

the new

**PAINT
VARNISH
and
LACQUER
CATECHISM**

by G. B. HECKEL

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THE PAINT SECTION

1. What is paint?

A mixture of opaque or semi-opaque substances (pigments, or finely divided metals, commonly known as "bronze powders") with liquids, suitable for application to surfaces by means of a brush or a spray painting machine or by "dipping," and solidifying ("drying") to form an adherent protective and/or decorative coating thereon.

2. What is the purpose of paint?

To protect or to decorate surfaces, or to serve both purposes.

3. What additional services does paint render?

It is a sanitary agency and a preventive of decay and corrosion. In white or light tints, it reflects and diffuses light, thus reducing the cost of interior illumination and eliminating eye strain.

4. What is House Paint?

Paint designed to protect and beautify the surfaces of materials used in the construction of buildings—especially of dwellings.

5. What is the best House Paint?

That which best and longest protects and beautifies the surfaces to which it is applied.

6. What materials are used in making House Paints?

Pigments, drying and semi-drying oils, volatile "thinners" and solvents, driers ("japans") and varnishes.

7. How may such pigments be classified?

As white "bases," inert or "reinforcing" pigments, natural earth colors, chemical colors or dyes, lake colors, etc.

8. What are the white colors?

White lead: the basic carbonate (of which there are several varieties), basic sulphate ("sublimed") white lead, zinc oxide ("Amer-

ican Process" and "French Process"), leaded zincs (containing definite percentages of lead sulphate, (5% to 85%), lithopone (of which there are four types), titanium dioxide (either pure or combined with definite percentages of barium sulphate or calcium sulphate?) and antimony oxide ("Timonax").

9. What is Basic Carbonate White Lead?

A compound of lead, carbonic acid (CO_2) and the elements of water (H_2O). Its chemical formula is $2 \text{Pb CO}_3 \cdot \text{Pb (OH)}_2$. The modern process of manufacture originated in Holland, hence the name "Old Dutch Process."

The American procedure may be outlined as follows: Lead is melted and cast into perforated disks, called "buckles," about six inches in diameter, which are placed in porcelain pots containing, in walls, about one pint of dilute 8% acetic acid (vinegar). These are placed in rooms holding several layers, or tiers, 600 to 1000 pots each. The pots are covered with boards and layers of tan-bark, placed between each tier. The rooms, technically called "stacks," are kept closed. During a period of about 120 days the heat and the carbonic acid gas generated by fermentation of the tanbark, together with the acid vapors, combine to transform the lead more or less completely into a white, flaky substance (basic lead carbonate).

This, after it is crushed, screened, sorted, ground in water and dried, forms the white lead of commerce, and is either sold in the dry state to paint and color manufacturers, or ground in linseed oil and sold for general painting purposes.

The product may be regarded as a compound of lead carbonate (2Pb CO_3) and lead dioxide ($2 \text{Pb O H}_2\text{O}$) the relative proportions of which vary according to conditions in different parts of the stack, these differences being compensated more or less completely when combined.

However, though Dr. S. P. Sadtler, in 1906, found the lead carbonate content of fifteen

commercial samples to vary from 60.7% to 81.9%, such variations have since been reduced to very narrow limits.

Basic carbonate, white lead, though not so intensely white as the other white pigments, is very white. It unites readily with linseed and other "drying" oils, stimulates their drying, works easily under the brush and produces a very opaque film, with correspondingly reduced "spreading rate."

10. What is "Carter" or "Quick Process" White Lead?

In this process the melted lead is blown into fine granules by means of a jet of air or superheated steam. This powdered lead is charged into large, slowly revolving wooden cylinders or drums, moistened with dilute acetic acid and subjected during several days to the action of air and purified carbonic acid gas from burning coke. The subsequent procedure resembles closely the methods of the old Dutch process.

The white lead produced is generally finer in particle, and somewhat whiter and more uniform than Dutch process white lead. Chemically it practically is identical with the latter, but owing to its greater subdivision, requires more oil to prepare it for use.

11. What is "Anacoda" or Electrolytic White Lead?

Lead plates—Anodes—suspended in a solution of Sodium Acetate containing a trace of Sodium Carbonate, and iron plates—cathodes—suspended in a solution of Sodium Carbonate, and iron plates—cathodes—suspended in a solution of Sodium Carbonate and the two solutions separated by a fabric diaphragm, form an electrolytic cell. On application of the electric current the lead dissolves as lead acetate at the anode and is precipitated immediately in the anolyte as basic lead carbonate. It is then carried in suspension by the flow of anolyte through the cell to a "settler." The clear anolyte returns to the

cell. The settled white lead is filtered, washed and dried. The carbonate ions that are removed from the catholyte, by migration through the diaphragm, to precipitate the white lead, are replaced by carbonation of the catholyte external to the cell.—F. O. Cesa.

The product is a very pure, brilliantly white and finely divided pigment.

11a. What is Euston White Lead?

Euston White Lead is made by a unique chemical process. Basic lead acetate solution is first prepared by dissolving lead oxide, formed on the surface of highly purified, feathered lead through the action of air, in normal lead acetate solution.

This basic solution is clarified and treated with CO₂ whereby the basic portion is precipitated as white lead. The white lead is separated from the normal lead acetate solution remaining and washed, dried, pulverized and packed dry or ground in oil.

The strict control possible is responsible for the exceptional purity and clean white color of Euston White Lead.

12. What are the Characteristics of Basic Carbonate White Lead?

It is one of the most opaque of white pigments, a fact due largely to the small proportion of liquid required to reduce it to painting consistency; its spreading rate, however, is correspondingly reduced. The lead hydrate contained in it may unite, under certain conditions, with the acids of linseed oil to form a lead soap, which, while improving its brushing qualities, may reduce its durability. It changes into the black lead sulphide on exposure to hydrogen sulphide gas, but further oxidation yields lead sulphate, which is, again, white. This reactivity, however, precludes its use with sulphide tinting colors, such as "quicksilver vermilion," cadmium, yellow, etc. While a most useful and valuable pigment on account of its opacity and working qualities, it is subject to gradual disintegration—"chalking."

13. What is Pulp Ground White Lead?

After washing and settling in tanks, the excess water is decanted. The residue is "pulp lead." Formerly this pulp was passed through a filter press and finally dried by heat. Later the preferential affinity of white lead for oil was utilized to displace the residual water in the "pulp." The moist pigment is agitated with oil in a special type of mixer and the displaced water is drawn off. The completeness of the displacement depends upon the energy and duration of the process. There is no appreciable difference in the products of the two processes, but the latter is by far the more economical.

14. What is "Sublimed" or Basic Sulphate White Lead?

"This product is so named because it is obtained by a sublimation process or 'fume process' from lead sulphide (galenite or 'galena') ores by a process analogous to that used to produce American zinc oxide and leaded zincs. The product is obtained directly as a very fine, impalpable white powder, without grinding. Chemically, it is different from ordinary white lead, being apparently a basic sulphate of lead and . . . has approximately the following constitution:

Lead sulphate	77%
Lead oxide	15%
Zinc oxide	8%

"It exceeds in the fineness of the particles the ordinary grades of white lead, and is at least equal to them in whiteness, body, covering power and wearing qualities. It differs from ordinary white leads in being less poisonous, and resists the blackening action of the sulphur compounds of sewer gas and of fuel gas to a much greater degree."—Ladd.

"The lead sulphate and lead oxide are chemically combined in sublimed white lead, forming the true basic sulphate (approximately Pb₃ S₂ O₇). This chemical combination of the sulphate and oxide into the basic compound explains the high degree of opacity which this

pigment possesses. Its physical structure is entirely different from the ordinary lead sulphate, which has no pigment value, because it is crystalline and transparent in oil. The zinc oxide present is caused by the presence of a small amount of zinc sulphide (sphalerite) in the ore used in its manufacture."—Hughes.

15. What are the Characteristics of Basic Sulphate White Lead?

"Like all pigments produced by sublimation process, sublimed lead possesses in its ultimate particles a fineness far superior to that of pigments otherwise produced. On account of the extreme fineness of its particles it does not settle out of liquid mixtures. Being an oxy-sulphate, it resists the discoloring action of hydrogen sulphide and other harmful gases in the atmosphere longer than does any other lead pigment. It is uniform in composition."

It reacts less strongly than the basic carbonate with the "drying oils." When used alone, it "chalks" rather more freely than corroded white lead. It is used by some manufacturers to introduce lead into the paint film and counteract the tendency to "crack."

16. What is Sublimed Blue Lead?

A sublimation product closely allied to sublimed white lead, the process of manufacture being similar, of somewhat different composition and color. A characteristic analysis follows:

	Per cent.
Lead sulphate	52.92
Lead oxide	37.48
Carbon	2.25
Zinc oxide	2 to 4
Lead sulphite	1 to 1½

"The carbon comes from the fuel of the furnace."

17. What are the Characteristics of Sublimed Blue Lead?

Being a "fume" product, its spreading power in oil is high (more than twice that of red lead). Its lead content is as high as that of other lead pigments. It remains well in

suspension and brushes well, having better "tooth" than most lead pigments. It is practically "inert" to linseed oil and is not affected by atmospheric gases. Official tests place it high among the class of "rust-inhibitors."

18. What is Zinc Oxide?

Zinc Oxide (ZnO) is a combination of one atom of zinc with one atom of oxygen. It is produced by two methods, one known as the "French" and the other as the "American" process. In the French process, the vapor of metallic zinc (or "spelter") is burned in a current of air and the product of combustion, zinc oxide, is collected in closed chambers. In the American process, ores of zinc mixed with powdered anthracite are reduced and volatilized in a closed furnace, having perforated grate bars, and the resultant zinc oxide, after being blown through a series of cooling flues, is collected in fabric bags.

19. What are the Characteristics of Zinc Oxide?

In particle size it is one of the finest of all white pigments and in color one of the whitest. A pound of dry zinc oxide occupies about 50.77 cubic inches, while a pound of basic carbonate white lead, in the same condition, occupies only 14.69 cubic inches. In consequence of its extreme fineness it requires more oil than most other white pigments to fit it for use with a brush. In one hundred pounds of zinc oxide paint ready for use there are about 46 lbs. of oil and 54 lbs. of pigment, while the proportions in a corroded white lead paint of similar consistency are about 73 lbs. of pigment to 27 lbs. of oil. Zinc oxide is unaffected in color by any gases present in the atmosphere, has no visible effect upon any pigment with which it may be mixed, and is non-poisonous.

20. What are Leaded Zinca?

Oxides of zinc produced from ores of zinc which contain in association a certain proportion of lead sulphide ores. In the process of

manufacture the lead sulphide is transformed into basic lead sulphate ("sublimed white lead") and intimately united with the zinc oxide. These pigments are made with definite percentages of basic lead sulphate, ranging from about five to about thirty-five per cent., according to the purposes for which they are to be used. The recognized grades contain respectively under five per cent. ten per cent., twenty per cent., and thirty-five per cent. of basic lead sulphate.

21. What are the Characteristics of Leaded Zinca?

In fineness they are similar to other zinc oxides, in whiteness slightly inferior. Their opacity and "body" in paint are measurably greater on account of the contained lead sulphate. Practically all western zinc ores contain some lead.

22. What is Zinc Sulphide?

The chemical formula of this pigment is ZnS . It is most readily produced by passing hydrogen sulphide gas through a solution of zinc sulphate, or by mixing the sulphate solution with a sulphide (such as sodium), and washing the precipitate. It is an important constituent of lithopone, to which the latter owes most of its pigment properties.

23. What are the Characteristics of Zinc Sulphide?

The pure pigment is intensely white and its hiding power is high in comparison with most other white pigments. It is used in both interior and exterior finishes.

24. What is "Lithopone"?

Lithopone is available in four distinct types: Barium Lithopone, Calcium Lithopone, "Titanated" Lithopone and High Strength Lithopone. They are all co-precipitated compounds of either barium sulphate or calcium sulphate with zinc sulphide. It is produced by mutual precipitation from aliquot solutions of barium