Zinc Pigments in Paint Manufacture

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From a paper read before a joint meeting of the Toronto, Cleveland and the Western New York Paint and Varnish Production Clubs at Niagara Falls, Ontario, in June, 1932

PRODUCTS

PIGMENTS, COLORS, CHEMICALS

"Ozlo" Leaded Zinc Pigment	*Zinc* 60% — *Lead* 40%		
	Zinc 65% — *Lead* 35%		
"Permolith" Lithopone	Normal	Blued	All oil absorptions
		Unblued	
"Permolith" Lithopone	Reinforced 50-53% Zinc Sulphide Titanated 15% TiO_2		
Pure Zinc Sulphide			
White Lead	Old Dutch Quick Process	Dry Pulped in Linseed Oil	
Colors, Dry & Pulped in Linseed Oil	Chrome Yellows—C. P. and Reduced Chrome Greens—C. P. and Reduced Chinese Blue Para Reds and Toners Toluidine Reds and Toners		
Litharge	Glass Makers Color and Varnish Makers Insecticide Manufacturers Oil Refiners		
Red Lead	70%, 85%, 92%, 95% Pb_3O_4		
Zinc Sulphate *("Rayon" brand)*	$ZnSO_4$ — $5H_2O$ $ZnSO_4$ — $1H_2O$		
Cadmium Metal	99.5+% Pure		

OZARK SMELTING & MINING CO.

EXECUTIVE OFFICES: 101 Prospect Ave., N. W., Cleveland, Ohio, U. S. A.

MINES: Magdalena, New Mexico

SMELTERS: Coffeyville, Kansas

FOREWORD

AT the present time it seems like a far cry back to the beginning of this decade when The Sherwin-Williams Company first took up investigation and manufacture of a Leaded Zinc Pigment and later purchased its now independent auxiliary, The Ozark Smelting & Mining Company.

Previous makers of Leaded Zincs had been poorly equipped in the way of any definite technical knowledge as to how best to produce it. Experience with Leaded Zincs made up to that time was largely unsatisfactory and disappointing, and while it seemed reasonable to believe that a combination sublimed lead and zinc pigment could be produced that would possess satisfactory all round paint qualities, the kernel of the thing was, to do it.

This was particularly difficult in the face of the pronounced opposition existing for many years on the part of the makers of other competing pigments.

In fact, long years after leaded zinc had proven its right to a place in the sun, it continued to be "damned by faint praise" by those whose interests it opposed.

However, nothing daunted by any discouraging antecedents, the company started its research and has continued through all of these years to improve its product to the point where "Ozlo" *(Leaded Zinc Pigment)* has become the one *best balanced* outstanding combination

white paint pigment, which for several years past has won an output of two to one *over all other leaded zincs made.*

"Ozlo" having for years demonstrated its superiority over similarly proportioned mechanical mixtures and moreover having shown that 65/35 and 60/40 Leaded Zincs afford by far the best carrying mediums known, for the various reinforcing pigments now being offered and used, a widely extended field has opened up which is destined from this time forward particularly, to vastly increase the tonnage of leaded zincs for use in high grade paints for exterior uses.

The policy of The Ozark Smelting & Mining Company is unique, in that it not only sells Pigments, Colors and Chemicals, but it also furnishes without charge, on request from its customers, a character of up-to-date technical service as to the best use of its products, which is unequaled by any other pigment manufacturer.

THE OZARK SMELTING & MINING CO.

DR. C. D. HOLLEY
Director of Paint Research
The Sherwin-Williams Co.,
Detroit, Michigan

Dr. Holley is recognized as one of the greatest living paint scientists. He has perhaps contributed more than any one man to the workable knowledge of the paint industry. While many others have kept what they learned locked up in the drawers of their laboratory desks, Dr. Holley has, from the platform, and by means of the printed page, published and circularized any information that might be profitably used by the cub or veteran paint chemist or technician. Among this material is the book, "Analysis of Mixed Paints, Color Pigments and Varnishes," co-authored by Dr. Holley and Professor Ledd, which is found in every good paint laboratory and reference library. Three books, published by Dr. Holley under his own name, which will be of interest and a source of valuable information to paint scientists are:

Lead and Zinc Pigments
Analysis of Paint and Varnish Products
Analysis of Paint Vehicles, Japans and Varnishes

ZINC PIGMENTS *in* PAINT MANUFACTURE

By DR. C. D. HOLLEY

Presented to a joint meeting of the Toronto, Cleveland and Western New York Paint and Varnish Production Clubs, at Niagara Falls, Ontario, in June, 1932.

This is a good time of the year to evaluate what we learned during the past twelve months, and also to emphasize some of the important things we have learned in previous years.

Our greatest improvements in pigments have come about from the lessons we have learned through our exposure tests. It seems a reflection on the paint industry that with all our efforts and experience we have not been able to agree on a standard exposure test procedure, either as to kind of wood, the type of exposure panel, or its position and location. It may be that an indifferent sort of an exposure test is better than no test at all. As your speaker travels about the country he finds too few paint companies who have a comprehensive and adequate exposure program. The speaker believes that our future progress in paint development will continue to be based on the evaluations of our exposure tests, and not on theoretical considerations, freakish merchandising angles, or laboratory tests.

In discussing some of the things we have learned about the zinc pigments in paints for exterior usage, let us for convenience divide them into four classes:

First—The so-called Pure Zinc Oxides, containing 98 per cent or more of Zinc Oxide.

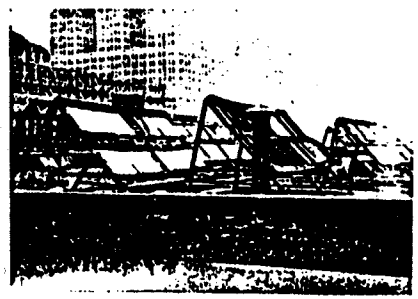
Second—The Leaded Zinc Oxides.

Third—The Lithopones.

Fourth—The Commercially Pure Zinc Sulphides.

Inasmuch as we have manufactured all four classes, our conclusions should not be viewed as biased, especially as we are also manufacturers of basic carbonate white lead, both by the Old Dutch and by the Carter Process.

Unfortunately, there has been in the last few years a tendency to swing away from the use of zinc oxide. This tendency, and the propaganda accompanying it, have been strong enough to be a matter of concern to everyone. You are all familiar with the recent lowering of the limit of zinc oxide permitted in U. S. Federal Specification Paints from 40 per cent to 30 per cent, and that Dr. Walker, Chairman of Federal Specification Committee, is apparently agitating for a reduction to 20 per cent.



Section of roof exposure tests in the heart of Cleveland, Ohio.

A number of paint manufacturers have dropped the zinc oxide content of their paints 5 per cent to 10 per cent during the last two or three years. One rather prominent manufacturer has brought out for painter usage, a prepared paint containing no zinc oxide. If these various decisions, lowering the percentage of zinc oxide, were based on proven service tests of an adequate character, there would be no reason to discuss the question. The speaker, however, does not believe that this stand on lower zinc oxide content paints is based on conclusive evidence. We know that there are bad zinc oxides as well as good zinc oxides; just the same as there are good basic lead carbonates and bad basic lead carbonates. A portion of this statement may come as a surprise to some present, but there is more than one paint company that knows the truth of this statement, to their sorrow. There is no more reason to discriminate against the usage of zinc oxide because some zinc oxides are bad, than there is to discriminate against white lead for the same reason, and the speaker has not heard anyone proposing a campaign to lower the white lead content of paints because there is some bad basic lead carbonate on the market. The truth of the situation is, either that the people who have been concerned with lowering the zinc oxide content of specifications and of their formulas have not informed themselves as to the progress which has been made in improving the quality of the zinc pigments, or else they ignore that fact and reduce the percentage of zinc, on the theory they can't draw a specification which will prohibit the use of a poor zinc oxide and proceed on the theory that the less the amount of zinc present, the smaller the risk.

The basic consideration in the improvement of the commercially pure or 98 per cent zinc oxide has centered around the question of particle size. If the zinc oxide pigment contains a considerable percentage of excessively fine particles, an abnormal reaction takes place with oil, particularly with the oil acids, forming zinc soaps to such an extent, that the paint film undergoes an early disintegration. If the excessively fine particles are absent, the degree to which the zinc soaps form is greatly lessened, the zinc particles are packed considerably closer together and film stresses are reduced and the service value of the paint is proportionately increased. One of the large zinc pigment producers has been rather successful in improving the wearing value of their 98 per cent grade of zinc oxide. Our organization has centered its efforts in this direction specifically on the *leaded zinc pigments*, and we believe with at least equal success.

We are convinced from the results of repeated exposure tests that particle size—at least the elimination of the excessively fines—plays a very important part in determining the wearing value of paints containing zinc pigments. If this feature is properly controlled, the speaker is firmly convinced that a paint containing 30 per cent to 40 per cent zinc oxide will prove wholly satisfactory, provided that the white lead if present as the basic carbonate should exceed the zinc oxide by at least 20 per cent. If the type of formulation employed does not permit of this excess of white lead, then according to our experience, all or the major portion of the white lead should be introduced as a basic lead sulphate in direct association with the zinc oxide, *in the form of a high leaded zinc*. The specific reasons for this conclusion will be discussed a little later.

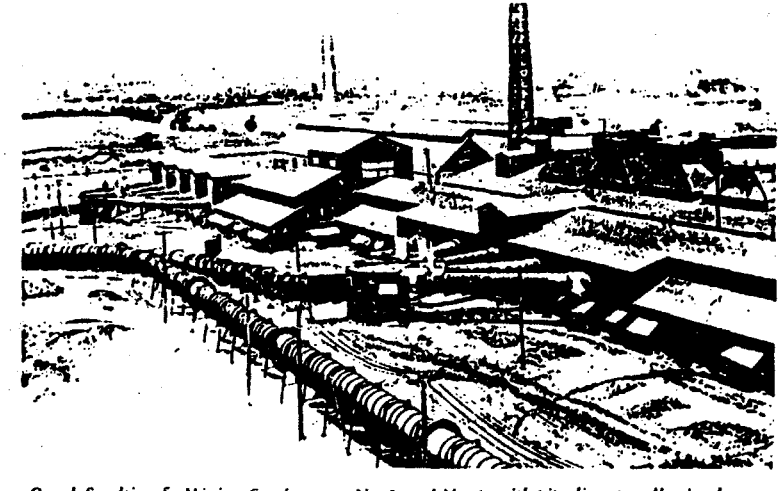
If you were asked which of the white pigments had undergone the greatest improvement in the last fifteen years, you would probably say lithopone. Those of us who have been active in paint formulation and manufacture realize the tremendous improvement which has been made in this pigment. Most of us do not realize, however, that there has been as great, and we believe an even greater improvement, in some of the leaded zinc pigments. In this connection reference is made particularly to the

leaded zincs of the [illegible] cent zinc oxide.

There is an old saying that first impressions are lasting impressions. Unfortunately, the first high leaded zinc pigments to appear on the market about a third of a century ago were by-product pigments of very low grade for paint making. I refer now to the old Canon City Standard Zinc Lead White which contained about 40 per cent lead sulphate and 60 per cent zinc oxide. Some present who have come into the paint industry in recent years may not be familiar with that product. The metallurgy of some of the western ores is particularly difficult. Many of these ores contain copper, gold, silver, and small amounts of arsenic and antimony in addition to the lead and zinc. It is, therefore, not surprising that leaded zinc pigments made from these ores contain excessive amounts of harmful impurities, and that notwithstanding the low cost at which it was sold, the old Canon City Standard Zinc Lead White passed out of existence.

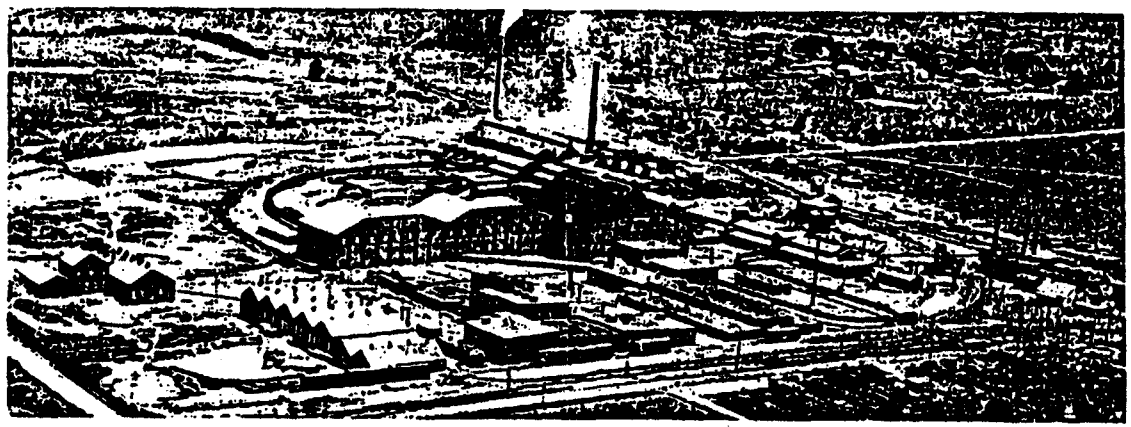
Producers of zinc pigments who entered the leaded zinc field after the Canon City people ceased to manufacture, appear to have suffered from an inferiority complex. They seemed to feel that leaded zinc was a substitute pigment, inferior to an equivalent mechanical mixture of white lead and zinc oxide. There, however, has been one exception. Our own organization entered the field not as a manufacturer of leaded zinc for sale at a price, but to use it in our own paint products. This necessitated production from carefully selected high grade lead and zinc ores, free from objectionable impurities. There is a fundamental difference between manufacturing a product for someone else to use, and using a large tonnage of your own manufacture in your own products where you have to accept the entire responsibility as to results. With that basic "urge" continually driving us on to improve our leaded zinc, it is rather interesting to look back over a quarter of a century and note what has been accomplished.

The specific improvements were rather scattered at first, but in the more recent years they have been rapid, and today there are reasons which appear sufficiently sound to us, leading to the conclusion that the high leaded zincs will generally displace equivalent mechanical mixtures of white



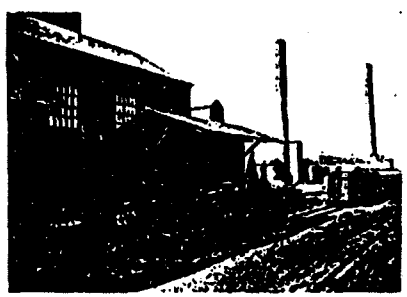
Ozark Smelting & Mining Co., Furnaces No. 3 and No. 4, with pipe lines to collecting houses.

The Ozark Smelting and Mining Co., Coffeyville, Kansas

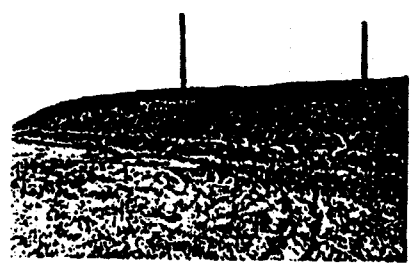


Ozark Smelting & Mining Co. Plant, situated in the heart of the Zinc-Lead Ore country, covering 40 acres, devoted to the manufacture of "Ozle" leaded zinc, "Permalith" lithopones, Zinc Sulphide, and "Rayon" brand Zinc Sulphate.

Ore Crushing Plant

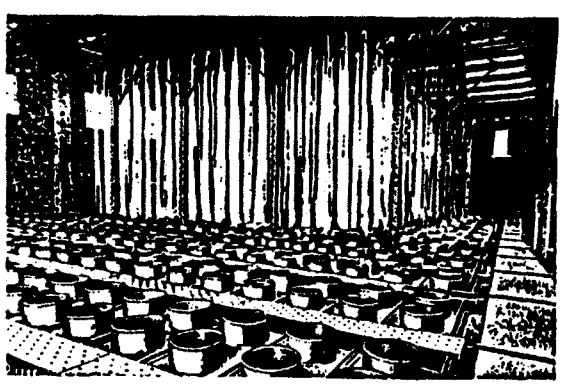


Ore Storage



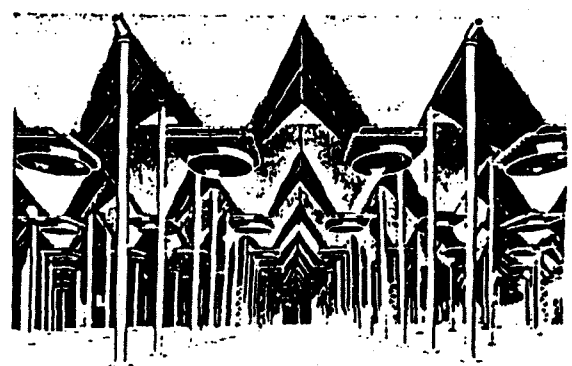
Zinc Oxide Collecting Houses

The Baghouse



Bags in position in upper Oxide collecting rooms.

Hopper bottom discharge in lower Oxide collecting rooms.



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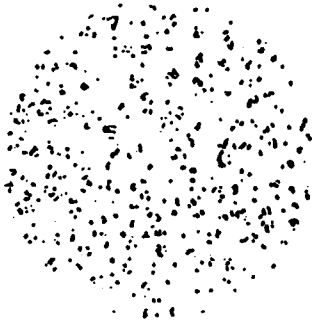
The superiority of "Ozlo" as shown by magnification to 2500 diameters.



"Ozlo"

Competitor "A"

lead and zinc oxide in prepared paints, *where durability is the important consideration.*

What are some of the reasons which lead to this optimistic viewpoint? Perhaps the first big improvement was a better understanding between the performance of neutral lead sulphate and a basic lead sulphate in a paint film. It is possible to so regulate the ore charges, the furnace design and the manufacturing procedure with leaded zinc pigments, to operate on either the acid side or the basic side of the metallurgical cycle of chemical reactions. Operation on the acid side produces a neutral lead sulphate and rather definite percentages of zinc sulphate and sulphur dioxide, both occluded and combined. Considerable of the criticism levelled against the leaded zincs during the earlier years was due to this method of operation. Operating on the basic side of the reaction cycles produces basic lead sulphates instead of neutral sulphates, and a minimum of zinc sulphate and sulphur dioxide, representing only a few hundredths of 1 per cent. This change produced a marked effect in improving the package condition and the wearing quality of the resulting paints.

Probably each one of us has a different conception of the function of white lead in a paint film, and the speaker includes under the caption of White Lead, both the basic carbonate and the basic sulphate. To your speaker the most important function of white lead in a paint film is its ability to form lead soaps, that is, lead linoleates which bring about excellent retention of adhesion to the surface, prevent the film from becoming hydrophilic, that is, swelling in the presence of water as does glue or gelatin. These linoleate soaps materially assist in maintaining a flexible film which adjusts itself to the stresses and strains resulting from progressive oxidation and the alternate contraction and expansion of the surface over which applied.

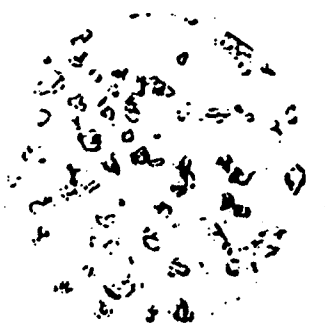
The next most important function of white lead is its relatively low oil taking capacity, permitting the pigment particles to be very closely packed together, thus materially reducing the effect of the shrinkage stresses by diminishing the volume of dried oil or linoxyn between

the particles. We all know that an exterior surface painted with raw linseed oil alone undergoes a very early disintegration. The speaker has yet to see a good paint — dark colors excepted — which has stood the test of time under the varying climatic conditions throughout the United States, which did not contain a substantial percentage of white lead, either the basic carbonate or basic sulphate.

The introduction of a definite degree of basicity, that is, of combined lead oxide into the lead sulphate of a high leaded zinc insures that it will form the normal amount of lead linoleate soap on the surface of the leaded zinc particles which makes each particle an integral portion of the film. Whereas a so-called inert pigment like barytes or the titanium pigments remain in the film by mechanical adhesion only. Unlike the lithopone and the composite titanium pigments — of which barium titanox is a typical example, in which we believe a large portion of the zinc sulphide and barium sulphate in the former, and the titanium dioxide and barium sulphate in the latter, exist as separate individual particles—we believe that in the high leaded zinc oxides of our own manufacture, the basic lead sulphate and the zinc oxide exist mainly in the same particle. Based on an X-ray study of the diffraction bands, these two components of the particle appear to exist in solid solution.

The result of this type of association of the basic lead sulphate and zinc oxide as shown by our exposures represented both by test fence and house tests, greatly affects the behavior of this pigment in the paint film. The tendency to produce a hard, brittle, inelastic film—so characteristic of zinc oxide — is markedly reduced. There is more of a tendency to chalk than to crack and peel. The adhesion to the surface is improved. In certain especially high lead content pigments which we have experimentally produced, where the lead content is between 40 per cent and 50 per cent, and the basicity, that is, the ratio of lead oxide to lead sulphate is high, we find the pigment taking on the essential characteristics in the film of a straight lead pigment — the zinc oxide characteristics having almost disappeared.

Competitor "B"



Competitor "C"

This we attribute in a large measure to the extensive formation of lead linoleate soaps in the film. Perhaps our picture becomes a little clearer if we recollect that we are dealing with pigment particles which are considerably less than a half micron in diameter. Then consider the tremendous surface area exposed to the action of the oil and its oxidation products. One cubic inch, actual volume, that is without voids present—of a typical leaded zinc, zinc oxide or titanium oxide, represents a combined surface area in excess of 2,500 square feet. This gives us a better conception of the opportunities for the formation of the brittle zinc soaps with pure zinc oxide particles and the plasticising effect of the flexible lead linoleate soaps. It also presents one of the important reasons why a paint in which the zinc oxide is introduced by means of *a high leaded zinc will outwear a similar composition in which the white lead and zinc oxide are introduced as separate pigments.*

The behavior of water toward white lead and the other pigments is very interesting. A paint film may be regarded as a semi-permeable membrane. Water in the gaseous or vapor phase passes quite freely through a paint film. The film breathes, as we say. Moisture in this form may pass into the wood behind the film, or it may pass out. This transference is not particularly rapid. If the vapor pressure of the moisture or water behind the film reaches a point beyond the capacity of the film to breathe, we have blisters or other manifestations of peeling.

Water in the liquid phase passes through a paint film with difficulty, and with a film containing substantial percentages of white lead and lead linoleate soap, with extreme difficulty. White lead, either the basic carbonate or basic sulphate, is extremely resistant to wetting with water—technically expressed its angle of contact is high—and what is true of white lead is true of the lead linoleate soaps.

The so-called inert pigments and also the titanium pigments have low angles of contact, that is, they wet easily. Zinc oxide occupies an intermediate position, and commercially pure zinc sulphide between that of white lead and zinc oxide. The high leaded zinc oxides also possess a high angle of contact and are hard to wet. When water comes in contact with linoxyn, that is, dried linseed oil, there is a tendency for the surface to absorb water and the surface portion of the film swells slightly. Later the water evaporates and the swelling disappears. If the film contains an excess of inert pigment or titanium pigments and little or no white lead, this alternate swelling and reduction of the surface causes the surface of the film to disintegrate, and these pigment particles which are held mechanically by adhesion, chalk off.

The presence of substantial percentage of either of the white leads accompanied by lead linoleate soaps renders the surface of the film extremely difficult to wet. Also it is very difficult for the water to penetrate between the lead or leaded zinc particles because each particle has become a field of action in which the lead linoleate soaps formed at the interface have diffused outward from the particle into the surrounding film. Therefore, this swelling action is greatly retarded and minimized and the disintegration of the film is retarded.

The presence in the film of a large number of leaded zinc particles of the type previously discussed because of their high angle of contact and their basic properties, are very effective in preventing the disintegration of the film by the process just described—much more so than that of a mechanical mixture of white lead and zinc oxide.

The importance of using a leaded zinc having a suitable degree of basicity has been carefully stressed, but not all of the basic lead sulphates which can be present in a leaded zinc or in a straight basic lead sulphate

pigment are desirable basic sulphates. In some of them, the combined lead oxide is so loosely held that the pigment may discolor badly after application, turning to a salmon pink color. In extreme cases they can cause caking in the package.

The increase in stability to a definite satisfactory standard of performance has been a very important accomplishment in the production of the high leaded zinc oxides.

These few glimpses into the technology of this pigment have been presented to show something of the painstaking research which has been conducted during the past decade to make high leaded zinc oxide a thoroughly dependable pigment.

The third class of zinc pigments—the lithopones—are very familiar to you. There have been enough technical men from the lithopone producing companies speaking before the various production clubs to cover this phase of the subject rather thoroughly. However, there are two or three phases which may be worth discussing for a moment. Shortly after the close of the World War a tremendous improvement in lithopone took place, as you all know. The hiding power was stepped up, the non-livering qualities in acid varnishes improved, and more particularly the resistance to discoloration in sunlight was improved to the extent that enabled lithopone to enter permanently the field of pigments for exterior usage.

There was nothing startling in the chemical features involved in bringing about these improvements—they were mainly mechanical. The lithopone plant prior to 1919 was a crude affair—requiring a large amount of unskilled manual labor, and the quality of the product varied with the efficiency of this labor. Today, manual labor has completely disappeared. Our most recently built lithopone plant constructed at Coffeyville, Kansas, and completed about a year ago, is so completely mechanized, that from the time the cars of raw materials arrive until the finished lithopone is placed in the warehouse, no manual labor is required. There isn't a laborer around the plant—only three or four operating chemists to a shift, who regulate the continuous flow of materials by opening or closing a few valves. The variable human element has been replaced with accurate scientific control and an exceedingly uniform product has resulted.

The demands made on lithopone as a pigment are much greater today than they were ten years ago. With the advent of the synthetic types of paint and enamel liquids we found that some lithopones which were satisfactorily lightproof with linseed oil vehicles, became quite sensitive with some of the synthetics. This has led to extensive research by all the leading lithopone manufacturers during the past two years with some interesting results. A given lithopone may show resistance with three different synthetics and be sensitive to a fourth. Therefore, it is not safe to generalize as to what will happen with a given vehicle until it is tried out.

The suitability of the lithopone of today as an exterior pigment does not require extended discussion. Too many paint companies are using lithopone successfully in exterior paints for us longer to hold to the viewpoint that lithopone is suitable for interior usage only. To those present who have adjusted your formulations to your own satisfaction we have no recommendations to offer. To those who are not yet satisfied with lithopone as a component of exterior paints, we would offer the following suggestions:

1. The inclusion of about 5 per cent of a heat processed linseed oil in the vehicle. This oil should have an acid value of about 9 or 10. It assists the formation of lead soaps which help plasticize the film and renders it

less hydrophilic. The formation of soaps, both lead and zinc, renders the lithopone less sensitive to discoloration in the presence of driers, particularaly cobalt.

2. The use of a linoleate drier in which the manganese should not be in a greater proportion than 1 to 40. Again the presence of a considerable amount of lead linoleate soaps from this source aids in the preservation of the film.

3. A high pigment volume relationship to the non-volatile vehicle of not less than 30 per cent—preferably 31 per cent to 32 per cent in the finishing coat.

4. *The use of a high leaded zinc oxide of good basicity.* Your speaker has yet to see a satisfactorily durable lithopone paint with a lead free zinc oxide and with the absence of white lead, either as the basic carbonate or basic sulphate. The best results, in our opinion, are secured with 50 per cent of a 60/40 leaded zinc in which the basic lead sulphate has a ratio of lead oxide to lead sulphate of between 1 to 5 and 1 to 6. This basicity again aids in the formation of the maximum quantity of lead linoleate soaps which we regard as extremely necessary where there may be said to be about 40 per cent of inert pigments present. This 40 per cent, of course, includes the barium sulphate content of the lithopone. A 65/35 leaded zinc is nearly as efficient as a 60/40, provided the basicity is fairly high.

5. This formulation contemplates the presence of not more than 35 per cent lithopone and not to exceed 15 per cent added inert pigment which can be the conventional combination of about half silica and magnesium silicate.

Reference has been made to the barium sulphate or blanc fixe content of lithopone as though it were a pigment separate from the zinc sulphide. This we actually believe to be the case. At least, we believe this to be true of the majority of particles. We do not consider that a lithopone particle has a coating of zinc sulphide precipitated on the blanc fixe particle and surrounding it, or even that it is to a large extent a coalesced particle, in which the zinc sulphide is sintered, on to the blanc fixe particle in the calcining operation. Lithopone particles are exceedingly fine and exist as aggregates made up of 2 to 30 or more individual particles, and it is doubtful if ordinary paint mill grinding completely breaks down these aggregates.

Your speaker does not claim lithopone is an ideal pigment for exterior usage, but does believe that surrounded with the safeguards we have enumerated, it will give reasonable durability—and its low cost based on units of hiding power has much to recommend it for popular priced paints. Your speaker does recognize that there is a degree of weakness in lithopone as an exterior usage pigment because of the 72 per cent of barium sulphate or blanc fixe present, the particles of which we believe to exist to a major extent individually, although they may be in more or less contact with the zinc sulphide by reason of mechanical adhesion in the form of aggregate. The small particle size of blanc fixe is a detriment rather than a benefit in exterior paints as regards the durability of the film. If this line of reasoning is correct, then pure zinc sulphide ought to be an excellent pigment for exterior usage as this permits the elimination of a large percentage of a finely particled inert pigment—and we, therefore, arrive at the fourth class of zinc pigments.

This brings us face to face with the requirement which is being placed on practically all paint manufacturers. That is, what pigment is the most satisfactory to use in increasing the opacity of our outside whites and light tints?

We have two choices—the titanium pigments on the one hand and the commercially pure zinc sulphide pigments on the other. Most of us have had extended experience with the titanium pigments. We know their good points—their high degree of opacity or hiding power, great retention of whiteness in the outside whites, accompanied by excellent dirt shedding qualities. Also their unfavorable characteristics—the tendency to chalk excessively unless the formulation is carefully controlled, the rapid fading of the light tints under relatively short exposure, and the retardation of drying, especially during cold weather. By reason of their very reasonable cost per unit of hiding power, the titanium pigments have had a wide acceptance.

Commercially pure zinc sulphide is our most recent high hiding power white pigment. Those who have worked with this pigment find it extremely interesting in its properties. It has approximately twice the opacity of barium titanox, and 60 per cent to 75 per cent that of pure titanium oxide. From a unit of hiding power standpoint it can become a vigorous competitor of the titanium pigments. Used in various pigment admixtures, its working qualities under the brush are distinctly superior to those of the titanium pigments. Several of the desirable features of pure zinc sulphide have been thoroughly demonstrated. It does not retard drying during cold weather as do the titanium paints. Therefore, less manganese and cobalt driers are necessary, which we will all agree is a good feature.

Light tints made with zinc sulphide retain their color equal to those with the best white lead and zinc oxide admixtures. This enables paint manufacturers to build up the hiding power of their light tints to any desired point. A feature which appeals to all, as most of us have hesitated to use titanium pigments for this purpose. Zinc sulphide possesses a good degree of whiteness and chalks rather slowly.

Like every other white pigment it has characteristics not so desirable. Unless carefully processed it is somewhat sensitive to sunlight in the presence of certain oils and driers. Alkali refined oils and cobalt driers are perhaps the worst offenders. Some types of glyceryl-phthalate vehicles also promote discoloration.

While it approaches white lead in resistance to wetting with water, it is a relatively inert pigment and requires the presence of a substantial percentage of lead pigment in the formulae in which it is used. The minimum percentage of white lead and the maximum percentage of zinc oxide which can be used with a given percentage of zinc sulphide in an exterior paint has not yet been determined to our complete satisfaction.

Its behavior is so unlike that of lithopone in a paint film that we are somewhat puzzled to account for elements pointing to a remarkable durability and long life in certain formulations. It can be said definitely that the use of pure zinc sulphide in exterior paints has passed the experimental stage. Its high degree of opacity or hiding power makes it an attractive pigment to use in formulating.

This leads to a few comments on hiding power measurements. Nearly all the data published on the comparative hiding power of white pigments deal with one pigment paints. This procedure, because of lack of dispersion and other causes, gives values much too low for the high hiding power pigments as compared with actual results when these pigments are used to re-enforce or bring up the hiding power value of a mixed paint.

In practice we find it necessary to use only relatively small percentages of actual titanium dioxide or zinc sulphide in an exterior paint to produce the additional hiding power desired. The range of titanium dioxide content

is usually from 5 per cent to 15 per cent, and zinc sulphide 10 per cent to 25 per cent. When we measure the increase in hiding power obtained by adding small percentages of these two pigments to a lead and zinc paint, we obtain much higher opacity than the literature indicates. For instance, the opacity of each pound of commercially pure zinc sulphide when 10 per cent is present in a formulation of lead and zinc pigments is 1½ times that of a corresponding pound in a straight zinc sulphide paint at the same pigment volume concentration.

In concluding, emphasis should again be placed on the fact, that today the zinc pigments comprising the four classes which have been discussed are the most important and the most largely used in paint manufacture. If we are to evaluate them properly and obtain the maximum of favorable results, then we must depend on our exposure test results and be certain that they are based on dependable procedures. In this connection, the work which the various production clubs are doing along the line of practical exposure will become increasingly valuable.

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