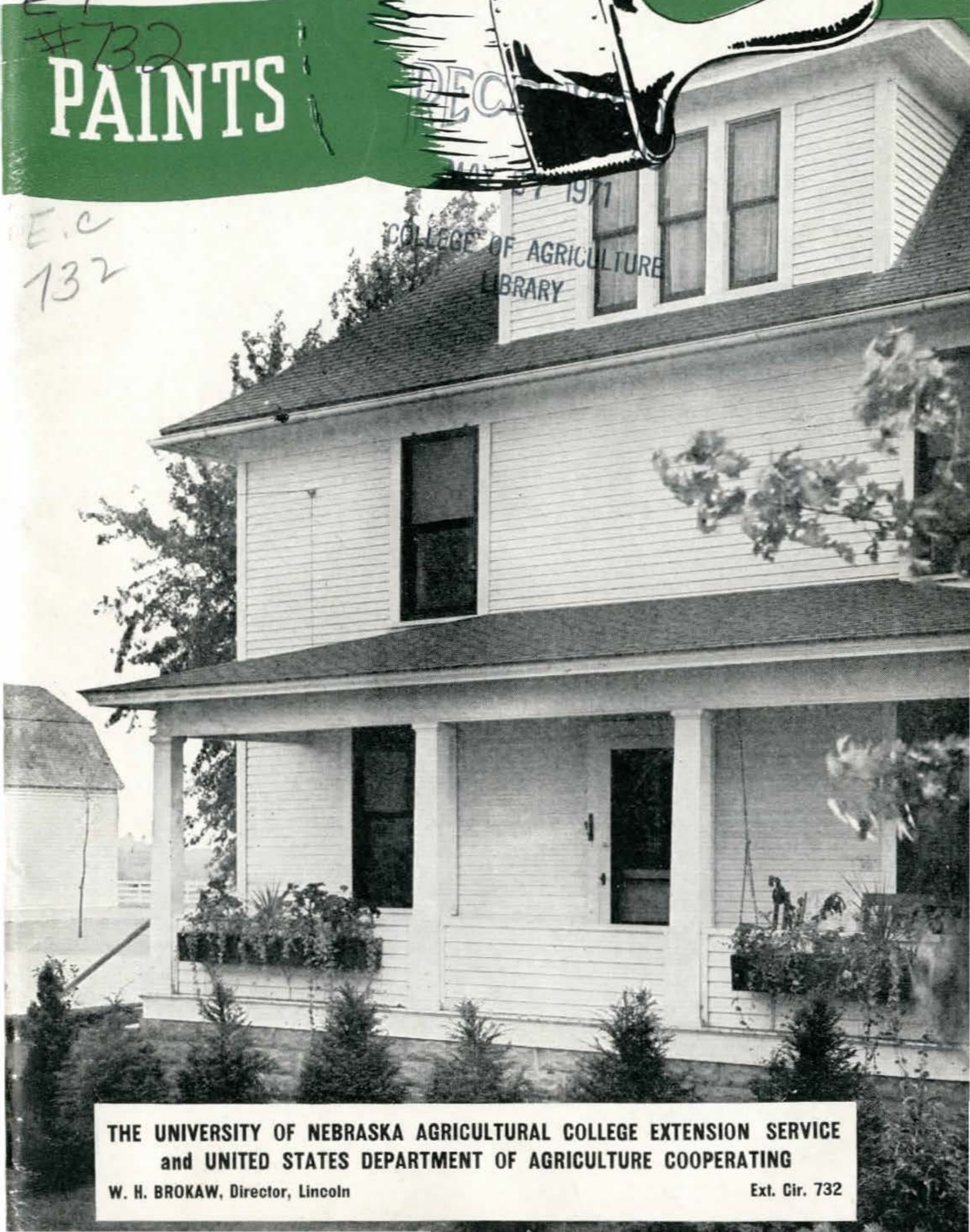
1934

EC732 Selecting and Applying Paints

C. H. Van Vlack

SELECTING AND APPLYING PAINTS



THE UNIVERSITY OF NEBRASKA AGRICULTURAL COLLEGE EXTENSION SERVICE
and UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

W. H. BROKAW, Director, Lincoln

Ext. Cir. 732

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ACKNOWLEDGMENT

The University of Nebraska Agricultural College Extension Service is indebted to Iowa State College Extension Service for the privilege of reprinting this Extension Circular.

Distributed in furtherance of co-operative agricultural extension work. Acts of May 8, 1914, and June 30, 1914. Extension Service of the University of Nebraska Agricultural College and U. S. Department of Agriculture co-operating. W. H. Brokaw, Director of Extension Service.

Selecting and Applying Paints*

By C. H. Van Vlack

WHY PAINT?

Interest in painting is founded on a many-fold basis. In the first place painting is done for appearance. It bolsters home pride and satisfaction. Too often children who grow up in farming communities are attracted to village and city because of the beauty of urban homes, parks and landscapes. The same attractiveness and beauty found in the city can be realized in the country if all buildings are well-painted and kept in good repair. Paint provides color and freshness, and the artistic use of tints and colors makes the home attractive and interesting.

Furthermore, good paint prevents wood from checking and warping, important factors in the depreciation of farm structures. Steel and metal work corrode unless covered with rust-preventing paints. Masonry walls tend to crack from alternate freezing and thawing because moisture gets into the material. Reinforced concrete which is not waterproofed allows water to penetrate, causing the steel to rust and the wall, floors or posts to crack. Stucco when not waterproofed allows water to penetrate to the steel lath which in turn rusts and loosens the stucco.

Although painting is valuable in light of the points listed above, its greatest contribution is to aesthetic and cultural attributes of country life. Buildings freshly painted in well-chosen colors are priceless in providing on the farm and in the community an environment which contributes to a gratifying rural life.

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*This bulletin pertains to exterior paints only.

Fig. 1. Planning a farm building painting program.

WHAT PROFITS WILL PAINTING RETURN?

The Missouri Agricultural Experiment Station has published a report[1], based on results of a survey of 273 buildings, comparing painted and unpainted service buildings. The following table and quoted paragraph are taken from this report:

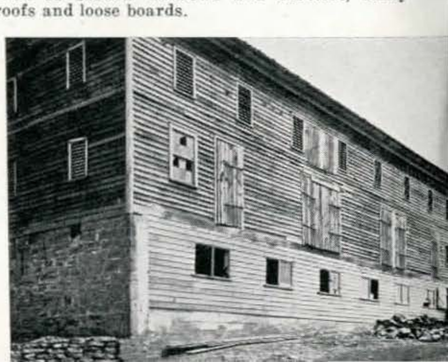
EFFECT OF PAINTING ON DEPRECIATION

Treatment	No. cases studied	Years of service	Increase in life due to use of paint	
			Years	Percent
Not painted	115	37.06	.....	.....
Painted when built but not after	66	45.86	8.80	23.7
Painted as needed	92	53.19	16.13	43.5

"A study was made to determine the returns on money invested in paint. To determine the benefits derived from painting, the investment in paint was credited with the annual depreciation charges and the interest charge on the building for the years of extended life due to painting. Using the formula for compound interest, the rate of interest on the investment in paint, compounded annually, was computed. The cost of paint was computed on the basis of 500 square feet per gallon for first coat and 700 square feet of surface for second and third coats. Paint was computed at $7 per gallon including labor of applying. Three coats were allowed for new structures and one coat each 10 years thereafter on buildings kept painted. Buildings of uniform quality were selected from each of the groups so as to eliminate differences in construction. The first painting is of more importance than any other, yielding 3.73 percent interest on the investment compounded annually. Where the

Fig. 2. Postponed painting eats up farm profits. The time to paint is as soon as the building is erected.

Too often unpainted buildings go hand in hand with other forms of neglect and disrepair, such as broken windows and shutters, leaky roofs and loose boards.



[1]Wooley, J. C. Farm Building Studies in Northwest Missouri. Mo. Agr. Exp. Sta., Res. Bul. 218. 1934.

Fig. 3. Well-painted farm homes increase family pride.

building was given one coat each 10 years following, the rate on the whole investment in paint was 3.22 percent compounded annually from the time each investment was made to the middle of the period of extended life due to the painting. This is a fair rate of interest and would appeal to many farm owners as a good investment, especially since there are decorative and many other benefits secured from the proper use of paint."

WHAT IS PAINT SERVICE WORTH?

Cost of paint maintenance should be considered on an annual basis, not on the total cost of a paint job as one large sum.

If the total cost of materials for painting a two-story house amounts to $24—enough paint to cover 7200 square feet once or about 2400 square feet with three coats—the annual cost for the valuable service that paint renders is less than $5 or less than 2 cents per square yard.

Just like insurance, telephone or electric light service, essentials of the average home, paid for at a certain rate per month, the up-to-date prosperous appearance of a set of farm buildings should be considered as a monthly or yearly investment and planned as such.

WHAT KIND OF WEAR MUST PAINT WITHSTAND?

Figure 4 shows a cross section of a typical wall covered with painted wood siding. The paint film resulting from a three-coat paint job is about 1/200-inch thick or the thickness of one sheet of paper used in printing this bulletin. This thin sheet of paint material if properly formulated and applied to a wood surface withstands many varying conditions. First a shower of rain may beat against the house; then a few hours later, hot sunshine (see fig. 4). In summer the temperature on the sunny side of the house may be as high as 120° F. Ultra violet rays of the sun hasten deterioration of paint. In winter snow and frost with temperatures well below zero in some localities are common. Changes in temperature and humidity result in expansion and contraction of building materials which

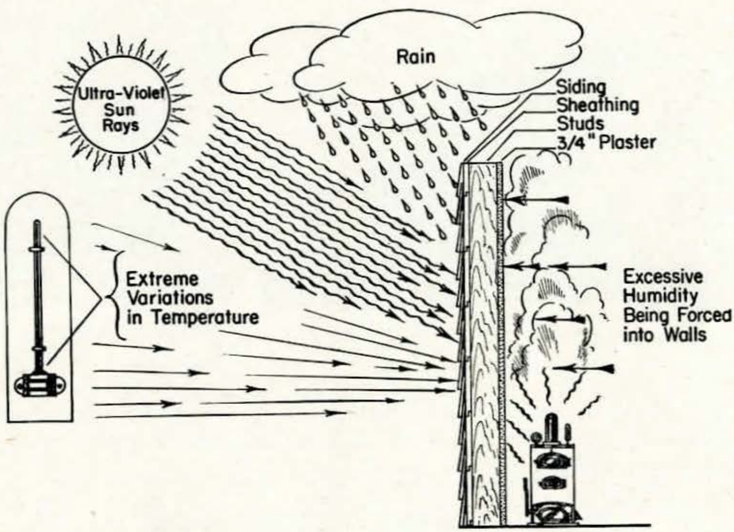


Fig. 4.

places considerable strain on the paint film unless it is tough, elastic and has good anchorage. In some instances water vapor in the air of the interior of a building may go through the exterior walls and condense in the wall materials under the paint film, later causing the paint to blister or peel. With all these possible hazards, it is very important in order to realize the best results that only well-proven paints of highest quality be applied.

WHAT SHOULD PAINTS CONTAIN?

There is nothing complicated or mysterious about paint. Good paint consists of an oil or binding liquid mixed with a powder, either dry or in paste form, known as pigment.

Durability of paints exposed to the weather depends to a great extent on the kinds of pigments and liquids used in making the paint.

PIGMENTS

The solid, finely divided (pigment) part of the paint gives it the power to obscure or hide and color a surface. Durability and good consistency of paint depend to a great extent on the pigments. If the paint is to hide well and color the surface, pigment should be opaque in linseed oil. Some pigments, although opaque in the dry form, are nearly transparent in linseed oil. These substances, known as fillers or extenders, are usually used to prevent the settling of the pigment and

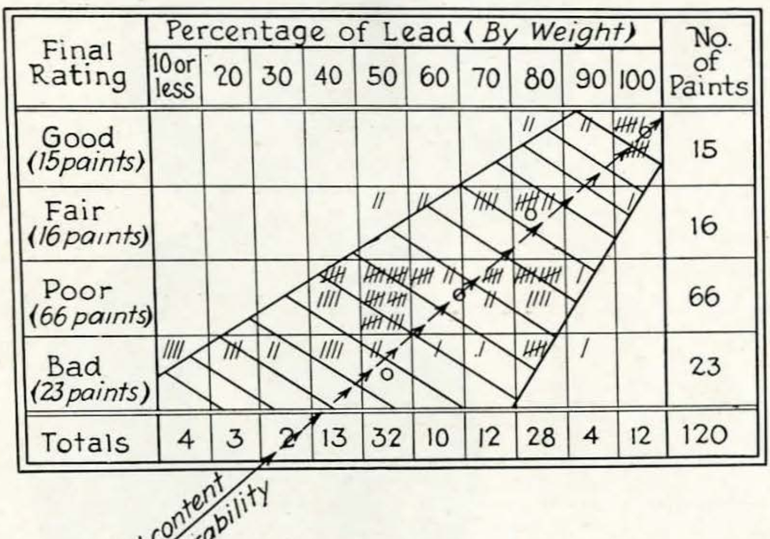
to reduce manufacturing costs. Paints of inferior quality contain excessive quantities of transparent pigments.

Good white outside paints contain either white lead alone as the pigment or a large proportion of white lead mixed with smaller quantities of other pigments. Colored pigments are added to the white to produce tinted paints or are used without the white to produce dark paints.

In evaluating paints durability of white and light-colored paints depends to a great extent on the percentage of white lead used in the paint. White lead is known as an "active" paint pigment. It has a strong affinity for linseed oil and reacts physically and chemically with this oil so that a tough elastic paint film results after the paint has been applied and dried by the action of the air.

White lead is the only white pigment which alone will produce a durable paint when mixed with linseed oil. White lead paint has excellent weathering qualities. With age and exposure it wears down slowly and evenly leaving an ideal

THE EFFECT OF LEAD ON DURABILITY*



* Based on data obtained from North Dakota Agricultural College's Report of various paints undergoing their fifth year of exposure on test fences

Fig. 5.

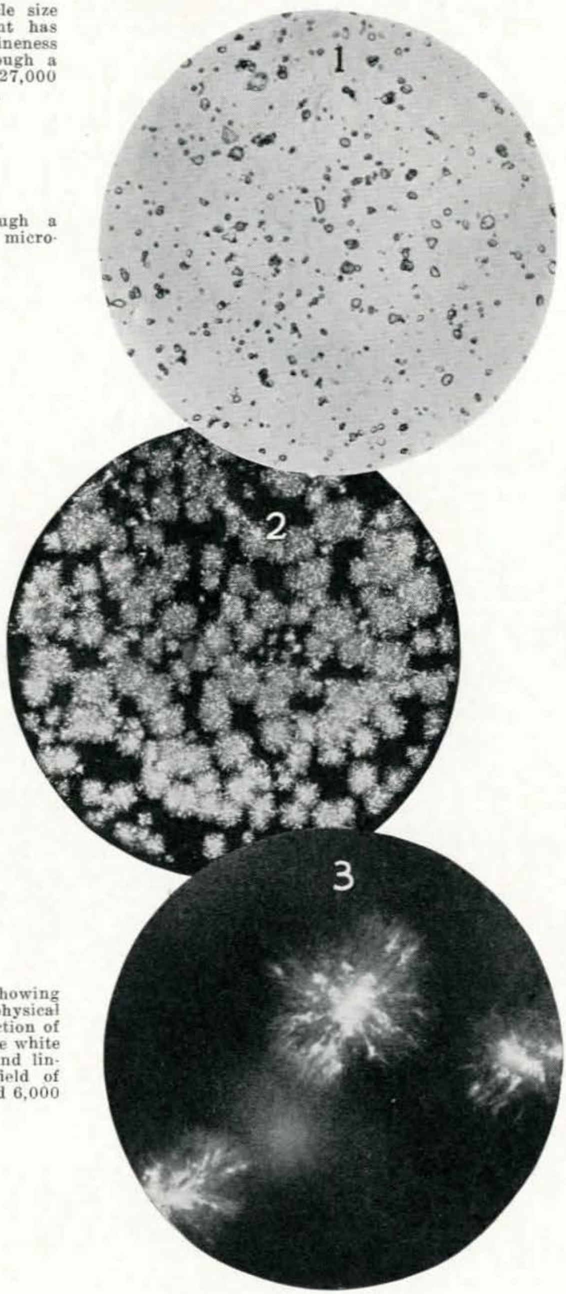


Fig. 6. The particle size of white lead pigment has been ground to such fineness that it will pass through a 27,000 mesh screen (27,000 holes per square inch).

(1) As viewed through a high powered microscope (X 1,000).

(2) Microscopic view (X 1,000) showing how the white lead particles "bloom out" in linseed oil.

(3) The final stage, showing result of the physical and chemical reaction of lead pigments (the white feathery spots) and linseed oil (dark field of picture) magnified 6,000 times.

surface for repainting rather than failing seriously by cracking or scaling.

Results of a test made some years ago at the North Dakota Agricultural College with 120 commercial paints which were exposed to the weather after being applied on four different kinds of wood, have been charted. These paints were gathered from many different sections of the United States. The 15 paints that graded the most durable had in them from 80 to 100 percent white lead. In general as the white lead content increased the durability increased, as is clearly shown in fig. 5.

A high-powered microscope shows that particles of lead pigments "bloom out" into interlocking masses of feathery appearing objects when added to linseed oil. (See fig. 6.) This photograph taken through a microscope illustrates why white lead is called an active pigment. No sharp lines divide pigment particles from the oil. This "blooming out" of an active pigment with linseed oil is credited by some chemists with providing part of the toughness and durability that result when the active pigment is used as a basis for white and light-colored exterior paints.

A combination of white lead and zinc oxide produces a harder paint and one which does not wear down from the surface quite so readily as white lead does, but it may be more likely to crack. Zinc oxide content should not be excessive, else the paint will be too hard and will crack badly. Increased hiding power is given a white lead paint by adding a small amount of titanium pigment.

The dark paints are more durable for some purposes than the white or lighter tint paints but in general are not so decorative. Iron oxide is a very durable pigment when used without excessive quantities of fillers or extenders. Its red color limits its use to barn-lot buildings. It is relatively cheap, however, and generally can be bought in either powder or paste form. The latter is more easily mixed and provides a more uniform coating.

Black paints made with carbon black and similar pigments, yellow, red and brown paints made with natural earth pigments, in which the color is due principally to iron oxide, are also very durable.

Red lead has about the same place in metal painting that white lead holds in outside wood painting. It is an "active" pigment and in linseed oil reacts physically and chemically as illustrated in fig. 6. It is insoluble in water, sticks tightly to the surface and is an excellent rust preventive. It is the most generally specified paint for structural steel, bridges and such metal work on buildings as downspouts, gutters and val-

ley tin. The brilliant orange tone of red lead is familiar to everyone.

Blue lead, a slate gray lead pigment, also has a good record as a protective paint for metals.

Metallic zinc paint is very good for rust prevention.

Following are some of the pigments used in manufacturing house and barn paints:

Opaque White Pigments. White lead, zinc oxide, leaded zinc oxide, titanium pigments.

Opaque Colored Pigments. Iron (ferric) oxide, umber, sienna and Venetian red. (Venetian red consists of ferric oxide combined with a large proportion of transparent extenders such as calcium sulfate, calcium carbonate and silicates.) Chrome yellow, Prussian blue, chrome green (chrome yellow and Prussian blue), red lead and the carbon pigments.

Transparent Pigments (Fillers and Extenders). Calcium carbonate (whiting or ground limestone), aluminum silicate and magnesium silicate (asbestine, talc, china clay or soapstone), silica (quartz, sand), barium sulfate (barytes), calcium sulfate.

Good paints of dark color, in which the opaque white pigments are either absent or present in minor quantities, may contain considerably smaller total amounts of opaque pigments than the white or light-colored paints. In good iron oxide paints (red barn paints), the iron oxide should amount to at least 30 percent of the pigments, and in good green or black paint at least 20 percent should be colored pigments. Of the colored pigments, the iron oxides are relatively cheap, standing between the transparent and the opaque white pigments in that respect. Iron oxide pigments, therefore, form the basis of barn paint. The durability, opacity and cost of the iron oxide pigments are proportional to their content of iron oxide, a factor which varies between wide limits.

LIQUID OR VEHICLE

The liquid or vehicle in oil paints (for exterior wood) should be at least 80 percent and preferably about 90 percent by weight linseed oil. The remainder may be made up of volatile thinner and paint drier, preferably below 10 percent. No liquid has been found to excel linseed oil in making outside paints for wood surfaces. Upon exposure to the air, pure linseed oil changes from a liquid to a flexible, almost transparent film solid. Its imperviousness to moisture, its toughness and elasticity when dry make it an ideal binder to hold the pigment to the surface.

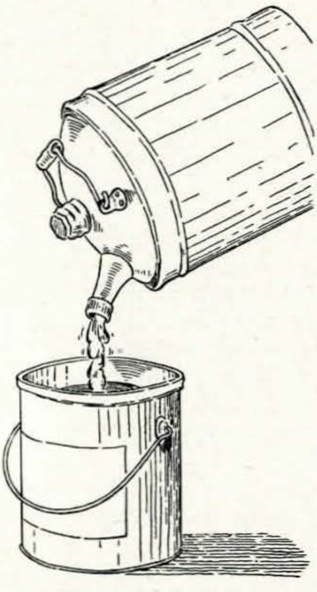


Fig. 7. Avoid kerosene, gasoline or mineral spirits in paint.

Care should be exercised in selecting a paint that such terms as "Pure oil" and "boiled oil" do not mislead. If a paint oil is not labeled "linseed oil," in all probability it is a linseed oil substitute.

Soybean oil proves satisfactory under certain conditions. F. L. Browne[2] reports: "Paint users should not themselves buy soybean oil to add to paint unless it is supplied by the manufacturer (not just the dealer) of the brand of paint they are using and not unless the manufacturer recommends that it be added to the paint. They should not put soybean oil in pure white lead paint.

"Soybean oil for use in paint must be properly refined to remove lecithin and other substances that greatly retard drying.

"It is not possible to state a figure that can be accepted as the maximum permissible proportion of soybean oil because that is closely tied up with other considerations. In some cases 10 percent would be too much white in other cases 50 percent may be all right. For the present, at least, the question must be left for the paint manufacturer to decide, and he should be the only one who adds soybean oil. The purchaser can then hold the manufacturer responsible for supplying paint that dries firmly overnight in any reasonable painting weather. This makes a good safeguard for the paint buyer."

Some thinner is desirable in the first or priming coat. It causes better penetration of the paint and leaves a flat finish which gives tooth or adhesive quality for the succeeding coat. Pure turpentine is best. In most low-grade "bargain paints," mineral spirits are often substituted as are also "mineral turps" or "substitute turpentine," gasoline and kerosene.

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[2]Browne, F. L. Senior Chemist, U. S. Forest Products Laboratory, Madison, Wis.

ELASTIC PAINT NECESSARY

The paint on a house should be designed to give a tough, highly weather-resistant coating and should retain its good appearance over a long period. It is important, furthermore, that the paint film remain elastic. Wood contracts and expands with changing weather conditions. A hard and unyielding paint film, or one that becomes so, cannot follow this alternate shrinking and stretching of the material to which it is applied; consequently, it pulls apart. Cracks appear in the film that may extend through to the wood beneath. Moisture enters these cracks, gets under the paint and causes it to scale from the surface, leaving bare spots that grow larger as time goes on. The inevitable result is an expensive preparation job before repainting. A white lead film is never subject to this defect. It remains elastic; conforms to the "give and take" of the surface beneath.

White lead paint wears slowly and uniformly. This desirable quality permits the white lead film to remain unbroken, smooth and even, providing efficient protection for the surface during the entire long life of the paint. Furthermore, this type of surface is ideal for repainting. A preliminary dusting is all a properly applied white lead paint surface needs when repainting time comes.

WHY IS "CHEAP" PAINT LOW-PRICED?

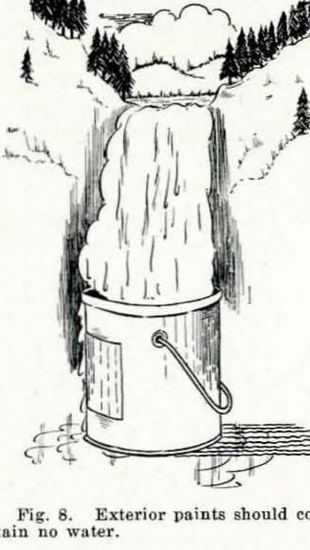


Fig. 8. Exterior paints should contain no water.

Low-grade paint can be sold at low prices because it is made of cheap ingredients. Generally the low-grade paint can is filled with extenders and fillers which have little durability or hiding power. By this procedure the manufacturer can reduce the cost of his materials tremendously, because the cost of most of the inert fillers is only about one-sixth that of an active pigment like white lead. (See table 1, page 15.)

Accentuating the low cost of these substitute pigments is the fact that most of them bulk much more than white lead; that is, a pound of the former fills more space in a gallon of paint than a

WHEN SERVICE IS CONSIDERED

THIS PAINT LOWERS PAINTING COSTS | THIS PAINT RAISES PAINTING COSTS

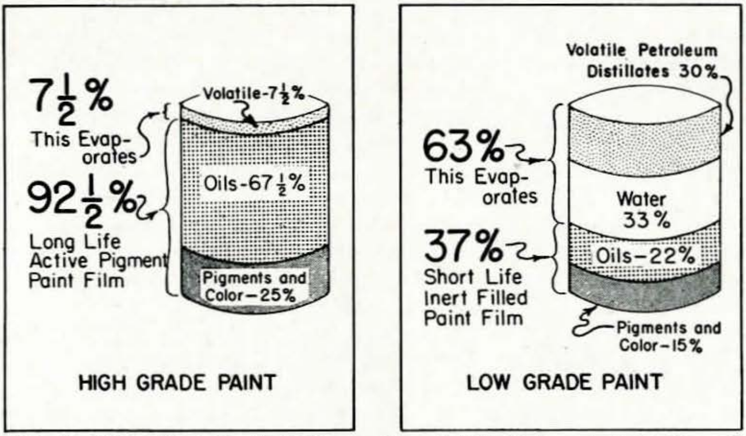


Fig. 9. These diagrams illustrate examples of high-grade and low-grade paint, respectively. In practice, both high-grade and low-grade paints may vary from these analyses.

pound of white lead. Therefore when extender is substituted for a certain volume of white lead in paint, less of it by weight is used, further reducing its cost.

The same may be said of the liquid portion of the paint. Linseed oil and a small amount of volatile thinner to produce good brushing qualities and penetration result in the most durable paint. Since volatile thinners are less expensive than linseed oil, they are usually found in excess in cheap paint. There are many cheaper oils, not durable in exterior house paint, likely to be substituted for linseed oil. Their inclusion always results in a less durable paint.

So far as the liquid portion of paint is concerned, the greatest fraud is the inclusion of water. Water not only evaporates after the paint is applied and therefore does not become a part of the permanent paint film but it hastens paint failure by wetting the wood, causing it to swell and later, after evaporation, to dry and shrink. Oil and water do not mix, hence an emulsifier must be added to promote mixing. The emulsifiers, even in small quantities, are extremely harmful to paint.

Unfortunately, low-grade paint looks, in the can, like high-grade paint, and it takes expert knowledge to distinguish between the two. Only after the paint user has had costly experience with the short life of low-grade paint can he understand the false economy in the purchase of inferior material.

The low-grade paint illustrated on page 13 contains 63 percent water and petroleum distillates that evaporate when the paint is applied, leaving only 37 percent of film-forming solids. That means that of the 231 cubic inches of paint in a gallon for which you pay, 145½ cubic inches disappear and do no good, while only 85½ cubic inches remain to form the film that actually stays on the wood after drying. Even this small portion usually is found to consist largely of inert pigments and cheap low-grade oil compounds, a combination of little durability when used for exterior paint.

On the other hand, durable, high-quality paint for direct weather exposure usually contains about 92½ percent film-forming pigments and oils with only 7½ percent volatile liquid by volume. This amount of volatile is desirable to give paint proper brushing qualities and penetration and to hasten the setting. Of the 231 cubic inches in the gallon of high-grade paint you buy, 213½ cubic inches stay on the wood to perform useful service, while only 17½ cubic inches disappear.

Therefore, in the case of high-grade paints you really get two and one-half times as much effective paint as you do in the low-grade product. In addition, the solids in a high-grade paint form a film that is more durable and that gives the necessary protection to the wood. The point is graphically illustrated in fig. 10.

Poor covering ability is also typical of low-grade paints. They often do not cover half so large an area as high-grade paints. This is because of their low opacity and poor working qualities.

WHAT IS ACTUALLY IN LOW-GRADE HOUSE PAINT?

Four low-grade paints which were being advertised and sold to the public were analyzed. Results are shown in table 1.

Contents of the opened cans looked all right, stirred easily because the oils and water were in complete emulsion, and the appearance would easily deceive an inexperienced paint purchaser. When applying the paints to new wood, the first three paints above were thin, drying to a very rough finish.

Note that the analysis indicates that all these low-grade paints contained practically no "lead," the pigment portion

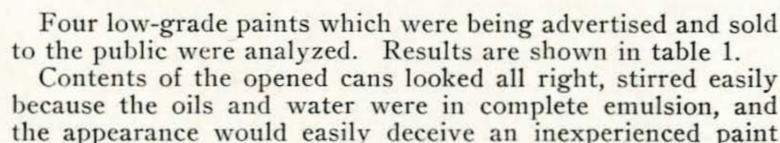


Fig. 10. Low-grade paint (left) and high-grade paint (right) after application.

TABLE 1. ANALYSES OF FOUR LOW-GRADE HOUSE PAINTS (Scientific Section, National Paint, Varnish and Lacquer Association).

Pigments found in the paints	Pearl gray	Sky blue	Cream	Light cream
	Percentage of pigments found in above paints			
White lead	.2	None	.2	None
Zinz oxide	13.0	11.8	13.0	7.4
Lithopone	20.8	24.7	24.7	30.1
Barium sulphate / Magnesium silicate (asbestine, soapstone)	32.7	61.9	30.2	30.8
Calcium carbonate (chalk)	31.8	....	30.3	27.9
Color and undetermined	1.5	1.6	1.6	3.8
Total pigment	100.0	100.0	100.0	100.0
Liquids found in the paints	Percentage of each liquid found in above paints			
Non-volatile matter (oils and driers)	25.4	34.3	36.5	67.2
Mineral spirits (evaporating petroleum products)	38.7	36.3	38.3	16.5
Water	35.9	29.4	25.2	16.3
Total liquid	100.0	100.0	100.0	100.0
Total percent pigment in the paints (by weight)	72.1	65.3	65.5	64.3
Total percent liquid in the paints (by weight)	27.9	34.7	34.5	35.7
Approximate raw material cost per gallon	34c	43c	50c	66c

containing instead a large amount of inert filler pigments, and the liquid contained excessive amounts of volatile thinner and from 16 to 35.9 percent water. From 33 to 74 percent of the liquids in these paints would evaporate after the paint was applied, leaving very little paint on the wood. All of these paints were advertised as comparing favorably with standard house paints.

HOW DOES PAINT ADHERE TO WOOD?

HOW HIGH-GRADE PAINT ANCHORS ITSELF

Figure 11 shows a cross section of a house siding as seen through a microscope. The cellular structure of the wood provides good anchorage for the paint films which are visible by the three white strips at the top edge of the picture. Note that the priming coat of paint (no. 1) anchors itself in the broken open cell walls and that some of the linseed oil and liquid portion of the paint penetrates down between and into some of the wood cells. Paint holds to wood by anchorage and adhesion similarly to the way a first coat of plaster keys itself between lath on an inside wall.

The priming coat of the first painting job applied to new wood is most important as it provides the foundation on which later repainting depends for successful anchorage and resistance to weather wear. The priming coat should not contain pigments that tend to make it too hard or brittle, rather it should remain tough and unbreakable.

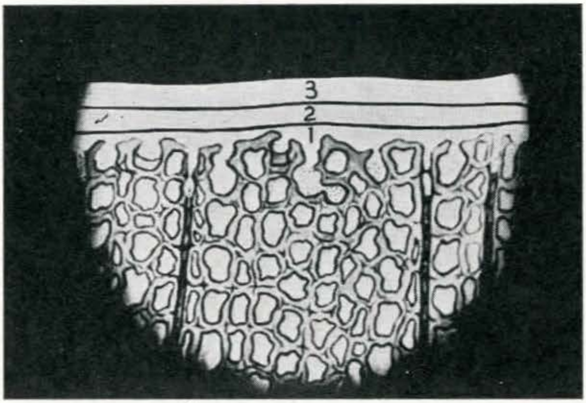


Fig. 11. Cross section (magnified 50 times) showing how a three-coat paint job anchors to the cellular structure of wood.

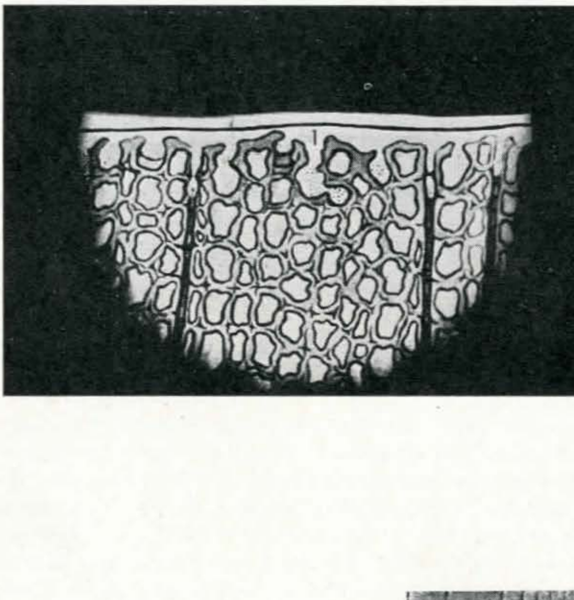


Fig. 12. Cross section (magnified 50 times) of paint film on wood after being exposed to the weather 5 years, part of the surface coats having gradually chalked away leaving the original priming coat anchored to the wood providing an even surface for repainting.

Fig. 13. Investigation of the formula before buying would avoid such results as these. Usually hard-type paints composed of cheap extenders and linseed oil substitutes fail like this.

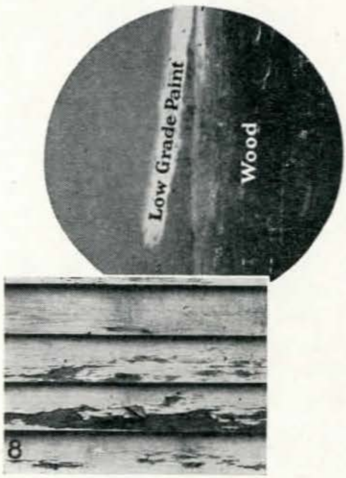


Fig. 14.

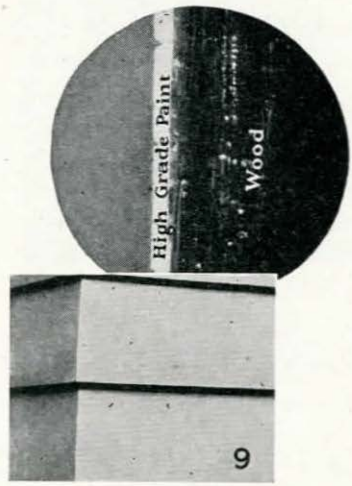


Fig. 15.

HOW LOW-GRADE PAINTS CRACK AND PEEL AWAY FROM WOOD

Figure 14 is a microphotograph of a cross section through siding showing low-grade paint scaling off after about 1 year of exposure. The wood has expanded and contracted with humidity and temperature changes. Since the low-grade paint was inelastic, hard and brittle, it was unable to expand and contract with the wood. This caused it to crack. Moisture then got behind the paint film through the cracks and forced the paint to scale off the wood. Obviously all this low-grade paint would have to be removed before the wood could be repainted successfully. Figure 13 shows what this paint looks like when one looks directly at the surface.

Figure 15 is another microphotograph, this a cross section through a high-grade paint film on siding after several years of exposure. The wood has expanded and contracted with changing humidity and temperature conditions just as has the wood painted with low-grade paint, illustrated in fig. 14. But the high-grade paint was tough and elastic. It was therefore able to adjust itself to the changes of the wood without cracking. The wood is still protected and rain cannot get behind the paint to scale it off. When repainting is necessary, new paint can be applied right over the firmly adherent old paint. The appearance is attractive at all times.

Fig. 16. One of the typical sets of farm buildings built by the Farm Security Administration, which are required to be painted with Type L paint. (See description of this paint in text below.) Pride in ownership, stimulated by well-painted buildings, helps make the farmer a good credit risk.

WHAT HAPPENS IF REPAINTING IS POSTPONED?

Based on the experience of paint maintenance divisions of state highway departments, railways, large industrial users of paint and some of the building and construction agencies of the federal government, the so-called soft type white lead in oil paints has given the most satisfactory results where there is a possibility of delayed repainting.

Recommendations found in Consumers Guide, Vol. 5, no. 17 of the Agricultural Adjustment Administration Division of the United States Department of Agriculture describes Type "L" (lead) paint as designed by the United States Forest Products Laboratory as follows:

"Type 'L' Paint: The pigment consists entirely of white lead except for the additions of colored pigments to make the tinted paints. This paint, if used exclusively, remains the best choice for house owners who wish to allow very long intervals, longer than the durability of any other white or tinted paint, to elapse between paint jobs. When worn out, a coating consisting wholly of white lead, on woods that hold paint well, will still go through a long period of neglect during which it looks shabbly but not unkempt. After such neglect, a white lead surface can easily be repainted without undue expense. Paint of type 'L' is recommended also for houses in which moisture at times collects behind the painted woodwork. The coating will blister as readily as other paints, but, if the coating consists entirely of white lead paint, the blisters usually disappear when the wood dries out without leading to a subsequent peeling and scaling."

Fig. 17. Typical Farm Security Administration poultry house, properly painted. Not only is good paint economical from the standpoint of service, but it is a labor-saver when the time comes to repaint. It provides a firm, solid base that need not be scaled off before the new coat is applied.

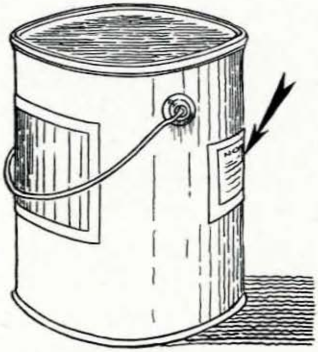


Fig. 18. Look for formula label on the can before you buy paint.

SHOULD THE PAINT FORMULA BE INVESTIGATED BEFORE BUYING?

Before buying any paint it is advisable to know of what the paint is made. Most reliable paint manufacturers are printing as part of their label on the paint can the name and amount, on a percentage basis, of each kind of pigment and liquid used in making paint. If the formula is not attached there may be doubt about the quality of the paint. Most paint manufacturers make second and third grade competitive paints to meet the demand of "bargain" buyers who consider most important low price instead of long durability. Because large amounts of low-grade liquids and cheap transparent pigments must be used in cheap paint, formula labels are often omitted entirely, or names of substitute pigments and liquids may be printed ambiguously in order that the average consumer cannot interpret it.

Common transparent pigments used for fillers and extenders in low-grade paints with the many different names that may be found on can labels are as follows:

Calcium carbonate (also called whiting, chalk or pulverized limestone).

Silica (also called silicious matter, quartz or sand).

Magnesium and aluminum silicates (also called asbestine, talc or soapstone).

Calcium sulfate.

Barium sulfate (barytes). A small amount of barium sulfate or calcium sulfate is used in colored paints as a carrier of coloring matter.

Fig. 19. Limestone (calcium carbonate) should not be in good exterior paint.

Fig. 20. Sand (silica) is transparent like glass—its value in paint is questionable.

Lithopone (barium sulfate—zinc sulfide). It is advisable to be cautious of exterior paints containing lithopone. Although this is a widely used opaque pigment for interior paints it should be used rarely, if at all, in high-grade exterior paints.

Careful investigation of the formula of paint to be purchased should be made.

Note on the label proportions of the pigment and liquid. To be really durable, house paints should contain not less than 60 percent pigment for more than 40 percent liquid by weight. (Fig. 21). The formulas should not have excessive amounts or high percentages of low-grade and transparent pigments and liquids.

In identifying cheap liquids some of the common names that may be found in the formula label are fish oil, oriental oil, "paint oil," "boiled oil" (other than linseed), mineral spirits, volatile oils and water.

Some inferior paints contain as much as 35 percent water, indicated on the formula as just water or as one of the following: "Emulsified solution," "colloidal solution," "solution" or "aqueous body agent." (See table 1, page 15.)

Not more than a trace of water should be found in formulas of exterior paint.

Two-thirds of a paint job on a building is the labor cost, and it is time and money wasted to use a low-grade short-lived paint. Some such paints may crack, peel or scale (fig. 22) and make such a surface that the old paint will have to be completely removed

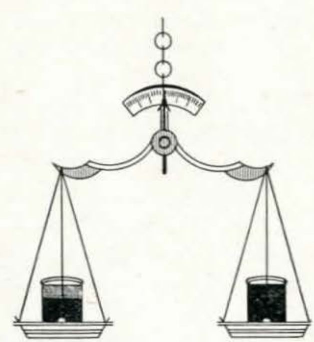


Fig. 21.

Fig. 22. Cracked or scaled paint such as this, resulting from the use of a low-grade prod.ict, must be removed before repainting.

before repainting can be done. This removing of paint costs almost as much as a two-coat paint job, and if cracking or peeling paint has to be removed, a good three-coat paint job will usually have to be put on instead of the two coats of paint necessary for an average paint job.

WHEN TO PAINT

Outside painting should be done during fair weather. Avoid painting during periods of high humidity. The weather and the surface should both be dry, and the temperature should be about 40° F. Paint is thinner when warm and this permits better working into the wood. If the weather is too hot paint may "crawl." An attempt should be made to avoid painting when insects are numerous or when dust may be blown badly. Early summer is an excellent time to paint. Very satisfactory results, however, can be accomplished in the spring and fall if care is taken to avoid painting over damp wood.

Allow enough time between coats so that the previous coat is dry and firmly set. Although conditions will vary a great deal, several days are usually necessary even during favorable weather.

WHAT CARE SHOULD BE TAKEN IN CONSTRUCTING BUILDINGS?

Satisfaction with exterior painting on new houses depends greatly on preventing errors of construction.

Regional lumber manufacturers' associations are enclosing with bundles of siding and attaching to sash and doors instructions to the carpenter and painter. (See page 23.)

TABLE 2. HOW TO THIN WHITE LEAD FOR PAINTING EXTERIOR WOODWORK.

	On new wood			For repainting	
	Priming coat	Body coat	Finish coat	Body coat	Finish coat
Soft paste lead	100 lbs.	100 lbs.	100 lbs.	100 lbs.	100 lbs.
*Linseed oil (raw)	4 gal.	1½ gal.	3 gal.	2 gal.	3 gal.
Turpentine	1¾ gal.	1¼ gal.	......	1¾ gal.	......
Liquid drier	1 pint	1 pint	1 pint	1 pint	1 pint
Gallons paint	9 gal.	6 gal.	6¼ gal.	7 gal.	6¼ gal.
App. coverage per gal.	600 sq. ft.	700 sq. ft.	700 sq. ft.	700 sq. ft.	700 sq. ft.

*When boiled oil is used no drier is needed.

In these instructions lumber manufacturers recommend the use of white lead or the highest grade prepared paint.

As soft paste white lead is packaged in concentrated form, it should be thinned as shown in table 2, page 21.

IS SPECIAL PREPARATION NEEDED FOR THE SURFACE?

If the building is in need of repair, badly worn, split and decayed materials should be replaced. Cracks, open joints or nail holes should not be puttied until after the first paint coat is applied so as to keep the oil required in the putty from going into the wood. If putty in the windows is becoming loose, some time should be spent in scraping off the old putty and painting the sash with a coat of thin paint. A few days should be allowed for drying, then the windows should be reputtied. Before puttying, the glass should be fastened in place with glazier's points. After the putty has set it should be painted along with the sash woodwork as the paint job proceeds.

Loose paint around checked and blistered places should be removed with a wire brush or scraper. Old paint which is very rough and badly checked should be removed with paste paint removers. It is not advisable to use a blow torch. Recently perfected paint removers are easier to use and leave a smooth surface for painting.

Tin work needs to be painted soon after being placed to prevent rust. Galvanized sheet metal will hold paint better if allowed to weather for at least 6 months. The choice of good materials properly proportioned, mixed and applied is a major consideration in securing a satisfactory job.

HOW MUCH PAINT?

HOW MANY COATS?

Two coats are sufficient for previously painted surfaces where the old finish is in reasonably good condition. See formula, fig. 33.

To insure satisfactory results, three coats should be applied to new wood or on a surface that has not previously been painted—a thin penetrating priming coat, a semi-gloss body coat and a glossy elastic finishing coat. See formulas page 27.

HOW TO COMPUTE AREAS

In estimating the amount of paint required for a job, first calculate the area to be covered. In the case of a complete exterior job, the area is easily found by measuring the distance around the house, and multiplying it by the height (not including gable). This will give the total side area of the

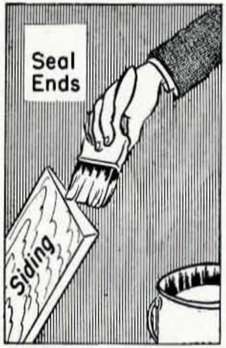


Fig. 23.

Fig. 24.

INSTRUCTIONS NOW FOUND IN BUNDLES OF SIDING OR ON LABELS ATTACHED TO SASH AND DOORS EMPHASIZE THAT:

1st. The siding be protected from rain or moisture conditions from the time it is delivered on the job, nailed on the building, and painted.

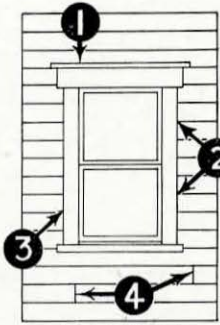
2nd. That carpenters be especially careful to join squared ends closely together see No. 4 in sketch) after first sealing ends of siding boards. That ends of siding be sealed and tightly joined against door and window casings (see Nos. 2 and 3). That carpenters make sure that all metal flashings over windows have been properly put on (see No. 1) to prevent rain from getting down behind siding which may later soak through to painted surface.

3rd. That the priming coat of paint be applied before any rain or fog reaches the surface of newly applied siding. If an unexpected rain should wet unprimed wood, always postpone applying first coat of paint until absolutely all water has re-evaporated from the siding. This means after one day of sunshine or drying winds have thoroughly dried the siding.

Fig. 25.

4th. Plastering in the new house be dried out by opening windows for plenty of ventilation so moisture is not forced through the walls into siding which will cause paint to peel.

Watch for the labels attached to sash and doors and follow the instructions, especially edge and end sealing.



Watch These!

Fig. 26.

Fig. 27.

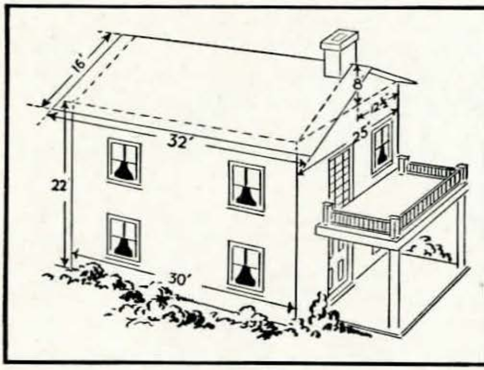


Fig. 28.

house, not including the gables; the gable area is calculated by multiplying the height of the traingle or gable by half its width.

To make the method clearer, the area of the house in the accompanying picture has been calculated:

Total side area (distance around × height)
$110' \times 22' = 2420$ sq. ft.

One gable (height × ½ width)
$8' \times 12\frac{1}{2}' = 100$ sq. ft.
$2' \times 100' = 200$ sq. ft., area two gables.

Porch (length × width)
$25' \times 7' = 175$ sq. ft., area of ceiling.
$2' \times 175' = 350$ sq. ft., area of ceiling and floor.

Total area..........2970 sq. ft.

Once these figures have been obtained, use the spreading rate of white lead paint as a basis and calculate the number of gallons of white lead paint required for the job by dividing the total area by the number of square feet a gallon of paint will cover. The coverage depends upon the condition of the surface and its porosity, as well as the skill of the painter. Generally, paint for the priming coat will cover about 650 square feet per gallon, while the second and third coats cover 700 to 750 square feet per gallon. In case old work is being painted, figure 800 square feet per gallon for each coat.

It is now necessary to find the number of gallons of paint that can be produced from 100 pounds of soft paste white lead. This depends on the formula you follow. Just remember this when preparing the paint; it is better to have a little too much than not enough. Any leftover paint can be used to paint roof gutters, cellar stairs, other odd jobs where color is not a primary consideration or for priming porch floors.

To find the approximate amount of paste white lead needed, the following method may be used for quick calculation:
First: Calculate area to be painted.

Second: Divide area by 700, the average number of square feet a gallon will cover on new work. This will give the gallons of paint required.

Third: Divide the number of gallons by six, multiply the result by 100. This will give you the pounds of paste white lead required for each coat.

Fourth: Multiply the pounds needed for each coat by the number of coats; this gives the total pounds of white lead required for the whole paint job.

TABLE 3. HOW TO FIGURE COSTS OF PAINT*

Total amount of material to purchase for applying a two-coat repaint job. This includes both the "body coat" and "finish coat" shown in mixing directions on page 21, table 2 and page 27, figs. 33, 34.

To paint square feet of surfaces	Pounds of paste white lead required		Gallons of boiled linseed oil required	Gallons of turpentine required	Total gallons of paint resulting	Approximate cost per gallon of paint ready to apply
	lbs.	(gals.)				
12500	500	(16¼)	12½	5	33¾	$2.16
5000	200	(6½)	5	2	13½	2.16
3700	150	(5)	3¾	1½	10⅛	2.16
2500**	100	(3¼)	2½	1	6¾	2.16
1900	75	(2½)	1⅞	¾	5⅛	2.16
1250	50	(1⅔)	1¼	½	3⅜	2.16
625	25	(⅞)	⅝	¼	1¾	2.16

The above table is not the mixing direction. See page 27 for directions on how to thin for each coat.

*There are 3¼ gals. by measure per 100 lbs. of white lead, which volume is used in arriving at total gallons of paint. In estimating the cost per gallon ready to apply, typical base prices were used as follows: 80 cents per gallon for linseed oil, 60 cents per gallon for turpentine, $12 per 100 lbs. for white lead—adding or deducting to such prices of the raw materials according to the current prices prevailing in different localities will give total cost per gallon of paint. The square feet of surfaces have been computed to agree approximately with the covering capacity of standard packages (25-lb., 50-lb., 100-lb.) used by painters in purchasing white lead.

**Example: If enough paint to cover 2400 square feet two coats is needed, purchase a 100-pound pail of white lead, 2½ gallons of linseed oil and 1 gallon of turpentine as shown in the above table to cover 2500 square feet with "body" and "finish" coats.

	Basis cost	Total
100 lbs. paste white lead (3¼ gals.)	$12.00	$12.00
2½ gals. linseed oil	.80	2.00
1 gal, turpentine	.60	.60
		$14.60

$14.60 divided by 6¾ gallons, the total volume of the paint ready to apply, makes a cost of $2.16 per gallon.

Fig. 29. First—Pour the soft paste white lead into mixing tub.

Fig. 30. Second—Thin it down with proper parts of turpentine and linseed oil.

HOME-MIXING OF THE BASIC PAINT MATERIALS

Home-mixing of paint usually saves money for the farm owner. In using paste white lead it is most economical to purchase the 50- or 100-pound package, measure out what is needed for the immediate paint work, cover the remaining paste lead with a small amount of linseed oil and replace the lid tightly. The paste does not deteriorate and can be used for many kinds of painting on the farm by tinting and mixing in oil and turpentine to suit the different buildings that are to be painted. With the paint materials on hand, buildings can be painted at odd times between regular farm work.

For thinning down the paste paints on the job, ample-sized, clean, dry and water-tight receptacles are an essential part of the equipment. Tight covers help to prevent evaporation and keep out dust and dirt when not in use.

After stirring in whatever free oil may be on top of the paste lead when the pail is opened, pour the quantity of lead needed into a clean mixing can and then thoroughly stir in the linseed oil and turpentine called for by the formula. (See figs. 29, 30 and 31.)

(Photographs courtesy of Red Cedar Shingle Bureau, Seattle, Washington.)

Fig. 31. Third—A few minutes stirring results in a uniform home-mixed paint ready to apply.

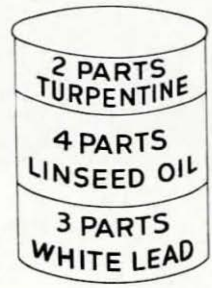


Fig. 32.

For the priming coat on new wood, thin down the paste by mixing:

3 parts paste white lead.
4 parts linseed oil.
2 parts turpentine.

Fig. 33.

For the body coat on new wood or repaint work, mix:

2 parts paste white lead.
1 part linseed oil.
1 part turpentine.

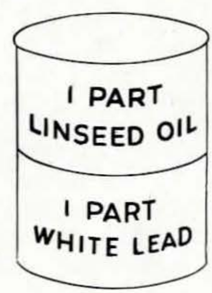


Fig. 34.

For the finish coat on new wood or repaint work, mix:

1 part white lead.
1 part linseed oil.

THE USE OF DRIER

Drier should be added to all paint thinned with raw linseed oil. Under poor drying conditions, such as cool, damp or humid weather, the amount of drier should be increased. If boiled linseed oil is used no drier is required.

Fig. 35. Painted with gray house paint made by tinting original white paint.
A wide variety of colors are available in oil for home-mixing with white paint. A number of formulas are given on the next page.

TINTING

Attractive individual colors and tints are easily made by adding one or more tinting pigments to the white paint. The quantity required depends on the tinting power of the pigment and the depth of color desired.

If heavy paste colors in oil are used, thin the paste with turpentine before stirring color into the white paint. Always tint the white paint after it has been made ready for application so colors are easily blended.

It is always advisable when following a color formula or matching a particular color to add small quantities of color at a time and mix thoroughly. Otherwise it is possible to put in too much color, leaving no alternative but to add more white paint to reduce the color strength.

One of the best methods to follow is first to tint a small amount, such as a cupful of the white paint. When it is tinted to the desired shade, spread some of it with a small clean brush on a board or a portion of the surface that is to be painted. Then if the color is satisfactory use this cupful as a standard. Keep it tightly covered in a screw top glass jar so that the same color can be reproduced later if remodeling of a building requires painting with the standard shade.

To complete the present tinting of the large batch of white paint and to determine with ease when the color of the batch is identical with the standard shade, pour a little of the standard tinted paint over a small piece of window glass. Spot some of the large batch of paint being tinted on a clean part of the glass, allowing the tints to flow together. When the tints are apparently of the same shade, turn the glass over and check the matching of colors through the glass. This is the method used by paint manufacturers in keeping tinted paints uniform with color card standards and likewise can be used to advantage in tinting home-mixed paint.

COLOR FORMULAS

Following are formulas for home-mixing some of the more popular colors. All are based on the use of good quality colors in oil. The quantities recommended are based on the use of 100 pounds of paste white lead and should be adjusted accordingly if a smaller or greater amount of white lead is to be colored. If paste white lead has already been thinned down

ready to apply, use approximately one-seventh of the amount specified of each color to tint each gallon of white paint.

To Make Colors for Exterior Paint

Light Tan
½ pt. burnt turkey umber
Leather Brown
1½ gals. burnt turkey umber
1 qt. Indian red
Light Lemon
¼ pt. lemon chrome yellow
Silver Green
1 qt. chromium oxide green
Foliage Green
1 gal. chromium oxide green
Light Buff
1 pt. raw Italian sienna
Spanish Pink
¼ pt. burnt Italian sienna
Deep Ivory
1/16 pt. medium chrome yellow
Deep Cream
½ pt. raw Italian sienna
Warm Gray
1 pt. raw turkey umber
Warm Drab
2 qts. ray turkey umber

Olive Drab
1 pt. light chrome green
1 qt. burnt turkey umber
Russet Brown
3½ qts. burnt turkey umber
1½ qts. Venetian red
Maize
½ pt. medium chrome yellow
Lifiht Blue
¼ pt. C.P. Prussian blue
⅛ pt. burnt turkey umber
Medium Gray
¼ pt. lampblack
Light Gray
⅛ pt. lampblack
Pottery Blue
½ gal. C.P. Prussian blue
⅛ pt. lampblack
Raffia
1 pt. raw Italian sienna
¼ pt. burnt turkey umber

GRAY BARN PAINTS

There is a growing tendency to paint all farm buildings white or light-tinted colors. A most attractive set of buildings results from painting the barn, poultry house, hog house, machine shed and other outbuildings a gray shade. Gray does not soil and show dirt and its use gets away from the dark red and brown colors that may not appear as decorative and fresh as the gray shades.

It is not economical to purchase and apply cheap gray paints on farm structures. Some gray paints are made of the lowest grade pigments and oils that soon wash away, color-fade and waste the time used in applying them.

From a stock of basic paint materials consisting of paste white lead and linseed oil, drier and turpentine, a gray paint of the same high quality as first-grade house paint can be made by adding a small quantity of lamp black in oil. This tinting may be done with any white paint remaining from previous paint work.

Fig. 36. *The right way*—This farm owner is painting as soon as siding is on his new corn crib. A priming coat appled to the siding before it is nailed on saves much labor. With only a small outlay for equipment, regular farm help can be utilized on the painting job.

Tinting white paint with lamp black or raw umber to make gray shades increases the durability of the paint.

HOW TO APPLY PAINT

If a contract for repainting the building is under consideration it is advisable to first engage an experienced painting contractor to examine the building carefully and advise what should be done in preparing the surfaces. If a contract for labor only is made, the farm owner can furnish the kind and amount of paint materials he has found in this bulletin to be necessary to secure the best possible paint job. When full amounts of materials are properly applied, a high-quality durable paint job should result. Usually a reliable painting contractor will cooperate in using the best materials and correct mixing formulas, as his future business in a locality depends on creating good decorative results at the most economical cost to the building owner.

If the farm owner wishes to apply the paint with his own farm help, he needs a 16-foot ladder for a one-story house or 16-foot extension ladder for a two-story house or large barn, a 10-foot stepladder and possibly some plank if occasional use is to be made of saw horses for some of the farm help who paint surfaces on lower parts of the buildings. A 10-gallon milk can, small barrel or tub should be cleaned and provided with a cover. Empty white lead containers, particularly the 25- and 50-pound sizes, make excellent paint pots. A few smooth, wood mixing paddles and pieces of cloth will come in handy.

A long bristled, 3½-inch or 4-inch brush for each man, a few 2-inch brushes and an inch brush will be necessary so that they can paint both long, flat side wall surfaces and small areas around windows quickly and neatly.

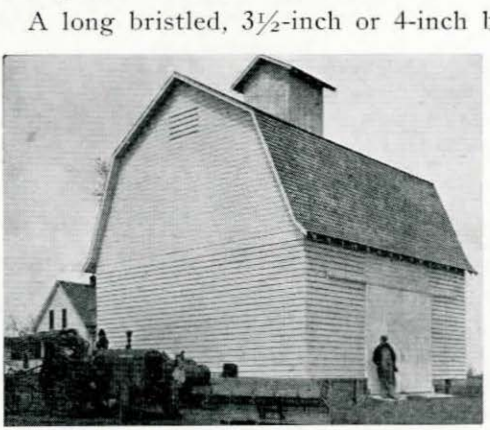


Fig. 37. This farmer is proud of his new 4,500 bu. corn crib promptly painted when constructed.

Measuring out oil and paint pigment is very easy, and anyone can do it by referring to the proportion formulas given on page 27.

(*Courtesy Consumers' Guide, U. S. Dept. Agr.*)
Fig. 38. Renewing their pride of farm ownership—protecting buildings against depreciation.

In some communities the farm owners organize a "painting ring" or club and, working like threshing crews, paint a whole set of buildings on each farm. The investment in ladders and brushes is shared by the group. The paint materials are bought in large quantities. As a result the whole community is brightened, with all the families taking renewed pride in their freshly painted farm structures. Where possible it would be advisable to employ an experienced painter both to oversee the painting and to demonstrate to workers the value of good technique in painting and consistent paint maintenance planning.

SPRAY PAINTING

It has been found practical in some counties where farm owners join into painting rings to purchase a paint spraying outfit. (See fig. 39.) If this is done it is necessary that the spray gun be operated by some one who learns the technique of paint spraying so that even uniform coatings are applied, avoiding piling up of paint that may cause sagging or streaking. In some cases a home-made spray machine is made by using a second hand auto engine with two cylinders acting as compressing units and fitting the necessary paint tank, air tank and spray gun to it.

Painting of farm machinery with red lead paints can be efficiently done with the spray outfit. Using this method the paint can be forced down into cracks and between parts that otherwise are difficult to reach with a brush.

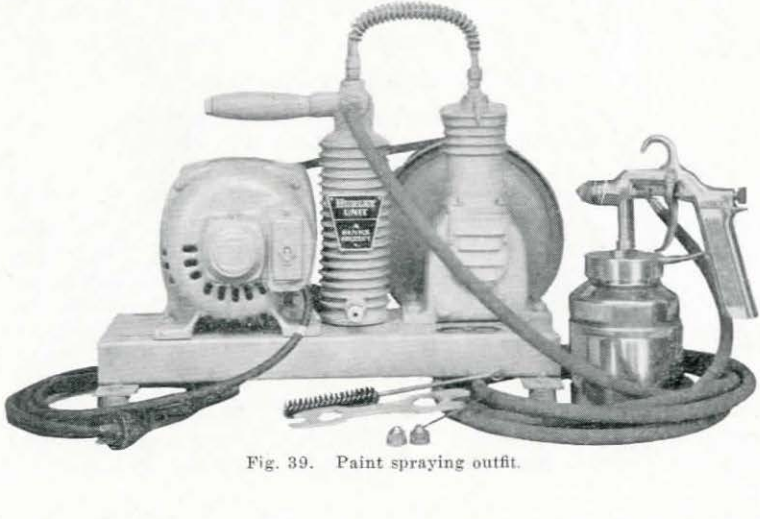


Fig. 39. Paint spraying outfit.

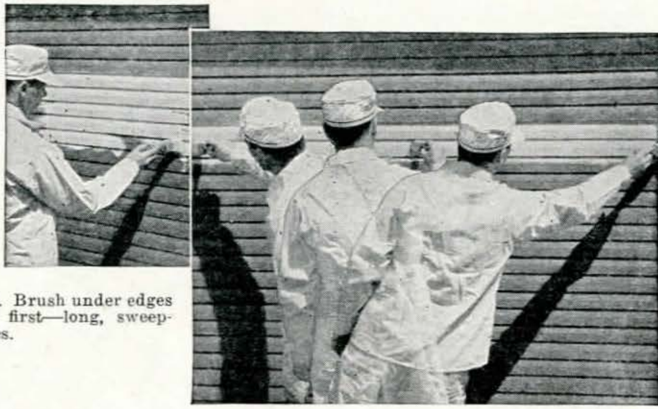


Fig. 40. Brush under edges of siding first—long, sweeping strokes.

CORRECT BRUSHING

Hold a small pot of paint in one hand. This will eliminate loss of time in stooping over to fill the brush and will save your back. Dip the brush and carry the load to the surface, spreading it only enough to empty the brush. Repeat this a half-dozen or more times, distributing the load over a surface about 2 feet wide and 4 to 6 feet long, depending upon your reach. Now spread out the paint with long strokes and lay it off with the fine flag ends of the brush. Use long, continuous strokes directed with the grain of the wood from one end of the stretch to the other. (See fig. 40.)

When applying paint a short paddle should be kept in the paint pot, and an occasional stirring will keep the oil and pigment uniformly mixed so that the paint film which is being brushed on the building will be of consistent pigment concentration and have uniform thickness and wearing properties.

MAKING THE PAINT ADHERE

Good adhesion is an inherent quality of good paint, but paint must be placed in intimate contact with the wood to get the best results. The surface tension and moisture film of the wood must be broken down by vigorous brushing so that the oil penetrates the wood cells, as illustrated in the accompanying photographs. Flowing on exterior paint or applying it in short jabbing strokes will not give the strongest adhesion. To make the paint adhere on new wood, first be sure that the surface is clean, then use a vigorous brush action.

PRIMING COAT

Always bear in mind that the priming coat on new wood is the foundation of the paint film. Brush the paint carefully into the wood and lay it off in an even film. (See fig. 41.)

Fig. 41. Brush in priming coat thoroughly.

When priming soft woods like cedar and redwood enough linseed oil should be added in the primer so that laps between stretches are not noticeable. Such laps are caused by the soft, porous woods soaking up the oil and leaving the pigment on the surface.

HOW DRY BEFORE NEXT COAT?

A test sometimes used by painters is to sandpaper some of the surface which was painted several days previously and if it is dry enough not to gum up the sandpaper, it is ready for the next coat. Under average weather conditions, several days should elapse between coats for best results.

HOW TO TAKE CARE OF PAINT BRUSHES

Hog bristles used to make good brushes are imported from China, carefully sorted by hand and welded into handles.

Good paint brushes cost money. They will paint many buildings if properly cared for between the paint jobs.

Keep the brush suspended in linseed oil, kerosene or turpentine by boring a hole in the upper part of the handle, and suspend the brush on a rod or wire resting across the top

Fig. 42. The WRONG WAY to save brushes.

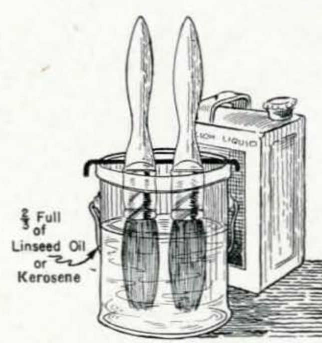


Fig. 43. The RIGHT WAY to save brushes.

edges of the pail. (Fig. 43.) Never let the brush rest on the ends of the bristles in a pail more than a few hours or it will warp the bristles (fig. 42) and cause uneven flow of paint when used again. After a paint job is finished, the brush should be washed out in painter's naphtha, mineral spirits, kerosene or turpentine until all paint pigment is out of the bristles near the handle. Then wash out in soap and water and allow to dry. If paint once gets hard in a brush it is almost impossible to renew its original paint-holding and even-spreading properties.

It pays to buy good brushes and take care of them until the bristles are worn to about half the original length.

HOW TO AVOID PAINTING ERRORS

Every painter or owner who does his own painting should learn to recognize the different kinds of paint failures. He should know how to avoid them and what to do when they occur.

To avoid paint troubles, it is advisable to follow the mixing and application instructions in this bulletin and make sure that moisture cannot get behind the paint film through faulty construction. Sidings and flashings must be properly fitted, for moisture behind the paint will cause a paint failure in spite of good materials and workmanship.

The causes and remedies for the more common paint failures are discussed as follows:

ALLIGATORING

Alligatoring (fig. 44) is caused by the application of a relatively fast-drying coat over another coat which is too soft. This softness may be due to the use of too much oil, insufficient drying time beween coats or the use of inferior oil which dries to a soft film.

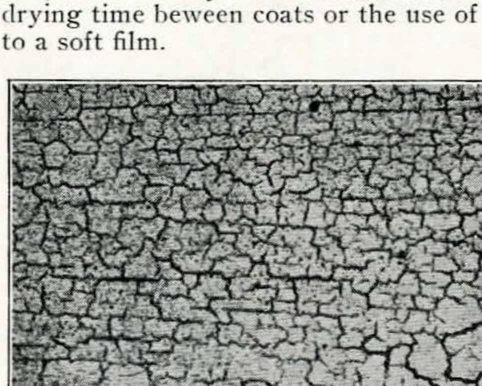


Fig. 44. Alligatoring.

To avoid alligatoring, formulate the paint correctly so that each coat is harder than the coat following. See that each coat dries thoroughly before applying another coat.

If alligatoring is not too severe, the cracked coat may often be removed by wire-brushing. If the cracks are deep,

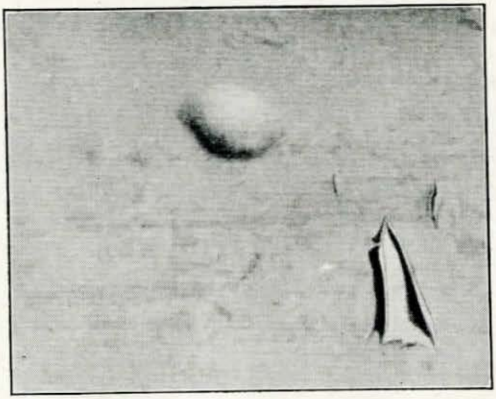


Fig. 45. Blistering and peeling.

however, (fig. 13) the old paint should be entirely removed. Then repaint the surface with white lead using formulas for painting new wood.

BLISTERING AND PEELING

Blistering (fig. 45) is caused by moisture in the wood. The sun draws this to the underside of the paint film. The pressure exerted raises the paint from the surface in blisters. Peeling eventually follows. Blistering may occur on walls of unventilated dairy barns by condensation of moisture forced through the walls. To remedy blistering of exterior paint, apply two coats of lead and oil paint or a good moisture-proofing paint on the back side of the siding.

Good paint never blisters or peels if the wood is dry when the paint is applied and if it remains dry afterward. If a rainstorm has wet new wood before it has been primed, allow a day of sunshine or wind to dry the wood before painting.

When repainting, eliminate or remedy any sources of moisture, such as leaking pipes, unventilated wet basement, loose siding or imperfect flashing over windows. Scrape off any old blisters, sand down the rough edges, touch up the bare spots with a priming coat before the body and finishing coats are applied over the entire surface.

BLOTCHING AND FADING

Blotching, fading and spotting show up in spots where the wood has absorbed all the oil from the paint. This is caused by giving the wood too few coats. Dark colors naturally appear to fade when the oil is absorbed. To avoid faded blemishes, use three coats of properly formulated paint with colors which are adapted to the purpose.

CHALKING

This is a term used by painters to describe the stage in the wearing away of a paint film when most of the original gloss of the paint job has disappeared, exposing part of the pigment particles which sluff off when rubbed slightly with the

hand. With high quality white and light tinted paints, such as white lead, the chalking stage does not appear until after about 18 months to 2 years, according to the degree of weather and sun exposure to which surfaces may have been subjected. A certain degree of controlled chalking is desirable in exterior paints as this slow, uniform wearing off removes soot, dust and grime, providing a continued bright clean appearance for the building and a good surface for eventual repainting. Premature chalking and loss of gloss is sometimes caused by rain, frost, fog or other excessive moisture during the application and drying period of a paint. Early chalking may also be noticeable in most low-grade, inert-filled paints which soon wear off and expose the wood or old paint surfaces if they have not failed already by cracking, scaling or peeling.

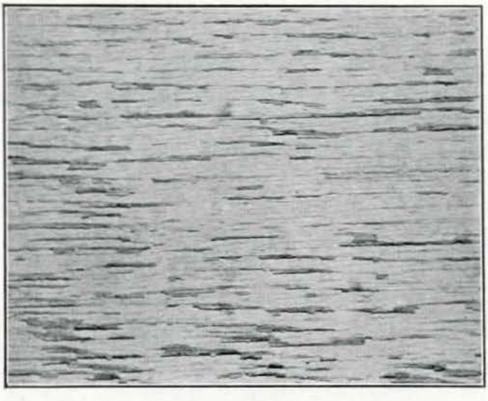


Fig. 46. Cracking and scaling.

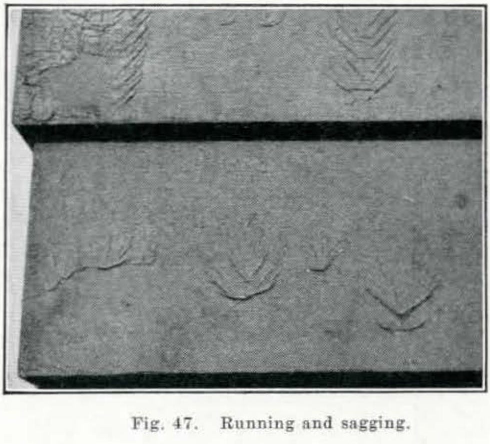


Fig. 47. Running and sagging.

CHECKING

Slight checking is not a serious defect as it does not affect either the durability or the protective value of the paint. Checking affects only the top coat of the paint and does not extend through to the undercoats. The flakes are small and disappear as the paint gradually chalks. Before repainting, brush the surface to remove any loose particles.

To avoid excessive checking, be sure that each coat is formulated correctly so that it will be harder than the succeeding coat, and allow each coat plenty of time to dry. (See page 27.)

CRACKING AND SCALING

This common type of failure is illustrated in fig. 46. It is usually the result of using a low grade inert filled paint that does not produce a tough and durable paint film for exterior exposure on wood.

When repainting, all the old paint must be removed, otherwise, it will continue to scale away, carrying with it the new paint. Apply three coats according to the formulas for painting new wood. (See page 27.)

RUNNING, STREAKING AND SAGGING

These may occur (fig. 47) when the paint contains too much oil and is applied too thick. Paint which is carefully formulated and skillfully applied will not show these defects.

Sometimes the old paint surface is too glossy and may cause running. The gloss can be cut by wiping the surface with a rag soaked with benzine.

Sand down the wrinkled places before repainting.

TACKINESS AND SLOW DRYING

Tackiness and slow drying often result in more serious defects if not avoided. Each coat must dry thoroughly before the succeeding coat is applied, else checking and alligatoring may result.

For quick drying in cold weather, it is advisable to use a little less linseed oil and make up the difference in volume with turpentine. Allow plenty of time for each coat to dry.

WASHING

This condition occurs (fig. 48) when a paint film contains certain substitute pigments soluble in water or when soluble compounds are formed by chemical reactions after the paint has been applied. Washing is observed in the form of streaks near the lower edge of siding and in accumulations on column footings or building foundations. Material dissolved out of the paint will collect in these places, and when the water evaporates the streaks can be plainly seen. If the mixing formulas appearing in this bulletin are followed, none of the water-soluble compounds will develop and result in washing off of the paint.

WRINKLING

When paint is applied too thickly (fig. 49), the surface skin dries quickly and leaves an undried portion beneath it. When this dries later, it causes the surface skin to wrinkle. Even in poor drying weather, wrinkling will not occur if each coat is brushed out to a thin film.

In some cases it is advisable to strip off all the old paint when wrinkling has occurred; but when the defect is not too serious, the wrinkled parts can be sanded down to a smooth surface before repainting.

BLEEDING OVER KNOTS

This discoloration is caused by a substance in the knot which rises to the surface when dissolved in the linseed oil of the paint. Stop bleeding of this type by coating the knot with resin-free shellac after it has been primed with white lead.

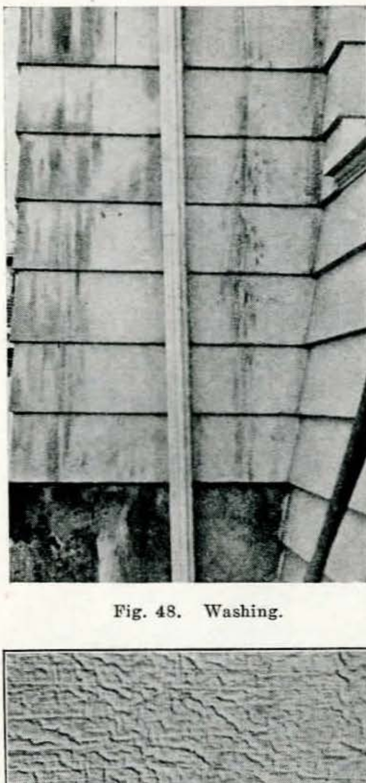


Fig. 48. Washing.

DISCOLORATION FROM COPPER SCREENS

Unprotected copper screens exposed to the weather are affected by atmospheric moisture and gases. Formation of copper salts results. These salts are washed over the surface of a paint film by rain. When the paint contains certain white pigments, the salts actually stain the film so that it is impossible to remove the discoloration. Pure white lead paint is never stained by these salts, and any normal discoloration deposited on the surface from this source does not become fixed but is washed away by average weather wear.

Fig. 49. Wrinkling.

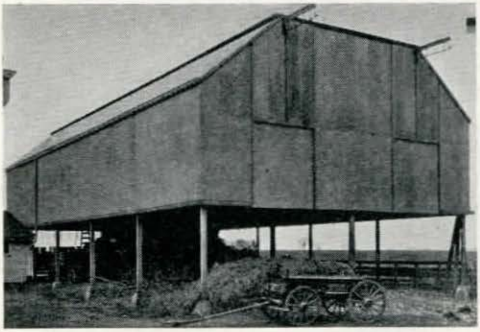


Fig. 50. Typical use of galvanized metal coated with 2 ounces of zinc per square foot. If metal with less coating is used and rusting occurs, brighten rust spots with a wire brush and paint metal with red lead or other good metal paint.

DIRT AND SOOT DISCOLORATIONS

In some communities, dirt, soot and coal dust rapidly collect on paint, discoloring it. It may be advisable to use the darker shades in such neighborhoods. Paints containing too much linseed oil will form a tacky surface which catches all kinds of dirt; but if the mixing formulas are correctly followed, a glossy, hard surface will result, and such dirt will be washed away by rain and weather exposure.

In exceptionally smoky communities, the paint may be made quick-drying by using less linseed oil and more turpentine as the liquid portion of the paint.

PAINTING METAL WORK

If the flashings over windows and around chimney or ridge rolls, downspouts and gutters on buildings are not made of sheet lead, copper or a heavily coated galvanized metal (preferably coated with 2 ounces of zinc per square foot), the metal work will usually rust.

NEW UNPAINTED METAL

The most satisfactory way to prepare sheet metal for painting is to allow it to "weather" 4 to 6 months.

However, when newly erected sheet metal such as galvanized iron or sheet zinc must be painted without delay (for appearance only), the surface should first be treated for painting by sandblasting, sandpapering, wire-brushing or dry scrubbing with steel wool. Paint should be applied immediately after dusting the surface clean.

Fig. 51. To paint metal, thin down red lead paste as indicated.

When these methods are not practical, a quick way of preparing galvanized metal for paint is to brush on a solution made by

Fig. 52. Brighten rust spots with a wire brush and repaint machinery with rust preventive paint. (See mixing formula, fig. 51.)

dissolving 4 ounces of copper acetate, copper chloride or copper sulphate in a gallon of water. This solution will roughen the surface slightly. After allowing the surface to dry for about an hour, brush it and rinse it with water until none of the black smudge produced by the treatment can be wiped off with a white cloth. When dry, the surface will be ready for painting. Only a rust preventive such as red lead, blue lead or metallic zinc paint should be used on new or old metal work. (See fig. 51 if red lead is to be used.)

RUSTY METAL WORK

Before repainting, all rusty metal work should be wire-brushed and then painted with a good rust inhibitive paint such as red lead, blue lead or metallic zinc paint. Some home-mixed white lead paint tinted to the shade desired may be used for the finish coats as it adheres exceptionally well to the above named rust preventive paints.

Red lead, blue lead or metallic zinc paint will also prevent deterioration of steel farm machinery. Rust spots should be wire-brushed thoroughly before painting.

PAINTING AND STAINING RED CEDAR SHINGLES

When western red cedar shingles are used for covering the sidewalls of old buildings, or are used instead of smooth siding on new structures, they may be painted by mixing the paint according to the same formulas used for painting smooth siding (page 27). For new shingles, however, more linseed oil should be added to the priming coat. The rough shingles absorb more of the oil, and to make a most satisfactory foundation for ensuing coats of paint, the wood surface should be well primed. (Fig. 41.)

When staining red cedar shingles the liquid portion of the stain should consist of 1 part turpentine to 2 parts boiled linseed oil. To obtain various colors, add color materials. A good gray may be obtained by adding 12 pounds of white lead to 1 gallon of the liquid mixture plus a little lamp black ground in oil to get the shade desired. A green shade may be made by adding three-fourths of a pint of chromium oxide paste (thinned with turpentine) to a gallon of white lead and

oil mixture. Never use creosote shingle stains if it is possible that the building may later be painted, because if shingles have been stained with oils that contain creosote it is difficult to keep the creosote from bleeding through white or light-colored paints. If the shingles have been on several years, the creosote may have weathered out of the wood. Before painting over stained shingles with white or light-colored paint it is best to paint a spot on one side of the house about 2 feet square up under the eaves or other protected place and let it stand a week or 10 days. If no bleeding of creosote shows up it will probably be safe to paint the house with the same paint used on the test spot.

Aluminum paint is sometimes used to stop creosote bleeding. This quality is due to its leafing properties and the sealing character of spar varnish with which the aluminum powder is mixed.

BACK-PRIMING SIDING

In improperly ventilated dairy barns the moisture vapor caused by livestock may become so great during cold weather that it is forced through barn sidewalls. It condenses when it reaches cold surfaces and with some hard types of paint causes peeling of the paint on the outside of the siding. With masonry walls such moisture freezes, causing cracking of mortar or concrete and crumbling of brick, making it impossible for outside paint to adhere properly to the surface of such wet walls.

To avoid possibility of such paint failures, wood siding and masonry walls should be painted on the back side or inside surfaces with two coats of white lead and lead mixing oil paint (see formula for second coat, page 44) or long oil spar varnish aluminum paint. This will seal the inside surface of the wall material, so high humidity conditions within the barn cannot force excessive amounts of vapor through the wall materials and cause paint peeling on outside surfaces.

If new buildings, especially dairy barns, are being constructed, bundles of siding should be opened and laid out on saw horses so that the lumber can be primed on both sides and edges before being nailed on the building. One of the great benefits resulting from pack priming tongue and groove lumber such as drop-siding and flooring is that painting the edges and both sides prevents warping and keeps the siding from shrinking and opening between laps. This also lessens shrinkage of shiplap and barn boards.

Priming new lumber before using saves enough labor, when compared with priming sidewalls after construction, almost to pay for the paint material used.

Fig. 53. Stucco houses should be water-proofed to prevent entrance of moisture in walls. (See mixing formulas, page 44.)

ALUMINUM PAINT

High quality aluminum paint, made by incorporating aluminum powder in a long oil spar varnish is sometimes used for painting metal tanks or buildings where metallic appearance is desired and heat-reflecting properties are important. Such metal surfaces should be first coated with red lead or blue lead rust inhibitive paints. In general, high quality white paints reflect more light than aluminum paint.

Aluminum paint is sometimes used for priming hard resinous woods or to stop bleeding through of creosote that may have been used in painting some buildings or fence posts. Its qualities as an interior moisture barrier are recognized especially in two-coat work. This quality is due to its leafing properties and the sealing characteristics of spar varnish. This does not, however, justify the recommendations of aluminum paint for situations where paint failures result from moisture, for unless the moisture condition is removed, any paint will fail.

Reliable information about the use of aluminum paint for repainting is lacking, but where the old coating has worn to the extent of baring the summerwood, this paint should give satisfactory results if it is followed by two coats of white lead or light-colored paint. Although it is bright in appearance, its luster is metallic. The aluminum powder and vehicle are often put up in two-compartment cotainers to be mixed just before application. The cost of aluminum paint is somewhat greater than good white paint. It is about as durable as good red iron oxide paint, depending somewhat, however, on the quality of spar varnish that is used as a vehicle with the aluminum powder.

PAINTING CONCRETE, STUCCO, PLASTER, BRICK, CEMENT BLOCKS AND ASBESTOS-CEMENT SHINGLES

Regardless of what building material is used for constructing side-walls of buildings, all such surfaces will become soiled

and streaked with grime from accumulation of dust, soot and pollen from growing grain which combines with rain and fixes it securely on exposed surfaces.

One method of cleaning exterior walls, if the wall material is not porous in texture, is to wash them with soap and water. Washing usually spots and streaks porous materials. Because it is such tedious work, nothing except porch floors is washed.

When re-beautifying practically all exterior wall surfaces, it is the custom to paint them. By adjusting the mixing of basic paint materials usually carried in stock in the average farm workshop, the farm owner can easily paint any of the masonry walls, making them appear brighter than when new, and seal the porous surfaces of asbestos-cement shingles, brick or concrete to largely prevent accumulation of soot and other grime. Painting will also seal the surfaces and tend to prevent the entrance of moisture which in freezing may crumble and deteriorate masonry materials. Painting prevents water from soaking through masonry walls into grain in storage bins and from possible spotting of interior wall paper or painted walls of a residence.

PREPARING THE SURFACE

Stucco, concrete work and the mortar in brick or stone work should be allowed to stand and dry at least 6 months before paint is applied. If painted within that period, it may be aged artificially by washing with a solution made by dissolving 2 pounds of zinc sulphate in 1 gallon of water. Stucco of magnesite composition should not be painted with oil paint.

At least 2 or 3 days of dry weather should precede the priming of unpainted brick, cement or cinder blocks.

On old brick work, if any mortar has become loose and washed-out, repoint all such damaged places with cement mortar before applying any paint. After priming, correct small defects in the surface with putty. If a water paint has been employed previously, the surface should be wire-brushed before oil paint is applied.

Never paint when the temperature is below 50° F.

ESTIMATING QUANTITY OF PAINT

Surfaces of the masonry or cement type vary greatly in degree of roughness and absorbency. For this reason it is impossible to give a coverage figure that will be absolutely accurate in every case, but it will be found that conservative averages are 200 square feet per gallon for the priming coat, 400 square feet for the second coat and 600 square feet for the finishing coat.

To paint concrete, stucco, plaster, brick, cement blocks or asbestos-cement materials use the following mixing formulas:

Priming coat:	Materials		
	White lead	100	lbs.
	Lead mixing oil or reducing oil	2½	gals.
	Linseed oil	2½	gals.
	Gallons of paint	8	gals.
	Coverage (200 sq. ft. per gal.)	1600	sq. ft.
Second coat:			
	White lead	100	lbs.
	Lead mixing oil or reducing oil	4	gals.
	Gallons of paint	7	gals.
	Coverage (400 sq. ft. per gal.)	2800	sq. ft.
Third coat:			
	Same as formula for second coat.		
	Coverage (600 sq. ft. per gal.)		

It is strongly recommended that surfaces not previously painted with oil paint receive three coats. If two-coat work is attempted, use the second coat formula for the first coat. Use the same formula, modified by reducing the lead mixing oil or reducing oil to 3 gallons, for the finishing coat.

SPECIAL PRIMERS

There is some doubt as yet about the value of painting with special priming paints for exterior woodwork. It has been stated by chemists who have tested paints over periods of years that the priming coat of a paint is not proven until the end of the third paint job. Average painting periods are from 4 to 5 years apart, so it would require about 15 years to prove a primer that in formulation may be satisfactory for several years but in later years might cause peeling and scaling of paint films when paints of varying formulas may be used for repaint jobs.

TWO COATS ON NEW WOOD?

The use of two coats on new wood or of one coat on repainting work is not good practice. In most cases, it is difficult to satisfy the dry, porous surface if one coat is omitted. This may lead to such defects as spotting, fading and early chalking. However, if two-coat work is attempted on new wood, the priming coat should be mixed so as to obtain good sealing of the wood surfaces. In some instances a priming coat made on the basis of 100 pounds of white lead, 1½ gallons raw linseed oil, ¾ gallon spar varnish, ½ gallon turpentine, 1 pint drier and ¼ pint raw umber has given satisfactory paint jobs on new wood when finished with a paint mixed according to the formula for "finish coat," page 27.

ENAMELIZED PAINTS[3]

Large proportions of bodied drying oils or varnishes (heat-treated mixtures of drying oils and resins) are not used in true house paints of good quality. Because of the high viscosity imparted by heat treatment, excessive proportions of volatile thinners must be added and, as a rule, the amount of pigment must likewise be reduced in order to obtain a brushable product. Moreover, the product takes on the flowing and leveling qualities of enamel, as distinguished from true house paint. Such products are sometimes called enamelized house paints.

For special purposes, for example, where it may be the intention to wash the coating frequently, enamelized paints may be advantageous but, as a rule, they are inadvisable for ordinary house painting because they are difficult to correctly apply and maintain. Enamelized paints tend to "pull under the brush" unduly, they must be applied in rather thin coatings to avoid running, sagging and formation of beads at sharp horizontal edges on vertical surfaces, and they accentuate irregularities in the underlying surface, such as raised grain in wood or flaked patches of the previous paint.

Varnish or resin of any kind in house paint has a rather bad reputation because very cheap paints often use varnish together with large proportions of mineral spirits and water. Such paints are unreliable and make it necessary to regard with suspicion any paint that contains varnish or resin. Nevertheless, there are a few good quality paints on the market in which small proportions of high quality resin are used. Such paints are called 'resin-fortified' paints and sometimes they are 'quick-drying' paints. They are also likely to be enamelized paints unless the amount of varnish used is very small. For most house painting purposes, quick-drying has more disadvantages than advantages. Fortification with small amounts of resin is sometimes used in order to dispense with zinc oxide as one of the pigments, resin having some of the action of zinc oxide as a hardening agent in paint. It is still questionable, however, whether there is any real benefit to be gained from the use of resin in white or light-colored house paints. In deep colored paints like dark green, dark brown and black paints in which little or no white lead or zinc oxide can be used, addition of some varnish or of a substantial amount of bodied drying oil is often advisable to insure prompt hardening after application and to prevent unduly early fading of the color.

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