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PAINT

A QUARTERLY

JOURNAL

DEVOTED TO

PAINT MATERIALS & PAINTING METHODS

Editor: P. GOPAL RAO, M. Sc.

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CONTENTS

COMMENT	...	33
A NEW DRYING OIL	...	35
PAINTING ON GLASS	...	38
DRIER IN PAINT	...	44

SODHAN
THE COTTAGE INDUSTRIES ASSOCIATION
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ECONOMICS OF SWADESHI

"I do not know much about tariff
but I do know this much :

"When we buy goods abroad we get
the goods and the foreigners get the
money; when we buy goods made at
home we get both the goods and the
money."

—*Abraham Lincoln*

COMMENT

THE board of scientific and industrial research was set up shortly after the out break of the present war. Many schemes of possible industrial enterprises were presented for investigation. At a meeting held in June, the board considered the schemes submitted and formed a dozen committees to deal with schemes of immediate importance. The schemes under investigation are many and men on the committees are eminent scientists with international reputation. We hope valuable time will not be lost in empty deliberations and work will be started in right earnest.

We would however like to stress one point in this connection. The committees are more academic than industrial. As far as we are aware the majority of committee members are distinguished university men with little practical experience in the day to day working troubles in manufacturing industries. No doubt many, have valuable original contributions to their credit, and have guided many Ph. Ds. and D. Scs. in research. But we are concerned with industrial research vitally concerned with the immediate development of new industries and reorganisation of old industries. For this scientists working in the industries concerned are required. A few research scholarships founded in universities and scientific institutes will not help matters. The object of the Research Board will be better realised if selected industries are subsidised to work on the schemes. The universities may be requested to help the industries in their investigations. But it must be realised that universities and such other institutions are only secondary for this particular purpose.

COMMENT

It must not be inferred however that we are minimising the contributions of universities towards industrial development. We are quite alive to the impetus given to industries by University Men. What all we wish to impress is that in this particular case the glove is on the wrong hand.

* * * *

The house painter on job comes across a variety of surfaces. Each differs from the other and requires a different treatment for satisfactory work. Glass is one of them, though not as common as wood, iron, and plaster. However insignificant, this is a line in which the average painter does not feel quite at home. A very instructive article on the subject, appearing in the April Issue of "The Decorator," is reproduced elsewhere to the benefit of our readers, by kind permission.

* * * *

We have pointed out in another issue that the half-hearted maintainance of structures exposed to one of the most trying climates in the world is due to the ignorance of the paint consuming public about paint materials and painting methods. We feel that a knowledge of the properties and functions of the paint forming materials is essential to select the proper material for the job on hand. This is the first of a series of articles we are arranging to publish about paint and its constituents. The language is as non-technical as it could be, and we hope will help the paint consumer to visualise the properties and functions of the important paint forming materials.



PAINT

JUNE, 1940

A NEW DRYING OIL

By P. Gopal Rao & B. Anjaneyulu

IN paint industry linseed oil occupies a very important position. No doubt from time to time, depending on local conditions, soya bean oil, fish oils etc. are used as substitutes for linseed oil. But **Introductory** it must be admitted that linseed oil has no serious rival. **Survey** Its substitutes, so far, are the main products. As such there could not be very great difference in prices in favour of the substitutes except perhaps in the case of cotton seed oil. The fact that in all the specifications framed by the Indian Stores Department, and Master General of Ordinance, linseed oil is specified as the only medium for paints is a sufficient proof of its unique position. Such oils as tung oil, perilla oil, dehydrated castor oil etc. have their own special properties and fields of application. They cannot be called as substitutes for linseed oil.

In the Guntur District of the Madras Presidency nearly one hundred thousand acres of land is being cultivated with a variety of Nicotiana Tobacum locally known as virginia tobacco. To have a thin leaf of the right quality and flavour, the flowering stalk is not plucked but allowed to produce tobacco seed in the normal way. But at present the leaf only is of economic value. The dried leafless stalks with their seeds are simply collected at one place and burnt. Mr. M. Narasimham, B. Sc. (Ag.) at present the Government Agricultural demonstrator at Guntur was the first to get himself interested in the economic utilisation of the virginia tobacco seed which is being simply burnt now. After some preliminary experiments he came to the conclusion that the oil may be used for edible purposes like gingili and ground-nut oils without any undesirable effects. Later, in April a sample of the oil was departmentally sent to our Sodhan Laboratories for investigating the possibilities of its utilisation as a drying oil in paints. Mr. M. Narasimham was kind enough to give us the analytical data furnished by the chemical examiner to the Government of Madras.

JUNE, 1940

PAINT

35

They showed the oil to have an iodine value of 142. The oil cake had a nitrogen per centage of 4.8 to 5.2 and P_2O_5 per centage of 2.5 to 2.6 depending on the extraction of the oil by cold or the hot method. Both the oil and cake are free from nicotine.

Preliminary investigations of the oil sample sent to us at the Sodhan Laboratories have shown that the Tobacco seed oil is a satisfactory drying oil. Its specific gravity is 0.925 at 60° F. It is slightly less viscous than ordinary fresh drawn Calcutta Linseed Oil.

Preliminary Investigations The oil refines to a water-white colour which is difficult to be had with linseed oil. The acid value is about 2. The rate of polymerisation of the oil is slower than that of linseed oil. The tobacco seed oil takes 12 hours to attain the viscosity of an 8 hour linseed stand oil. When the usual amounts of driers (0.25% lead and 0.05% cobalt) are added to ordinary raw tobacco seed oil it dries to an elastic film in 8 hours. The film however is softer than that of linseed oil similarly treated. When used in varnishes however no appreciable difference is noticed. The specially pale colour obtainable by refining tobacco seed oil makes it a nice medium for white paints whether stiff or ready-mixed where pale colour is an asset. Also during polymerisation the tobacco seed oil does not give out pungent throat irritating fumes as is the case with linseed oil. Detailed investigations are in progress.

There are very few references to this oil in the paint literature. Possibly in the United States of America where Virginia tobacco is extensively cultivated the seed problem and its economic disposal has not arisen. In all probability this is a local problem. But with nearly a hundred thousand acres under virginia tobacco cultivation and an estimated yield of nearly 200 lbs. per acre per year, we will have 20,000,000 lbs. of tobacco seed in the Guntur District alone. The extractable oil content of the seed is about 30%. Thus the extractable oil is nearly 6,000,000 lbs. or nearly 2,680 tons of oil per year.

According to reports available the oil cake also can be used for edible purposes. The oil cake is a nutritive cattle fodder and a good manure

too for the fields. One serious objection felt by the virginia tobacco cultivator is that the crop does not yield cattle fodder like other dry crops. As such the areas where there is tobacco cultivation, cattle fodder scarcity is keenly felt. The fact that the oil cake of the tobacco seed is cattle fodder in a highly concentrated form will be a great relieving factor. Besides the oil cake is a good manure for the fields.

In the matter of price the tobacco seed oil which is after all a bi-product of the crop can very easily compete with linseed oil which is the main product of the crop. With price in its favour and no serious objections for its use in paints there is a possibility of a bright future for this tobacco seed oil.

It will not be out of place to mention that linseed crop is mostly confined to Northern India (U. P., Bihar, Bengal and C. P.). The South India has to depend on the North for its supplies. If the results of the preliminary investigations are confirmed in the detailed study of the oil, now being undertaken to study its possibilities as a drying oil in paints there will be a good scope (many possibilities) for the starting of paint industries in the South. In South India there are huge deposits of Iron Oxide, Barytes, Graphite and other pigment forming minerals. With a suitable drying oil in the tobacco seed the way for successful efforts in the paint field will be easier.

The existing literature on the oil indicates that the oil cannot be classed as a good grade drying oil since linolenic acid with three double bonds is absent. But even if this oil may not be used

Some - - Possibilities all by itself in paints, it may be possible to replace to some extent the usual drying oil (linseed oil) in paints. When used in conjunction with oils and gums capable of forming three dimensional polymerides it may serve a useful purpose.

The yellowing of paint films is usually connected with linolenic acid having three double bonds. The destruction of this three double bond system during polymerisation is believed to remedy this after-yellowing

effect. It remains to be seen if the absence of linolenic acid will also mean the absence of the after-yellowing trouble with tobacco seed oil. Again the formation of three dimensional polymerides is believed to give hard drying films, while chain polymerides will have a reinforcing effect on such films. Since over 60% of the fatty acids in tobacco seed oil is linolic acid capable of forming only chain polymerides it is profitable to investigate into the possibilities of curing the premature cracking of zinc oxide paint films due to undue film hardening because tobacco seed oil is known to give soft films.

PAINTING ON GLASS

(From 'The Decorator' of 15th April, 1940)

In normal times the painting of glass does not play a very important part in the work of the average decorator and is more or less confined to the treatment of shop windows or the writing of glass fascias. ... Yet ... the painting of glass is frequently unsatisfactory and flaking and peeling occur after a relatively short time, not necessarily because due care has not been exercised but rather because the peculiar problems which such painting involves have not been sufficiently realised.

In the type of painting with which it is proposed to deal in this article, the work is carried out in the inner side of the glass, through which the painting or lettering is exposed to view. The first point of importance, therefore, is that this class of painting differs from any other in that the first coat of paint, even although it is covered up by others, is visible to the eye. The coat furthest removed from the decorative colour coat, moreover, is the one subjected to atmospheric influences.

The chief difficulty, needless to say, is that of obtaining adhesion. In practically every other kind of painting, this depends on penetration of the surface and / or on some degree of mechanical key which the latter affords; thus, woodwork or plasterwork of average porosity permits penetration and although metals do not, their surface contains minute pits or it can be roughened sufficiently to enable paint to maintain its grip. But glass, with its absolutely impervious surface has neither of these properties and adhesion must consequently be obtained by other means.

The first step towards securing it is to ensure that the surface of the work is absolutely clean and free from grease. Glass appears to be so smooth and hard as to be incapable of retaining a film of grease or moisture without showing it, but microscopically speaking, there is sufficient irregularity of the surface to retain a minute film of invisible impurity. It must be remembered, too, that owing to the lack of absorption on glass a very small amount of grease will spread a long way. It is necessary to stress the importance of complete cleanliness of the surface where painting of glass is concerned because it offers so little adhesion that every factor, however small, which is likely to impair the bond, must be eliminated. Small superficial impurities, which might not affect the paint finish if they were on wood, may make all the difference if they are allowed to remain on the surface of glass.

There are a number of proprietary window cleaning compounds on the market, based in most cases, on a mild abrasive with a dirt solvent, such as spirit and soap, or water and soap. A simple and effective medium is a mixture of whiting and methylated spirit, made into a thin paste and rubbed over the glass; this is allowed to dry and then polished off with a clean cloth. Equally good and more convenient is a solution of a good sugar soap in warm water; if the glass is in good condition, a fairly strong solution may be necessary, sponging off with clean water and leathering dry. Washing down with a warm solution of pure caustic soap is quite effective in many cases and it is a good policy to go over the glass with a rag moistened with ammonia, finally polishing with tissue paper.

In selecting paint for use on a glass surface, it should be borne in mind that protection does not enter into the question; the essential properties are that it should obscure well, go on evenly and above all, retain its adhesion for a reasonably long period.

Suitable Types of Paint Most of the leading manufacturers will supply paints formulated for use on glass. Broadly speaking, the most adherent types of binder for the first coat in direct contact with the glass are those which are based on a relatively high proportion of hard fossil gum or a suitable type of synthetic resin. These types are likely to give better service than are the more elastic and oily types.

The thicker the paint coating, the greater will be the contraction and consequently the greater, too, will be the risk of the film pulling away from the glass. The minimum number of thin coats to provide the necessary opacity is therefore desirable.

Thin Coats The main colour coat should, therefore, be prepared from the strongest and best quality pigments, so that only a thin film of the paint need be applied to obtain an uniform and opaque effect and this should remain adherent and elastic, even though it may become very hard on drying.

The necessity for opacity in pigments used in paints for application to glass inevitably restricts the palette, but it is important that as small a proportion of pigment to binder as possible should be employed. Of the whites, the most opaque is titanium, with lithopone a good second, while of other colours Prussian blue, vermilion, the red oxides of iron, and chromium oxide are useful from similar reasons. If pigments weak in obliterating or staining power are used, a great amount of pigment will have to be incorporated and the resulting paint will be under-bound and tend, in consequence, to shrink or peel away from the glass at an early date. When a sufficiently strong pigment is employed, the colour coat may be well bound in order to ensure maximum adhesion and should not dry out flat but rather with a full egg-shell gloss.

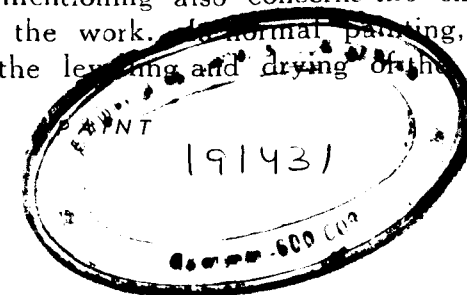
Excellent results are obtainable by using pure strong colours ground in gold size, thinned out with approximately equal parts of a good elastic mixing varnish and pure turpentine. Alternatively, pigments ground in turpentine, mixed with gold size, may be used. Paste colours in oil are less satisfactory unless sufficient gold-size is added to quicken up the drying and overcome the softness of the oil.

In most instances, one coat will be insufficient to give the required degree of obliteration, and a second coat will be necessary. This should be rather more elastic and preferably of identical, or almost identical shade in order to give a uniform and dense effect to the film when the latter is viewed through the glass.

The Backing Coat - - A third coat should seldom be required, but should it be found desirable, the same principle should be followed as obtains in other decorative work—that is to say, each coat should be progressively elastic and this includes the protective backing coat which will be exposed to the air.

When selecting colours for work of this kind, it should be remembered that the fact that the paintwork will be seen through the glass may considerably affect the colour. In most instances, the glass will impart a greenish tinge and the colour, when viewed through it, will show a marked difference from the same colour painted out on a wooden or similar surface. The tinge will vary according to the type and thickness of the glass, but unless the paint happens to be a blue or green, when only a slight difference is discernable the distortion of shade may be considerable. If, therefore, a very pale brilliant colour is required or a match is to be made to any given shade, full allowances must be made and steps taken to counteract the greenish cast by modifying the colour of the paint.

Another point worth mentioning also concerns the effect of the glass on the appearance of the work. In normal painting, a minute skin-layer floats out during the levelling and drying of the film, to a



different shade from that of the film itself. When looking at a paint film through glass this clearer, darker film is not seen, but a more densely-pigmented layer, usually of a slightly lighter and flatter tone, is seen.

Although common window glass and ordinary plate-glass cut off or absorb a large proportion of the ultra-violet rays from broad daylight, sufficient active rays penetrate to cause ultimate fading and as the glass surfaces are constantly exposed to light, care should be taken to use only pigments and colours which are fast to light. It is unlikely that the painter will be called upon to deal with the special type of glass which allows ultra-violet rays to pass, but in such an event, the use of light-fast colours is even more essential.

The difficulty of painting on glass, in many cases, is complicated by the existence of condensed moisture on the back of the glass—a form of trouble extremely prevalent in shops in cold or wet weather, when such establishments are over-heated and under-ventilated. Moisture from this cause is the worst enemy of paint-work on windows and will attack the film from the back, causing it to disintegrate and gradually to flake away from the glass. It should be remembered that glass is a good conductor of heat and is constantly chilled and re-heated rapidly with temperature variations from day-time to night-time, so that some form of condensation on the surface is to be expected.

When plenty of time is available for slow and complete hardening, it is advisable to use slow-drying and elastic backing coats. If these are employed, excessive oxidisation does not continue after the work has hardened and therefore the elasticity of the film is retained for a much longer time.

It is common practice to use varnish as a final backing coat and when this is done, care should be taken in the choice of a suitable type, particularly when condensation may be expected. Ordinary general purpose varnish will have relatively little resistance in such circumstances ;

what is wanted is a material of the type sold as boat or yacht varnishes since these have the highest possible resistance to moisture. In applying, the varnish as a backing to lettering and similar work where the paint-work does not cover the complete surface of the glass, the material should be taken slightly over the paint on to the surface of the glass itself, so as to provide as complete a seal as possible.

The decorator is sometimes required to obtain ground glass effects on ordinary window or plate glass surfaces. There are various ways of doing this, the most usual, in all probability, being to apply a coat of white paint, well thinned out, and stipple.

Ground Glass

Effects Another alternative is to apply one or two coats of flat varnish, rendered slightly more opaque by the incorporation of a little finely sifted whiting.

Though they do not give exactly the effect of ground glass, it is worth while mentioning, in this connection, the possibilities of cellulose crystallising lacquers. These are simply brushed on the surface of clean glass; in drying, the film takes on an attractive crystal pattern, the size of which depends on the thickness of the film and the speed with which it dries.

The Editor will be glad to receive articles of a practical nature, preferably accompanied with illustrations, on topics covered by this journal.

DRIER IN PAINT

The ready mixed oil paints consist of four important constituents:—

1. Drying Oils
2. Volatile thinners
3. Pigments and
4. Driers.

A good paint giving reliable service should be well balanced in all its constituents. The drier for example is hardly $\frac{1}{2}\%$ of a ready mixed paint. Yet its presence in the right proportion is essential. Without it paints and varnishes take many days to dry. An over-dose of it will lead to many defects in paint films. Air drying paints and oil varnishes must contain driers.

The drier quickens the drying speed of paint and varnish films. Its function commences only after the paint and varnish is spread out on a surface in thin films. It has practically no effect on the liquid paint in the sealed paint can. But when the can is kept open exposing the upper surface of the paint or varnish to oxygen in the atmosphere, the drier gets busy and goes on with its work till a thick film (skin) is formed on the surface. This is known as skinning in the paint can. This skin which is formed on the surface of the paint, effectively seals the ingress of oxygen to the paint underneath. Therefore the paint or varnish below the skin will be unaffected. Thus the drier functions only in presence of oxygen. The proportion and quality of the drier will influence the life of a paint film. It is therefore imperative for all those concerned with the formulation and application of paint to know about this vital ingredient in paint.

DRIER IN PAINT

In the early days when white lead only was used as a white pigment, the addition of extra amounts of driers and a detailed study of their characteristics was not very important. The widespread use of driers, in the sense in which we know them now, came in after the introduction of such pigments as lithopones, zinc oxides etc. which had no appreciable drying action on the paint media. In the early days red lead and litharge as also some types of umbers were known to accelerate the drying speed of paint and varnish films. Later manganese-dioxide was added to the list. Since it was found to be more efficacious than red lead or litharge, when properly incorporated, manganese was considered as a very effective drier. Its only drawback was that its use as drier discoloured the paints. In course of time some compounds of lead and manganese—notably lead acetate and manganese borate were found to get easily incorporated in drying oils without great discolouration. So manganese borate and lead acetate were preferred to others for white paints and pale varnishes etc. Only at the beginning of this century the use of cobalt as a drier forming metal came into prominence. Cobalt drier is considered to be the most powerful. In course of time with improved methods and better scientific knowledge, the preparation of driers became a subject by itself. Most paint works are satisfied to get driers in a concentrated form from makers specialising in the line. Though there are certain other metals as zinc, iron and vanadium, which are known to exert a drying influence on paint films, the drier forming metals are lead, manganese and cobalt only, as far as the painters and paint manufacturers are concerned.

When a drier forming metal combines with a drying oil or a resin we get a compound which quickens the drying speed of a drying oil film. This is called a drier. But it must be borne in mind that it is essential that the oil should be a drying oil which dries to a solid film. The drier can only accelerate the drying speed. It can never make an oil which is not a drying oil dry, whatever quantity of drier is incorporated.

**What is
A Drier**

Now let us see how the drier makes the drying oil films dry quicker. The constitution, or the arrangement of the component atoms of a drying oil molecule is such that it has a hunger for oxygen. This hunger is called unsaturation. Due to this unsaturation the drying oil molecules absorb oxygen from the atmosphere. The oil gradually gets more and more solid. This is known as the drying of the drying oil film. But there is one peculiarity about this oxygen assimilation. Though the drying oil has got great hunger for oxygen it cannot easily assimilate the oxygen as it exists in air. For example fish require oxygen to live but they cannot take oxygen from the air however free and abundant. They can take in oxygen dissolved in water only. Fish thus require the help of water to supply oxygen to them in an assimilable form. In the same way the oxygen hungry drying oil molecules require the help of a drier to supply the necessary oxygen in an assimilable form.

All the drier forming metals form at least two oxides. Thus one atom of the drier forming metal manganese, combines with one atom of oxygen and gives manganese monoxide. It combines with two atoms of oxygen and gives manganese-dioxide. Cobalt also exists in two combination stages. Lead on the other hand forms more than two oxides. For the metal to be an effective drier the oxygen in the higher combination product should be in such a state that the drying oil molecules can easily snatch the oxygen from it. At the same time the affinity, of the lower oxidation product for oxygen should be strong enough to absorb oxygen from the air and form the higher oxidation product. According to this hypothesis the drying oil molecules have a very great desire to take in oxygen and form higher oxidation products. But by themselves they are not able to utilise the atmospheric oxygen. The drier on the other hand can take in oxygen from air as it exists but its affection for the drying oil molecule is so great that it readily parts with its acquired oxygen when the drying oil molecule asks for it. The drier molecule after giving its acquired oxygen to the drying oil molecule takes another dose of oxygen from the atmosphere. As soon as it gets this extra oxygen a near by oxygen hungry drying oil molecule asks for it. The drier molecule cannot by nature turn down the oil molecule's request for oxygen. So it gives it

the oxygen and takes another dose of atmospheric oxygen. This cycle continues till the drying oil molecules in the paint film ask no more of oxygen. Thus one drier molecule can relay oxygen to many drying oil molecules and accelerate the drying speed. That is why only small amounts of drier is enough. The driers are said to function as accelerators or catalysts.

The drying oil molecules are comparable to innocent children who know no refusal for eatables and do not realise that too much of anything is bad. Oxygen is necessary for the drying oil films to dry, but more of it will destroy the film itself. The oxygen greedy drying oil molecules do not remain satisfied after their oxygen hunger is satiated (i. e.) after the oil dries to a solid film. They go on taking more and more oxygen whenever it is available till the dried oil film itself gets destroyed. The drier molecule is comparable to the fond granny who tries to give the grand children more eatables even after their hunger is satiated. It cannot therefore refuse the request of the irresponsible oil molecules for more oxygen. So it takes oxygen from the air and gives it to the oil molecules in an assimilable form. Thus the drier which is a helper during the drying stages of an oil film becomes its destroyer after the film dries. That is why paint chemists make incessant search for a method or material which allows the paint to dry but checks its destruction when once it dries. The first stage is called the drying stage and the next stage is the disintegration stage. But in both stages the principal reaction is oxidation. Without oxygen the reaction does not exist. The drying is necessary and hence driers are incorporated in paints. But the same driers accelerate the disintegration stage which is also oxidation. To check this disintegration a substance which retards oxidation is necessary. Such substances are called anti-oxidants and are used in some cases to check the rapid disintegration of paint films. But since these anti-oxidants retard oxidation they tend to counteract the accelerating effect of driers. Consequently drying is slowed down. That is why anti-oxidants have not been very popular.

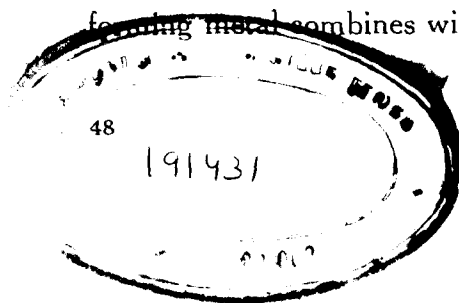
DRIER IN PAINT

Now let us see what happens when more than the required amount of the drier is incorporated. The rate at which oxygen is supplied to the drying oil molecules is naturally proportional to the number of drier molecules. Up to a certain limit an increase in the drier proportion increases the drying speed. Over this limit, (optimum) the rate of oxygen supply by the drier is more than the rate of oxygen consumption by the oil molecules. The difference is that between a well watered field and a flooded field. The oil molecules in their greed for oxygen outstep, so to say, the limits of decency and try to assimilate all the available oxygen. This haste results in waste. There is no uniform drying and a badly formed film with uneven drying results. Sometimes the film dries at first but later gets soft and tacky again. This is called sweating of paint films and can generally be traced to excess drier. It may be questioned why white lead and red lead paints do not wear out quick and exhibit film defects because lead is a drier forming metal and is present in such large proportions in those paints? But the position is different. The drier to be active should be soluble in oils and should be intimately dispersed in the paint medium. But red lead and white lead in the paints are not in a soluble state. Only a fraction of the lead unites with the drying oil and becomes a soluble lead drier. The early chalking of white lead paint films is attributed to the drier action of white lead. In the case of red lead sometimes an addition of 20% to 30% of an inert pigment as red oxide is advocated for better durability in place of genuine red lead.

The driers are classified according to the organic acid radical with which the drier forming metal combines. The rosinate are driers in which the drier forming metal combines with the organic acids in Rosin. The linoleates are driers in which the drier forming metal combines with the organic acids in linseed oil. The tungates are driers in which the drier forming metal combines with the organic acids in Chinese tung oil.

(To be continued)

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