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WHITE LEAD,

WHAT WE KNOW ABOUT IT,

AND ITS SUBSTITUTES.

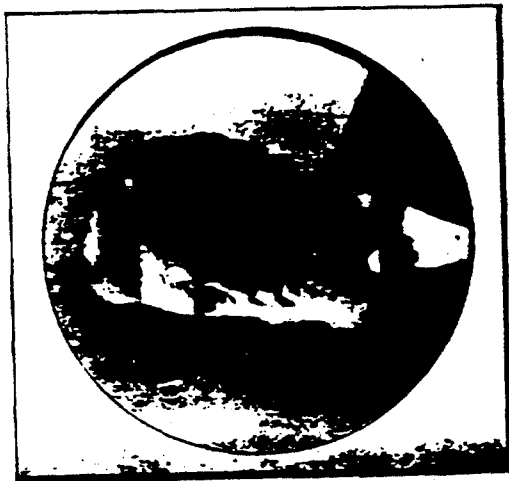
A Few Suggestions to Practical Men,

BY

OLIVER D. GOODELL.

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DETROIT, MICHIGAN.
1892.



Truly yours,
Oliver D. Goodell.

500031

N 3590

the full assurance that no *sublimed lead* will result from the ghastly operation, and that little or no lead can be found in the *analyses* of the remains, excepting perhaps a trace of that metal which has been absorbed into our system during our thirty years labor in endeavoring to cater to the wishes and prejudices of a friendly but exacting community.

Some authors apologize by stating that their works were "lashed off in some idle hours," or were the conclusions which had taken form and crystallized around an after dinner paper as a nucleus. We have been so busy during the past thirty years that we have had no "hours of idleness" in which we could dash off brilliant literary squibs, even had we the talent for such work. We would condemn ourselves as criminal, or at least careless, if we placed after dinner matter before our readers without good, earnest, thoughtful sifting. We have done the very best we could to put the matter in its true light, and have supplemented the result of years of close study with testimony of the strongest kind from reliable and able men. We have spent many weary hours over this feeble attempt to tell what we know about white lead.

THE AUTHOR.

What is White Lead?

THE White Lead of commerce is the carbonate of lead, by far the greater portion of which is produced by what is termed "The Old Dutch Process." It is not necessary to give a full description of the process here, but in a few words it can be explained as follows: Certain forms of blue lead, or metallic lead, are cast in moulds. These forms are suspended on ledges in earthen pots, each pot containing a little vinegar, or more strictly speaking, acetic acid. These pots are ranged to the number of five or six hundred, each containing the lead and vinegar, upon a bed of spent tan bark, mingled with a little stable litter; the whole is then covered over with boards; another layer of tan bark placed on top; then another layer of pots containing lead and vinegar; and so on until eight or ten layers are built up within the walls of a chamber about twenty-five feet square. The spent tan bark begins to ferment, or more properly speaking, a mild spontaneous combustion begins to take place in the tan bark. This generates heat, which causes the moisture in the tan bark, and the vinegar in the pots to evaporate and mingle as vapors, at the same time acting upon the lead. The action of the moisture and the vinegar vapors in connection with the oxygen present, form an obscure double compound

of basic acetate and hydrated oxide of lead. At the same time the combustion of the tan bark produces carbon dioxide, which, acting upon the basic acetate and hydrate, forms a carbonate. This process goes on for a period ranging from seventy-five to one hundred days, when the metallic lead has become nearly exhausted and nearly all turned into the carbonate of lead. The resulting carbonate is then separated from the remainder of the blue lead, ground in heavy stones with water, floated away in the form of a milky liquid, pumped into large tanks, and there allowed to settle; after which it is usually drawn upon pans to dry. This forms the dry White Lead of commerce.

There are other methods for forming carbonate of lead, but as they are not much used in the United States it will not be necessary to describe them in this small space.

The White Lead of commerce consists of about seventy per cent. of a true carbonate, and thirty per cent. hydrate of lead.* This hydrate of lead has an action upon linseed oil similar to the action of hydrate of soda or hydrate of lime, but is not as forcible in its action as the last mentioned hydrates. Nevertheless it does act forcibly upon the oil, forming a true chemical emulsion or soap. This chemical action between the lead and oil continues as long as there is any lead or oil, or both present to form

* The proportion of hydrate to carbonate is variously given by different able chemists, ranging from two parts of carbonate to one of hydrate by some, and by others four parts of carbonate to one of hydrate, the discrepancy being due no doubt to the varying circumstances under which the various samples were produced.

the action, and hence pure White Lead always becomes dusty in from six to eighteen months after its application; the time for this condition varying according to the circumstances and the age of the lead.

It is true that lead which has been ground in oil and has remained in that condition for a number of years before being mixed into paint, will after application last a great deal longer than would be the case where the lead is taken freshly from the stacks, ground into the oil and immediately applied to the work. This fact is recognized by nearly all practical painters. It has been known for years among them that strictly Pure White Lead has the great fault noted above, that of becoming dusty. No reasonable man will deny that White Lead covers well, spreads well, and dries well; neither will any man who has had a large experience in its use, deny that it will become dusty in from six to twenty-four months, according to the exposure and the circumstances and conditions under which it is applied.

The hydrate of lead is a very sensitive chemical compound, is acted upon very forcibly by the domestic gases, or more properly speaking, by those gases which are always present in thickly populated localities, and more especially about stables, out houses, etc., and where the human race, as well as animals, are domiciled.

Take a small portion of strictly pure lead, either dry or ground in oil, and spread it upon a paper, get from your druggist a mixture composed of one drop of ammonium hydro-sulphide, and one ounce of pure water. Now drop upon your exposed lead sample

a few drops of this diluted ammonium hydro sulphide, and it will be seen that it immediately turns black. The smell of the liquid in the bottle will immediately convince the most sceptical that the chemical present is hydrogen sulphide, which always acts thus upon all lead salts. This hydrogen sulphide is always present in nearly all inhabited places to a greater or less extent.

The hydrate of lead combines readily with all the colors, such as chrome yellows, chrome greens, and Prussian blue, as well as lamp black. This action upon the chemical colors causes a fading, as will be seen by the following experiment: Take a quantity of lemon chrome yellow, grind it into a quantity of strictly pure white lead, and the result of the mixture is a beautiful canary yellow, clear and pleasing. When this mixture has been spread as a paint for a few months it will be found to have acquired an ochreous or reddish tint, and its brilliancy is destroyed. This is due to the fact that the hydrate of lead present takes up a portion of the chromium, which is a component part of chrome yellow, thus forming a sort of basic chromate of lead, which is red.

It has been disputed that this action could take place in the presence of oil, but careful experiments by any intelligent and thoroughly practical painter, will convince him that this is true. Again, take a quantity of strictly pure lead, tint it to a clear azure blue by the addition of Prussian blue, or better, Chinese blue. After a time this beautiful azure blue will take a greenish tint, or what might be termed a robin's egg blue. In this case the hydrate

of lead has decomposed the blue to a certain extent and the yellow incident to the oil, japans, etc., pipes, have given it a greenish cast. This action is well known by nearly all practical painters.

The fact that these troubles are incident to the use of pure white lead, is well established and well known and acknowledged by all thoughtful men who have had experience in the paint business. It is not well to condemn the use of white lead entirely, although good results are obtained in nearly all branches of business without the use of white lead at all. On interiors zinc pure is by far the best article to use, but there has been difficulty in using pure zinc on exteriors, where the structures are subjected to vicissitudes and humidity, and it is well to use with the zinc, for exteriors, a portion of white lead to assist in drying and to render the zinc slightly porous. The question is, "How much lead is necessary, and what proportion of lead gives the best results?" This question can best be decided by the opinions of practical men when taken as a whole, and it will not be the province of this article to decide the question for so large and intelligent a body of men as comprises the fraternity of painters in the United States.

The younger portion of the community will scarcely be able to remember as well as the older people, that enamel visiting cards forty years ago were very expensive and at the same time very unsatisfactory, from the fact that the card board in the hands of the manufacturer, as well as in the hands of the dealer and printer, frequently became so dark as to render it entirely useless, and fre-

quently, after the cards had been finished, they became so soiled in the hands of the consumer that they were merely a mortification. The reason for this is easily found. At that period the beautiful enamel was composed almost entirely of white lead, and the tendency to blacken was not obviated until a French chemist found a way, which we shall have occasion to refer to later.

Carbonate of baryta or witherite, when exposed to a bath of dilute muriatic acid, freely dissolves.

This operation was carried on in a large way, and after procuring by this means a large body of chloride of barium in solution, it was removed after settling, to a clean tank and there precipitated with dilute sulphuric acid, forming a smooth white powder or paste, to which was given the name of "Blanc Fixe," or "Permanent White." This is now used almost exclusively in the finishing of enamel cards. Under the old or lead process, as has been explained, the lead composing the enamel was so sensitive to the gases that it was impossible to retain the brilliant white condition which alone rendered the cards valuable. On the other hand, "Blanc Fixe" is absolutely unalterable in any of the gases, and while very fine and smooth, even superior to white lead in those respects, forms a brilliant white enamel upon the cards, which is absolutely indestructible under all circumstances.

The principal object in painting seems to be to protect various structures with some substance which is durable. Linseed oil and good varnish seem to be the only articles which have successfully borne the test of time. A great many substitutes for

linseed oil have been proposed, but as yet it is not an established fact that there is any good durable substitute. To apply the oil properly it has been found desirable to mix it with some other ingredient for the purpose of retaining the oil upon the surface of the structure, and at the same time to impart uniform effects in the way of color, etc. It would seem therefore that those materials which have the least effect upon the oil would be the best materials to use for this purpose.

It has been shown, and freely admitted by nearly all experienced men, that white lead pure has a powerful effect upon linseed oil, and as heretofore stated, this chemical action upon the linseed oil continues while the lead and oil remain on the structure together. If, therefore, we mix with the linseed oil, zinc, with enough white lead to secure sufficient drying properties, and some inert matter to correct the hardness and impervious nature of the zinc coating, and at the same time insure sufficient covering power with desirable colors, it would seem that we had attained the object for which we have been seeking.

It might be asked why we use any white lead at all, and again, if white lead is good as an article of paint when used in small proportions, why not use it wholly? The answer for the first question has already been given, that white lead, when present in small quantities, acts as a dryer; and as it has good body, being at the same time white, it proves to be desirable when used in small quantities. The answer to the second question would be as follows: It is admitted by everyone who has made any study of

the matter, that a small quantity of oxygen is absolutely necessary to sustain animal and vegetable life. It has also been shown that pure oxygen will destroy animal and vegetable life. Pure oxygen is a very powerful agent in destroying nearly all organic and inorganic matter. Nature has provided oxygen to act as a purifier in this way, but nature provides it diluted with 80 per cent. of nitrogen, so that while animal and vegetable existence receives the benefit of the diluted oxygen in the 20 per cent. mixture, and is not injured by it, the 80 per cent. of inert gas, or nitrogen, has no effect either one way or the other, excepting to dilute this otherwise dangerous and exciting poison. So, too, pure white lead acts too forcibly upon the oil to render it a durable and reliable article for painting purposes; but if white lead is present in quantities just sufficiently large to act upon the oil as a dryer, and is diluted with inert matter of good body, like zinc, ochres, iron paints, lamp black, etc., with a slight admixture of coarser inert matter to more completely correct the zinc, we have a paint which, while it will cover the surface perfectly, will have no further effect upon the oil than to dry it as rapidly as we desire, and thus leave the oil to continue its protecting influences for an indefinite period.

In this argument, the only advantage which white lead possesses over zinc is deduced from the fact that it has been known longer. White lead has probably been used eighteen hundred years, and has gained such a foothold on account of its body, as well as its spreading and drying qualities, that it has become installed in the minds of the majority of

painters as the only suitable article where white paint is desired. *Zinc has been used largely only about forty years, and although it is constantly gaining in popularity, there was a period in which it was considered unsafe and unreliable. This reputation was accorded to it on account of its tendency to peel when applied to damp structures.

Painters, speaking in a popular sense, now say, "Oh, zinc is good, but it has no body." This is an erroneous idea. Zinc has nearly double the body of lead. Body is opacity, power to resist color, capacity for covering over dark spots. It is true that a given quantity of lead mixed into a paint ready for the brush, as compared with the same given quantity of zinc mixed in the same way, appears, in the hands of the brush man, to have greater power of covering; but when it is taken into consideration that a given quantity of lead by weight will make only half the quantity of ready mixed paint suitable for the brush that the same quantity of zinc by weight made into a ready mixed paint will produce, it will be seen that the covering power is wholly in favor of the zinc.

As an experiment, take two boards each fourteen feet long and one foot wide. Let the boards be of very nearly the same quality, and let the surfaces remain as they come from the planing machine. Now with a broad, soft pencil, write in bold letters or characters the whole length of the board, gradually lessening the intensity of the letter to the end. Write upon both boards as nearly the

* In the use of the word Zinc we mean Zinc Oxide, and use the term popular among painters for brevity.

same as possible. Now take eight ounces of strictly pure white lead in oil; add sufficient raw oil, say three fluid ounces, to make a good spreading paint and put it all on one of the boards. Be careful that all the paint in the dish and on the brush is applied to that fourteen square feet of surface. Now take six ounces of zinc ground in oil. Prepare this in the same way suitable for the brush and put it all on the second board, being careful to be just and fair in getting it all on the board if possible. It will be found that the whole of the zinc can be put on the board only with great difficulty and considerable care; but when it is so applied, the written characters will be obscured entirely by the zinc, while in the case of the lead the bolder of the written characters can be read through the coating of the paint without difficulty.

This experiment, which is a very true measure of body or opacity, will show that six ounces of zinc in oil will cover as much surface as can be covered with eight ounces of strictly pure lead in oil, and do it more thoroughly.

Another proof: Take one grain of dry lamp black; add to this one hundred grains of dry white lead and ten drops of oil. Rub them together thoroughly and spread them upon a glass. Now take one grain of the same lamp black, one hundred grains of dry zinc oxide, with ten to twelve drops of oil. Rub them as in the case with the lead, and spread upon a glass. It will now be seen that the paint made with the lead and black is very much darker than the paint made with the zinc and black. This proves that the power to resist color is very

largely in favor of the zinc. Zinc is unalterable in the gases spoken of as being present about dwellings. It forms a very hard, even impervious and glossy coating when mixed with linseed oil. When spread upon a wooden structure where there is any possibility of moisture getting behind it, it is liable to crack and peel off.

Zinc dries more slowly than lead, and is somewhat objectionable under certain circumstances on this account, but this does not argue against it as regards its durability. It has been found that a mixture of zinc with some inert matter like siliceous gypsum or baryta, with a portion of white lead to assist in drying, will make a more durable, more glossy, and in every way more desirable paint than pure white lead. The admixture of inert matter tends to make it porous, and such a mixture can be made which, while cheaper than pure lead, will cover better and remain on the structure longer than pure white lead.

In corroboration of these facts we will take the liberty of quoting from the very able articles of Prof. C. B. Dudley and F. N. Pease, chemist and assistant chemist for the Pennsylvania Railway Co. These articles appeared as a series of contributions in the Railroad and Engineering Journal. Prof. Dudley and his assistant have probably made more careful scientific researches into the question before us than any other men in the United States, and the author quotes them as good authority.

Prof. Dudley says:

"The action of deleterious gases is very familiar to those who have studied paints at all. In our experience White Lead

is the most readily acted upon in an injurious way by deleterious gases, and the gas most destructive is sulphuretted hydrogen. It is not at all uncommon to see a building painted with White Lead become quite black from the formation of sulphide of lead, and in this way the coating of paint is wasted away. We do not remember to have run across any clearly defined case of the destruction of paint due to noxious gases except sulphuretted hydrogen; and, as said above, white lead is apparently the paint which suffers most seriously from this cause.

"The obvious remedy for the destructive action of deleterious gases is to use, if possible, pigments which are not affected by these gases. We have never demonstrated any deleterious action on the binding material which holds the pigment to the surface, although it is probable that ammonia, which may occur in small amounts in the atmosphere, might have a deleterious action on the binding material and possibly in some cases on the pigment."

Sulphate of lead, and many other paints not affected by hydrogen sulphide alone, are forcibly acted upon by that gas when a very minute portion of ammonia is introduced, hence the combination is more destructive than the simple gas, and we find they are nearly always associated in stables and out houses where animal excreta are deposited.

Again, quoting from Messrs. Dudley & Pease:

"It seems probable, likewise, that with white lead there may be such a combination, resulting in the formation of a lead soap. It is, of course, impossible in the present state of our knowledge to affirm that these results actually do take place, but there seems strong probability that the deteriorating and wasting away of some paints, notably zinc white and white lead, may be due to this cause."

"The well-known tendency of chrome yellows, when used as paints, to turn greenish by exposure, may possibly be accounted for in this way. It will be observed that these things are all spoken of as possibilities."

"Unfortunately, only two fairly good whites, and neither of them satisfactory, are known to exist. These are white lead and zinc white. Both of them are inferior in covering power, both of them very greatly lack in durability, and both of them are moderately expensive. The lack of durability of these two pigments manifests itself apparently in diametrically opposite ways. White lead crumbles and powders away apparently as the result of chemical action between the

pigment and the oil, and is readily decomposed and blackened by sulphur gases in the air. Zinc white likewise apparently combines chemically with the oil; but instead of powdering, peels off in flakes, and the action of sulphur gases, if it takes place at all, does not result in blackening obviously because the sulphide of zinc is white. It is a very great misfortune that there is no white known which has greater covering power and greater durability than either zinc white or white lead, and, although neither of them is satisfactory, there seems to be no alternative at present except to use them as best we can. Our experience in absolute durability of these pigments is not as great as we could wish, although we have experiments in progress. We are therefore not able to give as positive information as we could wish on the subject. We are inclined to mix the two pigments rather than to use either one alone, especially for outdoor work."

Referring again to the matter of body or opacity, the opacity of zinc, as compared with the opacity of lead, can better be demonstrated by the following simple experiment: Take of strictly pure dry lead, say two thousand millegrammes (equal about 31 grains) with pure raw oil enough to make a smoothly spreading paint; in other words a paint which can be spread with a spatula. Having done this, spread the whole upon twenty square inches of glass, a convenient piece being ten inches long and two inches wide. Be careful to spread the whole upon the glass, and spread it evenly. Now take one thousand millegrammes of zinc dry (equal $15\frac{1}{2}$ grains) and add sufficient oil to make a smoothly spreading paste and spread that all upon the same area of glass, and it will be discovered that the preparation of zinc obscures the light more effectively than the preparation of lead. This proves that the zinc has more body than the lead; but as stated heretofore, zinc, when applied to wet surfaces, or in positions where dampness can be collected behind the structure, is liable to peel and crack. This is not due to

any chemical action between the zinc and the oil, but because the mixture of oil and zinc when dried makes an almost perfectly impervious coating upon the wood, and the action of the sun draws the moisture through the wood with such force as to separate the paint from the surface of the wood. If, however, a mixture of white lead and zinc is prepared with enough gypsum, barytes or silex, or some other inert matter, to render the zinc porous and at the same time secure the same opacity as pure white lead, we certainly have a more durable and reliable material for painting.

Parties who are the most deeply interested in the financial success of the National Lead Co. (or in other words the "Lead Trust"), have seen fit to attack the paint grinders and mixed paint manufacturers, in public print, all along the line, giving so-called analyses of the products of various grinders and manufacturers by (so called) eminent chemists, and at the same time calling attention to the great durability and purity of their pure white leads (of some dozens of different brands).

This great "Trust" has also taken the pains to go into the color making and color grinding trade to assist them in bracing up their already declining business. In the use of the word "declining," we wish to be understood as using it in a comparative sense only, for while the increase in the manufacture of white lead during the last quarter of a century has been very great, as all well informed paint men must allow, the increase in the manufacture of zinc has been four fold greater during the same time. The first zinc white however, made in this country,

was produced in 1849 or 1850, while white lead has been made in the United States, as nearly as can be ascertained from statistics, for a hundred years. The output of zinc in 1850 was not more than five hundred tons, while the output of white zinc in the United States for 1891 was nearly thirty thousand tons. These figures will show that zinc as a paint is gaining rapidly in the esteem of practical men. The French government has excluded white lead from all uses in public departments; the government of Sweden, it is believed, has also passed a law regarding the use of white lead as a paint, particularly in dwellings, supposedly on account of its poisonous qualities. There is no doubt that the time is approaching when white lead will be used only for such purposes as render its use imperative.

We have been intimately connected with the paint interest for nearly thirty years and were, from 1864 to 1875, the practical head in the manufacturing departments of the St. Louis Lead & Oil Co., at St. Louis, and deem it not presumptuous on our part to give our views somewhat extensively upon white lead as it was made previous to 1860 as compared with the article as now produced. We have no controversy or quarrel with the white lead manufacturers, and such reference to their action as we have been called upon to make in this work, has been called out by an unwarranted attack upon the goods manufactured by the company of which we are vice president and general manager. The facts in this unpleasant business are as follows: In the *Eau Claire Sunday Morning Forum*, published at Eau Claire, Wis., Sunday, July 10, 1892, there appeared

the following bold and unscrupulous item :

"Paint your buildings with pure white lead. It will cost less money. Because it will protect the surface of buildings better and its durability is much greater than that of any other paint. In buying white lead care is necessary to obtain a genuine pure article. There are numerous imitations and adulterated white lead in the market, composed largely of 'barvies' and very little white lead. This 'barvies' or 'baryta' is a heavy, white powder, nearly worthless as a paint; it costs only about one cent per pound and is used to adulterate and cheapen the mixture. The following analyses made by eminent chemists, of some of these misleading brands, show the small proportion of genuine lead they contain. The description of labels and brands on the package and the contents is as follows:

"On the side of the keg is a guarantee label which reads as follows, 'This package contains nothing but strictly pure materials ground in pure linseed oil, and we will pay twenty-five dollars in gold if not found as guaranteed. We offer a degree of fineness, whiteness and covering capacity unsurpassed.'

The word unscrupulous is here used because there was no real reason why it should have been published at all.

The quotations as shown were followed by four analyses with similar comments. We are deterred from publishing these analyses as we think it would be an unwarrantable invasion of private rights to publish such a list, especially as one of them is certainly erroneous either from accident or wilful falsity. With regard to the truth of the analysis, the ———— make other grades of leads than the article branded ————, and it may be true that some one or two packages of the inferior goods may have gotten out under the ———— brand, which would be a pure accident, but this is scarcely probable. If the eminent chemists found 50 94-100 per cent, of Barytes in the ———— lead, then knowing the true formula we are entitled to believe that a goodly

part of it at least was in the strictly pure dry lead purchased from a member of the "Trust" in good standing, and bought of said party in good faith.

It is unfortunate that the eminent professor has not published the distinction between barytes and blanc fixe, if indeed he is by his superior chemical knowledge able to explain the distinctive difference.

The attack upon the manufacturers mentioned in the article above referred to was unnecessary and entirely gratuitous, for there was nothing in the case of either of the four reliable and honorable manufacturers to call for such action on the part of the "Trust." Neither party claimed by their brands or labels that the goods were strictly pure carbonate of lead, as it would have been unwise to claim that their goods were less meritorious than they really were; especially as one of the brands at least has the national reputation of being more desirable and more durable than strictly pure lead, and further, that this reputation is fixed and honored by the lapse of nearly a quarter of a century.

The claims made in the same published article regarding the durability of strictly pure carbonate of lead as a paint are not borne out by the facts in the case, and we wish to emphasize the challenge to the lead "Trust" to produce any good proof that the criticisms upon white lead contained in these pages are not strictly and—unfortunately for their position—absolutely true.

In concluding this unpleasant duty of showing up the unworthy methods of the Lead Trust to advance their interests, a few words more. It will be noticed in the published remarks concerning barytes,

the article says it costs only one cent per pound, and they go on to argue that because barytes costs but one cent a pound, then a mixture of white lead, zinc and barytes is a poor paint. Here let the reader, if his brain can grasp the tremendous logic of the equation, figure out the result.

To the average common sense of America such an equation is a mere drollery, a huge joke. Another equally as sensible will relieve the solemnity of the occasion. If maple sugar (with the government bounty paid) and absolutely free from sand costs fourteen cents per pound, it will make better and more durable roads than washed gravel will produce, because gravel costs only fifty cents per cubic yard. Again: In the year 1840, caoutchouc, or so called India rubber, pure, cost about one dollar a pound according to the visible supply, but ranging from sixty-five cents to one dollar and a quarter according to quality. This India rubber had been known for years as a valuable resistant to water, and was used in some ways to great advantage. There were, however, very great obstacles to the widespread general usefulness which it has since attained. It was not reliable and was subject to great changes according to temperature; it was easily broken or distended, was not durable as an article of footwear. Its strength was not sufficient for fire hose, and about the only use for it in a pure state was for some few delicate uses or for surgical purposes. It is true it was used for twenty or thirty years in the form of overshoes, but they were expensive, unreliable and easily destroyed. In Great Britain it was used in a measure in combination

with strong fabrics for waterproof clothing, but was in that form so costly that in 1840 it was scarcely ever seen. The late Charles Goodyear discovered that by mixing it with sulphur, white lead and some other ingredients, he could produce an article which had all the virtues of the pure gum without its serious faults. The result every observant person knows. It has, in its *adulterated* form, superceded a great many other valuable products of industry. It is used in every branch of manufacture from the finest toilette article to fire hose and steam packing. Submarine diving has been made possible by relying upon its strength and perfect attributes. It is in the mouths of infants at the nursing bottle and in the mouths of old age as a foundation for artificial teeth and has been heralded to the world by the Hon. Proctor Knott in his happy speech regarding "Gum Washers for Car Axles."

How ridiculous would appear the argument that because sulphur costs one cent per pound and white lead five cents per pound, to say nothing about the barytes and clay mixed in the combination; we repeat, how ridiculous the argument that the improved article was not as good as the pure unadulterated gum, because sulphur costs one cent per pound. The contrary is the case; the adulteration has doubled, yes, quadrupled the efficiency of the product, and has reduced the cost below half the cost of the pure goods.

The argument introduced by the Trust has no force, in fact it is weak and ridiculous. We know, and every man who has taken the pains to try the experiment without prejudice and with intelligence

will testify, that a mixture of white lead and zinc, with gypsum or barytes, with pure linseed oil will, as a paint, wear longer, remain white longer, and will hold its gloss longer than the best strictly pure white lead under the same exposure. The question of the cost of the ingredients is not relevant to the question of durability. We will argue the matter of cost or money value in another paragraph fully.

We have evidence from our business relations during the last thirty years with the men at the head of the affairs in the various white lead manufacturing in the United States that they are honorable men; and while freely admitting this to be the case, and at the same time fearlessly canvassing their errors in a business way, would insist that they have not a monopoly of the honor or reputation, for during the last thirty years, more than half of which have been spent among the grinders of paints and colors, we are pleased to record that there has not been the first instance in which we have been instructed or asked or advised by the owners to brand any article of paint otherwise than its true formula would suggest and bear us out in doing.

It is not necessary to name the parties here referred to, because they are well known by all the white lead makers and are known to be men of unsullied character and reputation for honor, truth and integrity, and it is to be believed that the reputation of all the grinders taken collectively, will well bear comparison in these respects with the white lead manufacturers. We would here ask the question, if white lead pure is the only paint of value, why is it necessary for a great corporation like the "Lead

Trust" to make such frantic gyrations to preserve its preeminence? Why not let it rest assured of its victory? Is it in danger? Are they afraid of the grinders of mixed lead, and that their products will replace strictly pure lead in the market? It would seem so from the facts here laid before an intelligent public. We are not afraid to let the light into this matter, and to call upon the unprejudiced judgment of the public, especially intelligent painters.

A writer in the Painters' Magazine for November, 1892, says, among other things, as follows :

"Dr. Dudley has shown that inert material is no detriment to the standing qualities of some colors; the manufacturer uses inert material to meet the price of his customer, therefore the object of the chemist is to prevent the manufacturer from using barytes, or to detect the fraud if he does use it. But is it a fraud on a painter that wants twelve cents' worth for seven? That's the rub: he wants twelve cents' worth for seven and gets five, for the cost of packing, selling, etc., is the same, and must be paid for."

This brings us to the promised item on cost and on value. We know exactly the net cost of strictly pure white lead dry, when the price of pig lead is quoted, but do not think it advisable to add to the panic of the "Giant Lead Trust" by making the facts known. However, since they themselves have raised the question in the foregoing article regarding analysis, the consuming public are asked to look at some new arguments. The product called *adulterated* costs the grinders nearly as much as the strictly pure lead costs the corrodors. The question is, will the public pay the corrodors 40 per cent. gross profit upon the pure white lead, merely because it is white lead, when they can get a more durable article by paying the grinders 25 per cent. gross

profit? The next question is, will the consumers continue to go forward blinded by hoary prejudice and tradition, and pay into the coffers of this gigantic "Trust" their hard earned money, simply because the article is truly and faithfully named Strictly Pure White Lead? Will they not at some future time be willing to buy an article which has more merit, which is more durable, which is sold at a fair figure and is as truly and faithfully branded what it is? namely, a mixture of lead, zinc and barytes. These are the questions to be met in the near future. We have assured ourselves that a mixture of lead, zinc and barytes can be made which will cover better, dry as well and spread as well as white lead, and while retaining its whiteness and gloss longer than strictly pure lead, will be more durable and which can be sold at a price less than pure lead, and at a fair profit to the producer. The next question is, how many painters will take the pains to carefully test the truth or error of the conclusions here recorded?

It is no doubt true that the branding of an article in a way which is at variance with the facts is unjust and indefensible, but custom—a long used custom and one which was first inaugurated by the lead coroders—has made it proper to brand second and even third grade goods "Pure." Admitting the truth that the custom is wrong and a cheat, is it any less wrong to make use of claims which are not true regarding the durability of an article simply because it is pure, and thus endeavor to continue the false reputation of the **perishable** products of a **perishing** industry? But let us close this part of the subject

and look at the matter of white lead upon the broader platform of humanity, and from a sanitary point.

Ordinary house painters, or rather, common brush hands who do little else than spread common oil paints, have in these later days little trouble with lead poison, because the material they handle makes no dust. The better class of interior decorators where a great deal of sand papering and surfacing is necessary, to which must be added the carriage and car painters as well as the large crowd of boys employed in some of the larger manufactories of buggies, sleighs, etc., are exposed to an atmosphere filled with one of the most dangerous and insidious poisons known to medical science. The question arises, what can be done to remedy this danger? The answer—and the only answer—is either reduce the quantity of lead in the paint, which will only partially lessen the danger, or erect fans to remove the dust from the atmosphere around each individual operator, which will be better than the first; or still better, discard lead almost entirely. It is to be recorded that many manufacturers have adopted the first two of these plans, and some few the latter. This is not mentioned in any spirit of meddling, but as we are canvassing white lead in all its aspects, it is proper for one who is thoroughly conversant with the physiological effects of lead dust upon the human race, to give voice to this warning note so that all who will take the trouble to read, especially the young and thoughtless, may profit thereby.

There seems to be a cloud of uncertainty, and in cases dense ignorance regarding the true status of

white lead as a paint, some writers in their admiration styling it "our best friend." To those who deem it their best friend, we say we would not ruthlessly sever so *dear* a tie, but stand true to our motto:

"Magna est Veritas et Prevalebbit."

Some call lead "our old stand by." There are also those who, through their want of knowledge, say that lead is not now made as good as formerly. Let us introduce an excerpt from the September number of the *Western Painter*, Volume I, No. 8, entitled "A Chemist for the M. P. N. A."

"The local associations are discussing the advisability of the National Association of Master Painters engaging a chemist permanently. If the association is going into the business of analyzing all the goods manufactured in the United States and those sold here from foreign shores, it would very likely save money by hiring a permanent chemist."

"But when we have found out the ingredients of all the paints, oils and colors, are we prepared to discard those that carry a percentage of adulteration? Has it not been proven by actual practical tests that in many cases these adulterants add to the desirability of the paint? Is it not a fact that the change in the process of manufacturing one of our old stand-bys, white lead, has taken away its lease of life? While it may be as pure as the pigment itself, it will not stand the wear and tear of the elements as well as a lead with a per cent. of adulteration. Is not this a fact with other pigments and colors also?"

The whole article is here introduced and is evidently a piece of news matter. The position of the writer of the article we quote is not a correct one. No change in the process of the manufacture of white lead during the last thirty years has "taken away or shortened the lease of life" of his dear old stand-by. Upon the rest of the article we will make no comment but will let it speak for itself. The truth is about as follows: In 1863 it was

scarcely possible to obtain white lead which was absolutely white. The Atlantic and Jewett were rated as the best in that respect, but the tradition was accepted that lead was not truly white—in fact it was supposed to be creamy or gray in shade.

The lead corrodors are an intelligent and enterprising body of men and, having been in close communication with them, the writer is able to say that they have spared no expense in experiments and in apparatus during the last quarter of a century to improve their product. With their immense capital and great energy they have improved the product until it is as white as anything can be made. As a general thing it is nearly uniform in quality and is more thoroughly washed, and finer at this time than ever before; further, it is chemically pure so far as the writer has been able to discover. But these truths do not relieve it from the criticisms contained in this article. It is white lead, no matter how fine and white and pure, it still acts the part of white lead. Chemistry is an exact science and certain causes bring about certain effects. It is immaterial how roseate the color of the language may be in contradiction, the stubborn fact remains that strictly pure white lead will flour, or chalk, or dust off in a few months. All the criticisms concerning its action upon oil and colors, and its tendency to turn black, are true, even though it is as white as snow and as fine as smoke. These facts cannot be denied successfully.

Pulp Lead.

We quote from the Painters' Magazine again an article on pulp lead:

"The question of pulp lead is being ventilated, which naturally brings up with it another question; that is, water in paint. As to the merits of pulp lead, or what is termed pulp lead (and I believe Atlantic by one writer has been designated as such), I have no hesitation in saying that I am perfectly satisfied with it, even if it does contain some of the aqua pura. As to its standing qualities, which are condemned on account of the small percentage of water, it is amusing to one who has used a mixture of water in his color for over thirty years and found none of the evil results that the trade is conjuring up to themselves.

"As to pulp lead, I do not believe that the small amount of water it may contain, that is if it contains any, will injure it for the every day use of the trade. Lead is used in the trade for its covering qualities. It has been found to be the most economical and the best wearing of the pigments. It is made by a chemical process which the painter can know but comparatively little about, and until such time as we do know we should be careful in condemning too hastily our best friend."

This writer does not condemn the pulp lead, does not object to a little water, but admits that he knows so little of its chemical characteristics that he will be careful in condemning "his best friend."

Following up this matter of water in pulp lead; we have lately seen an advertisement in which the manufacturers of the erroneously styled "quick process lead" attack the process of pulp grinding. We beg leave to record our experiences as to the value and durability of lead so ground. We insert portions of the advertisement, which appeared in the Oil Paint & Drug Reporter, Nov. 21, 1892.

"For many years corrodors of white lead have endeavored to find some way of mixing white lead with linseed oil without going through the process of drying the wet lead after it comes from the washing tubs. It is a well-known fact that linseed oil will mix with pulp white lead by being constantly stirred, the lead taking up the oil and settling to the bottom of

the mixing tank, while the water rises to the top and can be drawn off.

"This process looks well enough in theory, and the mixed lead seems to be good, but it is not. No amount of mixing or stirring will eliminate *all* of the water, the lead still retaining from one to three per cent.

"The process is a much cheaper one than that of using dry lead, as it saves the cost of fuel and also saves a large amount of labor. Some manufacturers do not wash out the acid or tan bark used in corroding, but pump the lead direct from the wash tubs to the mixing machines. Some manufacturers do not even grind the lead after it is mixed, but pack it into kegs direct from the mixers. It is estimated that this kind of lead can be made for five dollars per ton less than that made from dry lead, not including the profit made on the sale of water contained in the mixture.

"We believe that the pulp process has been adopted and is in use at the present time by every corrodor of white lead in the country, excepting the "Carter Co."

"Pulp lead has a "cheesey" or "soapy" appearance. It is very short, the water having saponified the linseed oil so as to destroy its elasticity.

"Pulp lead is hard to break up, and when mixed with linseed oil for use it curdles and the kegs in the pot, usually more oil being added to "thin down," which destroys the body so that the paint will not cover. Painters are already becoming acquainted with the characteristics of pulp lead, and many complaints have been made, the matter being brought before the meetings of the Master Painters Association of the States of New York, New Jersey and Pennsylvania. The Carter Co. dry their white lead thoroughly before grinding and do not use the 'pulp process'."

We think we can show that the process of pulp grinding is not new, and will endeavor to answer the other criticisms of our friends, the "Quick Process" manufacturers, as well as to prevent in a measure our correspondent of the Painters' Magazine from being deceived in his "best friend." Hence we wish to add the weight of our knowledge regarding the matter before us, and hope in this way to contribute something to the general knowledge regarding paints, trusting that our friends will find some advantage in the perusal. In the early part of this

lead we described the finely ground white lead as settling in tanks. When the clear washing water superincumbent has been drawn off, it leaves the lead in the bottom of about the consistency of very thick whitewash. This consists generally of about 40 per cent. water and 60 per cent. lead, and when drawn upon copper pans and dried, it is the dry lead of commerce.

In 1873 the writer found that it was possible to grind this pulp lead in oil direct from the tanks without drying, and found the product far superior in every way to the product which had been dried before it was mixed with the oil. Upon imparting the fact to a friend, Geo. W. Banker, Esq. of New York City, Mr. Banker applied to that veteran paint maker, the Hon. Daniel F. Tiemann, Ex-Mayor of New York. Mr. Banker showed the written proposition to get a patent on the process, and the venerable color and paint maker replied:

"The process is not new. It has been done in Germany for years and it makes the cleanest, whitest and coolest lead that can be produced; further, it cannot be patented as no person at this late day can honorably claim originality; but there is no doubt that special apparatus for handling the pulp might be patented."

We have the original rough sketch and the correspondence of that date to show, and merely mention it here to give force to the opinions which are to follow.

Pulp lead, when forcibly agitated with oil to the amount by weight of eight or nine per cent. of the weight of dry lead contained in the pulp, will combine with the oil perfectly and throw out the least trace of water in a manner similar to the

operation of making butter in a churn throwing out all the butter milk.

In the advertisement mentioned, the Carter Co. speak of the acid and tan bark being left in the lead when the pulp is ground in oil. Do they mean that the acid and tan bark are expelled by drying? Their article so reads; but we can scarcely believe they mean it. We think this is a novel way to remove solids from liquids, for in all our researches we have been led to think that the way to recover solids like acetate of lead and tan bark from a liquid or solution is to evaporate the water by heat. The result of practical working refutes the statement, for if a quantity of powdered tan bark is mixed with a quantity of white lead pulp and allowed to remain long enough to get thoroughly water soaked, the tan bark will, upon the addition of the oil, all come out with the water. The acetate of lead, will, whether it is in dry lead or in pulp lead, combine with the oil. We have frequently tried this experiment carefully. The facts and theories are all in favor of the process of grinding pulp lead in oil, over the old process of grinding the dry lead in oil. There has always been more or less trouble in mixing dry white lead with linseed oil, especially when fresh and warm from the pans, and more especially during warm weather. The reason for this is due to the tendency of the lead to oxidize rapidly.

If five hundred pounds of dry lead fresh and warm from the pans, be put into a common rake and bar mixer with 9 per cent. of its weight of linseed oil, and if when the mass has assumed that rough and incomplete state which may (to use a homely expres-

shorter on account of grinding the pulp in oil. The cause for this is probably the use of rolls instead of mills partly, and partly the want of care in tending the feed. If pulp lead is ground in mills after the mixing is complete, it produces an article much smoother than is the case with dry lead mixed in the oil.

White lead when drying in the pans, cakes or mats into hard chalk like masses, especially if it is good hard winter lead finely ground, and when it is mixed with oil in this state it requires a great deal of mixing and milling to reduce it to a smooth paste. The pulp lead is in a finely divided state, there are no lumps in it and it combines readily with the oil, forming a stringy, smooth paste. There is no discoloration, the accidental vegetable matter is washed out with the water, and the lead is not subjected to the heat and dust of the kiln room. The process avoids the danger of dust to the workmen and there will be no water left in the product if properly manipulated. White lead when taken from the kilns is hygroscopic and generally too dry to work well. It will if stored in a cool, damp place take up a little moisture and work cooler and better for the change. The fact that it costs \$5.00 per ton less to produce it by the pulp method is not a good strong, sensible argument for business men to use. When unfounded prejudices regarding innovations are swept away and when facts, not theories, rule, it is probable—considering the matter from a sanitary point—for it is the dust that kills lead men generally—it is probable we repeat, that with improved methods and machinery,

sion) be likened to chicken feed, the mixer is stopped for any cause about two hours on a warm day, it will readily be perceived by the unbearable odor of a sickening, pungent nature, that rapid oxidation is going on, and the mass has assumed a strong yellow tint, and farther, if it is allowed to remain thus for six or eight hours, the whole mass will show a rich chocolate brown and smell like burnt oil. This we have seen a number of times in our practice where unavoidable accidents have happened to the machinery. It is true that where chasers or edge runners are used to incorporate the oil this danger is very much lessened or wholly avoided. In mixing the pulp lead with the oil the presence of the water excludes the free oxygen of the air until the lead and oil are perfectly combined, and the lead is always whiter in consequence. The advertisers claim that the process of grinding pulp lead leaves 1 to 3 per cent. of water in the lead. This may be true where the machinery is not perfect or where the operation is not judiciously performed; but it is not true as a general thing. We have mixed dry white lead as follows: 70 pounds dry lead, 30 pounds water, and strained the whole through a fine sieve; then added six pounds of oil, carefully mixed the whole and secured exactly 76 pounds of lead in oil, performing the experiment with scrupulous nicety. Again we have taken samples of the lead which have been ground from the pulp, and in a clean copper dish subjected them to a sustained heat of 212°F. for several hours, without appreciable loss of water or vapor.

Again the advertisers claim that the lead is

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all the pure lead used for paint, or nearly all, will be ground by the rollers from the pulp.

We do not object to the rolling process for incorporating the oil with the lead, in fact we think it better as it is much cooler in its operation and much more rapid. What we wish to infer is that while we have seen some highly finished work performed by rolls, it is possible to hurry the feed so much that the product is a little ragged and short. We believe however, the lead so hurried when mixed into paint is as good as any other. What we desire to say is that we think the product of nicely furrowed water cooled mills will generally be smoother, if not better than the product of rolls.

It is unfortunate that the Carter Co. has fallen into the same trap in their argument concerning the cost of production, which has caught their competitors in their theories regarding the cost of buytes. The cost of the handling is not essential to the facts in argument, and does not relate in any way to the question of actual qualities, for excellence and durability. In passing it may be well to say that waste of energy impoverishes the whole community, and as the drying of white lead when it is needed for the purpose of grinding in oil is a waste of coal, to which may be added the waste of extra power necessary to mix and grind dry lead in oil, we feel that the pulp process is a saving to the whole people, hence is an advantage to all.

We are sorry that the advocates of an article which has all the best qualities of material (of its kind), have been led into this error of judgment, because personally we think their product equal, if

not superior, to the best average white lead on the market at the present time; but the fact that it costs \$5.00 per ton less to grind pulp lead is not a good argument.

Since the advance sheets of this pamphlet were placed in the hands of the printer, our attention has been called to an article in the December number of the *Painters' Magazine*, signed by "New England Painter." We will not attempt any quotation from the article as it can be read in full in the valuable periodical cited.

We have no intention to excuse any of the errors attributed to the Lead Trust, as we are certainly under no obligations to them; and we think the *Oil, Paint & Drug Reporter* is amply able to defend itself. We have already answered all the points concerning pulp lead, and think our position will be verified by any candid person who will take the pains to try the experiment faithfully. We cannot, however, let this notice pass without a few words in rebuttal. We have shown that white lead is nearly one-third hydrate. When dry lead is taken from the pans it is as stated, hygroscopic and will usually absorb about one half of one per cent. of its weight of moisture in a cool, damp place. When the water held in true chemical combination as a hydrate as well as the carbonic acid gas are all expelled by heat, the remainder is anhydrous oxide of lead or litharge ($Pb. O.$). Hence the heating of white lead above a temperature of 212° to 216° causes it to turn yellow, and if the heating is carried far enough litharge will be the result. Hydrated oxide of lead is snow white. Anhydrous oxide of lead is lemon or buff. We have

already canvassed the subject of water in pulp lead thoroughly, and due to assume as follows: If a quantity of pulp lead sufficient to produce four tons of dry lead be divided into two parts, one part dried on pans in the usual way and mixed with oil, and the other part mixed with the oil as pulp, that New England Painter and his host of critics could not tell the difference between the two if their lives depended upon the precision of their Yankee guessing, unless indeed they were able to note that the pulp lead made a whiter and smoother article than the dried lead produced.

Farther argument is scarcely necessary, but the logic is plain to any fair minded person. All white lead made by the Dutch process is largely hydrate, hence there is always from three to five per cent. of water in its composition by chemical affinity; with a little free water held hygroscopically. If this water is driven off by heat there will be a change in color. All white lead ground in oil, whether ground from the dry lead or from the pulp, will upon heating up to the limit of discoloration lose about one-half of one per cent. in weight. No two samples of white lead are exactly the same in the amount of hydrate present in combination. These facts being established, it does not appear that the presence of a minute excess of water would materially affect the product, even if it was there, which we have shown however, cannot be the case.

In earlier days the painters had the pleasure of grinding the dry white lead in oil themselves; but since they have by one accord, allowed the correctors to grind it for them free of charge, we submit

that they ought to allow the correctors to manage their own mills in their own way if they furnish a good article by their processes.

The controversy between the parties who are producing pure carbonate of lead by the old Dutch process, and the one party who is producing the same goods exactly, as far as chemical conditions are concerned, by a process which has been erroneously termed the quick process, takes a wider range than has been noted regarding the grinding of pulp, and it is claimed by the old process advocates that the newer process is inferior, and vice versa. We would like to present both sides in a fair and impartial manner as it appears to us, and our reasons for our conclusions.

As explained previously, in the case of the first party the lead is cast in forms weighing nearly twelve ounces and presenting surfaces only equalling the exteriors or superficies of the forms, while in the case of the second party, the lead is atomized into mere dust, thus increasing the exposed surfaces or superficies many thousand times to a given weight of metal. It will be seen that if the chemical action forms a film of one thousandth part of an inch in a given time in both cases, the film is only a small part of the metal in the first instance, while it may be a large part of the small particles in the second instance. Both parties use metallic lead as the base of operations; both parties use vapor of acetic acid and vapor of water derived from the same sources; and both parties use oxygen from the atmosphere, and carbon dioxide. The first party gets the carbon dioxide from the slow combustion of tan bark; the

second party derives the same chemical elements from the artificial and rapid combustion of coke. The first party derives the heat from the natural combustion mentioned, as well as the vapor of water; the second party derives the heat and vapor by introducing a jet of steam. The films of carbonate form no more quickly in the case of the second party than they do in the case of the first; but the films when formed, exhaust the supply of metal present more quickly than in the first case, as explained. Hence we see the first party requires one hundred days to perform the same chemical process that is performed by the second party in ten days or less. The term "quick process" is a misnomer. Chemistry is a very exact and exacting science and the time necessary for the chemical interchanges is the same in both instances. The advantages which the second party has over the first party may be noted as follows: The second party has the privilege of examining the mass from time to time, and when the metal is all converted thoroughly, showing that a true chemical change is completed, he can remove the mass. The first party cannot see the progress, but must rely wholly upon his experience in building his beds, and the result varies according to the circumstances. Hence we see that when the beds are stripped, the average of the metal converted is seldom over 80 per cent. of all the metal placed in the crocks or pots.

The second party can regulate the temperature, the humidity, the acidity of the vapor and the supply of carbon dioxide at pleasure; but the first party can only build, ventilate and conduct his beds by experi-

ence, and trust to luck in a great measure, so that it is not uncommon for an experienced man to find the results of his management ranging from 55 to 95 per cent. of the lead put in, converted into carbonate; and this variation has been found in different layers in the same stack or bed. After the corrosion is completed both parties go forward in the same manner in a general sense, in finishing the product known as dry lead. The corroded product of the Dutch process is first carefully separated from the remnant of metal, and then ground in heavy stones, aided by streams of water. The same corroded product by second party has no metallic lead in it and is therefore ground directly without any separation. In fairness, it may be stated that the first party cannot so perfectly separate the residual metal from the mass that none is left in the product going to the mills; and hence it is common to find the metal adhering to the faces of the mills; but the quantity since the latest improvements in separators, is so small that it is practically not worth notice.

The second party has no tan bark or stable litter to contend with as will be seen, but the first party has to contend with the fact that careless laborers will sometimes allow the vegetable matter to fall into the crocks. This, however, has not of late been a serious trouble, owing no doubt to greater vigilance on the part of foremen, and better methods in handling the various materials used in constructing the beds.

This pamphlet is not an advertisement, and although we were for a number of years engaged in the manufacture of white lead we are not now so

engaged. We can therefore be fair to all in noting down what we know about white lead.

It is the tendency of lead hydro-carbonate to change in conditions with every change in temperature and humidity, and the avidity with which it combines with other elements, which renders it undesirable in a pure state as material for painting.

Our readers may say, you have made these statements, and you have cited your facts in evidence, but you have given us but a little insight into the causes which you have found for the decay of white lead as a paint. We will endeavor to give such reasons as we think are the principal causes. It has been known for a quarter of a century that pure white lead is fatally perishable when placed upon structures which are in exposed positions upon our sea coast. The reason for this is obvious, and the explanation as simple as the formula that sugar will sweeten water. When pure dry white lead is boiled with salt and water, carbonic acid is slowly eliminated and the lead present becomes a chloride of lead, which is slightly soluble in cold water, and perfectly soluble in hot water. The simple chemical reason by experiment is, that lead has greater affinity for the chloride combined in the salt, than it has for the sodium of the salt or the carbonic acid in its own combination, hence the chemical interchange of terms.

Chloride of lead is a powerful oil dryer, and has a very marked effect upon the oil, shortening its life in a serious degree.

Nearly all the combinations of lead by chemical action are sensitive to changes from the presence of

gases and hydrates, and during an experience of thirty years in making paints and colors, we have not only experienced the difficulties noted previously regarding white lead, but this sensitiveness to the presence of objectionable elements has been a great annoyance, especially during the manufacture of greens and yellows; the chromate of lead being so sensitive that a delay of a half hour in washing the color has frequently resulted in the defeat of the operation.

A list of the various lead compounds and their solvents, with some notes upon their other characteristics, is appended.

ACETATE OF LEAD (sugar of lead), soluble in water and sensitive to gases.

NITRATE OF LEAD; soluble in water and sensitive to gases. CHLORIDE OF LEAD has been noted previously.

CARBONATE OF LEAD; soluble in all the acids, eliminating carbonic acid and forming soluble salts with the acids mentioned; hence, acetate with acetic acid; nitrate with nitric acid; chloride with hydrochloric acid; sulphate with sulphuric acid; and chromate with chromic acid.

LITHARGE acts so nearly the same in the before mentioned acids that repetition is unnecessary.

RED LEAD AND ORANGE MINERAL are peculiar oxides of lead and are more obdurate, they are soluble only by boiling in a suitable mixture of alcohol and nitric or muriatic acid, or some other similar menstruum; but they are both very durable paints under nearly all trials.

SULPHATE OF LEAD is perfectly soluble in the alkaline solution of tartrate of ammonia, and as has been shown, is not affected by gases.

CHROMATE OF LEAD is fully soluble only in special mixtures, but is very sensitive to gases, and were it not for this, would be one the most durable colors known.

We have not attempted to give a chemical chapter on lead; but to bring before our intelligent readers

*When carbonate of lead is treated with sulphuric acid, carbonic acid gas is evolved, and an insoluble sulphate results.

some plain, simple facts which are not fixed by our prejudices, but which are laws fixed by and noted during operations in chemical research which have been made in the exact science of chemistry by able, honest and persevering men of great intelligence.

We do not object to lead because it is lead; we object to its use in a pure state because we know that the judicious mixture of other material renders it more durable. It is attempted to make it appear that white lead pure can stand alone, and that white lead pure alone is the only paint that will stand the crucial test of time.

We take the position that we should not, while admitting that a suitable proportion of white lead has its advantages, admit that we must buy pure white lead for all uses, when we can obtain more durable results with a mixture at less cost. The objection regarding white lead on the sea coast holds good, but in a modified degree, in the great lake region.

When painters have in a measure given up their Saturnine creed and plumbous catechism and have looked carefully at this matter from a practical standpoint, pure white lead and its present advocates will be obliged to concede the truth of the matter, or, attempting to stand alone, will so stand alone, a bleaching and aged monument to chemical frailty.

Sulphate of Lead.

A generous and brave public always quickly punctures the inflated bag of boasting.

Another of the various lead compounds merits some attention as an article for painting, namely, the sulphate of lead. This salt of lead is made in

two ways, first, by precipitating the lead solution by means of sulphuric acid or by the soluble sulphates. For many years the sulphate of lead by precipitation has been on the market in limited quantities as a by-product of dye works. In this form it is not always white, and is not uniform enough in quality to render it a desirable article for paint grinders' use. There are some manufacturers of this article by precipitation who have produced quantities of a very fine quality; but the fault with such products has been that the article is crystalline, the molecules forming in bead-like clusters similar to branch coral. This peculiar molecular structure renders the paint deficient in covering power, liable to run or sag, and to drag from the brush. One manufacturer has we believe partially or wholly obviated these difficulties by special methods, so that the product is a very good substitute for carbonate of lead. Another form of sulphate of lead is produced by sublimation at Joplin, Mo. This form is not quite pure sulphate, there being a small percentage of the true oxide (Pb. O.) in this composition as well as a slight trace of zinc. It is, however, a very serviceable and admirable article for painting, is not crystalline but truly amorphous, and is really better as far as durability is concerned, than the pure carbonate. Neither of the above mentioned sulphates has any chemical effect upon linseed oil, and neither is affected seriously by hydrogen sulphide alone, although the presence of ammonia causes the hydrogen sulphide to act forcibly upon both forms of this lead salt. This sublimed sulphate is gaining in popularity, but as it is at present, the product of strictly proprietary

formulae and methods, its advent is not as rapid as its good qualities would warrant. So great is the prejudice in favor of pure carbonate, and so strong is that prejudice against anything other than pure carbonate, that grinders who are using this sublimed lead in their formulae seemingly deem it discreet to keep their knowledge of the fact from the general public. One manufacturer who uses this sublimed sulphate nearly pure, but with a proportion of pure carbonate, evidently to prevent sagging and pulling, advertises it as pure lead, and is borne out in his claims by the analysis of a reputable chemist of national fame. This chemist says in the analysis that he finds 92 per cent. pure oxide of lead and 8 per cent. of pure linseed oil. We will not question the scientific methods of a chemist of broad reputation; neither cavil at the technical terms he thinks it proper to use in describing the results obtained in his careful research. It is probable that when he had secured the final results his figures showed 92 per cent. of lead. As practical people we would say that the paint was, say 80 per cent. sulphate of lead and 7 per cent. carbonate, approximately with the remaining 5 per cent. due to oxide of lead and oxide of zinc. There is no doubt that the solids were all lead or nearly so, and the oil pure, and in the present state of mind of the consuming public, it is judicious on the part of that manufacturer to withhold the real fact, as in so doing he cannot be charged with dishonorable practices.

The sentiments of the consuming public are such (and it is unfortunate that such is the case,) that an honorable manufacturer cannot tell the exact truth

about his really reliable products without running the risk of endangering his business prospects; but ~~we heretofore believed that~~ it is so, and that the sublimed lead is better in every way than the pure carbonate for the reasons heretofore given and here reiterated; that it has no destructive effect upon the oil, does not affect colors, is not affected by the gases mentioned and is non-poisonous or nearly so

Zinc.

Having devoted considerable space to the subject for which we originally intended this work, namely, white lead, we think a few words expressly devoted to zinc oxide will not be out of place, because we believe that this valuable article is not fairly understood.

Zinc oxide or zinc white, is the product of the sublimation either of the pure metal or of some of its valuable ores.

The whitest and most expensive varieties, such as the French and Belgic brands and our American brands of the best qualities, notably the "Florence," are made from the pure metal and are sublimed in muffles or retorts; hence they are free from the grosser products of the combustion of the fuel used, as well as being free from the contamination of sulphur and other impurities not present in the spelter or metal. The ordinary American brands are produced generally from the natural ores, and are sublimed in open furnaces of peculiar shapes adapted to the process.

All the American zinc whites are commercially pure as far as we have been able to discover, but they nearly all contain minute percentages of sulphur, silicic acid and chlorides; the quantity of such impurities is so small, however, that we may assume, that while no particular brand will contain all the above named impurities, and that while all the American brands do contain as small percentage of some one of the accidental contaminations, they are for all practical purposes chemically pure.

Metallic zinc or spelter fuses or melts at a temperature of about 773°F. and boils at about 1900°F. or a high red heat, when in this condition it readily combines with oxygen, forming clouds of dense white vapors of zinc oxide, which are carried off through systems of cooling tubes or chambers, and from these tubes allowed to fall into bags of a peculiar texture and structure.

When the ores are used instead of the metal, the process although somewhat different in detail, results in the same chemical product, zinc oxide, which is recovered in the same manner as in the case of the sublimation of the metal. As stated before, while the product is the same chemically in both instances there is a slight difference in purity and brilliancy as noted.

Zinc white forms only a very feeble chemical union with the oil if any, for we find that as there is in freshly made zinc oxide a slight trace of chlorine or chloride in some obscure form which attacks the oil, making the mixing troublesome, we cannot see, however, that it has any serious effect upon the oil.

Zinc white, kept for a few weeks in the store room, loses this peculiar property and works very differently from the freshly made article.

We have seen it stated that zinc requires so much oil to mix it, that its durability as a paint is greatly impaired.

We cannot see the drift of such an argument. Lampblack requires more than ten times its weight of linseed oil to make a paint suitable for the brush, and it is known as the most durable paint ever made, defying the elements for fifty years.

Signs painted with white lead, and lettered with lampblack can be seen, where the lead, and even the wood itself under the lead, have been deeply wasted by time and the elements, while the lettering stands out in relief nearly as good as ever. Lampblack and zinc are both very slow dryers, and as it is a good rule that all slow drying paints in pure linseed oil are more durable than rapid dryers, we shall insist that lamp black and zinc are oil preservatives. We note that zinc on interiors is very durable; that it is hard, fine and brilliant, and bears frequent washing and scrubbing well; we will state our reasons.

The lumber on interiors is generally clear and well seasoned, and this we think is the principal reason.

In former times architects and builders frequently hid the eave spouts and conductors in the cornices for the sake of appearances.

These metal contrivances retained a little water after every shower or storm, and when the external

heat was sufficient to evaporate the water, the cornices were converted into steam boxes or sweat boxes, hence we have often noted that while a house was in good order everywhere else, the cornices were peeling badly.

It was laid to the zinc, and we believe correctly, for while pure zinc will not bear this severe test, a mixture of zinc with white lead and barytes will, because and simply because it is porous.

We think it not safe to use pure zinc where there is any possibility for the accumulation of water behind the material on which it is placed.

If every clap board, and every piece of lumber used in a structure or carriage or car, were thoroughly painted on the back before being put in place, we could use zinc as well as lead with safety. This, however, is nearly impracticable, and the only way is to mix such material with the zinc as to render it porous.

It has been said with truth that pure zinc cannot well be used as a ground for graining. This is because it makes too smooth and glossy a surface, and not on account of any chemical action. It has no tooth as painters say, and hence the graining color works badly and does not adhere. The same want of granular formation renders it unsafe for varnish, unless it is used with great care by very expert decorators.

We have, however, seen very excellent work done upon a mixture of zinc lead and barytes.

We have we think shown very fairly the great faults in pure zinc, and are free to admit that the

labor incident to its use in mixing and spreading, is great as compared with lead when we count our time by the weight of material used, but are there not some other redeeming qualities which will induce us to continue its use and cause us to defend it?

Zinc does not affect the oil chemically, but makes a superb mixture of great brilliancy and fineness mechanically.

It does not injure colors, but on the contrary brings them out with clearness and fullness.

We have frequently painted samples of clean glass, clean iron, clean tin and clean dry wood, with pure lead, and pure zinc mixed with linseed oil, and after they had become dry, exposed them for months to the elements, and in every case the zinc has shown the greatest durability.

We believe that if we give zinc a fair chance it will hold its own as material for painting.

When false ideas, misrepresentations and prejudice, when chicane and chicanery in business, give way before the intelligent research of thoroughly honest and practical painters, we believe there will be a better understanding between the paint manufacturers and painters, and we feel that the day of honorable practices and truth in business is rapidly approaching. When that time comes, manufacturers will tell the truth about their products fearlessly, and painters will know exactly what they are using and can then be enabled to arrive at the truth regarding the true value of the different materials offered for their approbation.

"Abelt Invittla."

In conclusion we will say we feel that we have made our sentiments clear. We have brought forward many corroborating quotations and will add some few words from one of our honorable competitors, Mr. John Lucas, who needs no introduction to the paint consuming public. In a paper read before The Master House Painters' and Decorators' Association of Pennsylvania, at their fourth annual convention held in Philadelphia, January 29th and 30th, 1891, Mr. Lucas makes mention of very many of the vital points discussed here. We will say that we are ready to give Mr. Lucas credit for any repetitions which we have made of the truths he has given voice to, although we have been aware of the facts presented for years. We do not agree with Mr. Lucas in all he says, but his practical recommendations are worthy of all credit by thoughtful men. While we admit that the specific gravity of barytes is less than the specific gravity of zinc oxide according to the figures given by practical and thoroughly reliable chemists, we wish to make a practical qualification.

Brande and Taylor in their chemical writings give the specific gravity of the pigments mentioned below as follows:

Sulphate of Barium.....	4.6 to 4.7
Oxide of Zinc.....	5.6 to 5.7
Carbonate of Lead.....	6.4 to 6.75

Other chemists of known repute give nearly the same figures.

It is thus shown that our friend, Mr. Lucas, is theo-

retical. My correct in his statement that sulphate of barium is of a lighter specific gravity than oxide of zinc; but when we come to practical uses of these two articles we find that the sulphate of barium is very much more liable to settle than either carbonate of lead or oxide of zinc, in fact oxide of zinc will not settle in oil in months. This is due, it would seem, to its structural condition rather than to its specific gravity, and we know that the barrel which will hold only 250 lbs. of oxide of zinc closely packed, will hold 700 lbs of sulphate of barium, and nearly 800 lbs. of carbonate of lead. So, too, while 100 lbs. of barytes can be ground in a little over one gallon of oil readily, it will take two and one quarter gallons of oil to grind 100 lbs. of zinc. While these arguments have nothing to do pro or con with the value of sulphate of barium as a paint, all truths here expressed do have a bearing upon the practical uses of the materials mentioned, and we cannot help coming to the conclusion in a practical way that a given volume of barytes is much heavier than the same volume of oxide of zinc.

"Truth crushed to earth shall rise again;
The eternal years of God are hers;
But error, wounded, writhes in pain,
And dies amid his worshippers."

A word or two more about barytes.

In his admirable work on "Colors for Painting,"

Riffault says:

"Natural barytes or heavy-spar is employed in the manufacture of a handsome white color entirely innocuous, fast and resisting most reagents, but with little body or covering power, and that when properly prepared it is a very bright and dense white."

We quote again from the same work as follows: "For several years we have found in the market, under the name of blanc fixe (last white), an artificial sulphate of baryta, which is much better than the native sulphate. We owe it principally to Mr. F. Kuhlmann, of Lille, one of the greatest manufacturing chemists in France."

After a very exhaustive article by Mr. Kuhlmann upon the methods for preparing blanc fixe, he states: "This substance possesses an unexpected property, upon which I shall insist: it seems to form a slow, but intimate combination with the soluble alkaline silicates, and with these salts forms pigments of unmatched whiteness, possessing a certain lustre, and entirely unacted upon by sulphuretted hydrogen. It may also be employed for fixing other colors. A paint made of a mixture of zinc white and blanc fixe, acquires such an adherence and durability, that it may be safely applied upon old oil paintings. Such a result is of the greatest importance for Paris, London, Brussels and other large cities, where carefully built dwellings are covered with expensive oil paintings, which require to be often renovated."

Review.

We think we have shown that solids other than carbonate of lead make good paints, and that pure lead is rendered more durable by the admixture of other matter. We have shown that such minerals as ochres, siennas, and iron oxides make durable paints without the aid of lead. We think the recently noted decay of lead is not on account of the new and improved methods of manufacture, but because practical men have become more careful in their observations upon its behavior. We have shown that the lead hydrate attacks oils as well as colors, causing fading and that dusty condition spoken of. We have shown by argument that a proper mixture of zinc and barytes or blanc fixe will make lead more

desirable; we have shown a way to use zinc safely in almost all cases, and that barytes is not a detriment. We do not claim that barytes alone will be an economical paint, but that it is durable wherever used.

In addition to our own persistent experiments which we have explained, we have quoted largely from the best authorities, a long array—Mulder, Lefever, Leclaire, Muspratt, Ure and many others, including Dr. Dudley, Prof. Pease and other well known practical men of ability. We do not defend the practice of branding a mixture of lead, zinc and barytes as strictly pure carbonate of lead, for the double reason that it is misleading in the first place and in the second place, unnecessary, as the proper mixture is really better in fact than the pure lead. The use of the word "lead is only in a popular sense to designate a paste paint nearly white in color, while the use of the words "strictly pure carbonate of lead" upon the mixture is a fraud.

We have reiterated the well known trait of white lead to turn dark, and its sensitiveness to gases; and have shown that the other materials are not so affected.

We have repeated ~~again~~ ^{the warning} that white lead is a poison. It is due to the white lead makers to state that they have endeavored by the expenditure of thousands of dollars to mitigate the unhealthfulness of their operations; but the fact still remains that all who work in white lead factories and all who use this article in large quantities are in danger.

An old friend and associate of former years was

went to say. "lead will never hurt anyone unless it comes out of the muzzle of a gun." Alas! our old friend has to his sorrow after twenty years of exposure, found its hurtfulness in palsied and crippled limbs, and he feels the dart as in his passage through the dark valley he looks back upon the cause of his sufferings. If he survives he will recognize himself in this remembrance. Lead is a merciless poison. It is true that persons brought into contact with the dust in large quantities, are happy in having their first experiences in violent acute attacks, which by skillful and prompt treatment are often resisted and in a measure cured, or so far neutralized that the patients suffer but little in their later years; but when the poison is absorbed in minute doses by frequent, often repeated and protracted exposure, there is scarcely any escape from very serious consequences. The action of the poison is insidious and cumulative; it does not when absorbed in small quantities show itself in violent symptoms, but gradually affects the nerves and organs of circulation to such a degree that it is next to impossible to restore them to their normal condition. We are not alarmists and do not make these statements in a meddlesome spirit; these facts are already patent to most of the makers and users of white lead, and as we are writing of lead we feel it not out of place to put this warning before the younger and less thoughtful. We do not think or expect that the use of white lead will be abandoned entirely; we believe that the use of limited quantities will continue to be found advantageous, and in the present state of sentiment regarding its use there

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is no danger of a serious decline in the demand; but we are warranted in believing that as time passes there will be found many practical men who after careful experiment will coincide with our views.

Having endeavored to be fair in our remarks we hope that some good may be derived in the perusal by those who are not wearied with the length of the article, or disgusted with the crude work of compiation; and we trust that our generous readers will so receive our labors that we may feel the same sentiment as is expressed by our dear American poet Whittier, in closing his elegant poem, "Snow Bound:"

"And thanks untread to lips untown
Shall greet (us) like the odore blows
From unseen meadows newly mown,
Or lilacs floating in some pool,
Wood-fringed, the way-side gaze beyond;
The traveller owns the grateful sense
Of sweetness near, he knows not whence,
And, pausing, takes with forehead bare
The benediction of the air."

"*Magna est veritas et prevalebit.*"

O. D. G

