR

Test Method Immersion coated steel specimen is suspended inside a bottle containing distilled Water and bottle placed in thermostat such that the lower half is maintained 10°C above room temperature Continuous condensation takes place on the specimen surace. Observations made after 24 hours are given

No.	Type of film forming material	Clarity of the dissolved lacquer	Appearance of the coated surface	Visual Observations: Protection given to the unscratched portions	Visual Observations: Protection given to the scratched portions
1	Drying Oil Modified Alkyd Short Oil + Meta Dinitro Benzene.	Clear	Clear	Rusted	Rusted
2	Urea = Formaldehyde (Butylated) + Meta Dinitro Benzene.	,,	,,	Rusting along the edges.	No rusting along the Scratches and rusting along the edges —here and there
3	Drying Oil Modified Alkyd Short Oil + Ammonium Stearate	Suspended particles present	Stained	Rusted	Rusted
4	Butylated Urea = Formaldehyde + Ammonium Stearate	Suspended particles present	,,	,,	,,

It may be seen from the above Table that mere incorporation of a known vapour phase inhibitor may not give satisfactory results In the case of ammonium stearate it is also found that the clarity of the film formed is affected

TABLE 3

PROTECTION GIVEN TO STEEL BY INHIBITOR FORMED *in situ* IN A FILM FORMING MATERIAL

Test Method Immersion coated steel specimen is suspended inside a bottle containing distilled water and bottle place in thermostat such that the lower half is maintained 10°C above room temperature Continuous condensation takes place on the specimen surface Observations made after 24 hours are given.

Film forming material + Inhibitor	Clarity of the Dissolved lacquer	Appearance of the coated surface	Observations: Protection given to the unscratched portions	Observations: Protection given to the scratched portions	Protection given to the bare specimen adjacent to the coated one
Drying Oil Modified Alkyd short oil + Inhibitor I	Clear	Clear	No rusting	No rusting	Very little rusting
Urea Formaldehyde (Butylated) + Inhibitor I	Clear	Clear	No rusting	Rusting at very few places	Rusted

R BHASKAR PAL

Patents Officer,

Dated this 7th day of October 1965. *Council of Scientific & Industrial Research.*

COMPLETE SPECIFICATION.

IMPROVEMENTS IN OR RELATING TO LACQUERS FOR CORROSION PREVENTION.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, Rafi Marg, New Delhi-1, India, an Indian registered body incorporated under the Registration of Societies Act (Act XXI of 1860).

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed.

This is an invention by MEYYAPPA SUNDARAM Scientific Assistant, NARAYANASWAMI SUBRAMANYAN, Scientist, KUMMATTITHIDAL SANTHANAM RAJAGOPALAN, Scientist, and KADARUNDALIGE SITARAMA DOSS GURURAJA DOSS, Director, all of the Central Electrochemical Research Institute, Karaikudi-3, India, all Indian citizens.

This invention relates to improvements in or relating to lacquers for corrosion prevention.

The materials used for the prevention of corrosion during storage and transit of corrodible metal stores and which can be easily removed with the help of solvents are known as temporary protectives One class of temporary protectives known is the hard film solvent—deposited type Hard film solvent deposited protectives are commonly known as lacquers and consist of solutions of plasticised resins in volatile solvents This type of temporary protective is required for use under a wide variety of conditions, for example, to protect parts made in one part of the country and transported for assembly in another, for spare parts to be kept in storage for machines between manufacture and so on It has generally been found that such protectives do not give satisfactory protection at places where the protective has been removed during handling Further, it has also been observed that acidic constituents liberated by degradation of the resin base sometimes promote corrosion

Vapour phase inhibitors are widely used in anti-corrosion packaging of metallic stores Protection by the use of vapour phase inhibitor alone is found to be (1) costly (2) inhibition is dependent on proper packaging and (3) the degree of protection is very sensitively dependent on atmospheric pollution inside the packaging and lastly (4) it can be used safely on composite items consisting of both ferrous and non-ferrous parts

The object of the invention is to ensure that in the case of items protected by the hard film solvent deposited type of protective, protection is given at places where the film has been removed during handling

We have found that rusting of exposed portions on items protected by the hard film solvent deposited type of temporary protective can be largely overcome by incorporation of vapour phase corrosion inhibitor as an integral part of the hard film solvent deposited coating (*See* Tables 1 and 2)

We have found that vapour phase inhibitor can be produced as an integral part of solvent deposited film, if the acidic constituent can be reacted upon by addition of a suitable basic constituent, for example, morpholine, ethylene diamine, leading to the formation of the corresponding salt which has valuable property of vapour phase inhibition (*See* Table 3)

We have developed a corrosion preventive lacquer, which has the valuable property of giving protection to metals from corrosion at surfaces exposed by the removal of lacquer during handling

The invented process for the preparation of corrosion preventive lacquer consists in the formation *in situ* of a vapour phase inhibitor such as amine salts of fatty acids in plasticised resins such as drying oil, modified alkyd short oil, urea formaldehyde, nitrocellulose dissolved in volatile solvents such as xylene, chloroform, acetone, rectified spirit

The above-mentioned lacquer is produced by incorporation of a suitable substance having the property of vapour phase inhibition into any of the well-known solvent deposited film forming materials.

TABLE I

Corrosion of steel in the presence of resins

Test Method Immersion coated specimen is suspended inside a bottle containing distilled water and bottle placed in thermostat such that the lower half is maintained 10°C above room temperature. Continuous condensation takes place on the specimen surface Observations made after 24 hours are given :

No.	Type of film forming material used	Clarity of the dissolved lacquer	Appearance of the Coated surface	Observations	
				Protection given to unscratched portions	Protection given to scratched portions
1	2	3	4	5	6
1.	Drying Oil Modified short Oil . .	Clear	Clear	Rusting at the edges	Rusted
2.	Butylated Urea Formaldehyde Resin .	Clear	Clear	Rusting at the edges	Rusted
3.	Resin Modified Phenolic Resin . .	Clear	Clear	No rusting	Rusted

It may be seen from the above Table that the constituents in the resin can promote corrosion in some cases.

TABLE 2

Protection given to steel by film forming material + a known vapour phase inhibitor

Test Method Immersion steel specimen is suspended inside a bottle containing distilled water and bottle placed in thermostat such that the lower half is maintained 10°C above room temperature. Continuous condensation takes place on the specimen surface Observations made after 24 hours are given .

No.	Type of film forming material	Clarity of the dissolved lacquer	Appearance of the coated surface	Visual Observations	
				Protection given to unscratched portions	The Protection given to the scratched portions
1	2	3	4	5	6
1.	Drying Oil Modified Alkyd short Oil + Meta Dintro Benzene	Clear	Clear	Rusted	Rusted
2.	Urea—Formaldehyde (Butylated) + Meta Dintro Benzene.	Clear	Clear	Rusting along the edges	No rusting along the scratches and rusting along the edges —here and there
3.	Drying Oil Modified Alkyd short Oil + Ammonium Stearate	Suspended particles present	Stained	Rusted	Rusted
4	Butylated Urea Formaldehyde + Ammonium Stearate	Suspended particles present.	Stained	Rusted	Rusted.

It may be seen from the above Table that mere incorporation of a known vapour phase inhibitor may not give satisfactory results. In the case of ammonium stearate it is also found that clarity of the film formed is affected.

TABLE 3

PROTECTION GIVEN TO STEEL BY INHIBITOR FORMED *in situ* IN A FILM FORMING MATERIAL

Test Method Immersion coated steel specimen is suspended inside a bottle containing distilled water and bottle placed in thermostat such that the lower half is maintained 10°C above room temperature. Continuous condensation takes place on the specimen surface. Observations made after 24 hours are given

Film forming material inhibitor	Clarity of the dissolved lacquer	Appearance of the coated surface	Observations		
			Protection given to the unscratched portion	Protection given to the scratched portion	Protection given to the bare specimen adjacent to the coated one
1	2	3	4	5	6
Drying oil modified alkyd short oil + inhibitor (cyclohexyl amine).	Clear	Clear	No rusting	No rusting	Very little rusting
Urea Formaldehyde (Butylated) + inhibitor (cyclo hexyl amine).	Clear	Clear	No rusting	Rusting at very few places.	Rusted

TABLE 4

Ingredients	Workable range	Preferred range
1. *Plasticised resins*		
Drying oil Modified Alkyd Short oil, Urea-formaldehyde, Nitro-cellulose	45—60 per cent	50—55 per cent
2. *Volatile solvents :*		
Xylene, Chloroform, acetone, rectified spirit etc.	30—50 per cent	40—45 per cent
3. Vapour-phase inhibitors like amine salts of fatty acids	1— 5 per cent	4—5 per cent

We claim :

1 A process for the preparation of corrosion preventive lacquer by the formation *in situ* of a vapour phase inhibitor such as amine salts of fatty acids in plasticised resins such as drying oil, modified alkyd short oil, urea formaldehyde, nitrocellulose dissolved in volatile solvents such as xylene, chloroform, acetone, rectified spirit

2 A process for the preparation of corrosion preventive lacquer which when used for the prevention of ferrous items can give protection to steel even if the steel is exposed to scratches produced by mechanical handling substantially as hereinbefore described.

3 A corrosion preventive lacquer which while giving protection to steel does not cause corrosion of non-ferrous parts that may be present in a composite item whenever obtained according to a process substantially hereinbefore described.

R. BHASKAR PAI,

Patents Officer,

Council of Scientific & Industrial Research,

Dated this 5th day of August 1966.

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