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P A I N T

A QUARTERLY **JOURNAL** DEVOTED TO
PAINT MATERIALS & PAINTING METHODS

418 428

Editor : P. GOPAL RAO, M. Sc.

Vol. 1 OCTOBER 1940 No. 4

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S O D H A N
THE COTTAGE INDUSTRIES ASSOCIATION
T E N A L I

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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

OUR READERS

WE have started this Journal for serving the paint consuming public. We are regularly sending you copies of our publication since January 1940. This is admittedly the first Paint Journal in India. Being a pioneer attempt it may have some shortcomings due to inexperience of the management. But all the same, with an undying fervour to serve, we have taken upon ourselves the difficult task of educating the paint consuming public about Paint Materials and Painting Methods. In course of time, we want to include a paint manufacturing section also, where practical problems in paint manufacture will be discussed.

All this is difficult to achieve without your whole-hearted co-operation. We request you to let us know your painting troubles and your views on painting methods. We would very much appreciate your constructive criticism about the get up, standard, and general trend of articles of our publications. We feel that your critical opinion will be invaluable for perfecting the existing shortcomings if any.

That is not all. No venture, however pious, can succeed without financial backing. We have the zeal to serve. With your helping hand, we shall be the connecting link between the paint manufacturer and consumer in our country and strive hard to raise the existing painting standard. We request you to remit your annual subscription of Rs. 2/- if you have not already done so. Please also recommend us to your friends who may be interested in the line. At your service ever with pleasure,



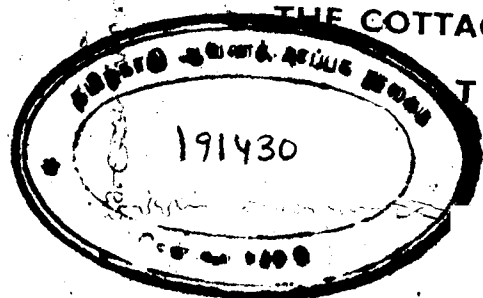
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COMMENT

Due to war, paints increased in price as also the painting brushes and all other painting requisites. But we find that the painting rates have not increased proportionately. We are not referring to the

Painting In position with private house owners. Their position is
Departments different. We expected the Government and Semi-

Government Departments with technically qualified staff to realise the situation and revise their schedules. After waiting for a year we have to say that the departments have not realised the position and altered their schedules. What they have done in some cases is to stop the maintenance expenses due to war. Due to war, the staff is not reduced. Only the works they have to do are reduced. We had occasion to see the condition of some buildings and bridges in some local-board areas. It is no exaggeration to say that they have not seen paint during the last decade. No doubt the convention is to repaint them every three or five years! But that is on paper. In practice the bridge or building is painted when first constructed. Even then the general contractor is asked to finish it up. He gets some paint and finishes somehow. Then there is an end of the matter. The officers forget its very existence when drawing up maintenance schemes. Painting is considered of no consequence. This is all the more lamentable when qualified engineers are in charge of such works.

Reverting to the painting schedules in departments, sometime back we had occasion to go through the schedule of rates in the Public-

Painting Works and Local Administration Departments. Our Impres-
Schedules sion is that they stand in urgent need of rectification.

In working the general schedule of rates the approved paint is taken as the paint satisfying the specifications of the Indian Stores Department. These specifications ensure a minimum in the quality of paint supplied and are revised from time to time. To quote an example, till 1933 the chocolate paint to departmental specifica- tion should contain not less than 35% Iron Oxide (Fe_2O_3) the balance

excluding stainers to be barytes. After 1933 when these specifications were brought in a line with British Standard Specifications chocolate paint was specified to contain not less than 50% Iron Oxide (Fe_2O_3). This increase in quality has naturally increased the price; but the cost of chocolate paint in schedules remains much the same. How is this explainable?

Paints prepared to such specifications are not branded and marketed. Their prices too will bear no comparison with the prices of bazaar brands since they are a matter of All-India competition between various paint works in the annual tender invited by the Indian Stores Department. No trade discounts are included in such quotations. Due to price and other considerations it happens that all paints are not supplied by the same manufacturer; one may supply the red oxide paint and another a grey paint. Supplies for these paints at prices quoted can only be indented through the controller of stores. This is the position regarding the supply of the approved paints in the general schedule of rates. But how are the painting jobs, in the departments done. The officers-in-charge rarely take pains to see that only paints up to specification are used. Even if they want they have not the necessary knowledge about them. They invite tenders for painting, including paint supply, and accept the lowest tender so that they will not have to shoulder the responsibility to explain any audit objections about the increase in painting expenditure. Smaller works are given at estimate rates. No one bothers himself what paint is used? and whether it is up to specification? The only concern is obviously to get the work done some how at least cost.

The contractor cannot get the I. S. D. qualities in the market at workable prices. He gets instead a paint which is cheaper—the bazaar quality. Its use will enable him to make a little more out of the job. He may even quote a much lower rate in the tender, without sacrificing his margin and stand a good chance of getting the work because the lowest tender is generally accepted. We are not against economisation in the spending of Public and Local Departments; but we strongly criticise the prevailing ignorance about things which they ought to know. We cannot help point-

**Existing
Practice**

ing out when third rate bazaar varieties are used on important works under the very nose of the supervising authorities when the specification which they are expected to follow suggests the use of quite a different variety. If this is the state of affairs in well organised departments which employ technically qualified men how can the painting standard in this country be improved to protect structure from severe climatic conditions. The lay public will look to the schedules and specifications of these departments for guidance. When official schedules are faulty what are the public to do?

Can this state of affairs in departments be due to ignorance? If so, the sooner they realise it the better. At least the supervisors on painting works should know to distinguish the right variety from the wrong one. They should be given the necessary training or a separate arrangement should be made to ensure better maintenance. No doubt, from time to time the attention of the subordinates is drawn to the unsatisfactory nature of Painting jobs. But since the circulars do not get to the bottom of the trouble, they are, we think, simply filed and old practices continue unchecked.

On one occasion when it was pointed out to a workspot supervisor that the paint he was using was not up to specification, his reply was typical. He said: "I know, there is even a recent circular from the headquarters not to use bazaar varieties but to use only superior qualities. But what am I to do? My schedule provides only as. 2 per pound. If I use the proper quality the job will cost more. When the yearly audit comes the auditor will not see all these things. He asks me why I spent as. 5 per lb. when, according to the schedule, it is only as. 2 per lb. I am asked to explain why this extra spending should not be recovered from my pay. I am a busy man and hate submitting explanations. To avoid all this bother I just leave things to go on. If care is taken to have the painting done neatly my superiors also will not be able to know what paint is used. As a matter of fact few in the department know about paint and they are not inclined to bother themselves. Circulars come and go but our methods go on as usual." If this depicts the general position in the departments, it is high time that proper steps are taken to prevent this

type of misuse of public funds. Circulars will not do unless proper steps are taken to enforce them. We are given to understand that in the Public Works and Local Administration Departments of the Madras Presidency alone the painting expenditure is over Rs. 3 lakhs annually. We think the amount is big enough to warrant better attention.

The root cause of the trouble, to our mind, is the indiscriminate way in which the principle of accepting the lowest tender is practiced.

There seems to be a false notion that by this, expenses *Lowest Tender* can be brought to a minimum. This notion presupposes that contractors are a vicious lot whose profiteering can only be checked by internal competition. It is not realised that proper work must be properly paid. If the contractor who has to live on contracts, thinks that under bidding will secure him works, he is tempted to lower his rate by deteriorating the standard. When the departments are manned by technically qualified people who know their job the estimate rates and working rates need not differ and troubles due to bad workmanship and inferior qualities need not arise. The tender system put price considerations before quality considerations and unless such pit falls are guarded against and proper adjustments are made all efforts at raising the standard of work are bound to fail.

Since the publication of the article "A New Drying Oil" in our July issue, Sri M. Narasimham, B. Sc. (Ag.) Agricultural Demonstrator, Guntur, Wrote to us to

substitute

"Mr. R. Swami Rao, L. Ag., Assistant Director of Agriculture, Guntur and Mr M. Narasimham, Agricultural Demonstrator, Guntur, were the first to get themselves "

for

"Mr. M. Narasimham.....to get himself" on page 35 of the July (1940) Journal.

We, therefore, request our readers to note the correction.

PAINT AND WOOD WORK (I)

Painting wood is so common a thing for the painter and looks so simple that many fundamental principles for sound finishing are overlooked

The result is a perplexing variety of painting defects difficult to explain and more difficult to remedy. It may be, *Painting on wood* that defects in painting works may not be immediately evident in many painting works. Actually the troubles may not come till the second or third repainting. Then the superimposed paint coats will be thick enough to impose sufficient strain on the weak spots in the priming. In such cases even when a first class paint is used over a seemingly sound surface, flaking of the newly applied paint will result, sometimes detaching older paint coats under it from the structure. The success of the painter and his reputation for faultless working depends on an intimate knowledge about the character and condition of the surface he has to deal with. Wood is no exception to this rule. Actually vagaries in wood are more than in any other building material. There are many types of building timber with widely differing characteristics. Even in the same log the direction of the cut will materially alter the behaviour of the cut planks and sizes towards paint and other atmospheric agents. In the same house many types of wood may be used. In all such cases it may not be practicable to have a different painting procedure for each type. Also it may be that too great an attention to details may lead to the neglect of general broad principles for sound painting. But a knowledge of surfaces, he has to deal with, will enable the painter to accurately diagnose and understand the paint failures "instead of being forced to take the blame, foot the bill and wonder why the job went wrong". He will also be in a position to rectify the defects in the most satisfactory manner. Therefore, it is advisable for every painter to have at least an elementary knowledge about the internal structure of tree trunks from which building timber is produced.

Wood used for building purposes is got from big trees which grow in forests or regulated plantations. The timber used in South and Central India is mostly from Angiosperms—the highest evolved plant type.

In the Punjab and the United Provinces, however, timber from trees of the pine family is used extensively. The pines belong to Gymnosperms—a class just below the Angiosperms in the evolution series. Among the angiosperms the timber from dicotyledonous trees is most in use. Occasionally, however, the trunks of trees belonging to monocotyledons particularly of the palm family are used. But it is very rare that a painter is called upon to paint them. So, for our purpose, the internal structure of dicotyledonous tree trunks has to be understood. From the point of trunk structure the dicotyledonous angiosperms and gymnosperms of the pine family do not differ materially.

The felled tree trunks after seasoning in timber yards are cut into various sizes as planks, reepers, rafters etc. according to requirements. Finished wood work after planing may look smooth and solid to the naked eye. But a close examination with a magnifying glass will reveal its cellular structure. What we call grain in wood is the visual manifestation of different cell-combinations. When a log of wood is cut transversely the transverse section will be found to consist of a number of dark and light coloured rings one inside the other. The trunk will be seen to consist of three distinct regions :- (1) The outermost zone just inside the bark called cortex or sap-wood, (2) the intermediate zone called secondary xylem or heart-wood, (3) the central region called pith. The cortex is composed of cells which were engaged in the process of assimilation and nutrition in living trees. Though this region contains rigid walled cells it is relatively weaker than heart-wood and also lighter in colour. It is liable to dimensional changes depending on weather conditions. Its very name sap-wood indicates that its role in living trees was to supply sap from roots to leaves and twigs of the tree. Generally speaking, most of the resin-producing cells are found in sap-wood. There are certain types of wood pines which are very resinous. The resinous matter in such woods is easily soluble in the solvents used in paints and varnishes. So, as soon as a paint coat is applied over such wood the resin softens, dissolves in paint thinners, comes out to the surface and will show itself as persistent yellow patches on light coloured paint coats.

The secondary xylem or heart-wood is formed by secondary growth due to the formation of cellular rings which, in course of time, lose their cell contents. The cell walls get filled with tannin, lignin etc., which gives a dark colour and preserves the wood from decay. This heart-wood is best for building purposes. The rings in heart-wood are known as annular rings and are formed twice in a year. The cellular ring formed in spring consists of thin walled, light coloured cells with larger cell cavities. This spring wood is soft and porous and takes stains easily. The cellular ring formed in autumn (just after the rains are over) consists of thick walled cells with smaller cell cavities. It is hard and less porous and does not take as dark a stain as spring wood. It is also darker in colour.

This annular ring structure determines the behaviour and appearance of wood according to the direction in which it is cut. When wood is cut in a radial manner the edges of the grain are exposed. When such wood comes in contact with water bearing brick-work or concrete, water is sucked in and forced out through the other side. If this side is painted without effectively sealing the back side which is in immediate contact with the moist wall, blistering of paint work will result. In the case of wood boards with flat grain got by tangential sawing of the tree trunk this transmission of moisture is kept at a minimum and the tendency of the paint to blister is reduced. If, however, the timber is cut in such a way that the cut annual rings will be within the board and do not open out on the other side, moisture will not be easily transmitted through the board. Again thin walled spring wood cells carry water more easily than heavy walled autumn wood (also called summer wood). So when blisters arise due to this drawing of water to the painted surface, blisters will first appear over bands of spring wood. Blisters in paint work may also be caused by the difference in the swelling and shrinkage of spring and autumn cells. Poor quality wood may shrink and change shape to such an extent that scaling and flaking away of paint may be almost inevitable. There is another strange feature of some flat grain boards which should be known. When directly exposed to weathering agents the grain peels off in layers some times. It is found that the grain on the pithside has a tendency to shell out due to weaker adhesion while the grain on the barkside does not

show this defect. Therefore the barkside of flat sawn boards is better than the pithside. Such boards should, therefore, be turned barkside out when being fixed in exposed portions.

There is another feature in living trees which becomes important when considering the problems of painting wood. This is the madulary ray. In cross section the madulary rays are seen as lines radiating from the central pith to the outer cortical region right through the heart-wood. These function as food-ducts in living trees. These when present will help the transmission of moisture from damp contacts to the drier side.

Now a word about the origin of knots known to painters as a perennial source of trouble particularly in resinous woods. When the branch of a vigorously growing tree is cut or broken the layer of growing tissues (cambium) around the margin of the damaged protion try to heal it up. They produce a soft tissue called callus which covers up the damaged portion. The burried portion is the knot as we see it. Due to the pressure exerted by the surrounding tissues it becomes hard. As the wood cells in the knot lie more or less transversely across those forming the bulk of the timber they provide passages through the annular rings and aid the transmission of water and resinous substances etc. to the surface of the painted board. To ensure reliable results such knots should be treated on both sides to check both the ingress and escape of moisture etc.

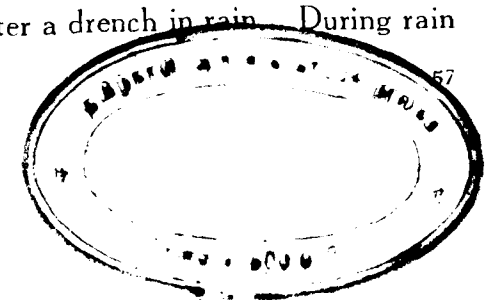
The above considerations should no doubt prevail when timber is selected, sawn into required sizes, and fixed in position, and are strictly within the province of the carpenter. But since the painter is called in to give the finishing touches and make the structure presentable and durable a knowledge of the wood work used will be very useful to plan out the most suitable painting procedure.

Coming to the painting of wood the problem of preparing the surface is of atmost importance. The preparation of surfaces depends to a large extent on the type of finish required. Finishing wood may be classed under four heads. 1. Plain painting with one or more solid colours. 2. Decoration work with paints, stains etc. as graining and marbling effects. 3. Copal varnishing. 4. Polishing and staining.

Moisture in Wood

Each finishing process differs from the other in detail but the character of wood and its physical state is a common consideration for all. The most important consideration is the moisture content of wood. Closely connected with this is the problem of checking dry rot and fungoid growth.

The fibers and intercellular spaces of wood in living trees are filled with sap and other watery liquids. As such, new wood is saturated with water. This wood to be suitable for building purposes should be dry and free from excess moisture. This is accomplished in timber yards and the process is called seasoning. Well seasoned wood is necessary for all sound constructions. During the seasoning process the moisture content in wood decreases gradually till it is in equilibrium with the surrounding atmospheric conditions. This air seasoning is a slow process taking years. To quicken this drying process timber is dried artificially at higher temperatures. The use of this type of timber (kiln dried timber) is rare in India. By careful kiln drying not only is moisture content reduced to a minimum in a short time, but any existing resinous parts are also hardened. So the troubles due to resinous woods are minimised. On the other hand, however, carelessness in the temperature maintenance in kiln drying and too rapid drying speed will lead to what is called case hardening. The outer layer of wood becomes dead and gets hard and brittle. If painted over, the paint is prone to peel off along with this hardened layer, when it gets separated from the stronger wood-below, due to temperature changes. For such case-hardened woods the priming paint should be of a thinner consistency with more proportion of turpentine or other better penetrating solvents. Then only will the primer have enough penetrating power to soak down into the vital wood below the hardened layer and get a foot hold. Unseasoned or partially seasoned woods are liable to great dimentional changes and shape distortion with changing weather conditions. By proper seasoning this undesirable property is brought to a minimum. Even then, it must be understood that, well seasoned wood also does not withstand abnormal conditions for long without appreciable change. Thus unprimed wood structures as doors and windows etc., even when made from well seasoned wood should not be given the priming coat a few hours after a drench in rain. During rain



some moisture must have soaked in, which takes at least a couple of days (in dry weather) to dry well. Otherwise, when the surface temperature is raised by direct sun or hot weather the imprisoned moisture under the priming coat tries to come out and the paint blisters. The penetrating power of primers is very low in moist woods. Such moisture laden woods do not afford good anchorage for paints.

Moisture in wood creates favourable conditions for mould growth and consequent "dry rot." Timber protected from fungus attack will last many years. The destructive action of a species of fungus which makes the timber lose weight and volume, and crumble away is called 'dry rot'. Once 'dry rot' has gained a foot hold, it is a difficult and costly process to prevent further spread of infection. It would be better therefore to practice methods of prevention rather than attempt methods of cure. Incipient fungus attack is very difficult to detect as outward signs are frequently missing and seemingly sound structures may collapse without warning.

The fungal attack may be effectively checked by (1) keeping the wood dry and (2) poisoning the food supply for the fungus by impregnating the wood with a toxic substance. Coal tar creosote is perhaps the oldest and by far the most widely used wood preservative but when exposed to air the more volatile portions, which are really more toxic, volatilise away reducing its preservative properties. Secondly, creosote not only soaks through (bleeds) all oil paints but retards their drying appreciably. So creosote impregnated woods cannot be painted over as usual with oil paints. Thirdly, not only is the colour of creosote impregnated wood is not pleasing to the eye but it has an offensive smell. Therefore, the use of creosote as a wood preservative has many limitations.

Of late many wood preservatives have come into the field which are claimed to be equal to or even better than creosote, with the added advantage of paintability. The ideal wood preservative should not only be colourless, odourless and cheap but also,

- (1) very effective and permanent in effect,
- (2) harmless to the higher animal life.

- (3) completely insoluble in water when once it is injected into the wood tissues, so that it will not be leached out by water,
- (4) easy of application and possessing good penetrating power in wood tissues even when wet,
- (5) free from any tendency to bleed through the subsequent paint coats.

It is now known that certain metallic derivatives of some selected naphthenic acids have good timber preserving properties without the disadvantages of coal tar creosote. But since naphthenates are not definite chemical entities but comprise of a series of cyclopentane carboxylic acids care should be exercised in the correct selection of the naphthenates. Actually the naphthenates of some metals as copper and zinc are being offered as very effective wood preservatives. In our country, Mr. Kamesam's name (now with the Travancore State) is associated with a process of wood protection (petrification) against deterioration, which is being widely appreciated. Thus all wood work intended for painting over should not only be quite dry but should also be in a sound condition free from damaging fungoid growths and preferably impregnated with the right type of wood preservative.

It goes without saying that most of what is told above pertains to the selection and preparation of wood for structural purposes over which the average painter has no control but that in no way justifies his remaining in ignorance of the correct procedure. An ambitious painter should be conversant with all details of construction and be able to avoid pit falls. His is the final work which makes or mars the whole appearance when finished and no knowledge of detail is too much for him.

Before the giving of the priming coat to wood work the surface should be well prepared by rubbing down with sand paper etc. The preparation of surfaces is a much discussed but little practiced subject. One may wonder why the preparation of surfaces, so essential for good finishing, is not given the attention it deserves. The defect lies elsewhere. The cost of a painting job is the sum total of three items:—(1) The cost

of cleaning and preparing the surface (2) The paint cost. (3) Painting labour. Usually the three items cost about the same. Where removal of old paint becomes necessary the cost of cleaning and surface preparation is even more than the other two items put together. But the painter should be paid for the work he does. In practice, however, people for whom the painter works on a contract basis seldom realise the importance of surface preparation prior to painting. The practice of accepting the lowest tender coupled with the ignorance of responsible people about painting does not allow adequate provision for executing a sound job. The painter obliged to compete on price basis has to economise. This economisation is easily practiced in the preparation of surfaces since the property owner does not appreciate its necessity. There is, however, no meaning in blaming the painter. The rate allowed is hardly sufficient to cover the material cost and painting expenses and nothing is usually left to be spent on surface preparation. More often the rate allowed does not allow the use of even good quality paint; and a painter doing work on contract basis has to use inferior cheap paints to escape loss. The best way, from the property owner's point of view, to ensure good surface preparation is to pay the painter to do the work properly and not argue with him over the cost of surface preparation.

The painter should see that the surface to be primed is dry and clean, free from plaster and mud splashes and grease. The back side of door and window frames meant to be in contact with the walls should be effectively sealed against the intake of moisture etc. and then fixed. In this country liquid coal tar is generally applied to the sides to be in contact with walls and other plaster or mud work. In this connection it is interesting to note the results of experiments carried out at the Forest Products Research Laboratory*, issued by the Information Bureau of Building Research Station, England. Tests on 1/2" thick beech wood planks were carried out with a variety of coating materials ranging from lime hardened Rosin Solutions in Naptha to good grade sparvarnishes and bituminous paints on the one hand and from a single coat treatment with pink priming to

* Summarized from a note appearing in "The Decorator" of October, 1933 under the heading "Damp resisting tests on wood."

a three coat treatment with a white lead paint on the other. The results based on the exposure of the painted pannels. in a damp room for 7, 14 and 28 days showed that lime hardened Rosin Solution has the highest water insulating efficiency, with bituminous black paint coming second. Linseed oils, raw or boiled, were found to have practically no water resistance. Water resisting sparvarnishes and pink primers were also found to be unsatisfactory. These results, it must be noted, are contrary to the common belief and actual experience in other spheres that lime hardened Rosin solutions have poor water resistance.

Having effectively sealed the back sides of frames to be fixed in the walls etc. (against moisture absorption from damp contacts,) the painter should turn his attention to the sealing of knots. Knots should be sealed on both sides with a good sealing solution (a concentrated solution of shellac in methylated spirit) so that the ingress and egress of moisture etc. is effectively checked. Then the painter should see that the iron bars fixed in window frames etc. are effectively protected against rusting. Usually the iron bars are fixed in the holes cut in the bottom piece in a careless manner. When such frames get wet in rain the water gets into the void in the wood and rusting of the iron bar in the wood starts. Since rust occupies more space than iron (metal) the bottom piece of the window frame gets split in the middle and the bars get loosened. In course of time, the bars wear away to pencil points and can be bent apart. All this can be avoided if the hole cut in the bottom piece of the wooden frame (to receive the bar) is first filled with a stiff paste of genuine red-lead in linseed oil and then the bar is thrust in. Then the void between the wood and the bar is effectively filled with redlead paste. So no moisture can collect itself there and the bar ends will not rust. These all look insignificant details, but this should be noted and carefully attended to before a regular coat of priming is given.

It goes without saying that cracks and small holes in wood work, as also depressions around nail heads etc. should be filled with good quality putty (putty is good quality whiting with a small proportion of white-lead ground to a stiff paste in genuine raw linseed oil). Many painters prefer to do the puttying after the priming coat is dry and before the

next painting coat is applied. Because:— (1) The cracks etc. in wood will be more in evidence and easily seen after the priming coat is given. (2) If the putty is applied on unprimed wood the oil in the putty will be absorbed by the surrounding oil-hungry wood tissues thereby reducing the strength and adhesive power of the putty.

DRIER IN PAINT (II)

In the last issue the importance of drier in paint, and the mechanism of drying were discussed at some length in a non-technical way. In this issue it is proposed to deal with the methods of preparation, properties of driers individually and in combinations, and the influence of other constituents in paints as also of atmospheric conditions on drier efficiency. As usual an attempt is made to explain the fundamental principles involved and no particular attention is paid to conform to scientific and technical details.

The preparation of driers is carried out in two ways:—(1) The fusion method. (2) The precipitation method. To understand them we should know the meaning of the four words in Chemistry:—

Methods of Preparation

(a) The salt (b) the ester (c) the soap and (d) the drier. When an inorganic acid like hydrochloric acid and an inorganic alkali (base) like caustic soda react and combine the resulting product (sodium chloride) is called a SALT. When an organic acid as acetic acid and an alcohol as amyl alcohol react and combine the resulting product (amyl acetate) is called an ESTER. When an organic acid as oleic acid and an inorganic base (alkali) as caustic soda react and combine, the resulting product (sodium oleate) is called a SOAP. When, however, the metal in the reacting base (alkali) is a drier forming metal the resulting product is called a drier. Thus when fatty acids in linseed oil react and combine with lead hydroxide the resulting lead linoleate is called a DRIER. In the preparation of driers the drier forming metal is made to combine with the organic acids in the drying oil or with resin (usually common rosin).

In the fusion method the oxide or a suitable salt of the drier forming metal is heated with sufficient quantity of the drying oil or resin till the metal combines with the oil or resin and forms the drier.

Fusion Method Suppose you want to prepare a lead rosinate drier. Then, say about 10 lbs. of litharge or lead acetate are cooked with 30 or 40 lbs. of Rosin till the lead compound is completely taken up. This is a tedious method requiring high working temperatures. Again the metal content (percentage of the metal) of the drier cannot be theoretically deduced and has to be actually estimated. Sometimes, some of the drier forming metal remains undissolved while in other cases the amount of the drier metal is not enough to react with the whole oil or resin. Again, since the cooking temperatures are high and cooking times long, these fused driers are dark and discolour pale varieties of paints when used in their preparation. In the fusion method if the organic acid is in its free state and not in combination the preparation is easy. Thus since in colophony (common rosin) the organic acids (mostly abietic acid) are present in a free (uncombined) form the rosins are easily made by fusion. But in the case of linseed oil the organic acids are present in combination with glycerine. Therefore, the formation of linoleates by fusion alone is difficult. In such cases the free fatty acids of the drying oil are first prepared and then the free fatty acids so prepared are fused with a suitable compound of the drier forming metal. Thus for preparing lead linoleate by fusion method the linseed oil is first converted into a soap by treating with an alkali hydroxide. Usually, 19 lbs. of pure caustic potash or 12.5 lbs. of commercially pure caustic soda are required to convert 100 lbs. of genuine linseed oil into soap. The procedure is the same as that adopted for making any soap. This soap is well agitated with twice the amount of water and then an equivalent amount of sulphuric acid (a little over 15½ lbs. of pure acid) is added gradually with constant stirring. The sulphuric acid splits the soap, combines with the alkali radical to form a sulphate, and sets free the free fatty acids. These free fatty acids are oily by nature and float to the top when warmed. These acids are then heated with litharge or a lead salt to get the lead linoleate drier. The rosins and linoleates of other drier forming metals are prepared in the same way.

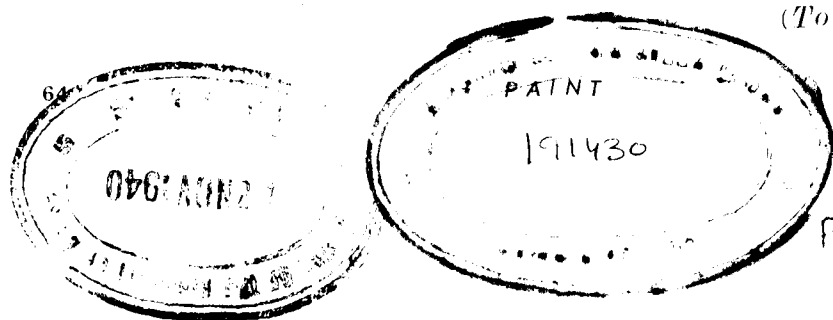
DRIER IN PAINT (II)

In the preparation of driers by the precipitation method, the soap of the drying oil or resin is first dissolved in water, and, to this soap solution, is added an aqueous solution of a salt of the drier forming metal. Thus to prepare lead linoleate the linseed oil soap is dissolved in water and to this is added an aqueous solution of lead acetate. The lead linoleate separates as a white curdy precipitate. This reaction is double decomposition pure and simple where two water soluble substances interact and form a water insoluble and a water soluble final products. Since the precipitated lead linoleate is a definite chemical compound, the percentage of the drier forming metal in it is definite. For all practical purposes it is the same as the theoretical percentage. Also these precipitated driers are easily soluble in drying oils and solvents. It goes without saying that the precipitated drier is separated and dried free from water etc. before incorporation in paints.

The driers obtained by the precipitation method are pale and contain a higher percentage of the drier forming metal. So naturally they are more powerful since the drying properties are directly proportional to the metal content of the drier. The metal content in fused driers is very much less than the theoretically possible amount. In the case of precipitated driers the metal content approximates to the theoretical amount. Thus the metal content in fused lead resinate or linoleate is only about 12% while in the precipitated resinate or linoleate it is about 26%. It is difficult to make, by fusion method manganese resinate with a metal content over 4% and cobalt resinate with a metal content over 3%. By the precipitation method, however, we get cobalt and manganese resinates with a metal content around 9%.

The driers whether fused or precipitated as above are known as concentrated driers. They are bought or sold and evaluated according to the metallic content. Thus a cobalt linoleate with 3% cobalt is cheaper and less effective than a cobalt linoleate with 6% cobalt metal. In the market, however, we do not get these concentrated driers. We get the diluted driers under a variety of trade names.

(To be Continued)



OCTOBER, 1940

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P. 5855-117

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Printed by M. Subrahmanya Sarma at The Orient Power Press, Tenali and Published by
P. Gopal Rao, for Sodhan—The Cottage Industries Association, Tenali.