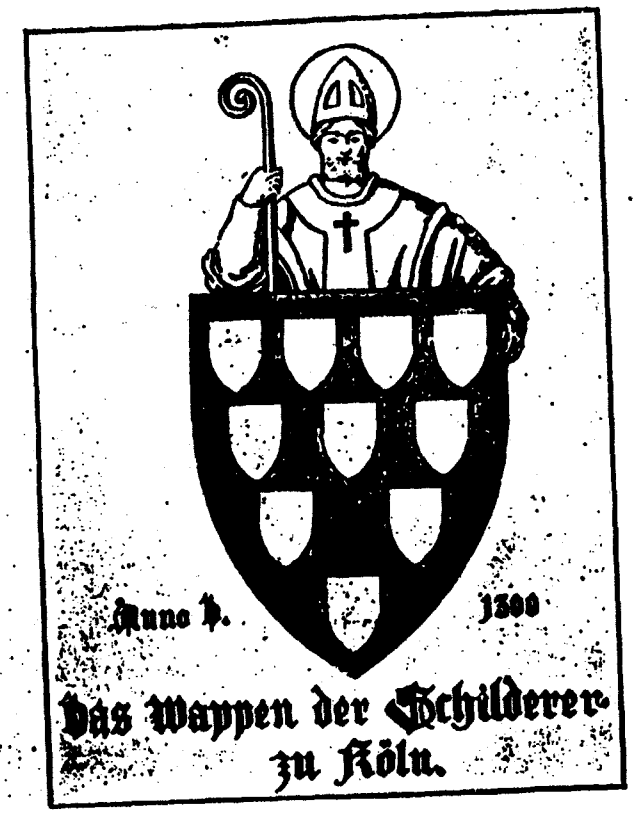


ANCIENT COAT OF ARMS OF THE SCHILderers' (Painters) Guild of Cologne, Germany, granted by the Emperor in 1300 to show his high regard for the craft. The full story of painters' coats of arms is told in Book Nine, the Historical Supplement.

PAINTING AND DECORATING CRAFTSMAN'S MANUAL AND TEXT BOOK

INCORPORATING THE FUNDAMENTAL PRINCIPLES AND PRACTICES OF THE PAINTING AND DECORATING CRAFT, WITH DETAILED DATA ON NEW MATERIALS, PRACTICAL METHODS, BRUSHES, TOOLS AND EQUIPMENT, TOGETHER WITH AN INTRODUCTORY OUTLINE TO THE STUDY OF COLOR, COLOR MIXING AND MATCHING AND COLOR STYLING...

FOR APPRENTICES, JOURNEYMEN PAINTERS AND ALL OTHERS CONCERNED WITH THE PROFESSIONAL ASPECTS OF THE PAINTING AND DECORATING INDUSTRY.

Prepared and Sponsored By

PAINTING AND DECORATING CONTRACTORS OF AMERICA

THEO. AUDEL & CO. PUBLISHERS
49 WEST 23rd. STREET, NEW YORK 10, N.Y.

PAINTING AND DECORATING
CRAFTSMAN'S MANUAL AND TEXTBOOK

Printed in The United States

CONTENTS

Book One

MATERIALS

Introduction

Chapter One

Contents

Contents

Book Two

BRUSHES: EQUIPMENT: SAFETY: HEALTH

Chapter One

Chapter Two

Operation: Equipment: Spraying Technique: Cleaning the Gun: Failures and Defects: Ventilation

Contents

Chapter Three

Chapter Four

Chapter Five

Book Three

PAINTING SPECIFICATIONS: PRACTICAL PROCEDURE

Chapter One

Contents

Chapter Two

Chapter Three

Chapter Four

Chapter Five

Chapter Six

Chapter Seven

Chapter Eight

Chapter Nine

Book Four

PAINT FAILURES AND THEIR REMEDIES

Chapter One

Chapter Two

Chapter Three

Book Five

COLOR

Chapter One

what and the *how*, much emphasis has been placed in this volume on the *why* of doing things, because that is the essence of current vocational teaching in the painting and in all other industries. Unless a student masters the *why* of modern-day paint production, processes and procedure he will be unable to cope with the problems with which he will be confronted.

Obviously, it cannot be expected that apprentices and journeymen have full knowledge of paint chemistry and the complexities of paint formulation, but it is essential that they have an understanding of paint composition, of the new theories of multi-pigmentation, of the functions of vehicles, of the attributes of extenders, thinners and driers, of the delicate balances of these components, and of the necessity for adhering to directions for application of modern materials.

In the preparation of this volume, many men in the Painting and Decorating Industry have contributed from the wealth of their practical experience, and full use has been made of the technical reports of the Scientific Section of the National Paint, Varnish and Lacquer Association, the Bureau of Standards of the Department of Commerce, the Forest Products Laboratory of the Department of Agriculture, the research laboratories of various State universities, the catalogs and current literature of materials and equipment manufacturers, and the published addresses of scientists in the paint, oil and chemical industries.

In making acknowledgment and expressing appreciation to these sources of technical and practical information and illustrative matter, it is recommended that students and their teachers maintain constant contact with them in order to keep abreast of ever-changing conditions.

By accepting this challenge, each reader—be he teacher, apprentice, journeyman or painting contractor—will be upholding and passing on to the next generation the best traditions of this great craft!

Book One

MATERIALS

Introduction

COMPREHENSIVE knowledge of the materials used in the Painting and Decorating Industry always has been vitally important: for the apprentice just learning the craft, for the journeyman, the foreman, the superintendent, the employing contractor, the architect, the builder, the decorator, in fact for all those concerned with the application or specification of protective and decorative coatings.

This knowledge is now more essential than ever before. Why? Because paint production processes have made such revolutionary progress in the last twenty-five years. This progress embraces the development of new pigments and pigment combinations, the perfection of synthetic resins and synthetic oils to replace natural products, the introduction of new solvents, the creation of entirely new formulations and the utilization of modernized manufacturing processes . . . all of which have completely revised previously accepted concepts of durability, protective and decorative qualities, speed of application, drying time and general serviceability.

Furthermore, the forces responsible for the streamlining of the paint manufacturing industry are continuing at work . . . constantly evolving new coatings for a great variety of "end uses", experimenting with new processes, working out new theories, and cooperating with raw material suppliers in a program of imaginative and practical research. It is because of

the progress that has been made and the further progress that is bound to come that such great emphasis is here put on the importance to the student of the Painting and Decorating Industry of knowledge of available materials.

All industry leaders agree that the progress made in the last twenty-five or thirty years has exceeded that in all the known history of paint making. Seemingly that is an extraordinary statement when reference to the story of paint making, given in the Historical Supplement of this volume, will show that paint making is actually "as old as the hills" . . . going back in fact to the hillside homes of the ancient cave dwellers who lived 50,000 years, perhaps even 100,000 years ago.

What is the justification for this claim? Simply that in recent years paint making has developed from an art to a science. Mechanical "rule-of-thumb" production processes have given way to chemical and engineering controls. Skilled artisans and those peculiarly gifted individuals known as varnish "cookers" of the old days have been supplanted by chemists, laboratory researchers and plant technicians who work with production "blue prints", test tubes and a complicated assort-

THE FIRST PAINTERS: CRO-MAGNON ARTISTS IN THE Cavern of Font-de-gaume. Painted by Charles R. Knight under direction of Henry Fairfield Osborn. Courtesy American Museum of Natural History.

ment of precision measuring and film testing instruments.

By their wizardy, the chemists of the paint manufacturing industry and the chemists of the raw materials industry have achieved truly magical results. From the blackest of ores they have developed the whitest of pigments and from the most transparent gas, the blackest of pigments. They have perfected pigment combinations not dreamed of at the beginning of the Twentieth Century, when apprentices were breaking their backs in learning to "break up" white lead. They have "cracked open" the tiny molecules of drying oils to find out what made them "tick", and then put them back together again in new arrangements in a way that makes them do their drying job better. They have taken the lowly castor oil—known and hated as a medicine for children years ago—and by special treatments made it into an oil with non-yellowing characteristics so highly to be desired in the painting world.

Development of Synthetic Resins

Synthetic chemicals—which simply means man-made combinations and rearrangements of known chemical elements—have been perfected and developed into a profusion of resins previously referred to, which have made possible the formulation of superior products for a wide range of uses. Some of these chemicals have been pulled out of the very air itself. One of them has made possible the development of a new blue, described by scientists as the greatest advance in the color world in two hundred years. The same chemical on which this blue depends and which is the basis of other industry products was the vital ingredient of non-flash smokeless powder and also of the material which chased mosquitos away from American troops in the Far Eastern jungles in World War II. Truly a miraculous product!

In a large measure, the paint manufacturing industry's progress noted here has come as a result of the jolting demands

of the armed forces and industrial establishments at the time of World War II. The United States, as we are proud to recall, went "all out" for victory by building up the greatest Army, Navy and Air Force known to history, which meant personnel, equipment, guns, ammunition, ships, planes, transportation facilities and services of supply. Everything, absolutely everything, that was used on land or in the air or on the sea or under the sea required a protective coating . . . some form of paint, varnish or lacquer.

There was a saying in Washington that "everything that fights, flies or floats" needed a product of the paint industry to enable it to accomplish its purpose. Finishes had to be provided speedily, and in huge amounts, that would withstand the tremendous heat generated in a gun barrel and which would not crack in the sixty below zero temperatures of the stratosphere . . . finishes which had to be resistant to oil, gasoline, radiator and brake fluids, hot coffee, delousing chemicals and chemical warfare . . . finishes which had to protect priceless range-finding apparatus and all manner of equipment from the unbelievable ravages of jungle moisture . . . finishes which would neither burn nor sustain combustion . . . finishes which would camouflage installations from the prying eyes of infrared cameras and others which would glow after dark. New specifications for materials came to the paint industry from the War and Navy Departments in quick succession, almost as exigent as battle orders . . . and the industry chemists had to fulfill them practically overnight despite acute shortages and actual scarcities of the needed raw materials.

War-Time Advances

The paint industry rose to the World War II emergency in a magnificent manner which won the acclaim of the Government and American industry as a whole, and the fact that it was able to do so is attributable to the revolutionary changes which

began about 1924 when research chemists and chemical engineers actually took over as controlling factors. According to Robert J. Moore, noted authority on synthetic resins, the "revolution" was brought about by the need for greater speed and efficiency in industrial finishing, especially in the automobile field, which led to the adoption of the synthetic materials, and thus started the chain of production progress which has been noted.

Progress in All Products

While it is true that the technological advances since 1924 chiefly have had to do with the finishes for automobiles, refrigerators, radios and other household equipment (for which the American public should be truly appreciative), and while it is true that the wonderful World War II achievements of the paint industry were based on studies of these industrial finishes, it must be remarked that it is not too far a step from the lustreless olive drab coatings of the gigantic American tanks to the beautiful synthetic gloss enamel finishes for a home. Painting and decorating contractors, interior decorators, architects, builders and property owners will benefit from the paint industry's progress in the last few years . . . and here, in brief, is how:

1. Development of high-hiding, quick-drying, durable and washable wall finishes of greater whiteness and color-retention qualities, through multi-pigmentation and the utilization of special synthetic resins, solvents and oils.
2. Production of purer, stronger colors, permitting the creation of striking decorative schemes without fear of fading. Improvement of non-yellowing qualities in whites through special methods of treating oils.
3. Improvement of water-thinned paints, especially the resin emulsion type, with gloss finishes added to this group.
4. Development of luminous paints, fire-retardant paints,

metal paints, fungicidal paints, waterproofing materials, etc.

Chemistry may be said to be a science of constant change, and now that the chemist and chemical research have become dominating factors in the paint making industry it is certain that the work of experimentation, development and improvement will be carried forward intensively. At the turn of the Century there were few paint chemists. To-day, of every thousand chemists registered in the United States, 41 are employed in the production of paints, varnishes, lacquers and colors. All but three other industries requiring chemical technique trail the paint industry in utilizing the services of chemists, and it is particularly significant that about 40 percent of all paint chemists are engaged in research.

What Will the Future Bring?

What will come from their continuing activity? New products, refinements of old ones, perhaps even developments which will further revolutionize the entire theory of paint application. House paints as we know them to-day dry chiefly by oxidation and evaporation—that is, through action of the air. But is this process the final answer? Who can say? Perhaps hitherto neglected pigments combined with entirely new vehicles will produce coatings that will dry almost instantly, permitting a two-coat job on a wall without moving a ladder! Fantastic? Maybe and maybe not.

It is a generally accepted statement that the paint plant superintendent of thirty years ago would be thoroughly confused and bewildered by the manufacturing technique and the formulations of to-day . . . and it is a matter of record that only eighteen years ago a distinguished industry leader, addressing a convention of the Painting and Decorating Contractors of America on what materials might be developed in the future declared emphatically that we would never have the emulsion type of paints which are now in such widespread and successful use.

Painting contractors who are still under fifty years of age now buy finishes which were non-existent at the time of World War I . . . and the G.I. painting trainee of World War II must learn not only the craft's age-old basic principles but a great many more things which were unknown to his father and grandfather before him.

And in the field of color we must again note a revolutionary change: the illuminating engineer has entered the picture in recent years and has altered entirely the formerly fixed relationship between color and light as essential partners in a decorative scheme.

Color and Light

Harold Rambusch, nationally-known decorator, commenting on the new order, says: "Light through all the ages, right up to our time, was essentially the same. Fires, torches or lamps all involved burning wood, pitch or oils. These all produced essentially the same light—warm yellow or golden. The relationship of color and artificial light through the ages was, therefore, constant. Color and light could be planned together. If a decorative scheme was pleasing in the 15th Century under artificial light, it would be equally pleasing in the 17th Century. This constancy of relationship does not exist nowadays."

The reason The introduction first of incandescent light, and then of fluorescent light. In fact, color effects under fluorescent light are as different from incandescent lighting as an incandescent bulb is from natural daylight. These facts are treated in greater detail in Book Five of this volume devoted to Color. They are mentioned here briefly, simply to point to a conclusion which should be obvious to all:

Painting, even as paint making, has now developed from an ancient art to a modern science!

Chapter One

COMPOSITION AND PROPERTIES OF BASIC MATERIALS

Section I: What Is Paint?

PAINT in its simplest form is a white or colored material which is applied as a thin liquid coating on wood, plaster, metal, masonry or composition surfaces, and which dries generally-speaking by oxidation or evaporation—action of the air—to become a solid, durable finish. The paint film for an average three-coat paint job is between 1/350 and 1/200 of an inch thick, or about the thickness of a sheet of newspaper. Paint is intended to serve the following basic purposes:

Protection: All structural materials are subject to the disintegrating action of the natural elements—rain, snow, ice, wind, the ultraviolet rays of the sun, heat and cold. Resistance to moisture and the controlled passage of moisture through various surfaces constitute perhaps the greatest protective functions of paint. Moisture causes wood to swell, warp, rot and decay. All things made of metal rust and corrode. Porous masonry is attacked and ruined by moisture. Interior wall finishes are marred and ruined through neglect of exterior surfaces. Protective coatings preserve the billions of dollars invested in American homes, commercial and public buildings, industrial plants, transportation equipment and farm properties. Hundreds of millions of dollars a year are lost through neglect. "Save the Surface and You Save All" is the industry's famous advertising slogan . . . and it clearly reveals paint's value as an economic factor in our life.

Beautification and Decoration: From the very beginning, mankind has aspired to self-improvement and the attainment of some form of beauty in the home and in working surroundings. For centuries it was merely a crude and seemingly hopeless striving. Slowly, the creative and decorative urge found an outlet in the ornamentation of public buildings, the palaces of the great and the wealthy, and religious edifices, and in the period of the Renaissance it flowered into an era of magnificence in art and decoration. To-day, beautification of the home through painted decoration is a possibility, a reality for all, rich and poor alike.

The term "paint" comes down to us from Sanskrit, oldest known written language, and means "to adorn"; in the ancient

PAINTING CONTRIBUTES TO THE ARCHITECTURAL beauty of America's homes, large and small, and is a vital factor in the protection and preservation of the vast national wealth invested in property.

Greek language it meant "many-colored" . . . and it is therefore natural that the material designated by this word should have decoration as one of its principal purposes. Color itself is a fundamental science embracing many fields of modern life. Painted color as a decorative medium, long recognized as an art, is now moving into the realm of science, as was noted in the Introduction. It has become a factor in the paint and painting industries of prime importance.

Functional: Until comparatively recently, Protection and Decoration were considered the two main purposes of paint products, but now scientific management recognizes the use of paint for functional purposes . . . by which we mean that paint can do a real job in contributing to improvement of manufacturing processes in other industries, that it is a factor in the great national movement for safety and accident prevention, that it is vital to health and welfare activities. Functional painting has become an essential in factories where scientifically selected colors for machinery, walls and floors are known to lessen eye and nerve strain, prevent accidents, improve worker morale and increase production. The relationship between color and incandescent and fluorescent light, as stated, is a functional consideration of tremendous importance, as are the light reflection qualities of paint, its value in electrical insulation, its use in traffic control and its resistance to specific liquids and chemicals. Functional colors in schools, hospitals for mental and physical patients, and institutions for the blind, have been developed by scientific experimentation with remarkable results. Functional painting applies, also, to homes by correcting architectural defects, improving interior lighting, conserving fuel costs, etc. These subjects are dealt with in detail in later sections of this volume. They are mentioned here simply to emphasize the ever-broadening field of the paint and painting industries.

Component Parts of Paint

Paint—again using the term in its simplest form—is made up of four principal component parts, which by their individual properties and their relationship to each other comprise the essential elements of protective, decorative and functional coatings. These component parts are:

1. The Pigment: A substance in fine powder form which imparts color and opacity to a paint and largely determines its consistency and general character. Pigments are divided into several groups, the most important of which is the opaque type·

PAINTING IS THE BASIS OF THE COLOR SCHEMES which give beauty and distinction to the American home. Note the Section on Color Styling in Book Five.

Opaque literally means "not transparent". This opaqueness—"opacity" is the proper term—is the property which enables a paint to hide and color a surface. Pigments which do not have this capacity are known as inerts, fillers and extenders. A full discussion of the functions of pigments is given in later sections.

2. The Binder or Vehicle: A liquid medium which binds the pigment particles together, contributes to the spreading and covering properties and, with the pigments, gives strength and life to the paint. Oil paints take their name from the obvious fact that the vehicle is an oil. There is an old industry saying that "oil is the life of paint". Binders and vehicles are of several types, which are described later in detail.

3. The Thinner or Solvent: Liquids which achieve their purpose through solvent action, which means that they act on the combination of pigment and oil and make it easier to apply. These thinners are volatile liquids; that is, they evaporate after the paint has been applied. They have no film-forming properties, but they do aid greatly in the penetration of the paint into a surface.

4. The Drier: Specially compounded materials designed to do exactly what the name implies: accelerate the drying time of the oils by absorption of the oxygen.

Additional details of these component parts and an analysis of the many types of materials now in use are given in the pages immediately following.

Section II: Pigments

Pigments used in house paints may be divided into three major classifications: (1) white pigments, or bases; (2) colored pigments—of mineral, chemical, vegetable or animal origin; and (3) the extenders.

Opaque white pigments used for the purpose of hiding the surface to be coated are in the great majority, but they are

often used in admixture with colored tinting pigments to enhance the decorative value of the finished film. (Clear or transparent coatings do not contain pigments.)

Mention should be made at this point of the real meaning of the term "hiding power". It should not be confused, as is

STEEL IS THE BACKBONE OF AMERICAN INDUSTRIAL life, and paint is the great protective agent which saves hundreds of millions of dollars annually through loss by rust and corrosion.

sometimes the case, with mere covering of a surface. The true measure of hiding power of a pigment is its ability to reflect away the destructive ultra-violet rays of the sun and by so doing to lengthen the life of a paint coating.

Hiding power, in the language of the paint chemist, depends on the difference between the refractive indexes of both the pigment and the binder or vehicle. And what are refractive indexes? A refractive index is the "bending" of the light ray. Did you ever put a stick of wood in water and notice that it appears bent or broken? That effect is caused by refraction. Another way of putting it is that refractive index is the measurement of how one type of surface throws off a ray of light or of heat.

Paint chemists have contributed enormously to the industry's advancement by their studies of this entire subject. They have discovered, for instance, that the hiding power of a pigment depends on the size and shape of the pigment particle and the relationship of these factors to the wave length of light involved. Thus, changes may be achieved in the hiding power of a single pigment species by the proper conditioning of the pigment particle with respect to size and shape.

This comment, though it verges on the technical, is important to an understanding of modern painting materials. Likewise, it is important to know and appreciate the new theories of the relationship between pigment volume and vehicles, which is dealt with in detail in Chapter Five of Book One of this volume.

A. WHITE PIGMENTS

1. WHITE LEAD

White lead is the oldest known white pigment and is mentioned in literature as early as 430 B. C.—2,378 years ago.

It is, therefore, the "grand-dad" of all white pigments, the material with which master painters and their apprentices have been most familiar and which to-day is a fundamental ingredient in a large variety of exterior and interior finishes.

Several processes are used in making the types of white lead available to the industry. Most frequently employed in commercial products is the type known as Basic Carbonate White Lead—a compound in the form of a white powder of metallic lead, acetic acid (strong vinegar) and carbon dioxide gas.

Basic Carbonate is one of the most widely used white pigments, combines readily with linseed oil to make a smooth and easily brushable paint. Two special properties may be noted: (1) it has peculiar drying qualities within itself which react with the linseed oil to facilitate drying, and (2) it is subject to gradual disintegration, a process known as "chalking", in which the film loses its gloss and wears away in a fine powdery substance. Mild and slow chalking is a desirable thing, as it provides a good surface for repainting without preparatory work; but heavy chalking which leaves the surface exposed is something to be avoided. White lead if neglected fails ultimately by checking and cracking.

Basic Carbonate White Lead

There are four principal processes employed in the production of Basic Carbonate White Lead:

a. Old Dutch Process (with American improvements): Ordinary lead metal is melted and cast into perforated plates of irregular shape called "buckles". These are put in earthen jars containing dilute acetic acid (vinegar), and the jars are placed in layers in a closed room. Between each layer is a thickness of tanbark. The room is kept sealed for three months. The carbon dioxide gas produced by the fermentation of the tanbark and the

action of the acetic acid on the "buckles" cause the metal to corrode, and thus produce the fine powdery substance called white lead. This is sold in dry powder form to paint manufacturers, or it is combined with oil and sold for general painting purposes.

b. The Carter Process: In which the melted lead is blown into fine granules by means of superheated steam, and then subjected to the action of acetic acid, water and carbon dioxide in large wooden cylinders. After that, the material is treated practically as in the Old Dutch process, resulting in a white lead that is somewhat whiter and more uniform than in the Old Dutch process. This process requires about 10 to 12 days.

c. The Electrolytic Process (Also known as the Sperry Process): In which lead plates are dissolved and precipitated as Basic Lead Carbonate in an intricate process involving chemical solutions and electric currents. The resulting product is a very pure, brilliantly white and extremely fine pigment.

d. The Euston Process: Feathered lead metal is dissolved in acetic acid to form basic lead acetate which is treated with carbon dioxide.

Basic Sulfate White Lead

Basic Sulfate White Lead is obtained by a process of fuming from lead sulfide ores, in a manner similar to that used to produce American zinc oxide. Fuming is essentially a "burning" operation. The resulting product is a very fine, white powder and, because of its chemical composition, it has a high degree of opacity. In the language of the chemists, it reacts less strongly than the Basic Carbonate with the drying oils, and when used alone it "chalks" rather more freely than the corroded lead.

2. ZINC OXIDE

All through the development of the paint industry, zinc pigments have figured prominently in various formulations.

Among the most commonly known and widely used is Zinc Oxide, one of the finest of all white pigments and actually one of the whitest. Zinc, like lead, is obtained from a mined ore. Zinc Oxide has been in use for more than 125 years. It is produced by two methods: one called the French and the other the American. The French process utilizes metallic zinc in a burning or fuming operation, in which the oxide is collected in closed chambers. The American process takes the actual ore, mixes it with powdered anthracite, subjects it to furnace heat and then through a series of cooling operations a powdered substance is obtained which is the zinc oxide.

Leaded Zincs

Much of the zinc ore mined in the United States contains a certain proportion of lead sulphide ore, basis of lead sulfate. When basic lead sulfate is united with zinc oxide you have what is known as a leaded zinc. Leaded zinc has great opacity and "body" because of the lead sulfate content.

Zinc Sulfide

An intensely white pigment of high hiding power, produced by different chemical processes. It is an important constituent in the production of lithopone.

3. LITHOPONE

Lithopone, first produced in the United States in 1906, is among the most widely used white pigments in the paint industry, being employed in flat interior paints, the newer emulsion oil paints, exterior house paints and in industrial finishes, in a variety of formulations and combinations with other pigments, notably zinc oxide. Lithopone is produced by co-precipitation of zinc sulfide and barium sulfate from solutions

of barium sulfide and zinc sulphate. The chemical mixture of the two is the crude Lithopone, which, when filtered, dried, heated again, ground wet, dried and ground again becomes the actual commercial product. Ordinary Lithopone contains about 28 per cent zinc sulfide, from which it derives its hiding power.

4. TITANIUM DIOXIDE

Titanium Dioxide is the "baby" of the white pigment family, having been introduced generally about 1919, but it is a lusty and powerful infant, with extraordinary qualities and characteristics. Called the "whitest of whites", it is produced by chemical wizardry from the "blackest of black" ores—known as ilmenite, which is found chiefly in India and also in various parts of the United States. Titanium, which takes its name from the Greek word "Titanes", meaning "sons of earth", is the ninth most common element in the earth's crust—there is more of it in existence than all the lead, zinc, tin, antimony, nickel, copper, gold and silver combined. However, the ores which contain titanium in quantities commercially practicable for converting into titanium dioxide are so dispersed that the processing is highly complicated.

Impurities, mainly iron, are removed from the ilmenite and then the material is subjected to an intricate series of mechanical and chemical treatments: grinding, dissolving in sulfuric acid, filtering and roasting.

Titanium Dioxide is an extremely fine powder pigment of high refractive index (See previous comment in this Section) and fairly high density, which give whiteness and hiding power to white paints and clarity to lighter colors. There are two forms, "anatase" and "rutile", the properties and utilization of which are discussed in the later Section on "Modern Paint Formulations".

In addition to its value to the paint manufacturing industry, Titanium Dioxide is in great demand for use in making coated fabrics, linoleum, paper products, white rubber, white leather, and even soap. It was used during World War II in making protective creams that safeguarded skin against painful flash burns inside turret guns, and in other creams that gave protection against sunburn and insects in the tropics.

Chemically, titanium pigments are inactive.

5. ANTIMONY

Antimony oxide is a white pigment of low hiding power which formerly was used with anatase titanium dioxide to delay chalking. It is now used in paints of the fire retardant type, but is principally used in ceramics and other fields.

Chemically Active Pigments

Chemically active pigments, such as lead and zinc pigments, are so termed because they react with the oil of the vehicle to form lead or zinc "soaps" which influence the hardness and toughness of the film, increase durability, and increase resistance to fungus growth such as mildew.

Other pigments such as zinc chromate (zinc yellow) and red lead are also chemically active in another sense, in that when used in metal protective primers they tend to inhibit corrosion by reacting with acids formed at the metal surface.

B. OTHER PIGMENTS: EXTENDERS

Extenders once had a rather shabby reputation in the paint industry, having been classed by some people as mere adulterants, put into the paints as fillers whose only purpose was to cheapen the product and defraud the buyer. That is definitely not so, as extenders are now known to play an important part in the pigment volume concentration and durability of a ma-

terial, as is discussed in Chapter IV on "Modern Paint Formulations". Paint chemists are continuing their study of these extenders with a view to further developments of their use. The principal extenders are:

1. Barytes or Barium Sulfate: This mineral is found in the United States and is processed by grinding, purification, bolting or sedimentation. It is practically colorless in oil and thus has no modifying effect on the color of a pigment. Used with white lead and zinc oxide and in production of certain colors. "Blanc fixe" is made synthetically from a soluble barium salt.

2. China Clay (Aluminum Silicate): One of several forms of aluminum silicate, a rather complex hydrated material, which means the base is combined with the elements of water. Inertness and practical absence of color are its chief properties.

3. Mica, Water Ground: Mica is the group name for a number of silicates, principally silicates of aluminum produced in many varieties. The water ground type is that used in the paint industry. Some benefits claimed are that it adds to ultraviolet ray resistance qualities of a coating, helps to prevent checking and cracking and improves tint retention.

4. Silica: This is silica, a quartz rock, one of the most common parts of the earth's "crust". Treated by heating, sudden quenching, grinding and "bolting"—sifting. Known for its extreme hardness and colorless properties. Widely used as a paint inert and in making paste wood fillers.

5. Talc (Magnesium Silicate): A combination of silica, magnesium and oxygen. Has various forms, one of which is known as soapstone. Is inert and very fine which makes for a smoother paint and is said to retard settling. Magnesium silicate is the most widely used extender in house paints.

6. Whiting (Calcium Carbonate): One of the oldest paint materials known to man, having been used by the ancients to adorn their private and public buildings. Calcium carbonate is an earth product in various forms—limestone, marble, stalactite, chalk, etc. Whiting is called variously bolted whiting, Paris white and "cliffstone Paris white", the latter name coming from the fact that one of the best varieties are obtained from the famous chalk cliffs of Dover, England. The chalk is prepared by grinding in water, drying, and regrinding.

NOTE ON EXTENDERS

In much paint industry literature, the terms "extenders" and "inerts" are used interchangeably, but "inert" is being dropped from usage because it means chemically inert or inactive to many people. The chief difference between these materials and white lead, etc., is that they impart but very little hiding power. Some can be chemically active (chalk) and some are chemically inactive (silica).

C. COLOR PIGMENTS

In the realm of color, there are many pigments used in the production of exterior and interior paints, some of which are as ancient as the industry itself and some of which are, as the saying goes, as new as to-day's newspaper.

These pigments are principally the reds, blues, yellows, browns and greens. It is in the field of blues that the most modern development has been recorded. This is known as "phthalocyanine blue", and, as mentioned in the Introduction, it is hailed as the greatest color advance in nearly two hundred years. It is an organic blue pigment which is outstanding for the clearness and brightness of its tints with white pigments, and its outstanding fade resistance. The base of this remarkable product is the miraculous "Phthalic Anhydride", which is described in the Section on "Synthetic Resins". There is also a "phthalocyanine green", and paint chemists are hoping to develop reds and yellows with the same properties.

Color pigments may be generally divided into four groups: (1) the Earth Colors, which are those obtained from natural mineral deposits in the ground and prepared for use by various

Burnt Sienna is obtained by roasting Raw Sienna, thus driving off the water combined chemically with the molecule and increasing the percentage of ferric oxide in the mixture. The result is a strongly reddish brown pigment. Although it is used to a lesser extent than the raw, Burnt Sienna is a very valuable pigment for both tinting and glazing. The tints are on a reddish buff order and the glazes quite red in tone.

The Two Umbers

Raw Umber as in the case of other earth colors, varies in composition, though it is somewhat the same as Sienna. The principal point of difference rests in the percentage of manganese dioxide, which is considerably greater in the Raw Umber, giving it a darker grayish brown color. Extended with white, it produces very permanent gray tints having slightly olive brown tones. Some of the best grades of umber earth come from Turkey and the pigment is widely used on both the interior and exterior, for tinting, staining and glazing. One of the earliest references to this pigment occurred in literature in the year 1600.

Burnt Umber is made by calcining or roasting the raw. It is a richer, redder brown, as might be expected, since the roasting drives off a large amount of the combined water and results in an increase in the percentage of red ferric oxide. Its uses are the same as in the case of Raw Umber, and it is much more popular because of its more pleasing tone when used straight and in tints. One of the earliest written references to Burnt Umber occurs in the year 1649.

4. CHEMICAL COLORS

Chrome Yellows

In the group designated as chemical colors, there are the chemically pure chrome yellows, which are generally prepared

in three shades—lemon or light, medium, and orange. Occasionally the painter encounters another light shade called Primrose, and also a deep shade called Dark Orange Chrome Yellow. Chrome yellows, except in the case of basic lead chromate, are formed by combining chemical solutions of bichromate of soda with a dilute solution of some common lead salt such as acetate or nitrate. Modifications of shade are obtained by co-precipitation of other insoluble lead compounds with the chromates. These yellows are pure chemical pigments, and their manufacture can be so carefully controlled that uniformity in color can be readily maintained. Extreme care must be exercised in their preparation, however, if the resulting pigment is to be rich in tone, high in tinting strength and of desirable permanence.

Chemically pure Lemon Chrome Yellow is a combination of white normal lead sulphate and normal lead chromate, which is responsible for the pale lemon tone. It is used principally for tinting, but is less in demand than the medium shade. While the first reference in literature to the word "yellow" appears in 700, the term "lemon yellow" was not employed until 1598, and the words "lemon chrome" as a paint term did not appear until 1875.

Chemically pure Medium Chrome Yellow is composed of normal lead chromate. It is, without question, the most commonly used of all the chrome yellows, possessing considerable tinting strength and a rich, brilliant yellow tone. While no medium chrome yellow can be described as permanent, it is, nevertheless, generally regarded as sufficiently durable under conditions of normal exposure, for all practical purposes. The term "middle" or "medium" chrome yellow first appears in literature, in reference to a paint pigment, in 1818.

Chemically Pure Orange Chrome Yellow is essentially a basic lead chromate. It is, of course, considerably richer than

the Medium Chrome Yellow, is distinctly permanent as to color, and possesses a high tinting strength. The use of this term first appeared in literature, as referring to a paint pigment, in 1818.

Basic Lead Chromate

Chemically pure Basic Lead Chromate is precisely what the name implies, consisting of a lead chromate, basic in character, carrying a strong scarlet tone. A selected shade of this color has recently come into international prominence as an adopted standard for use in identifying and rendering more visible objects such as high bridges, towers, etc., that present a hazard to air navigation. Because Basic Lead Chromate is produced in a shade consistent with a standard that has been universally adopted in the above mentioned connection, it is often referred to as International Airways Orange. This pigment is exceptionally durable when used as a self-color under the most severe conditions of exterior exposure. It is sometimes known as "Chrome Scarlet" and appeared in literature, as referring to a paint pigment, in 1800.

The Green Pigments

The next group of colors that are of extreme value to the painter are the green pigments, and these have to be prepared chemically. It is true that there are green earths that have a limited use, but they are considerably inferior in tone and tinting strength to the manufactured greens. The chrome greens are by far the most commonly used in the painting industry. Although these colors are all produced by the combination of chrome yellow and iron blue, there are various methods of manufacture. The quality of the product is governed by the care exercised during the various steps of the process, as well

as by the purity of the raw materials employed. Good chrome greens are made by co-precipitation of chrome yellow and iron blue under carefully controlled conditions, and expert attention in their preparation must be exercised. The most perfect greens should, after washing, drying and grinding, be pure and bright in tone, showing little or no separation of the blue. As in the case of chrome yellows, chemically pure chrome greens are manufactured in light, medium and dark shades. The light shade contains more yellow, and the dark shade more blue, than does the medium. Such colors are high in tinting strength and form reasonably durable paints for general use, when used either straight or in combination with white to produce tints. The three shades of chrome green as paint pigments are first referred to in literature in 1815.

Although chemically pure Chromium Oxide Green is referred to in literature as far back as 1838, it has only in comparatively recent years been used to any extent as a paint pigment. Since it is a very stable chemical compound, chromium oxide shows a remarkable degree of permanence when subjected to conditions of exterior exposure. It is usually made by fusing a mixture of potassium bichromate and boric acid, after which it is washed and dried. While the resulting green is very pleasing as to tone, it is slightly grayed and lacks the richness and tinting strength of the chrome greens. When used as a self color, it is excellent as a green finish on sash, shutters and doors, but its relatively high cost limits its extensive use on larger areas.

Phthalocyanine Green

This pigment is similar to phthalocyanine blue, with the same outstanding clean tone and fade resistance, but differs from the blue in that a green mass tone is obtained through the introduction into the molecule of several chlorine atoms. It is not as extensively used as the blue.

The Blues, Old and New

Most blue pigments of the present day are artificially prepared. Years ago there was a blue obtained from natural sources, but at great expense. The rare stone called lapis lazuli, when finely ground, provided a deep, rich blue color known as ultramarine, which was used extensively by artists in earlier days. The name ultramarine means, literally, deeper than the blue of the sea. While natural ultramarine blue is now practically obsolete, the present-day product closely resembles it chemically. There are two principal types of ultramarine blue, the sulfate ultramarine and the soda ultramarine. The former is light in color and shows a greenish cast, while the latter is deeper and more on the violet order. Both are comparatively low in tinting strength. They are useful for glazing and, to a certain extent, for tinting. It is interesting to note that the present artificial blues, although they are considerably cheaper than natural ultramarine, are much better in tone, tinting strength, opacity, and other qualities. The name "ultramarine" is first referred to in literature, as a paint pigment, in 1598.

Cobalt Blue in its true form is a compound of the oxides of cobalt and aluminum and is so costly that its commercial use is prohibitive. Commercial cobalt blue of the type generally used by the painter is, in reality, a cobalt-toned ultramarine blue. In general characteristics it resembles ultramarine and is employed as a glazing color and, to a limited extent, for tinting. The name Cobalt Blue, used in reference to a paint pigment, first occurs in literature in 1777.

Chemically pure iron blue is an iron compound known as ferric-ferrocyanide. It is unquestionably the most valuable of the blue pigment group. The tone is variable, but can be controlled in manufacture so that a uniform product is obtainable. Its tinting strength is greater than that of most pigments, and it is fairly permanent. The term "Chinese" Blue is often used

in place of Prussian, since the composition and general characteristics of these pigments are practically the same. It is first referred to in literature as a paint pigment early in the 1700's, while the name "Chinese Blue" does not appear until the following century.

Milori Blue is another shade in this group of iron blues.

Phthalocyanine Blue

An organic blue pigment made synthetically from phthalic anhydride, that remarkable chemical which is so important in the production of alkyd resins. Phthalocyanine blue is used principally for making tints of light blue from whites, and for making green trim and trellis paints as well as being used occasionally in industrial maroons. It is outstanding in fade resistance and tint retention, and produces shades of unprecedentedly clean tones. It is widely used in exterior finishes where color permanence on long exposure is important. Described as the most important color development in many years, phthalocyanine blue is manufactured under several trade names.

Most Important Red Pigments

The most important red pigments fall naturally into two groups—namely, the iron oxide reds and the organic reds. This classification omits red-lead, which, although very important as a red pigment, cannot properly be classed with colors-in-oil. The iron oxide reds, as their name implies, contain iron oxide in large amounts, and include such colors as Venetian Red, Indian Red, Tuscan Red, etc. These vary in composition according to the iron oxide content and the nature and quantity of the remaining components. Some are natural earth pigments, occurring as hard rocks, while others are produced artificially, or else consist of some natural earth pigment containing ferric oxide toned up with an organic compound.

Venetian Red is one of the most widely used red pigments. A large percentage of the total Venetian Red sold at the present time is made by a precipitation process and calcining, and contains about 20 to 50 per cent of ferric oxide, the remainder being principally calcium sulfate, with small amounts of silica and other impurities. This pigment, whether natural or artificial, gives a pleasing range of tints. It is also used straight, as well as with other colors. It is first referred to as a paint pigment in 1753. The natural iron oxide-silica pigments are extremely durable for outside use, as are also the pure synthetic iron oxides.

Indian Red, as used commercialy, is a prepared pigment produced by roasting copperas (iron sulfate) in a muffle furnace. The color and hardness is governed by the temperature at which the copperas is roasted. In general, the higher temperatures result in a darker, more violet-toned red, while at lower temperatures a lighter, redder color is produced. Indian Red is high in iron oxide, is unaffected by sunlight, and its deep, rich tone makes it highly satisfactory as a straight color. When used as a tinting material with white, the resulting color is dull and somewhat bluish in tone. Indian Red was first referred to as a paint pigment early in the 1600's.

Tuscan Red Variations

Tuscan Red varies in composition to a considerable extent among different manufacturers. It is usually an Indian Red toned up in such a way as to increase the richness of the color. While seldom employed as a tinting material, Tuscan Red does offer an excellent medium for the production of soft tints when it is mixed with white. It is often used straight, as a self-color on sash and trim, and it occasionally serves as a base for outside paints. Its permanence is satisfactory for all practical purposes. Tuscan Red appears in literature, as a descriptive paint term, early in the 1800's.

Rose Lake consists of an inorganic or mineral base colored by an organic dyestuff. It is semi-transparent, brilliant in color, and fairly permanent—sufficiently so for interior work. The color is used for tinting and glazing, and to a considerably greater extent for staining. While Rose Lake as a paint term did not appear in literature until early in the 1800's, the term Rose Pink was recognized as far back as 1382.

Toluidine Red is an organic pigment, prepared from certain coal tar products. The pigment is permanent when used alone or as a tint. It exhibits no bleeding tendencies, due to the fact that it is insoluble in most paint vehicles. It is used widely as a straight color for sign work, store fronts and vehicle painting. A color on the order of Toluidine Red is generally called "Vermilion", a term first appearing in literature as early as 1300.

Permanent Red is an aniline lake pigment consisting of an aniline dye precipitated on a suitable base pigment. It is reasonably permanent as to color and is generally used straight for the painting of signs, store fronts, etc. When extended into a tint by the addition of white, it assumes a distinctly bluish cast entirely different from the more orange tint obtained through the use of vermilions. The name Permanent Red first appeared, as describing a paint pigment, in 1896, so that as a term it can be considered as fairly recent.

5. THE BLACKS

While there are several blacks, distinctly different in character, that are well known to the painting industry, one is outstanding because of the extensive use to which it is put. This color is Lampblack, which is well known to the industry, and it provides an extremely important tinting material. It is used for many purposes in addition to the most common—that is, the production of gray tints.

Many times, a small amount of black is added to a tint in order to tone it down slightly. Lampblack is derived from the imperfect combustion of coal tar oils and is collected in a settling chamber. The lampblack deposited therein is simply unburned carbon that is very pure, finely divided, and uniform in color. While it is not the blackest of the blacks, it is most commonly used for tinting paint, since when properly made it provides a clear gray of bluish cast when added to white. Lampblack has exceptionally great tinting strength and is extremely permanent. No record is available that provides the date when this term "lampblack" first appeared in literature as applying to a paint pigment.

Durable black enamels are made from carbon black smoke type pigments of which there are various grades of jetness. The best grades are expensive and used in automotive finishes. When mixed with white they give a muddy brown tint and are little used for this purpose.

Bone black is produced by carbonizing animal or vegetable matter.

Graphite, used chiefly in protective coatings, is classed as a carbon pigment and comes in two forms: flake and amorphous.

(For further data on the subject of Color, refer to Book Five.)

Section III: Binders or Vehicles

Binders or vehicles, as was stated previously, are the means of binding the pigment particles together and to the coated surface, giving strength and life to the paint. In the great variety of finish coatings on the market, approximately 42 per cent are what is known as "oil paints", which means that drying oils are a principal part of their composition.

The great progress in the paint industry as recorded would certainly not have been possible had it not been for the scientists' conquests in the field of drying oils. Cut off by World War II from sources of certain oils they had come to regard as indispensable, the chemists had to find substitutes—and they found them. For example, the wide use of the alkyd resins (See later Section on this subject) was increased by the dehydration of castor oil, which has many of the characteristics of Chinawood or tung oil, for years an industry standby but which was a war-time casualty. This oil has the added advantages that it is odorless and that it retains its clear color without yellowing with age—a vital factor in a decorative finish.

The chemists, to quote one of them, "took linseed oil apart to find out what made it tick. They put it back together, leaving out some of the parts, and made it dry better". This process is called fractionating . . . separating the molecules.

Soybean oil which is now definitely established in the industry is being treated in the same manner. One fraction produces a low-cost drying oil and also a food fraction comparable to cottonseed oil. There are non-yellowing virtues also in the soybean oil. Other new developments in the study of natural drying oils include such lowly but well-known plants as the sunflower and the milkweed, and the latter is said to be even better than the soybean in non-yellowing qualities.

Linseed Oil

Of the oil bases, the most widely used in the paint industry is linseed oil, which is obtained by crushing the seed of the flax plant. Knowledge of this plant dates back to Biblical days and it has been grown in this country since the Revolutionary War. Although tens of thousands of acres in the Northwest part of the United States are devoted to the growing of flax, the output is not sufficient for the needs of the paint industry (and other

industries which are dependent upon it, such as the linoleum makers), and hundreds of millions of pounds of flaxseed are imported each year, mainly from the Argentine Republic.

There are three principal kinds: (1) the raw oil which is sold to the industry after basic impurities such as "foots" have been removed; (2) heat bodied oil, which is made from alkali-refined linseed oil which is kettle-bodied, or *polymerized*, under heat with temperatures ranging from 550 degrees to 600 degrees Fahrenheit until the desired *viscosity* is obtained; (3) Boiled oil is raw oil to which a certain proportion of driers have been added under heat of much less temperature than bodied oil—between 250 and 300 degrees.

Polymerization means the uniting of two or more molecules to form a larger molecule. *Viscosity* means the fluid thickness or thinness of an oil, varnish, paint or enamel.

Tung Oil

Next in importance is tung oil—called China wood oil by Marco Polo back in the Fourteenth Century—which is a comparative newcomer in the United States. The Chinese have known about its waterproofing properties for centuries, and used it in lacquers and enamels. American paint manufacturers use it in making certain types of quick-drying oil paints, varnish and enamel. While there are tung trees and crushing plants in some of our Southern states, the bulk of our supply of tung oil still comes, in normal times, from China. There, coolies gather the nuts of the tung trees and remove the kernels from the shell. The kernels are ground into a fine meal with a heavy stone roller which is operated with the aid of water buffalo. The oil is then pressed from the meal and is placed in paper-lined bamboo baskets which are transported over rough trails and down rivers for hundreds of miles to the seaports.

Soybean Oil

Soybean oil is classified as a semi-drying oil, being intermediate in character between olive oil (a non-drying oil) on the one hand and linseed oil (slow drying) on the other. Soybean oil which has in no way been treated to change its chemical nature is extensively used in coatings today along lines developed during the 1930's. For example, alkali-refined soybean oils are widely used in the manufacture of oil modified alkyd resins, (See later Section) which can be modified with even non-drying oil to yield excellent finishes for many purposes. The use of soybean oil is particularly advantageous in this application because of the oil's non-yellowing characteristic; in this manner soybean oil is frequently a component of the gleaming white-baked finishes on modern appliances such as refrigerators, stoves and washing machines.

One of the most important results of applied research on soybean oil has been the development of soybean oils of improved drying properties with characteristics approaching, and in some instances surpassing, those of linseed oil.

The improved soybean drying oils are usually made from alkali-refined soybean oil, but sometimes are based on the fatty acids derived from the oil. Generally speaking, they polymerize or "body" in the varnish kettle much as do the linseed varnish oils. Thus they are finding extensive application in varnishes and enamel vehicles. Such oils are also used with further chemical and heat treatment in the formulation of outside house paints. As a matter of fact, outside house paint has been formulated from 100 per cent improved soybean oil vehicles and has been found to show excellent weathering characteristics, very comparable to those obtained when using pure linseed oil vehicles. It should not be concluded, however, that soybean drying oils could completely substitute for or replace linseed oil, as it is generally agreed that such is not the case.

Dehydrated Castor Oil

Castor oil has had increasing industrial uses in recent years. Although dehydration of castor oil, which converts it into a drying oil, was first accomplished about 25 years ago, the process continued to be a laboratory phenomenon until about 1936, when it began to be produced on a commercial scale. Developments of its production and use was stimulated by the growing scarcity of tung oil, prior to and during World War II. Dehydrated castor oil has been found to be an especially satisfactory replacement for tung oil in the formulation of highly specialized baking varnishes, usually in combination with a synthetic resin. Another place where the non-yellowing characteristic of dehydrated castor oil is used to advantage is in the formulations of mill whites and of the highest types of interior enamels where color maintenance is often stressed.

Scientific research in connection with its use is continuing.

Perilla Oil

Another important oil is called perilla. Used in both paint and varnish making, it is a quick-drying oil and is weather resistant. Perilla is also obtained from the Orient in ordinary times although experiments have shown that it can be grown in the Southern United States.

Oiticica Oil

Then there is oiticica oil which is produced in Brazil. Practically unknown in this country until 1934, oiticica oil is being used in constantly increasing quantities. Obtained from the nut of the oiticica tree, the oil is used mostly in the manufacture of varnishes and enamels.

Fish Oil

Even the fish of the sea contribute a share toward the making of paint. Fish oils, mainly extracted from the menhaden, pilchard and sardine, are soft drying. The paint made with them is particularly satisfactory for covering smoke stacks or other hot surfaces where a hard-drying paint would not be suitable. After treatment to remove the soft-drying components, fish oil becomes important for other uses.

NOTE ON REPLACEMENT OIL

Replacement oil, described by some as more a reducing liquid than an oil, was developed toward the end of World War II as the result of a War Production Board Order limiting the paint industry's quota of linseed (and other) oil, because oils were acutely scarce and much of the available material was needed as foodstuff in various nations. The crisis confronted by the paint industry was: (1) to make less paint; (2) to find replacements, or (3) to spread the allotment of oil more broadly over normal production. The paint industry chose the latter course, and formulas were worked out by which the percentages of raw linseed oil were decreased and the percentages of heat-bodied linseed oil were increased and likewise the percentages of thinner and drier. Adjustments in pigment content were also made.

A simple explanation of how this oil conservation measure worked may be had in the following comment on a United States Army Engineer Corps specification for a house paint. This specification called for a pigment content of 64 per cent and a vehicle content of 36 per cent. The vehicle was divided as follows: raw oil, 83 per cent; bodied oil, 5 per cent; thinner, 12 per cent.

By changing the raw oil to 33⅓ per cent, increasing the bodied oil to 33⅓ per cent and the thinner and drier to 33⅓ per cent, an oil saving of 26.3 per cent was effected. Other formulas gave even larger savings of oil.

Paints were made with the usual mixtures of lead, zinc and titanium and proved to be highly serviceable materials.

Section IV: Thinners and Solvents

Thinners and solvents are used to make the combination of pigment and oil easier to apply. The material is classed as a thinner when it is employed in a paint with a liquid binder or vehicle (oils) and as a solvent when the binder is a solid, such

as resins in varnishes. Thinners are volatile, which means that on exposure they evaporate quickly, some more rapidly than others. They have no film-forming properties. The principal thinners are listed here:

1. TURPENTINE

Turpentine has been known and used since the time of the ancient Egyptians. It was produced by the French in this country as far back as 1606 and was one of the first export products of the Jamestown Colony in Virginia. The Federal Naval Stores Act lists four classifications. Turpentine is classed as a Naval Stores item, because the gums, resins and other products of the pine have been used in the maritime industry for many centuries. The classifications are:

a. Gum Spirits of Turpentine, which is obtained from the living pine trees in the Southern states. The tree trunks are slashed with special knives and a substance termed oleo-resin oozes from the wounds and is collected in cups which hang just beneath the slashed spot. The crude gum thus obtained is often dirtied up with barks, twigs, etc. It is hauled in barrels to a large copper still, where water is added to the sticky oleo-resinous mass and the distilling process begins. In the old-fashioned stills, wood fires were used but more modern stills are gradually being introduced. The results are the same: the liquid turpentine is obtained by the distillation; the residue becomes the rosin of commerce.

b. Steam Distilled Wood Turpentine. Pine wood stumps are ground up and the turpentine is produced by live steam being turned on the pieces. Steam distilled wood turpentine is used in paint and varnish products in the same way and for the same purpose as the gum spirits.

c. Destructively Distilled Wood Turpentine. In this process, the ground up stumps are roasted in stills. The vapor given off

is condensed and turpentine and other products are obtained from the liquids.

d. Sulphate Wood Turpentine. This is extracted from the crude waste liquor of paper mills, which use pine pulpwood. It is the strongest of the turpentines in solvent power, but has a more pungent odor than the other turpentines.

2. MINERAL SPIRITS AND V. M. & P. NAPHTHA

Mineral Spirits and Varnish Maker's and Painter's Naphtha (the initials are always used) are petroleum products intermediate between kerosene and gasoline. Some naphthas evaporate more slowly than turpentine and others much faster. There is a great variety of these products.

3. BENZOL AND SOLVENT NAPHTHA

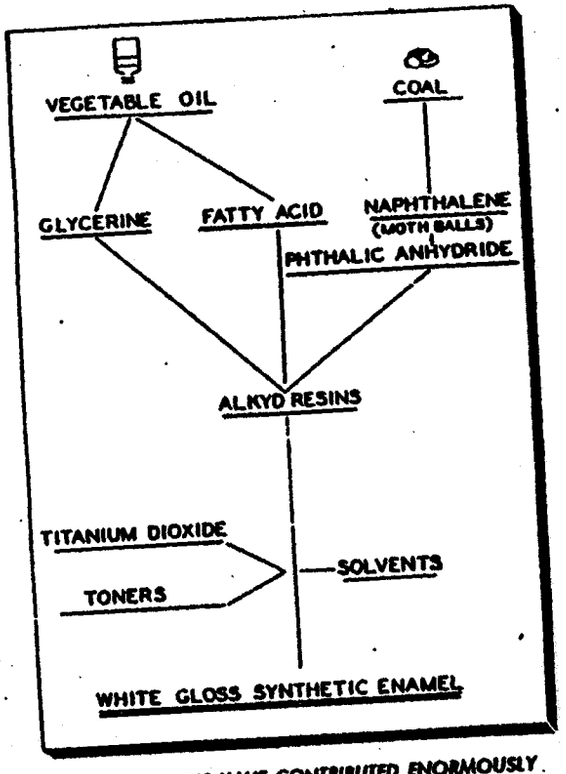
Solvent naphtha is distilled from coal tar and is used chiefly to dissolve gums and resins. A pint to a gallon of paint is sometimes recommended when painting a highly resinous surface in order to soften the pitch or gum.

4. BENZINE

This is a petroleum solvent and is not popular as a paint thinner except for spray application as it does not allow the paint to spread easily, and also it works short, because of its quick evaporation, which also causes brush marks and other defects. It can be used as a brush cleaner.

Section V. Driers

Driers are used in many types of coatings to hasten the drying of the film by promoting absorption of the oxygen. Particular driers for particular purposes are determined by the manufacturer in accordance with specific formulas; their excessive use can easily ruin a paint coating.



ALKYD RESINS HAVE CONTRIBUTED ENORMOUSLY to paint industry progress in recent years. This diagram shows their component parts, one of which is the almost miraculous chemical known as Phthalic Anhydride.

This was a development of a Swiss discovery of a hundred years ago, which resulted in the production by an American of celluloid products. Do you recall the celluloid collars that men used to wear? And other celluloid items? These were but the forerunners of the modern plastics, based on synthetic resins.

Without any doubt, the most important development in the paint and painting industries in recent years has been the perfection and extensive use of resins known as Alkyds. Many authorities writing on the subject call it the Alkyd Revolution. Vital ingredient in an Alkyd Resin is Phthalic Anhydride, that miraculous chemical to which reference was made in the Introduction. Phthalic Anhydride is a white powder, made from Naphthalene (known to you and all others in its familiar form of moth balls) and plain, ordinary air that we breathe.

Its versatility is almost beyond belief. When reacted with wood alcohol it makes a mosquito repellant, vast quantities of which were shipped to our forces in the jungles in World War II, to protect the men against malarial mosquitoes; just why it was effective against mosquitos is not known but the insects will not come within six inches of it . . . it is a basic ingredient of the phthalocyanine blue of which we have made mention as being the greatest color development in 200 years . . . it is first cousin to the chemical compound known as Phenolphthalein, which is not only the principal ingredient of commercial laxatives but which for years has been known in the chemical industry for its extreme sensitivity to alkali. Old-time journeymen applied it to plaster walls to determine the presence of alkali.

Also, Phthalic Anhydride was an essential component in the production of non-flash smokeless powder.

Now the Phthalic resins are being employed in peacetime uses, and their use in what the chemists call their true and modified forms is resulting in the production of a wide range

of highly satisfactory finishes. At first, Alkyd vehicles had to be sprayed and required baking at high temperatures in order to dry; also they required extremely strong solvents such as alcohol, xylol, etc. New methods have been found, however, to produce Alkyd resin varnishes so that they will brush and air-dry in a normal manner and at the same time permit reduction with turpentine or mineral spirits without loss of their remarkable properties.

There are approximately thirty types of synthetic resins now in use in the protective coatings industry, most of them in what we call specialized products finishing—which means everything from the tiniest to the biggest items of everyday necessity made and sold to the American public. One of the most widely used is made from Phenols . . . which are simply forms of carbolic acid. Another is based on Formaldehyde, that smelly disinfectant which has been known to housewives for many years. Its combination with a crystalline substance called Urea, or with melamine, produces a really remarkable synthetic. What is Urea? Well, for one thing it is the principal solid substance in the urine of men and animals.

Vinyl resins are rapidly coming to the fore, and their development possibilities are beyond ordinary imagination, according to the scientists of the paint, chemical and oil world. Newer finishes based on Vinyl resins are used principally for industrial work and product finishing. However, the painting contractor may occasionally find use for this type of paint or enamel in finishing certain parts of an industrial plant where very high resistance to moisture, acid, alkali or other chemicals is required.

Silicone resins are among the new-comers which are being studied and developed, with predictions for extraordinary future uses. Silica practically-speaking is nothing but regular beach sand and when it is combined with carbon you have the basis for the resin which, according to the authorities, has heat-

resisting properties far exceeding anything previously known in paints; it also has value as an insulation against electric current. Panels coated with this material have been baked at a temperature of 600 degrees Fahrenheit for many days with little or no color change taking place. In view of these two factors and the abundance of supply of the basic ingredient, sand, the future of Silicone Resins is definitely assured.

Chlorinated rubber, mentioned later in connection with rubber based paints, is also classed as a synthetic.

Of course, in the production of coatings based on these Synthetic Resins the marked advances noted with regard to soybean oil and dehydrated castor oil have played an important part. Glycerine, a widely-known by-product of soap-making, is also an essential.

It may be guessed that the production of these Synthetic Resins requires considerable scientific and technical skill, and yet there should be nothing mysterious about them. They are simply the brain-child of research chemists who have spent years studying paint industry needs and in so doing have improved on Nature's way of doing things.

Chapter Three

TYPES OF SURFACE APPEARANCE

PAINTS made from the pigments, vehicles and thinners listed in Chapter One preceding dry on the surface to produce three different types of surface appearance, in accordance with the manner in which they are compounded. The names of these

types are common knowledge in the painting industry. They are: (1) Flat. (2) Semi-gloss, or eggshell. (3) Gloss.

Flat is about what you would imagine from the name itself; a finish that is formulated to give a lustreless coating. *Gloss* is characterized by the high sheen which it gives to the surface. *Semi-gloss* is, of course, something between the two. As previously stated, these finish appearances depend on the proportions of the materials used. The white pigments have no properties within themselves to produce gloss. Linseed oil paints and most varnishes dry with a gloss, but added turpentine cuts it down. A full *Gloss* paint would result from using about one-fifth turpentine and four-fifths linseed oil, while a *Flat* would come from adding to the pigment one-fourth linseed oil and three-fourths turpentine.

Enamels, also, generally dry with a gloss finish—although there are semi-gloss and flat products as well—and this fact brings up a most interesting question that has often been asked: "What is the difference between the word *enamel* and the word *gloss*?" Strictly speaking, there is no comparison between the two words although it is admitted that industry practice in labelling and descriptive matter has caused some confusion. Here are two definitions which could be the subject of further discussion:

1. **Enamel.** An enamel is a specific type of coating. It is a pigment plus a varnish vehicle. For exterior enamel the vehicle is of course a longer one—a water-resistant spar varnish instead of an interior varnish. The quick-drying enamels on the market have a synthetic resin base. Pigmentation varies with the purpose for which the enamel is intended—outside or inside—and on the matter of grade. (See Section on Enamels.)

2. **Gloss.** "Gloss is the ability of a surface to reflect light regularly". That is a quotation from Dr. Henry A. Gardner in his standard work on "Paints, Varnishes, Lacquers and Colors".

Thus, whereas the word "enamel" denotes a type of paint, the word "gloss" denotes a characteristic of appearance. This is said strictly from the word interpretation point of view and not from paint industry practice.

Although the dictionary defines gloss as "brightness or luster of a body proceeding from a smooth surface" there is another and older definition which tells you that "gloss" is a difficult word needing explanation or definition of meaning. This is from the ancient Greek and the "Greeks always have a word for it."

Dr. Gardner further states: "The gloss or luster of a painted surface is usually measured qualitatively by observing how good a mirror the particular surface may be. The results are reported as glossy, semi-glossy, matt, etc. The difficulties in making such reports objective so that the results of an examination by one operator may be compared mathematically with those of another are apparent. There are many points on which differences of opinion on gloss can originate.

"Gloss is intimately tied in with surface appearance, in that some of the characteristics of appearance are appreciated as gloss and some are appreciated as surface texture. The dividing line between gloss and surface texture is not definite, but depends upon the judgment and experience of persons who examine and rate these qualities."

Paint scientists and technicians have spent many years in the study of gloss in its strictest definition and machines and methods have been perfected to measure the gloss of materials.

Despite the statement we have made that "enamel" is a type and "gloss" is the capacity for light reflection, there is no denying the fact that industry labelling and advertising practices have grown to the point where "gloss paint" and "semi-gloss paint" must be recognized as types.

This is understandable because light reflection has come to be a talking point in paint selling and formulations of house

paints both for the exterior and interior have been arranged to give the appearance values most readily describable as "gloss," "semi-gloss", etc. The manner in which these surface characteristics are obtained is one of formulation, particularly in the vehicle, as noted above, and it is quite true that in some of the lower grades of interior enamels, where extenders and lower grade varnishes are used, there is a great similarity in composition to second-grade gloss wall paints.

Glosses and enamels can be readily identified only by knowledge of the pigment-vehicle relationship in the several classifications and by reliance on the reputation of the manufacturer whose material is used.

Chapter Four

MODERN PAINT FORMULATIONS

TIME was when journeymen painters and painting apprentices learning their trade in shops worked only with a single white pigment, a single drying oil and a single thinner. "Breaking up" heavy white lead was the beginning of every job and it was indeed a back-breaking, arm-tiring process. Oil and thinner and drier were laboriously stirred in, largely in accordance with memorized and fixed formulas for varying types of work.

But times have changed: White lead, still retaining its long-established properties of whiteness and durability, is used in appreciable volume by the painting industry as an exterior white, but it is now supplied to the trade in paste and semi-paste form to enable the journeyman to use it without loss of time in reducing it to painting consistency, and it is also available in ready to use form. The paste and semi-paste types are

reduced to brushing consistency by stirring in additional oil, driers and thinner and they may be tinted with colors in oil to any desired shade.

It is imperative for the best results to follows the directions of the manufacturer exactly in the reducing process, for the reason that following directions will yield a finished paint of the most favorable pigment volume ratio which is essential to good durability.

The vital importance of this pigment volume ratio is fully explained in the section immediately following, which is devoted to a discussion of the formulation of exterior white paints of the ready mixed or paste type, showing the development of what the chemists term "multi-pigmentation" and revealing the scientific balancing of all ingredients to produce materials of desirable characteristics. It is this balance which must be preserved if best results are to be obtained on the finished job.

Section I: Exterior Formulas

Modern exterior paints are either paste and semi-paste paints or ready mixed paints used by the painting contractor and purchased from reputable paint manufacturers. These paints are not mere mixtures but are products representing many years of research and development by paint chemists as noted in the introduction to this Book. Before they are placed on the market extensive field tests are conducted by the technical staff of the company developing the product. They are made with scientifically designed equipment. To get the best results with such a paint, it is imperative that the paint be used in accordance with the directions on the container, particularly with respect to reducing with oil or adding thinner.

The older ready mixed paints which were most successful were lead and zinc paints, so called from the fact that the prime

white pigments used were white lead and zinc oxide. A typical lead-zinc paint is represented by the following formula:

Ready Mixed Lead-Zinc Paint (100 gallon batch)

	Gals.	Lbs.	Per Cent
Basic Carbonate White Lead	9.95	563	32.8
Zinc Oxide	9.50	452	26.2
Magnesium Silicate	4.76	112	6.7
Refined Linseed Oil	53.50	415	24.3
Bodied Linseed Oil	6.00	48	2.9
Japan Drier (lead-manganese)	2.60	19	1.2
Mineral Spirits	15.69	102	5.9
Total	102.00	1,711	100.
Loss	2.00		
Yield	100.00		

Pigment volume 29%

This type of paint is still used somewhat to-day as a white base for making tinted colors such as grays and buffs, and as a second line paint. However, the most modern ready mixed paints and paste paints contain titanium dioxide, typical formulas for which are shown below:

Pre-war Type Ready Mixed Outside White Paint (100 gallon batch)

	Gals.	Lbs.	Per Cent
Titanium Dioxide (Anatase)	3.58	116	7.6
Basic Carbonate White Lead	2.17	122	8.
35% Leaded Zinc Oxide	8.62	438	28.7
Magnesium Silicate	11.37	270	17.7
Refined Linseed Oil	59.10	458	30.
Bodied Linseed Oil	6.38	51	3.3
Japan Drier (lead-manganese)	2.62	20	1.3
Mineral Spirits	8.16	52	3.4
Total	102.00	1,527	100.
Loss	2.00		
Yield	100.00		

Pigment volume 29%

Current Type Ready Mixed Outside White Paint (100 gallon batch)

	Gals.	Lbs.	Per Cent
Titanium Dioxide (Anatase)	3.65	118	8.5
35% Leaded Zinc Oxide	7.45	378	27.2
Magnesium Silicate	11.50	273	19.7
Mica (water ground)	2.98	73	5.2
Refined Linseed Oil	24.40	184	13.1
Bodied Linseed Oil (light bodied)	23.30	184	13.1
Japan Drier (lead-manganese)	2.22	13	0.9
Mineral Spirits	26.50	172	12.3
Total	102.00	1,395	100.
Loss	2.00		
Yield	100.00		

Pigment volume 35%

"Master Painter's" Paste Paint, Outside White (100 gallon batch)

	Gals.	Lbs.	Per Cent
Titanium Dioxide (Anatase)	6.50	214.0	11.2
Basic Sulphate White Lead	4.35	232.0	12.2
Zinc Oxide	9.30	438.0	22.9
Magnesium Silicate	25.70	618.0	32.3
Refined Linseed Oil	23.10	179.0	9.4
Blown Linseed Oil	.53	4.4	0.2
Bodied Linseed Oil	9.60	76.0	4.
Japan Drier (lead-manganese)	1.72	13.0	0.7
Mineral Spirits	21.20	135.0	7.1
Total	102.00	1,909.4	100.
Loss	2.00		
Yield	100.00		

Such paints as are shown above are not products which a painting contractor could mix successfully. They are products made with modern manufacturing equipment and under careful laboratory control.

The difference between composition of a paint and formulation of a paint should be thoroughly understood by the student

Composition refers to what the paint contains—such as titanium dioxide, linseed oil, and the other ingredients. The composition is indicated on the label analysis found on the container.

Formulation, such as the formulas above illustrate, refers to the scientifically correct balance of the ingredients, and the choice of ingredients used, in order to produce a paint which will have the maximum desirable characteristics such as durability, freedom from dirt collection, self-cleaning properties, good color retention, and easy application properties. Formulation is the work of paint chemists with many years of study and experience backed by years of research on each product and elaborate scientific equipment.

Note that the above formulas are for white paints. Accordingly, titanium dioxide of the anatase crystalline structure is used because it chalks faster than the titanium dioxide of rutile crystalline structure. Refined linseed oil is used instead of raw oil to give better initial color when the paint is applied. If the above paints were to be used as white bases for tinting to such colors as buffs, creams, grays, and the like, titanium dioxide of the rutile crystalline structure would be used, and they could be made with raw oil instead of refined.

In outside white paints, the current practice is to replace part of the linseed oil in the formula with a chemically processed soybean oil. Indicated on the formulas is the per cent pigment volume. This is of tremendous importance in paint formulating and will be discussed below with respect to the importance of following the manufacturer's direction in application, as printed on the container label.

Some states require by law that the label on the paint container give an analysis indicating the composition of the paint in the container. It is well to remember that label analyses are written to comply with the minimum requirements of the law, and yet they do not reveal any more than is absolutely necessary regarding the formulation of the product. Accordingly,

a typical label analysis for a paint such as the current type ready mixed Outside White formula above would appear on the label somewhat as follows:

Pigment		60.3%
Titanium Dioxide	14.0%	
White Lead	15.8%	
Zinc Oxide	29.3%	
Silicious matter	40.9%	
	100.0%	
Vehicle		39.7%
Raw and processed vegetable drying oils	66.7%	
Driers and solvents	33.3%	
	100.0%	
Total		100.0%

A label analysis does, however, serve a useful purpose, provided you are sufficiently familiar with paint composition to interpret it. If you are aware that a first quality paint in so far as pigment composition is concerned should contain from 13 to 17 per cent of titanium dioxide and a lead-zinc combination totaling from 40 to 45 per cent, with silicate extenders, then you can determine from the label analysis on the container that in so far as the pigmentation is concerned you are getting a first quality product.

With respect to the vehicle portion, label analyses do not reveal anything with much certainty except to indicate when there is an excess of solvent or when the paint has been "soaped" up to give a lot of false body.

In using ready mixed or paste paints manufactured by paint companies, it is imperative that a journeyman follow to the letter the directions for use as printed on the can. These directions are not loosely set up, but represent the procedure which research studies have established will give the best durability performance of the paint job. Following directions is important from the business standpoint of customer satisfaction both with the paint itself and your work as a craftsman. It may be

said without hesitation that many men, because they do not follow the directions on the container but insist upon adding more oil and doing a mixing job on paint that is already mixed, ruin the quality and performance of thousands of gallons of perfectly good paint and bring upon themselves much dissatisfaction and ill will.

The key to this problem, and the chief reason why it is so imperative that the user follow the directions on the container is the matter of pigment volume referred to above and noted on the above formulas. The thinner in a paint, such as mineral spirits or turpentine, is volatile. After application of the paint, the thinner which was put into the paint in the first place only to dissolve the vehicle and reduce the viscosity to a workable and easy brushing consistency, evaporates, leaving on the surface the solid portion of the paint which is pigment and oil. Long years of research has established that a paint of the pre-war type gives its maximum long life and durability when the volume of pigment in the dried paint film is from 28 to 30 per cent of the volume of total paint in that film. Similarly, in the current type paints where less oil is used and a higher proportion of the oil has been chemically changed by heat bodying, the best durability and long life of the paint is obtained when the volume of pigments in the paint film is around 35 per cent of the total volume of paint solids.

When the first coat of paint is applied to an old surface, the directions usually call for the addition of one pint of oil per gallon of paint. This is done because the surface, being porous, will absorb some of the oil out of the paint and upset this desirable pigment volume ratio. The oil is added to allow for this absorption and still leave on the surface a coating wherein the oil and pigment volumes are in good balance. For the same reason, the directions usually call for application of the second and third coats *without* the addition of any oil, but allowing

the paint to be thinned somewhat with turpentine or mineral spirits if the painter wants to do so for easier brushing.

If oil is added to the second or third coats, it stays in the film and upsets this ratio of the volume of pigment to the volume of oil in the paint film. This makes the paint less durable and more impervious to water, therefore it won't last as long and will be much more apt to peel. These effects caused by a user's refusal to follow directions makes the customers dissatisfied with the work, and usually they tell other potential customers of their unsatisfactory experience.

Thinners may be added to the second or third coats if you feel it is necessary to make the paint brush and flow better, but only in moderate quantities. Never overthin a paint to make it go farther even though it still hides the surface. You will get a film that is too thin, and it will not last. Neither should you apply a film that is too heavy because it will not dry through properly, and will again not have good lasting properties. It is best practice to apply the paint with a good body, and brush it out well because you then get a practical film thickness.

Likewise, in using paste paints such as the "master painter's" product illustrated in the formula above, it is important to follow directions explicitly, using the exact amounts of oil, thinner and drier specified in the directions when reducing the paste to a finished, ready-to-use paint. When you do this, the finished paint then has the correct pigment volume percentage to give you and your customer the maximum in durability and other performance characteristics. Here again, to use more or less oil than specified will be detrimental and likely to cause peeling and premature failure of the paint film. The thinner can be varied somewhat, within reasonable limits, to suit your taste in ease of brushing and general working properties, but overthinning should be avoided because this will result in a too thin film and be apt to cause runs and sags in application, as well as poor durability.

Section II: White Pigment Bulking Values

The accompanying Table A lists the bulking value and the relative hiding power of the most important white and extender pigments used in exterior paints. The paint formulator uses the wet weight per gallon of pigment (pounds per gallon) or the wet bulking value (gallons per pound) in calculating the yield in the paint formula. He also uses it in figuring the important factor of pigment volume in making up the formula. The additional data on relative hiding power of the various white pigments referred to zinc oxide at an arbitrary figure of 100, simply indicates the relative power of different pigments to hide or cover a surface. It is to be noted that titanium dioxide is much more effective than any other white pigment.

Pigments in Group A are used in paints to make them hide the surface and give a good white appearance. When the paint film starts to fail after several years of service and exposure, paints made with certain pigments such as zinc oxide and lead fail initially by slight chalking and ultimately by checking and cracking. This gives a poor surface to repaint, making it necessary to do a lot of scraping and burning off of the old paint. Certain other pigments such as titanium dioxide pigments and lithopone fail by chalking and erosion of the paint film from the surface downward. Accordingly, in a good quality house paint, these pigments are scientifically balanced in proper combination so that the checking pigments are balanced by the chalking pigments. Then the formulation is moved slightly on the chalking side to make the paint self-cleaning and give the best color retention and freedom from dirt collection for the life of the paint.

Hence, a good properly formulated white house paint will look its dirtiest between a year and eighteen months after it

TABLE A: WHITE PIGMENT DATA

Paint Pigments, White	*Bulking Value*	*Wet Weight per Gal.*	*Relative Hiding Power*
A. Prime White Pigments (most important)			
Basic Carbonate White Lead	.0177	55.64	80
Basic Sulphate White Lead	.0182	54.98	60
Lithopone (28% ZnS)	.0279	35.82	135
Titanium Dioxide (Anatase)	.0308	32.49	500
Titanium Dioxide (Rutile)	.0285	35.10	650
Titanium-Calcium Pigment (30% TiO_2)	.0384	26.07	195
Titanium-Barium Pigment (30% TiO_2)	.0279	35.82	195
Zinc Oxide, Pure	.0212	47.06	100
Zinc Oxide, 35% Leaded	.0208	48.05	90
Zinc Sulphide, pure	.0300	33.32	260
B. Extender Pigments			
Barytes (barium sulphate)	.0270	37.07	None
China Clay (aluminum silicate)	.0462	21.66	None
Mica, water ground	.0413	24.19	None
Silica	.0453	22.07	None
Talc (magnesium silicate)	.0421	23.74	None
Whiting (calcium carbonate)	.0445	22.49	None

is applied. Then chalking begins. The rain washes off the chalk forming on the surface and carries the dirt with it, leaving a bright appearance. When the paint film eventually begins to fail and it is time to repaint, an excellent surface for repainting is presented, requiring a minimum of surface cleaning and preparation.

Pigments in Group B are inert pigments which have essentially no hiding power, but are used to build up the pigment volume of a house paint to give maximum durability to the film, and make the paint film sufficiently porous so that moisture from inside the walls may pass through the film into the atmosphere without pushing off the paint film, causing failure by moisture peeling. However, no paint can be made to withstand abnormal moisture conditions caused by leaks or defective structural design.

Section III: Making Paste Paints

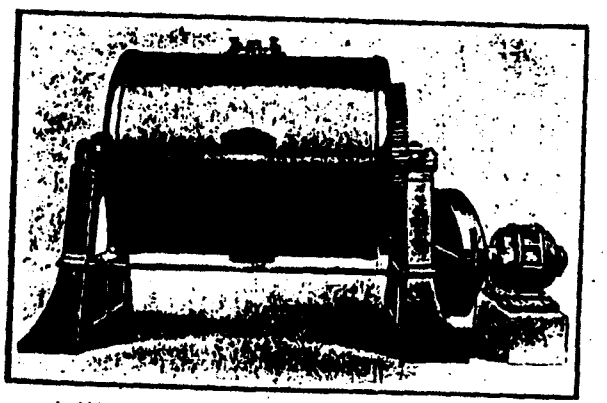
Paste paints are manufactured on a plant production basis by the operations of mixing, grinding, laboratory testing and packaging. The mixing involves loading a large power mixer with the vehicle composed of oils and some solvents to which are added the pigments in the formula, and the mixer is allowed to run until a smooth paste is formed. This paste is then ground on a roller mill or a burr stone mill, where a special shearing action of the mill breaks up the pigment agglomerates and disperses the small pigment particles in the vehicle. (See "Enamels", Chapter Five, for mill description.) The production of ready mixed paints is accomplished by charging a similar paste, called a mill base, into a mixer in which the pigments and part of the oils are used. This is ground on stone, roller, or high speed carborundum mills and discharged into a mixing tank where the remainder of the oils, driers and thinners are added and the batch mechanically agitated until uniform. These mixing tanks vary in size from small portable tanks to stationary tanks of 1,000 to 2,000 gallons capacity, depending upon the size of the batch desired and the size of the plant.

In the mixing tanks, constantly stirred by agitators, the batch is shaded to match a certain color standard. On large batches, the mixing and grinding operations are frequently done in a ball or pebble mill, which is a large cylinder containing steel balls or flint pebbles. Manufactured silicious pebbles are also used. These balls or pebbles cascade when the cylinder drum is rotated, exerting a pounding action against the side of the mill and against each other, breaking up the pigment agglomerates and dispersing the pigment particles in the vehicle. When ground to proper fineness, the mill base is discharged into a mixing tank.

After the batch, regardless of size, is shaded, a sample is sent to the control laboratory where it is tested for fineness of grind, weight per gallon, viscosity, color, drying time, and a lot of other properties peculiar to each individual product. If the batch fails in any test, it is rejected by the laboratory and the deficiency must be corrected before it is approved on retesting. After the laboratory approves the batch, it may be put into containers, labeled, and shipped.

Flat Wall Finishes

The same general procedure of manufacture applies to flat wall finishes as to house paints, but the vehicle, instead of being oil and solvents, consists of special varnishes and resins.



A MODERN PEBBLE MILL USED FOR GRINDING AND mixing paint, as described in the accompanying section on manufacturing.

ester gum, maleic or phenolic resins, or any combination of these or of hundreds of special alkyd or rosin modified materials. The plasticizers may be alkyd resins, esters such as dibutyl phthalate, tricresyl phosphate, diethyl sebacate, or any of a host of other esters or miscellaneous materials such as chlorinated diphenyls.

The solutions of solid materials are then let down with carefully balanced solvent combinations made up of alcohols, esters, ketones, and naphthas to give the correct evaporation rate, solubility, viscosity, and application performance. Lacquers are usually pigmented by grinding in ball mills, or by special roller mill lacquer chip processes. Many small lacquer manufacturers buy their pigments already ground by companies which specialize in lacquer pigment dispersion. The pigments are ground in a selected part of the liquid, with the other materials then added to the ground mill base; and the finished lacquer, laboratory tested, packaged, and shipped. Finishes based on vinyl or acrylic resins, are also usually of the lacquer type of formulation, but contain no cellulose. Lacquers are low in solids content and require several coats to give a film thickness equivalent to a varnish or enamel coat.

Section VI: Shellac

Shellac is an exceedingly useful material, employed variously as a sealer and finish for floors, as a sealer and liquid filler on trim and furniture and under varnish finishes, for sealing knots and sap in wood and for touching up "hot spots" in plaster. For the latter purpose, a 4-pound cut is used. Shellac's natural color is amber and in this state it is known as orange shellac; for the white shellac of commerce this is bleached.

Shellac is derived from a resinous substance called "lac," deposited on trees by an insect native to India. After the dirt is removed, the lac is prepared in the form of thin flakes or shells to give shellac, which are dissolved in alcohol to form shellac varnish.

While paint chemists have worked miracles in devising new formulas of all kinds, they have, as yet, been unable to duplicate this resin synthetically. To-day the lac bug of India continues to be the only source of material for the manufacture of shellac.

Section VII: Aluminum Paints

Aluminum paint has been in use for many years in both the industrial and home markets. Recently improved aluminum pigments, plus better methods of combining the vehicle with the paste or powder, have enabled paint manufacturers to produce a ready-mixed paint which is easier to mix and apply and gives more uniform results.

Aluminum paints are well established for their protective weatherproofing and waterproofing tendencies and most applications can be covered satisfactorily by one of three types. Aluminum house paint is for weather-exposed wood. Aluminum metal and masonry paint is best suited for hard surfaces such as metal roofs, silos, machinery, and the like. Aluminum enamel imparts an especially high gloss to inside decorative applications as well as being highly heat reflective.

One of the newest developments is a mixture of aluminum powder or paste with a black asphalt varnish for use on roofs.

Section VIII: Metal Protective Paints

Paint industry progress in solving problems of corrosion of steel and non-ferrous metals has been marked in recent years and fine protective coatings of this type are now available.

Paint chemists in their studies have found that the fundamental factors in corrosion resistance in addition to film durability are moisture resistance, chemical resistance and presence of an inhibiting pigment. Moisture resistance in wood protective coatings has long been a desired consideration, and in the matter of metal surfaces it is even more vital, because all metal has a molecular film of moisture which must be overcome. Since no organic coatings are 100 per cent moisture-proof, there is an initial alkaline reaction which can only be met by applying primers of proved chemical resistance. Metal protective primers and paints must also have the chemical resistance properties necessary to all atmospheric conditions, fumes, acids and other corrosive chemicals.

There are several types of metal primers available: Dry red lead mixed in linseed oil; sublimed blue lead; zinc oxide and iron oxide; zinc dust and zinc oxide; zinc dust, zinc oxide and iron oxide; zinc chromate (zinc yellow); chrome orange. Studies in zinc chromate's inhibitive qualities have shown remarkable results in performance, and primers of zinc chromate and special synthetic varnishes are now in commercial supply. Zinc dust formulations are advocated for use on galvanized surfaces.

One or two coats of the metal primers are followed in modern practice by two or more coats of exterior paint, frequently a chemical-resistant enamel, aluminum powder or other pigments in the same vehicle as the primer.

Preparation of the surface before metal painting is a vital consideration, as it is in all painting operations, as failure to have a clean base is a definite cause of subsequent failure.

Section IX: Fire Retardant Paints

For many years, the paint industry has been experimenting with fire-retardant paints and they have now been perfected

to the point of real effectiveness. One type is largely based on antimony oxide, chlorinated rubber and other chlorinated compounds. When exposed to flame, the chlorine compounds in the coating evolve to smother the fire. Another type of fire-retardant paint includes zinc borates, and various types of phosphate compositions are also used. The action of these products is to seal the surface when exposed to heat, the fusion of the products forming a more or less glass-like coating which tends to prevent the flames from igniting the combustible areas beneath.

Section X: Luminous Coatings

Luminous paints, greatly improved during World War II, provide the painting industry with material permitting it to develop an almost magical type of decorative effect. With one type calling for use of ultraviolet—"black light"—bulbs and another requiring only ordinary illumination as a light source, they can be employed in the creation of unusual treatments in living, dining and game rooms; and certainly they will have a vogue for rooms where television sets are installed, from both a practical and decorative point of view. Decorations in formal patterns or fanciful figure murals will glow with a striking brilliance unobtainable in any other way. It is known that a luminous paint on a nursery wall will calm a child's fear of the dark, because of its gentle glow as the youngster drops off to sleep. Then, too, safety guides throughout the house become possible through painting bands or spots in certain hazardous areas, these "guides" remaining on the job long after lights are out.

The field for these comparatively new paints includes also the interior painting of motion picture theatres, night clubs and restaurants. While murals executed in luminous paints are important wall decorations, in many cases other simpler motifs such as bands, geometrical designs and stencil designs have

and (2) in recent years quite a number of products have come on the market which are sold as self-sealers, requiring no sizing or sealing. However, the size as now developed has a definite place in wall preparation, especially, as noted, in hanging wallpapers and wall coatings.

Section III:

Special Vehicles: Reinforcing Oils

In recent years, paint chemists have developed a type of material known variously as special vehicles or reinforcing oils, which are compounded of treated drying oils and synthetic resins, which may be used by themselves for many purposes and also may be combined with other materials to produce a wide variety of finishes. Added to exterior paint mixtures, they afford extra toughness and water resistance; they may be used to give glossy qualities to interior flats or in the making of enamels in combination with special pigments; they may be used straight as a heavy duty varnish and in floor finishing; and they may be incorporated in various types of white and colored finishes to increase spreading, hiding and weather resistance.

Lead Mixing and Flatting Oils

These are special oils for use as flatting, sealing and waterproofing vehicles for white lead paste paints.

Section IV: Paint and Varnish Removers

The paint industry sought for years to develop a solvent paint and varnish remover before the present day materials were perfected. There are now several types employed in

industrial plants, but these will not be described here. The type of remover most generally used in the commercial painting field is based on mixed solvents and comes in liquid form for use on horizontal surfaces and as a semi-paste for vertical and overhead surfaces. This mixture is applied to the surface with a brush and allowed to stand, in accordance with the manufacturer's directions—ten to twenty minutes. When the paint or varnish is soft, it is scraped off with a putty knife or steel scraper, or rubbed with steel wool.

This type of material is toxic and contains highly inflammable materials, so it should be used with caution against open flames and with due regard to full ventilation. Also, in using a scraper or knife, avoid striking an exposed nail head in such a way as to create a spark. There are non-inflammable removers on the market for use where the need is imperative.

Many removers contain paraffin wax and this must be thoroughly washed from the surface with turpentine or benzine if the paint coatings later applied are not to be affected.

For removing shellac coatings, only denatured alcohol is effective and sometimes even this does not produce results. If alcohol won't remove it, try an alkaline remover.

The solvent materials used in the paint and varnish removers mentioned above are closely related to the brush cleaning fluids discussed in the Section on Cleaning Brushes.

(For further data on Removers, refer to Book Three, Chapter Nine.)

Section V:

Spactling Compounds, Putty, Etc.

In addition to the surface preparation discussed in the Section on Primers and elsewhere, it is highly important that all cracks, nail holes, dents and depressions be filled if the com-

for smoothing and polishing surfaces. It is sold in numbered gradations of one-half—from 8-000 to number 3—according to the size of the abrasive coating. The larger the number the coarser the cutting surface. There are two types, viz.: Wet and Dry, the former being used with water for faster cutting purposes, the latter type is used dry.

Emery cloth is similar to sandpaper except it is finer and the abrasive coating is applied to cloth instead of paper.

Steel wool (steel shavings) is also used for cleaning and polishing. It comes in various sizes or grades from very fine to coarse and is sold in packages of one and five pounds.

In using any of these abrasive materials, it is advisable to move it on the surface with the grain of the wood. Moving across the grain will cause cuts and scratches which are hard to remove and which will be likely to cause an unsatisfactory job.

Machine sanding and hand scraping are seldom done by the painter, this being part of the carpenter's work. However, the painter may find it necessary to do some hand sanding in preparation for his work, as well as sanding between coats of various materials.

Masking Tapes

In addition to the standard types of masking tapes, there are new plastic liquids which are applied with a brush to the area to be protected, and dry quickly to a hard film. After the sash, for example, has been painted, the plastic coating is stripped off and with it comes the unwanted paint.

Miscellaneous Equipment

Included in the standard essentials for work in a paint shop or out on the job are wire brushes, sponges, wiping rags, cheese cloth, felt rubbing pads, mixing tubs, paint pots, pot hooks, mixing paddles, paint strainers; also a few simple tools such as a hammer, screw driver, and pliers.

Chapter Five

HEALTH: PERSONAL AND GENERAL

THE HEALTHY worker is a happy and efficient worker. That is now fully realized by all employees and employers, particularly in the hazardous industries where men are exposed to accidents and occupational diseases; it is the basis of modern enlightened procedure by medical men, insurance experts and industry leaders looking to the establishment of preventive medical care, regular health examinations, hospitalization, etc. As is the case with accidents, ill health causes individual suffering, family hardship and economic loss.

In the Chapter on "Ladders: Scaffolds: Rigging" we strongly emphasize the need for knowledge and care in using various types of off-the-ground equipment to prevent crippling and fatal falls.

This Chapter now considers the personal health phases of a painter's life: how he must keep himself in good general condition, learn to know the dangers of certain toxic (poisonous) materials and the precautions he must take in handling inflammable substances, to prevent burning himself and the starting of costly fires.

Safety and Health Codes of the several states should be studied and observed. The principal points which will be found incorporated in most such Codes are dealt with here.

Personal Health Measures

Journeymen painters should eat good substantial meals, especially at breakfast before going to work. Food gives energy.

Sleep eight hours a day with open windows.

Never eat or sleep without washing hands, face and mouth.

Never eat or sleep in a freshly painted room.

Never drink water that has been standing in a room where there are paints or in a freshly painted room.

Take a hot bath often and wash the teeth night and morning.

Never wash your hands in turpentine, as it relaxes the muscles and affects the joints.

Avoid alcohol. Drink lots of water and milk.

Keep your system clean; see that the bowels move once a day.

Insist on good working conditions: an unventilated room is a hazard . . . workers should not be called on to use dirty or unsanitary waste as rags . . . drop cloths should be clean and free from dust . . . wear a cap, overalls and jumper while at work . . . clean overalls should be available once a week . . . . Do not spit in a room where you are working and request others not to do so.

Never allow dirt to accumulate under your finger nails.

Never neglect a wound, cut or bruise. Have a first aid kit handy, containing iodine swabs, sterilized gauze, adhesive plaster and bandages.

Call a doctor if you are hurt, consult one if you feel ill.

Lead Absorption and Poisoning

Careful observance of the above Personal Health Measures, plus further precautions such as the exclusive use of the wet process in sandpapering lead-painted surfaces, are necessary requirements to avoid lead absorption into the system, with consequent possibility of poisoning. Burning off old lead paint indoors also may produce dust that will be inhaled.

Lead has long been known as one of a group of many metals with toxic (poisonous) properties but industry leaders feel that there has been a definite tendency to blame lead for almost any

condition that could not readily be explained otherwise. That statement is based on an address by Felix E. Wormser, at that time Secretary of the Lead Industries Association, at a "Conference on Lead Poisoning" presented at the seventh annual Congress on Industrial Health in 1946.

He also stated that "As a result of investigations which extend over a period of twenty years it is apparent to-day that despite the large amounts of lead used in everyday life (1) the lead hazard in industry and to the public is relatively small and can be effectively controlled when it cannot be entirely eliminated, and (2) it is not difficult but it requires careful work to determine whether or not a person has been leaded".

Dr. May R. Mayers of New York, another speaker at the Conference, listed these three principal characteristics in lead poisoning:

(1) A group having predominantly gastroenteric (stomach) disturbances including lead cholic; (2) one having predominantly neuromuscular disturbances including peripheral neuritis and wrist drop, and (3) one characterized by disturbances of the central nervous system. Dr. Mayers further pointed out the importance of distinguishing between lead "absorption" and lead "poisoning", saying:

" 'Lead absorption' actually means nothing more than the absorption of lead into the body. It implies nothing as regards toxicity. When lead absorption is sufficiently great, however, to disturb the person's sense of well-being, i.e., when lead absorption reaches the stage of toxicity, it results in true 'lead poisoning'. Such a worker does not have to have the characteristic symptoms brought to his attention by careful history taking. He complains of troublesome symptoms which interfere with his sense of well-bring and for which he seeks relief. 'Lead poisoning' is thus the toxic stage of lead absorption."

The paint industry is the third largest user of lead but speakers at the Conference pointed out that because of in-

creasingly effective methods of control the incidence of serious occupational lead poisoning is declining.

Therefore, as pointed out above, proper personal precaution will go a long way in enabling painters to avoid potential ill health from this source.

Protection From Acids

Where painters use acids diluted with less than 50 per cent of water, acid-resisting gloves should be worn.

Acids of all kinds are more or less dangerous, especially in the hands of the inexperienced person. If by chance acid gets on hands or body, first wash it off with plenty water. If the acid is on the hands, hold them under the faucet and allow the water to run over the burns. Then use a weak alkali solution, such as washing soda in water. A clean salve may then be used or applied. This remedy may be followed for all acid burns, but see a doctor as soon as possible.

Hydrofluoric acid, used by painters to etch and frost glass, will burn the flesh severely.

Nitric acid will burn wood and dissolve metal, and burn the flesh very seriously.

Mixing acids:—When two or more harmless acids are combined they may form a dangerous one. One safe rule is never to mix substances except by an approved formula, and do not try new things without the help of those who know what they are doing.

Caustics and potashes:—Some of these are very strong and dangerous to handle. Some will burn like red hot iron and the wound will be a long time healing. If you are burned with these substances, wash off at once with water and plenty of vinegar to neutralize the alkali in the potash.

Menace of Fumes

Fumes from oxalic acid, especially the dust from this acid,

are poisonous when inhaled. Always wipe up oxalic acid with a cloth saturated with benzine or turpentine.

Carbon bisulphide as used in some paint and varnish removers, can affect the painter quickly. When using remover, have doors and windows open and allow no smoking.

Collodion (new skin) pyroxylin is used to stop mahogany stains from coming through new paint. It contains 24 per cent alcohol and 75 per cent ether in it, so care should be used to protect both worker and property. Have plenty of air in the room and allow no fire or smoking.

Quick-drying paints, varnishes, enamels and lacquers contain powerful solvents and thinners, which evaporate readily, and working with them in a closed room would tend to produce headache, dizziness, nausea. Work with open windows and get out in the air if you feel ill.

Wood alcohol as used in varnish removers and shellac is, of course, a well-known poison.

Banana oil contains wood alcohol and benzol and should never be inhaled.

Carbon monoxide is deadly and cannot be detected by the sense of smell. It can be developed in a closed room where a salamander is being used to dry the walls.

Fire Hazards

Fire obviously is not only a personal danger but it is a menace to property, and carelessness can result in bodily injury and costly damage suits as well.

Learn how to respect the fire potentials of a blow torch, and observe all established safety rules in its use.

Have regard for the inflammability of certain paint and varnish removers, solvents, oils and turpentine. Keep them away from open flame and do not smoke near them.

Be most careful about discarded rags and waste soaked with inflammable materials. They can produce spontaneous combustion. Do not leave them in working clothes or in containers that will burn.

Keep floors clean and clear of debris.

Electrical Contacts

Journeymen painters should be most careful when they are at work in the vicinity of electrical installations, especially in industrial establishments where the current is frequently of high voltage. They may suffer slight or severe burns, or they may receive shocks which may cause them to fall from ladders or scaffolds with consequent serious injury. Particular care should be exercised while using wet sponges or steel wool near wiring or electric fixtures. The safest precaution is to make certain that the electric current is cut off during the course of painting operations.

Points in Review on Brushes, Equipment, Safety

1. *What was the largest natural bristle-producing country in the world prior to World War I?*
2. *How has the natural bristle supply situation changed in recent years?.*
3. *What are synthetic bristles?*
4. *What are the five essentials of good paint brushes?*
5. *What is meant by "flag end", "butt end", "chiseled edge", "taper", "lousy" with reference to brushes?*
6. *Can you name fifteen different styles of painters' brushes?*
7. *Is it necessary to break in a new brush?*
8. *Give half a dozen simple rules for caring for a brush.*

9. *Describe the standard procedure for cleaning paint and varnish brushes, and for calcimine and casein brushes.*
10. *Name the two major fields in which Spray Painting operations are used.*
11. *What are the several types of spray gun equipment and how do they operate?*
12. *Name half a dozen causes of failure and defects in connection with spray painting.*
13. *In using scaffolds, ladders and rigging, what are the most important factors to be considered?*
14. *Name the principal types of ladders and scaffolds used in painting operations.*
15. *Can you name the nine principal units used in the operation of a swing stage scaffold?*
16. *Describe the working of the "falls".*
17. *What are the three most common types of roofs that a painter must work on?*
18. *List ten essential factors in use of scaffolds.*
19. *What is the electronic moisture meter and why is it invaluable to every painter?*
20. *What are the personal health measures a painter should take?*
21. *Describe the latest theories on lead poisoning.*
22. *What is the menace from acids and fumes in painting?*

PREPARATORY WORK IN TWO SENSES OF THE WORD: THESE boys are students at the Isaac Delgado Training School in New Orleans, and they are preparing themselves for their professional careers in the painting and decorating industry by applying themselves to that most important operation—the proper preparation of the surface, without which any job will fail, whether it be on plaster, wood, metal or other types of structural material.

It is boys such as these who are so greatly needed to become journeymen painters and master craftsmen capable of carrying on in the centuries-old traditions of the painting and decorating industry.

Book Three

PAINTING SPECIFICATIONS: PRACTICAL PROCEDURE

Foreword

Books One and Two of this volume are devoted to (1) the composition and properties of the basic painting materials, (2) a classification of the types and "end uses" of the great variety of finish coatings and accessory products, (3) a descriptive analysis of the brushes, equipment, mechanical appliances and manual tools essential to the industry, and (4) a summary of the safety and health factors which should govern the everyday work of the men in the craft.

Book Three now deals with the practical application of the industry's materials and the proper use of tools and equipment in the execution of various types of exterior and interior jobs.

As part of its service to the American public, to the construction industry, to the architect and to its own members, the Painting and Decorating Contractors of America has issued from time to time a set of standard specifications, designed to prescribe painting procedure that will assure satisfaction to the American property owner through quality workmanship and the upholding of established traditions of the painting industry.

Because the responsible contractors who are members of the Painting and Decorating Contractors of America are fundamentally concerned with the proper training of painting apprentices and because they, in cooperation with the Brotherhood of Painters, Decorators and Paperhangers of America and the United States Government, have established vocational education standards for the new generation of craftsmen, it is deemed proper that the PDCA Standard Painting Specifications be incorporated in this Book as the framework on which to develop the lessons regarding practical application of painting materials.

The PDCA Standard Specifications, with supplementary comment, are given below.

Chapter One

PREPARATION OF THE SURFACE

COMPLETE and adequate preparation of the surface in a painting job is the mark of the professional. It is vitally essential, whether the work be on wood, plaster, metal or masonry . . . inside or outside. To conform to this truth means the execution of a successful, satisfactory job; to ignore it means certain trouble. Often, preparatory work seems trivial, unnecessary, a bit of a nuisance which can be avoided, but experience has proven that this is an utterly wrong attitude.

The sections of the Standard Painting Specifications prepared and approved by the Painting and Decorating Contractors of America dealing with this phase of work, and related aspects, are as follows:

Conditions of the Surface

On new work, the Painting Contractor is to receive the surface to be painted or otherwise treated by him, free from foreign

matter such as concrete, plaster, grease, etc., caused by other crafts, and shall only be required to do a nominal amount of sandpapering and cleaning before proceeding with his work.

Foreign matter shall be removed by the craft responsible for its presence, and the surface made acceptable to the Painting Contractor and the Architect's Inspector or Owner's Representative.

Materials

All materials to be used under this section of the Contract shall be the brand and quality specified and shall be delivered at the building in the original containers, with labels intact and seals unbroken.

All tinting and mixing required shall be done at the factory or on the premises when possible, and no materials are to be reduced or changed except as specified by manufacturer of said materials. All tinting and matching of colors shall be done to the satisfaction of the Architect, and in cases where samples are required, they shall be executed on the job. The Painting Contractor is to include a charge for a reasonable amount of time for this service. The Architect is to approve all colors before application of materials.

All materials, except as otherwise specified, shall be of the "best grade" or "first line" paint made by reputable, recognized paint manufacturers, approved by the Architect.

Workmanship

All work shall be done by skilled mechanics in a workmanlike manner. All paints, stains, varnishes, etc., must be smoothly and evenly spread on or flowed on, and shall be free from runs, sags, crawling, or other defects. All painting shall be done

under favorable weather conditions, or conditions suitable for the production of good, durable work.

No succeeding coats shall be applied until the preceding coat is thoroughly dry. As a precautionary measure against an excessive amount of alkali in the plastered surfaces, the Architect may specify, under Parts II and III of these specifications, a wash coat of two pounds of zinc sulfate to each gallon of water, to which is added a small amount of phenolphthalein in order to detect lime spots.

PREPARATORY WORK (New Work)

No priming of wood shall be done on or in buildings while plaster is being applied or in process of drying. On new work, all knots and sappy places shall be coated with liquid shellac (not over two-pound cut) after the priming coat has been applied and becomes dry. In case of two-coat work, apply shellac before the priming coat. A thin coat of aluminum varnish may be used instead of shellac.

All greasy and oily metal surfaces to be painted shall be cleaned with benzine or mineral spirits before any paint is applied. All new galvanized metal surfaces shall be treated with a solution made by adding eight ounces of either copper acetate or copper sulphate to one gallon of warm water in an earthenware or glass vessel, or with a proprietary etching liquid. The solution is to be applied with a brush, and allowed to dry on the surface before proceeding with the priming coat.

The Painting Contractor may use the following alternate treatment: all galvanized surfaces shall be washed with benzine or mineral spirits to remove the film of oil or other foreign matter, and a coat of zinc dust—zinc oxide, or other standard prepared galvanized primer, red or blue lead made especially for this purpose, applied.

No paint is to be applied to a metal surface in temperature below forty degrees Fahrenheit.

All necessary puttying of nail holes, cracks, open joints, and other defects shall be done after the priming or first coat is dry, and before the second coat is applied. The putty is to be a pure linseed oil-white lead-whiting putty, colored to match the finish coat. Putty made with substitute oils will not be acceptable.

At least twenty-four hours shall be allowed between the coats under most favorable conditions. All coats shall be of the proper consistency and well brushed out.

Where priming and back painting is a part of this Contract, it may be done at the mill, if same is located in the vicinity of the project.

PREPARATORY WORK (Old Work)

1. Wall Covering: When wall covering is specified, the Painting and Decorating Contractor shall do all necessary preparatory work such as sanding, ordinary minor plaster repairing, and sizing.

2. Exterior Woodwork: Remove all loose, scaly, or otherwise defective paint, using sandpaper and scrapers. If desired, the Architect may specify that all alligatored or otherwise defective paint shall be removed by burning off or using paint remover. Prime all bare wood. Putty all nail holes and other irregularities.

3. Interior Woodwork: Wash all glossy paint surfaces with a mild alkaline such as sal soda, trisodium phosphate, or sodium silicate, and rinse thoroughly. Remove all loose, blistered, or otherwise defective paint. Putty, glaze, or spackle out all cracks and other minor irregularities. Sand down thoroughly and prime all bare wood.

4. Plaster Surfaces: Wash all glossy surfaces with a mild alkaline such as sal soda, trisodium phosphate, or sodium silicate, and rinse thoroughly. Remove all loose, blistered, or otherwise defective paint, and smooth edges by sanding. Cut out and properly fill all plaster cracks with patching plaster, spackle, or Swedish putty. Glaze out all unevenness in plastering so that surface will be smooth. Prime all bare plaster.

5. Metal Surfaces: Remove all rust and defective paint film and touch up bare surfaces with an approved metal primer. Thoroughly clean all metal surfaces such as downspouts, gutters, flashings, roof decks, etc., of all accumulated dirt before proceeding with the painting.

Responsibility

The Painting Contractor shall be held responsible for the finishing of his work in the manner and form prescribed by the Architect, and he shall not be required to begin any part of the job on surfaces that are not in condition to receive application of materials.

The Painting Contractor shall not be held responsible for the finishing of work when the surfaces have been inspected by the Architect or his Inspector, and passed on by him to the Painting Contractor to proceed with his work in accordance with the specifications. Neither shall he be responsible for undulations or other defects in plaster surfaces not apparent until exposed by the sheen of paint. Nor shall he be required to repaint, without additional compensation, plaster surfaces which are condemned after painting because of faulty plastering.

The final coat on interior trim shall not be applied until all other crafts are finished with their work, their material and debris removed, and the premises turned over to the Painting Contractor in broom-clean condition.

Protection

The Painting Contractor shall protect the work of all other trades against damage or injury by his employees, or by his materials, tools, or utensils used in connection with this Contract. Any damage done by him shall be repaired at his own expense, without any additional compensation beyond the Contract price.

The Painting Contractor shall not be held responsible for repairs to his own or other work made necessary by the defective workmanship or carelessness of other crafts.

Cleaning

Upon completion, the Painting Contractor shall remove from the building all materials and debris created by him, and leave his part of the work in a clean and finished condition acceptable to the Architect or the Owner. Washing and polishing of window glass, mirrors, etc., shall be done under separate contract, unless specifically mentioned in Parts II and III of these specifications.

Chapter Two

NEW EXTERIOR WORK

(PDCA Standard Specifications)

NOTE: All mixing, thinning, and application of material shall be done according to the manufacturer's directions for the particular material being used and surface being coated.

I. NEW EXTERIOR WOOD (Except Shingles)

Refer to Chapter One for preparatory work.

1. Ready Mixed Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed exterior house paint or a special exterior house primer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of ready mixed exterior house paint of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed exterior house paint of the desired color.

NOTE: Tint second coat slightly darker than the desired shade for the last coat. If so specified, the Painting Contractor shall caulk all window and door openings after the first coat is dry, and paint iron. Varnish all copper in contact with wood in order to prevent staining of the paint finish.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint.

b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: Lead and oil paint in these specifications refers to either soft or heavy paste type lead and linseed oil. Tint second coat slightly darker than the desired shade for the last coat. If a darker color than can be obtained by coloring white lead and oil is desired (such as brown, dark green, maroon, black, red, or other deep colors), specify ready mixed exterior house paint in place of lead and oil paint for the second and third coats. If so specified, the Painting Contractor shall caulk all window and door openings after the first coat is dry, and paint iron. Varnish all copper in contact with wood in order to prevent staining of the paint finish.

3. Stain and Varnish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of oil stain of the desired color.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of exterior spar varnish.

c. THIRD COAT: Same as b.

NOTE: If so specified, the Painting Contractor shall caulk all window and door openings after the first coat is dry, and paint iron. Varnish all copper in contact with wood in order to prevent staining of paint finish.

II. NEW EXTERIOR SHINGLES

Refer to Chapter One for preparatory work.

1. Stain

a. FIRST COAT: Dip shingles two-thirds their length in shingle stain of the desired color before the shingles are applied to roof or siding.

b. SECOND COAT: Apply a coat of shingle stain of the desired color after shingles are in place.

NOTE: In case it is desired to stain the shingles after they are applied to roof or sidings, the specifications should read:
"All shingled roofs and sidings specified to be stained shall receive two coats of shingle stain of the desired color".

2. Ready Mixed Oil Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed exterior house paint or a special exterior house primer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of ready mixed exterior house paint of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed exterior house paint of the desired color.

NOTE: Tint second coat slightly darker than the desired shade for the last coat. If so specified, the Painting Contractor shall caulk all window and door openings after the first coat is dry, and paint iron. Varnish all copper in contact with wood in order to prevent staining of the paint finish.

3. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint.

b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: Lead and oil paint in these specifications refers to either soft or heavy paste type lead and linseed oil. Tint second coat slightly darker than the desired shade for the last coat. If a darker color than can be obtained by coloring white lead and oil is desired (such as brown, dark green, maroon, black, red, or other deep colors), specify ready mixed exterior house paint in place of lead and oil paint for the second and third coats. If so specified, the Painting Contractor shall caulk all window and door openings after the first coat is dry, and paint iron. Varnish all copper in contact with wood in order to prevent staining of the paint finish.

If necessary to reduce first coat, omit second coat.

III. NEW EXTERIOR CONCRETE, BRICK, STUCCO, AND STONE (Except Floors)

Refer to Chapter One for preparatory work.

1. Ready Mixed Oil Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed exterior concrete, cement, and stucco oil paint.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of ready mixed exterior concrete, cement, and stucco oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed exterior concrete, cement, and stucco oil paint of the desired color.

NOTE: No concrete or brick surfaces less than six months old should be painted with an oil paint unless special preparation is made to take care of alkali and dampness, such as neutralizing the surface with a wash coat of two pounds of zinc sulphate to one gallon of water, and using a concrete primer especially made for this type of surface.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint.

b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: If a semi-gloss finish is desired on all concrete, brick, stucco, or stone surfaces, omit one gallon of linseed oil per hundred pounds of lead and substitute one gallon of exterior spar varnish for the last coat.

3. Clear Waterproofing Liquid

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of clear waterproofing liquid.

b. SECOND COAT: Same as a.

NOTE: For best results, spray on this material.

4. Water Thinned Paint

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of exterior cement-water paint of the desired color.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of exterior cement-water paint of the desired color.

NOTE: Use either brush or spray method of application. This paint should be factory tinted when possible. Thoroughly wet down all surfaces to receive water paint, but allow them to dry until only slightly damp before applying this material, unless manufacturer directs otherwise. For curing purposes, keep surfaces damp for several days after application of last coat.

5. Resin Oil Emulsion Paint

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of resin oil emulsion paint of the desired color.

b. SECOND COAT: Apply a finish coat of a best-grade manufactured brand of resin oil emulsion paint of the desired color.

NOTE: When resin oil emulsion paint is used, surfaces should not be wetted down prior to the application of material. Use either brush or spray method of application. This paint should be factory tinted when possible.

IV. NEW EXTERIOR CONCRETE OR CEMENT FLOORS

Refer to Chapter One for preparatory work.

1. Exterior Concrete Floor Enamel

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of exterior concrete floor paint.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of exterior concrete floor enamel of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of exterior concrete floor enamel of the desired color.

NOTE: Concrete floors less than six months old, or laid directly on dirt sub-floors, should not be painted. Use a moisture detector.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint.

b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: Note under IV. 1, is applicable to this finish.

3. Floor Dye

a. FIRST COAT: Apply a solution of 33% muriatic acid in water and rinse thoroughly.

b. SECOND COAT: Apply a coat of floor dye of the desired color.

c. THIRD COAT: Apply a coat of floor dressing of the same color as the dye.

d. FOURTH COAT: Apply a coat of floor wax of the same color as the dye.

NOTE: This floor treatment is preferable when concrete is laid directly on dirt. Use a moisture detector.

V. NEW EXTERIOR WOOD FLOORS

Refer to Chapter One for preparatory work.

1. Exterior Floor Enamel

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed porch and deck paint.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of ready mixed porch and deck enamel of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed porch and deck enamel of the desired color.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint.

b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color.

VI. NEW EXTERIOR STEEL SASH

Refer to Chapter One for preparatory work.

1. Ready Mixed Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed metal primer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of ready mixed metal paint of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed metal paint of the desired color.

NOTE: Spot paint all abraded surfaces before first coat is applied. If priming of steel sash has been done by others, omit first coat. The painter is to receive the steel sash thoroughly cleaned of all foreign matter, and the glazing putty true and straight.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of either red or blue lead and oil paint.

b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: Spot paint all abraded surfaces before first coat is applied. If priming of steel sash has been done by others, omit first coat. The painter is to receive the steel sash thoroughly cleaned of all foreign matter, and the glazing putty true and straight. If a darker color than can be obtained by coloring white lead and oil is desired (such as brown, dark green, maroon, black, red, etc.), specify ready mixed metal paint in place of lead and oil for the second and third coats.

VII. NEW EXTERIOR IRON AND STEEL: (Ornamental, Structural, and Miscellaneous)

Refer to Chapter One for preparatory work.

1. Ready Mixed Oil Paint

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of ready mixed metal primer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of ready mixed metal paint of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed metal paint of the desired color.

NOTE: Spot paint all abraded surfaces before first coat is applied. If priming of iron and steel has been done by others, omit first coat.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of either red or blue lead and oil paint.

b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: Spot paint all abraded surfaces before first coat is applied. If priming of iron and steel has been done by others, omit first coat. If a darker color than can be obtained by coloring white lead and oil is desired, (such as brown, dark green, maroon, black, red, etc.), specify ready mixed metal paint instead of lead and oil for the second and third coats.

VIII. NEW EXTERIOR GALVANIZED IRON

Refer to Chapter One for preparatory work.

1. Ready Mixed Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of paint of the zinc dust-zinc oxide type, or other galvanized iron primers made especially for that type of surface.

b. SECOND COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed metal paint of the desired color.

NOTE: Thoroughly clean all new galvanized iron with benzine or mineral spirits and wipe dry prior to the application of the first coat. For greater lasting qualities, use as few coats as possible to produce the desired color and covering.

IX. NEW EXTERIOR SHEET METAL (Siding, Roofs, etc.)

Refer to Chapter One for preparatory work.

1. Ready Mixed Oil Paint

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of ready mixed metal primer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of ready mixed metal paint of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed metal paint of the desired color.

NOTE: For best results, apply three thin coats, well brushed out. Spot paint all abraded surfaces before first coat is applied. If necessary to reduce first coat, omit second coat. If priming of sheet metal has been done by others, omit first coat. When painting oil tanks, etc., the use of aluminum paint or fume proof white paint for the last coat is preferable.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of either red or blue lead and oil paint.

b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: Note under IX. 1. is applicable to this finish.

Chapter Three

NEW INTERIOR WORK

(PDCA Standard Specifications)

NOTE: All mixing, thinning, and application of material shall be done according to the manufacturer's directions for the particular material being used and surface being coated.

I. NEW INTERIOR WOOD (Enamel Finish) (Enamel and Glaze Finish)

Refer to Chapter One for preparatory work.

1. Enamel Finish

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of interior wood primer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of enamel undercoat of the desired color.

c. THIRD COAT: Apply a coat composed of three parts best-grade manufactured brand of enamel undercoat and one part best-grade manufactured brand of enamel of the desired color.

d. FOURTH COAT: Apply a finish coat of a best-grade manufactured brand of enamel of the desired color and luster.

NOTE: If a five-coat enamel job is desired, the fifth coat should be the same as that specified for the fourth coat, and should be applied and flowed on within forty-eight hours (before the fourth coat is thoroughly dry and hard) so that the two coats of enamel will adhere and bind properly to each other. If a rub job is desired, rub the last coat with pumice stone and oil (or water) to the desired sheen. Sand each coat lightly with number 00 sandpaper, and clean free from dust before applying succeeding coats. Putty all nail holes and imperfections with white lead putty after the first coat is applied. If necessary to reduce first cost, omit third coat. If a dull gloss enamel job is desired without rubbing, the Architect should specify that the last coat of enamel be dull or eggshell gloss.

2. Enamel and Glaze Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of interior wood primer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of enamel undercoat of the desired color.

c. THIRD COAT: Apply a coat composed of equal parts of a best-grade manufactured brand of enamel undercoat and a best-grade manufactured brand of interior gloss enamel of the desired color.

d. FOURTH COAT: Apply a coat of a best-grade manufactured brand of glaze, in colors desired by the Architect; wiped, mottled, stippled, or blended to the desired effect. Do not apply the glaze until surface is thoroughly dry.

e. FIFTH COAT: Apply a coat of a best-grade manufactured brand of semi-gloss or flat varnish.

II. NEW INTERIOR WOOD (Stained and Varnished Finish)

Refer to Chapter One for preparatory work.

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of wood stain (oil, penetrating spirit, or water stain) of a type adaptable to the wood.

b. SECOND COAT: If open-grained wood, follow with a coat of a best-grade manufactured brand of paste wood filler (colored to match the stain) well rubbed in across the grain.

c. THIRD COAT: Apply a coat of a best-grade manufactured brand of white or orange shellac.

d. FOURTH COAT: Apply a coat of a best-grade manufactured brand of interior gloss varnish.

e. FIFTH COAT: Same as d.

f. SIXTH COAT: Same as d.

NOTE: If close-grained wood, omit the filler. If stain is very dark, use orange shellac; otherwise use white shellac. Shellac should not be above two-pound cut. If a rub job is desired, use a rubbing varnish for the fifth and sixth coats. The last coat may be rubbed with pumice stone and oil (or water) to the desired sheen. If it is desired to avoid rubbing, the specifications for the last coat should read: "—rubbed effect or flat varnish". All window stools and sashes should be finished with spar varnish, either left in the natural gloss, or rubbed to match the sheen of the adjacent finish. If necessary to reduce first cost, omit fifth coat. If a four-coat job is desired, omit fourth and fifth coats; in which case, the surfaces cannot be rubbed. Putty all nail holes or defects after the third (or Shellac) coat. Sand with 00 sandpaper between coats, and clean thoroughly. Allow twenty-four to forty-eight hours between coats for drying. If water stain is used, sponge with water before staining and filling.

III. NEW INTERIOR WOOD (Stained and Waxed Finish)

Refer to Chapter One for preparatory work.

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of wood stain (oil, penetrating spirit, or water stain) of a type adaptable to the wood.

b. SECOND COAT: If open-grained wood, follow with a coat of a best-grade manufactured brand of paste wood filler (colored to match the stain) well rubbed in across the grain.

c. THIRD COAT: Apply a coat of a best-grade manufactured brand of white or orange shellac.

d. ADDITIONAL COATS: Apply two or more coats of a best-grade manufactured brand of paste wax, well rubbed into the wood.

IV. NEW INTERIOR WOOD (Lacquer Finish, Bleach and Lacquer Finish, and Driftwood Finish)

Refer to Chapter One for preparatory work.

1. Lacquer Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of wood stain (oil, penetrating spirit, or water stain) of the desired color, and of a type adaptable to the wood.

b. SECOND COAT: If open-grained wood, follow with a coat of a best-grade manufactured brand of paste wood filler (colored to match the stain) well rubbed in across the grain.

c. THIRD COAT: Apply a coat of a best-grade manufactured brand of lacquer sanding sealer.

d. FOURTH COAT: Apply a coat of a best-grade manufactured brand of clear lacquer.

e. FIFTH COAT: Apply a finish coat of a best-grade manufactured brand of semi-gloss or dull lacquer.

NOTE: For best results, spray on sealer and lacquer. If close-grained wood, omit the filler. If water stain is used, sponge with water before staining and filling. If a fine job is desired, apply several coats of lacquer sanding sealer before applying clear lacquer.

2. Bleach and Lacquer Finish

a. FIRST COAT: Apply one or more coats of a best-grade manufactured brand of wood bleach, and bleach wood to the color desired by the Architect.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of lacquer sanding sealer.

c. THIRD COAT: Apply a coat of a best-grade manufactured brand of semi-gloss or gloss water-white lacquer.

d. FOURTH COAT: Same as c.

NOTE: If open-grained wood, apply a coat of paste wood filler after bleaching. For fine finish, follow with several coats of sanding sealer before lacquer is applied.

3. Driftwood Finish

a. FIRST COAT: Apply a coat of stain made by dissolving one-half pint of asphaltum varnish in one gallon of turpentine. After this is set, wipe off surface.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of interior flat white paint.

c. THIRD COAT: Apply a coat of a best-grade manufactured brand of white paste wax, and polish lightly.

NOTE: Experience and type of finish desired should govern this type of work. The second coat may be colored and wiped to the desired finish. Clear Alkyd Resin or rubbed effect varnish may also be used instead of white paste wax for the last coat.

V. NEW INTERIOR WOOD (Grained Finish)

Refer to Chapter One for preparatory work.

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of interior wood primer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of enamel undercoat, to which a small amount of spar varnish has been added.

c. THIRD COAT: Same as b.

d. FOURTH COAT: Grain in either oil or water color to imitate the desired wood.

e. FIFTH COAT: Apply a coat of a best-grade manufactured brand of interior gloss varnish.

f. SIXTH COAT: Apply a finish coat of a best-grade manufactured brand of interior flat varnish.

NOTE: For best results, add one pint of interior spar varnish to each gallon of enamel undercoat for the second and third coats. Color these two coats slightly lighter than the lightest portion of the wood to be imitated. The last coat may be rubbed with pumice stone and oil to the desired sheen; in which case, the Architect should specify a gloss rubbing varnish for the last two coats.

VI. NEW INTERIOR WOOD (Paint Finish)

Refer to Chapter One for preparatory work.

1. Ready Mixed Oil Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed exterior house paint or a special exterior house primer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of ready mixed exterior house paint of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed exterior house paint of the desired color.

NOTE: Add a small amount of spar varnish to the last coat.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint.

b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: Lead and oil in these specifications refers to either soft or heavy paste type lead and linseed oil. Add a small amount of spar varnish to the last coat.

VII. NEW INTERIOR WOOD FLOORS

Refer to Chapter One for preparatory work.

1. Fill, Stain, and Wax Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of paste wood filler of the desired color.

b. SECOND COAT: Apply a thin coat of a best-grade manufactured brand of white or orange shellac.

c. THIRD COAT: Same as b.

d. ADDITIONAL COATS: Apply two or more coats of a best-grade manufactured brand of floor wax (liquid or paste), polished to the desired sheen.

NOTE: If close-grained wood, omit the filler, but apply a coat of stain of the desired color. The wax should not be applied until twelve hours after the application of the last shellac coat.

2. Fill, Shellac, and Varnish Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of paste wood filler of the desired color, well rubbed into and across the grain.

b. SECOND COAT: Apply a thin coat of a best-grade manufactured brand of white shellac.

c. THIRD COAT: Apply a coat of a best-grade manufactured brand of floor varnish.

d. FOURTH COAT: Same as c.

e. FIFTH COAT: Same as c.

NOTE: If necessary to reduce first cost, omit fifth coat. If a dark colored floor is desired, use orange shellac for the second coat. For a very dark finish, the floor should be stained before being filled.

3. Stain-Wax Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of paste wood filler, colored to match the finish desired.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of stain-wax of the desired color.

c. THIRD COAT: Same as b.

NOTE: If close-grained wood, omit the filler. Polish first coat of stain-wax before applying second coat. Polish last coat of stain-wax to the desired sheen. The above specifications may also be used on interior trim.

4. Preservative Oil Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of preservative oil and sealer.

b. SECOND COAT: Same as a.

c. THIRD COAT: Same as a.

NOTE: If open-grained wood, apply a coat of paste wood filler before applying the preservative oil. Floors should be buffed after each coat.

5. Enamel Finish

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of wood primer or lead and oil paint.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of floor enamel of the desired color.

c. THIRD COAT: Same as b.

VIII. NEW INTERIOR CONCRETE OR CEMENT FLOORS

Refer to Chapter One for preparatory work.

1. Concrete Floor Enamel Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of interior concrete floor paint.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of interior concrete floor enamel of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of interior concrete floor enamel of the desired color.

NOTE: Concrete floors less than six months old, or laid directly on dirt sub-floors, should not be painted. Use a moisture detector. For best results, use a rubber base concrete enamel.

2. Floor Dye Finish

a. FIRST COAT: Apply a solution of 33% muriatic acid in water and rinse thoroughly.

b. SECOND COAT: Apply a coat of floor dye of the desired color.

c. THIRD COAT: Apply a coat of floor dressing of the same color as the dye.

d. FOURTH COAT: Apply a coat of floor wax of the same color as the dye.

NOTE: This floor treatment is preferable when concrete is laid directly on dirt. Use a moisture detector.

IX. NEW INTERIOR CONCRETE, CEMENT, BRICK, OR SMOOTH TILE (Except Floors)

Refer to Chapter One for preparatory work.

1. Ready Mixed Oil Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of concrete, cement, and stucco paint.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of concrete, cement, and stucco paint of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of concrete, cement, and stucco paint of the desired color.

NOTE: If a semi-gloss finish is desired, add a small amount of spar varnish to each gallon of paint for the last coat. If necessary to reduce first coat, omit third coat. For best results, use a special prepared concrete paint of the "breather" type.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint.

b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: No lead and oil paint should be used on new concrete, brick, or tile surfaces. Such surfaces should be permitted to age six months before applying lead and oil paint. In mixing lead and oil, use a special processed oil manufactured by leading lead manufacturers. If a semi-gloss finish is desired, add a small amount of spar varnish to each gallon of paint for the last coat.

3. Casein or Resin Oil Emulsion Paint

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of either casein or resin oil emulsion paint of the desired color.

b. SECOND COAT: Same as a.

NOTE: For best results, spray on this material.

4. Cement Water Paint

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of cement water paint of the desired color.

b. SECOND COAT: Same as a.

NOTE: Use either brush or spray method of application. This paint should be factory tinted when possible. Thoroughly wet down all surfaces to receive water paint, but allow them to dry until only slightly damp before applying this material, unless manufacturer directs otherwise. For curing purposes, keep surfaces damp for several days after application of last coat.

X. NEW INTERIOR PLASTER

Refer to Chapter One for preparatory work.

1. Flat Wall Finish

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of oil or varnish plaster primer.

b. SECOND COAT: Apply a coat composed of one part best-grade manufactured brand plaster primer and two parts best-grade manufactured brand flat wall paint of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of flat wall paint of the desired color.

NOTE: If surface is exceptionally porous and alkaline, the second coat should be one-half flat wall paint and one-half plaster primer.

2. Stippled Finish (Lead and Oil Paint)

a. FIRST COAT: Apply a priming coat of lead and oil paint.

b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color. Stipple this coat.

NOTE: In mixing lead and oil, use a special processed oil, manufactured by leading lead manufacturers. Use two gallons of spar varnish to each one hundred pounds of lead for the first coat, in order to thoroughly seal the surface. If a semi-gloss finish is desired, omit one gallon of mixing oil, and replace it with one gallon of spar varnish to each one hundred pounds of lead for the last coat. The nature of semi-gloss paint does not require stippling, although it may be stippled when applied on smooth plaster surfaces, thus producing a slight orange-peel effect. If glazed walls are desired, glazing should be done after the third coat (flat finish) is thoroughly dry, and a fourth and fifth coat should be added, making the specifications read:

d. FOURTH COAT: Apply a coat of a best-grade manufactured brand of glaze of the desired color, and wipe, mottle, stipple, or blend to the desired effect. The Architect should specify the number of colors.

e. FIFTH COAT: Apply starch or buttermilk, stippled to leave no brush marks.

3. Stippled Finish (Prepared Stipple Paste Paint)

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of oil or varnish plaster primer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of special prepared stipple paste paint of the desired color, reduced to brushing consistency.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of stipple paste paint of the desired color, reduced to produce the texture desired. Stipple this coat.

NOTE: Note under X, 2 is applicable to this finish.

4. Crackle Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of lacquer undercoat.

b. SECOND COAT: Same as a.

c. THIRD COAT: Apply a coat of a best-grade manufactured brand of slow-drying gloss lacquer of a dark color. Spray on this coat.

d. FOURTH COAT: Apply a coat of a best-grade manufactured brand of flat quick-drying lacquer of the desired color.

NOTE: If a pronounced crackle is desired, the undercoat should be of a much darker color than the last coat. Crackle lacquer may be obtained on the market. Only experienced decorators should attempt this finish.

XI. NEW INTERIOR PLASTER (Water Paint Finish)

Refer to Chapter One for preparatory work.

1. Calsomine Paint

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of water mixed size.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of calsomine of the desired color.

NOTE: The Architect may specify a priming coat of oil or varnish plaster primer instead of the water mixed size.

2. Casein Paint

a. FIRST COAT: Apply a thin coat of a best-grade manufactured brand of casein paint of the desired color.

b. SECOND COAT: Same as a.

NOTE: Casein paint may be used in one thin coat over acoustic tile or plaster surfaces; in which case, it should be sprayed on. Casein paint may also be used on fiber board surfaces in two or more coats, sprayed on.

3. Resin Oil Emulsion Paint

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of resin oil emulsion paint of the desired color.

b. SECOND COAT: Same as a.

NOTE: For best results, spray on this material.

XII. NEW INTERIOR PLASTER (*Semi-gloss or Gloss Finish*)

Refer to Chapter One for preparatory work.

1. Ready Mixed Oil Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of oil or varnish plaster primer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of ready mixed semi-gloss or gloss paint of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed semi-gloss or gloss wall enamel of the desired color.

NOTE: The second coat may be a mixture of one-half primer and one-half wall paint, in order to properly seal the surface. The nature of semi-gloss or gloss paint does not require stippling, although semi-gloss paint may be stippled when applied on smooth plaster walls, thus producing a slight orange-peel effect.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint.
b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.
c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: The nature of semi-gloss or gloss paint does not require stippling, although semi-gloss paint may be stippled when applied on smooth plaster walls, thus producing a slight orange-peel effect. In mixing lead and oil, use a special processed oil, manufactured by leading lead manufacturers. If a gloss finish is desired, omit one and one-half gallons of processed oil and replace it with one and one-half gallons of spar varnish to each one hundred pounds of lead for the last coat.

XIII. NEW INTERIOR PLYWOOD WALLS

Refer to Chapter One for preparatory work.

For best results, treat plywood with a clear Alkyd Resin primer immediately after sanding.

1. Ready Mixed Oil Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of oil or varnish plaster primer.
b. SECOND COAT: Apply a coat of a best-grade manufactured brand of flat wall paint of the desired color.
c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of flat wall paint of the desired color.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint.
b. SECOND COAT: Apply a coat of lead and oil paint of the desired color.
c. THIRD COAT: Apply a finish coat of lead and oil paint of the desired color.

3. Varnish Finish

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of wood stain (oil, penetrating spirit, or water stain) of the desired color.
b. SECOND COAT: Apply a thin coat of a best-grade manufactured brand of shellac.
c. THIRD COAT: Apply a coat of a best-grade manufactured brand of gloss varnish.
d. FOURTH COAT: Apply a finish coat of a best-grade manufactured brand of flat varnish.

NOTE: Plywood may also be finished with lacquer; in which case use lacquer sanding sealer for the second and third coats, following with either gloss or flat lacquer and wax.

XIV. NEW INTERIOR TEXTURE WALLS

Refer to Chapter One for preparatory work.

1. Oil Base Material

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of oil or varnish plaster primer.
b. SECOND COAT: Apply a coat of a best-grade manufactured brand of oil texture material of the desired texture, indicated by the Architect.
c. THIRD COAT: Apply a coat of a best-grade manufactured brand of glazing liquid in colors selected by the Architect; wiped, mottled, or blended to the desired effect, and in the number of colors indicated by the Architect.

NOTE: A coat of starch or thin flat varnish may be applied over all texture and glazed surfaces.

2. Waterbase Material

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of water mixed size.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of texture material of the desired texture, indictated by the Architect.

c. THIRD COAT: Apply a coat of a best-grade manufactured brand of oil or varnish plaster primer.

d. FOURTH COAT: Apply a finish coat of a best-grade manufactured brand of glazing liquid in colors selected by the Architect; wiped, mottled, or blended to the desired effect, and in the number of colors indicated by the Architect.

NOTE: The Architect may specify one or two coats of flat wall paint as a sealer before walls are glazed.

XV. NEW INTERIOR WALL COVERINGS

Refer to Chapter One for preparatory work.

1. Wallpaper

a. FIRST COAT: Apply one or two coats of a best-grade manufactured brand of water mixed size.

b. SECOND COAT: Hang wallpaper of the pattern, texture, and grade specified by the Architect.

NOTE: Wallpaper may be either butted, wire-edged, or lapped, as specified by the Architect. If a fine wallpaper job is desired, surfaces should first be covered with lining papers before the wallpaper is hung.

(See Book Six, "Wallpaper")

2. Canvas

a. FIRST COAT: Apply one or more coats of a best-grade manufactured brand of water mixed size.

b. SECOND COAT: Paste a best grade manufactured brand of sheeting, muslin, or prepared canvas on all ceilings, walls, etc., as designated; the covering on the walls to be hung vertically.

NOTE: Paint finishes under X, 1, 2, and 3, are suitable for paint finish on canvas surfaces.

3. Burlap and Leatherette

a. FIRST COAT: Apply one or more coats of a best-grade manufactured brand of water mixed size.

b. SECOND COAT: Hang burlap or leatherette of the pattern, texture, and grade specified by the Architect, and butt all seams.

4. Flexwood

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of special flexwood primer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of flexwood adhesive.

c. THIRD COAT: Apply a best-grade manufactured brand of flexwood adhesive to the back of the flexwood before hanging same. Follow manufacturer's directions explicitly in application of flexwood.

d. FOURTH COAT: Apply one or more coats of a best-grade manufactured brand of clear water-white flat lacquer.

e. FIFTH COAT: Apply one or more coats of a best-grade manufactured brand of quick-drying flat paste wax.

NOTE: Only experienced decorators should attempt this finish. For best results, finish flexwood natural. If it is desired to stain flexwood, apply one coat of stain of the desired color, follow with a thin coat of shellac, and finish with two coats of flat paste wax. Allow sufficient time for drying between all coats. Thoroughly clean and lightly sand flexwood before applying the first coat of lacquer. For best results, spray on lacquer. Open-grained wood should be filled and finished as above. Flexwood may also be bleached.

Chapter Four

REFINISHING OF PREVIOUSLY COATED SURFACES

NOTE: All mixing, thinning, and application of material shall be done according to the manufacturer's directions for the particular material being used and surface being coated.

I. OLD EXTERIOR WOOD

Refer to Chapter One for preparatory work.

1. Ready Mixed Oil Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed exterior house paint or a special exterior house primer of the desired color.

b. SECOND COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed exterior house paint of the desired color.

NOTE: Remove all loose, scaly paint, and spot paint all abraded surfaces before first coat is applied. Putty all nail holes and replace loose putty on window sashes, etc. If the old paint is in extremely bad condition, the Architect or Owner may specify its removal.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint of the desired color.

b. SECOND COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: Lead and oil in these specifications refers to either soft or heavy paste type lead and linseed oil. If a darker color than can be obtained by coloring white lead and oil is desired (such as brown, dark green, maroon, black, red, or other deep colors), specify ready mixed exterior house paint in place of lead and oil paint for the second coat. If so specified, the Painting Contractor shall caulk all window and door openings after the first coat is dry, and paint iron. Varnish all copper in contact with wood in order to prevent staining of the paint finish.

II. OLD EXTERIOR SHINGLE ROOFS AND SIDINGS

Refer to Chapter One for preparatory work.

1. Stain Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of ready mixed shingle stain of the desired color.

NOTE: If previously stained surfaces are extremely bare, the Architect or Owner may specify two coats of shingle stain.

III. OLD EXTERIOR ASBESTOS-CEMENT ROOFS AND SIDINGS

Refer to Chapter One for preparatory work.

1. Special Prepared Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of special prepared asbestos-cement paint of the desired color.

b. SECOND COAT: Apply a finish coat of a best-grade manufactured brand of special prepared asbestos-cement paint of the desired color.

NOTE: If a dark color is desired, use a gilsonite type of paint. This specification may also be used for painting creosoted shingles.

IV. OLD EXTERIOR CREOSOTED SHINGLES AND SIDINGS

Refer to Chapter One for preparatory work.

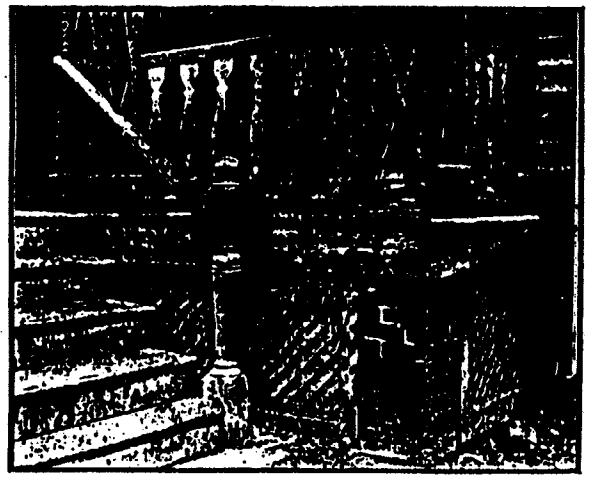
Surfaces covered with creosoted or stained shingles of a doubtful nature should be finished as follows:

1. Ready Mixed Oil Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of aluminum paint.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of ready mixed exterior oil paint of the desired color.

c. THIRD COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed exterior oil paint of the desired color.



BEFORE: A STRIKING EXAMPLE OF THE RESULT OF neglected paint maintenance on an exterior. Wood and brick alike reveal need for repairs, to say nothing of the unsightly appearance.

NOTE: If necessary to reduce first cost, omit second coat.

V. OLD EXTERIOR CONCRETE, BRICK, STUCCO, AND STONE

Refer to Chapter One for preparatory work.

1. Ready Mixed Oil Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed exterior concrete, cement, and stucco oil paint or a special exterior concrete primer of the desired color.

AFTER: SAME PORCH RESTORED BY PAINTING, a little caulking and a new balustrade . . . and it can be kept in this condition by recoating from time to time.

b. SECOND COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed exterior concrete, cement and stucco oil paint of the desired color.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint of the desired color.

b. SECOND COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: If a semi-gloss finish is desired on all concrete, brick, stucco, or stone surfaces, omit one gallon of linseed oil per hundred pounds of lead and substitute one gallon of exterior spar varnish for the last coat.

3. Clear Waterproofing Liquid

a. FIRST COAT: Apply one or more coats of a best-grade manufactured brand of clear waterproofing liquid.

NOTE: For best results, spray on this material.

4. Cement Water Paint

Surfaces previously coated with cement water paint should be finished as follows:

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of exterior cement water paint of the desired color.

b. SECOND COAT: Same as a.

NOTE: Use either brush or spray method of application. This paint should be factory tinted when possible. Thoroughly wet down all surfaces to receive water paint but allow them to dry until only slightly damp before applying this material, unless manufacturer directs otherwise. For curing purposes, keep surfaces damp for several days after application of last coat.

5. Exterior Resin Oil Emulsion Paint

Surfaces previously coated with resin oil emulsion paint should be finished as follows:

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of resin oil emulsion paint of the desired color.

b. SECOND COAT: Same as a.

VI. OLD EXTERIOR METAL

Refer to Chapter One for preparatory work.

1. Ready Mixed Metal Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed exterior metal paint of the desired color.

b. SECOND COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed exterior metal paint of the desired color.

NOTE: Note under 1. 1. is applicable to this finish.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint of the desired color.

b. SECOND COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: Note under 1. 1. is applicable to this finish.

VII. OLD INTERIOR WOODWORK

Refer to Chapter One for preparatory work.

1. Enamel Finish

a. FIRST COAT: Apply a coat composed of equal parts of a best-grade manufactured brand of enamel undercoat and a best-grade manufactured brand of enamel of the desired color.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of either semi-gloss or gloss enamel of the desired color.

NOTE: If an extra good job is desired, two coats of gloss enamel may be specified and the last coat rubbed with pumice stone and oil to the desired sheen.

2. Varnish Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of clear gloss varnish.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of gloss, semi-gloss, or flat varnish.

NOTE: If the Architect or Owner desires a rub job, he should specify that both coats be rubbing varnish, and that they be rubbed with pumice stone and oil to the desired sheen.

3. Wax Finish

a. FIRST COAT: Apply one or more coats of a best-grade manufactured brand of paste wax.

NOTE: Thoroughly clean previously waxed surfaces prior to the application of the first coat. If surfaces have previously been coated with stain-wax the specifications should read:

a. FIRST COAT: Apply one or more coats of a best-grade manufactured brand of stain-wax of the desired color, and thoroughly buff each coat.

VIII. OLD INTERIOR WALLS (Smooth or Sand finish Plaster)

Refer to Chapter One for preparatory work.

1. Ready Mixed Oil Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed oil or varnish plaster primer of the desired color.

b. SECOND COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed flat wall paint of the desired color.

NOTE: If a gloss finish is desired, the Architect or Owner may specify that the last coat be semi-gloss or gloss paint; in which case, a coat of enamel undercoat should be applied as a second coat, and followed by a coat of semi-gloss or gloss paint. If it is desired to stipple the last coat, apply a coat of a best-grade manufactured brand of stippling paste paint, and stipple to the desired texture. However, glossy finishes should not be stippled. If surfaces are to be glazed or otherwise decorated, the Architect or owner should specify the number of colors.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint of the desired color.

b. SECOND COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: Note under VIII, 1, is applicable to this finish.

3. Water Paint

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of casein, or resin oil emulsion paint of the desired color.

b. SECOND COAT: Same as a.

IX. OLD INTERIOR PLYWOOD OR KNOTTY PINE

Refer to Chapter One for preparatory work.

1. Ready Mixed Oil Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed flat wall paint of the desired color.

b. SECOND COAT: Apply a finish coat of a best-grade manufactured brand of ready mixed flat wall paint of the desired color.

2. Varnish Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of gloss varnish.

b. SECOND COAT: Apply a finish coat of a best-grade manufactured brand of flat varnish.

NOTE: Touch up all abraded stained surfaces with stain of the proper color before application of the first coat. If surfaces are waxed, the wax must be removed before varnish can be applied. If a rub job is desired, the specifications should read: "Apply two coats of rubbing varnish and rub with pumice stone and oil to the desired sheen".

3. Lacquer Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of clear gloss lacquer.

b. SECOND COAT: Apply a coat of a best-grade manufactured brand of clear flat lacquer

NOTE: This specification refers to previously lacquered surfaces only. If surfaces are waxed, the wax must first be removed before lacquer can be applied.

X. OLD INTERIOR CONCRETE AND BRICK WALLS

Refer to Chapter One for preparatory work.

1. Ready Mixed Concrete Oil Paint

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed concrete, cement, and stucco oil paint of the desired color.

b. SECOND COAT: Apply a finish coat of a best-grade

manufactured brand of ready mixed concrete, cement, and stucco oil paint of the desired color.

NOTE: If a semi-gloss finish is desired, add a small amount of spar varnish to each gallon of paint for the last coat.

2. Lead and Oil Paint

a. FIRST COAT: Apply a priming coat of lead and oil paint of the desired color.

b. SECOND COAT: Apply a finish coat of lead and oil paint of the desired color.

NOTE: Note under X, 1, is applicable to this finish.

3. Cement Water Paint

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of cement water paint of the desired color.

b. SECOND COAT: Same as a.

NOTE: Note under V, 4, is applicable to this finish.

4. Casein Paint

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of casein paint of the desired color.

NOTE: If surfaces are bare, two coats should be specified.

5. Resin Oil Emulsion Paint

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of resin oil emulsion paint of the desired color.

NOTE: Note under X, 4, is applicable to this finish.

XI. OLD INTERIOR WOOD FLOORS

Refer to Chapter One for preparatory work.

1. Varnish Finish

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of gloss floor varnish.
b. SECOND COAT: Same as a.

NOTE: Touch up all abraded stained surfaces with stain of the proper color before application of the first coat. If present floors have a stain-wax finish, they should be refinished with the same material.

2. Penetrating Sealer

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of penetrating sealer.
b. SECOND COAT: Same as a.

NOTE: Note under XI, 1, is applicable to this finish.

XII. OLD INTERIOR CONCRETE FLOORS

Refer to Chapter One for preparatory work.

1. Ready Mixed Floor Enamel

a. FIRST COAT: Apply a coat of a best-grade manufactured brand of ready mixed concrete floor enamel of the desired color.
b. SECOND COAT: Same as a.

XIII. OLD INTERIOR WALL COVERINGS

Refer to Chapter One for preparatory work.

1. Canvas

a. FIRST COAT: Apply a priming coat of a best-grade manufactured brand of ready mixed oil or varnish plaster primer of the desired color.
b. SECOND COAT: Apply a finish coat of a best-grade manufactured brand of flat wall stippling paste paint or lead and oil stippling paste paint of the desired color.

NOTE: Stipple the last coat. If surfaces are to be glazed, highlighted, or embellished with stencils or other decorations, the Architect or Owner should state the number of colors. As a protective measure, the Architect or Owner may specify a coat of starch, buttermilk, or flat varnish over all decorated surfaces.

2. Wallpaper

a. FIRST COAT: Hang wallpaper of the design and quality selected by the Architect or Owner.

NOTE: All patterns shall match neatly, and only the best workmanship will be accepted. The Architect or Owner should specify if this is to be butt or lap work. All old paper should be entirely removed, plaster repaired, and surfaces to be papered sized with either water mixed or oil mixed size. For a better job, hang lining paper on all surfaces to be papered before applying wallpaper.

(For further data on Wallpaper, refer to Book Six.)

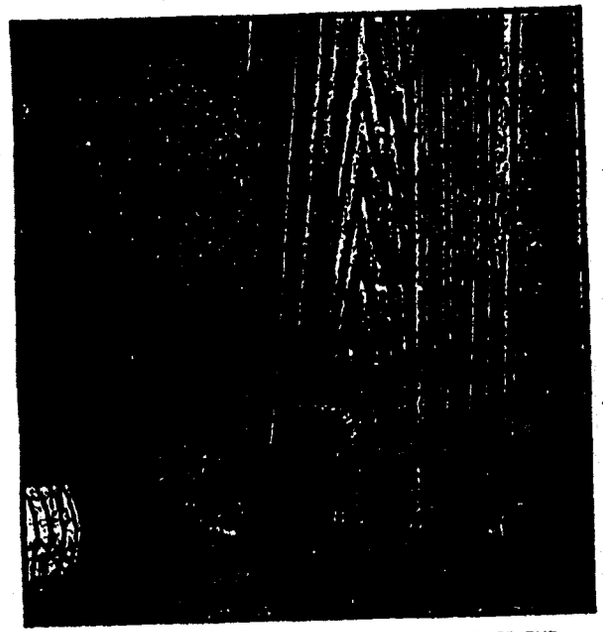
Chapter Five

WOODS COMMONLY USED FOR THE INTERIOR

NOTE: All trim should be back-primed to prevent warping.

Birch: Close-grained. No paste filler required. Can best be stained mahogany or walnut. Penetrating stain best. Often finished natural, gloss or dull varnished, lacquer or wax finish. Good for enamel. May also be bleached.

Fir: Close-grained. No paste filler required. Use any stain except water stain. Poor for enamel. Should call for spackle or putty glaze after priming when specified for enamel finish.



SAME PANEL: BLENDER BRUSH BEING USED OVER THE "top" grain section to give a softening effect.

YELLOW PINE

GROUND—White tinted with chrome yellow M.

GLAZE—Yellow ochre, burnt and raw sienna. For pitch pine deepen with venetian red.

WALNUT

GROUND—White, ochre venetian red and burnt umber.

GLAZE—Burnt umber and Vandyke brown.

Chapter Nine

WOOD FINISHING

BRIEF mention was made in the Standard Specifications of woods most commonly used for interior work, and an indication was given of treatments called for by the several types. Further comment is here presented on this subject, with the observation that wood finishing is a real art and calls for careful study of the structure and nature of various categories of woods.

Wood finishing may be described as the application of transparent and semi-transparent coatings with the object of accentuating the delicate markings of the grain, of enhancing the beauty of the natural color or of changing the natural color and altering certain characteristics in a way that will make one type of wood take on the aspects of another type, particularly a more expensive type.

Hardwoods such as oak, maple, birch, walnut and mahogany are generally preferred in their natural finishes, because of their beauty, while soft woods such as pine, fir and cypress lend themselves not only to natural finishes but to treatment which tends to change their original appearance.

In the study of wood finishing, it is advisable to have on hand samples of the various kinds of wood most commonly used. Plywood can be obtained for this purpose from local lumber yards or mills. After studying the wood structure, these pieces may be used for finishing jobs as outlined under the sections on staining, filling and varnishing. Also, pieces of old furniture or the furniture in a class room can be employed for refinishing as part of an instruction program.

The following outline of the most common woods—more detailed than that in the Chapter on Specifications—deserves careful study by anyone desiring to become familiar with the possibilities in finishing and imitating various woods.

NAME	TYPE OF WOOD	GRAIN	FINISH
Ash	Hard	Open	Requires filler.
Alder	Soft	Close	Stains readily.
Aspen	Soft	Close	Paint. Not used for construction.
Basswood	Soft	Close	Paints well.
Beech	Hard	Close	Poor for paint, takes varnish well.
Birch	Hard	Close	Stains and varnishes well.
Cedar	Soft	Close	Paints well. Finishes well with varnish.
Cherry	Hard	Close	Requires filler.
Chestnut	Hard	Open	Must be filled. Not suitable for paint finish.
Cottonwood	Soft	Close	Good for paint finish.
Cypress	Hard	Close	Takes paint or varnish. Finishes well.
Elm	Hard	Open	Not suitable for paint. Requires filler.
Fir	Soft	Close	Can be painted, stained or finished natural.
Gum	Soft	Close	Can be finished with variety of finishes.
Hemlock	Soft	Close	Paints fairly well.
Hickory	Hard	Open	Requires filler.
Maple	Hard	Close	Takes any type finish.
Oak	Hard	Open	Requires filler.
Pine	Soft	Close	Takes any type finish.
Walnut	Hard	Open	Requires filler. Takes all finishes well.
Mahogany	Hard	Open	Requires filler.
Teak	Hard	Open	Requires filler.

Plywood

Plywood is being installed in increasing quantities in all types of interiors. The smooth surface of the panels provides an ideal base for a paint job, while new types of sealers and lacquer finishes bring out many attractive effects of the natural grain and wood colors.

Fir plywood is among the most popular and economical. Because of the pronounced character of the grain in this type, which is of alternate hard Summer growth and softer Spring growth, a special sealer is absolutely essential to avoid a "wild" appearance. These have been perfected by the industry, and should be used according to instruction. Complete data on a great variety of finishing methods is also available from the manufacturers.

Stains

Stains are classified according to the liquid used and not by the color content, that is, as oil stain, varnish stain, spirit stain and creosote shingle stain. The coloring or staining capacity is different on each kind of wood according to its porosity. For example, a walnut stain will produce a rich brown color on gum, while the same stain on white pine, basswood or poplar would appear nearly black.

In mixing stain follow the same procedure as in mixing paint, by thinning the colors and then adding to the liquids in small amounts until the desired color is obtained. Use wood blocks for testing the strength and color of the stain.

Before applying stain, the wood should be properly prepared by removing all foreign matter and special attention should be paid to planer and sander scratches which must be removed.

In using water stains the wood should first be wet before applying the stain. Water stains and spirit stains require skill in their application as they penetrate on the spot where each brushful of stain is started, so it is desirable to use a comparatively dry brush to obtain a uniform color.

Fillers

Open grain woods such as oak, ash, chestnut and walnut require a filler to fill the pores of the wood so as to avoid a surface with a pitted appearance. Many materials are used as the basis for fillers, such as silica, clay, lead, zinc, bronze, corn starch and whiting, along with color pigments. With the prepared paste fillers on the market, in shades and colors, it is seldom necessary for a journeyman painter to make his own.

In preparing any filler it is first necessary to thin to proper brushing consistency, about like thin cream, generally with turpentine, naphtha or some type of volatile thinner.

In applying the filler, brush crosswise of the grain as much as possible in order to fill the pores of the wood. The better fillers "set" but do not get hard in ten to twenty minutes. If allowed to set too long they will harden to a point where they are impossible to remove. If wiped too soon, the filler pulls from the pores and the object is not accomplished.

Sometimes it is advisable to use both stain and filler to obtain the desired results, in which case the stain is applied first. For example, a silver grey finish on oak may be obtained by first staining the wood with a silver grey stain and then filling with a zinc or white filler.

When finishing with stain and filler, in separate operations, it is advisable to give the surface a coat of thin shellac after the stain has become thoroughly dry before applying the filler.

Blonde Finishes

Wood finishing has come in for great changes in the past few years and the dark stains and fillers have been replaced with lighter tints and shades of finishes.

These newer types—blonde finishes—are made with special oils and pigments which in many instances reduce the number of

applications required on a finish job; some do not require wiping and may be applied with a spray gun. Some are constructed with hard drying, wear resistant material that fills the pores of open grain woods and seals the surface at the same time.

Special pale, clear materials for finishing woods done with blonde stains are available and recommended for this type of finishing. They are durable and may be used for exterior as well as interior and on any kind of wood.

It is absolutely important that the surface be free from dirt, smudges, discoloration and all foreign matter.

Bleaching Woods

In refinishing, it is sometimes desirable or necessary to bleach all or portions of the wood after the old finish has been removed. There are special materials on the market for this purpose as well as for bleaching new wood to secure the popular blonde finishes.

After applying any bleach, the wood must be thoroughly sanded and dusted before applying any new finish. In some instances it may be necessary to apply the second coat of bleach to obtain the desired results.

In using manufactured bleach, follow the directions on the container. Most bleaches contain acids or chemicals which are injurious to the skin and it is necessary to handle them with care, generally using rubber gloves to protect the hands. Some bleach is sufficiently acid to destroy the bristles of a brush, so read and carefully follow the directions on the container.

After bleaching, apply an alkyd resin with white pigment—tinted if needed—and wipe.

Remove all the old finish before attempting to bleach wood as the bleach will not otherwise give the desired results.

Varnish and Shellac

The application of varnish and shellac is similar, inasmuch as both must be applied without permitting sags or runs. In the

case of varnish, this may be "picked up" but shellac when once in place must be left.

The brushing of varnish is done in much the same manner as that for an enamel. The brush should hold about as much material as possible without dripping. A small area is quickly covered and the varnish is spread out evenly, brushing across the grain and then lightly with the grain, with even strokes so as to obtain uniform thickness.

Atmospheric conditions are highly important in the application of varnishes and a temperature below 70 degrees during the operation is likely to produce trouble. Blooming is one of the defects connected with varnishing and is generally attributable to moisture in some form on the varnish during the drying stages.

Shellac must be applied rapidly in straight strokes back and forth, working toward the finished section to avoid laps as the material sets very fast.

Shellac is not recommended for window sash and stools which are exposed to the direct sunlight. The condensation on the glass will cause the shallac to turn white and the sun rays will have a damaging effect on the finish. For this surface it is better to build up the foundation coats with spar varnish.

Enamel

In applying enamel, care must be exercised to avoid sags and runs. Enamel like varnish is flowed on, using plenty of material to cover the surface, then cross brush diagonally and then across the grain or surface, finally laying it out lengthwise with the tip of the brush.

Never fight enamel. If the enamel brushes hard or pulls, do not fight it. This generally is a sign of not a sufficient amount of material. Flow it on for it was built to be applied with a full brush. If you try to brush it out you will get a surface which is

ropey or is piled on thick in places and thin in others, causing a very unsatisfactory job.

Sometimes it may be necessary to rub enamel to obtain the desired results, in which case a sufficient number of coats must be applied to produce a film that can withstand rubbing.

In tinting enamels, it is better to use colors in japan. If colors in oil are used, do not add the color right to the enamel, but pour off some of the liquid, and mix the color into it thoroughly, then pour back into the can. Repeat this until the desired shade is obtained. This process will prevent bleeding of the color, which will ruin the job.

Rubbing and Polishing

A dull or satin finish on varnish or enamel is obtained by removing the natural gloss with pumice stone and water or oil, after the last coat has become dry and hard, usually three to eight days. A job which is going to be rubbed should have a sufficient number of coats, generally four to eight.

Rubbing With Water

Rubbing is done with a thick felt, dipped in water, and finely ground pumice stone. Rub lightly over the surface, being especially careful on the edges and corners not to rub through. Mouldings and carved surfaces may be rubbed with a short stiff brush instead of the rubbing felt. Then wash off the pumice with clear water and wipe dry with a clean cloth.

Rubbing With Oil

The process of rubbing with oil and pumice is the same at with water. Here again we find a difference of opinion as so which is the better for rubbing; some prefer a light grade of

motor oil while others say raw linseed oil and benzine or other volatile thinner is better. Some suggest paraffine oil.

Regardless of whether oil or water is used, the corners and angles must be cleaned out with a stick, sometimes referred to as a "pick stick", so no surplus material remains anywhere on the surface.

Polishing

An extra fine job may be obtained by using finely ground rotten stone and water which will remove any fine scratches left by rubbing with pumice stone.

Removing Old Finish

In the case of previously painted or varnished surfaces, it is essential to completely remove the old finish in order to assure a good new job. There are many brands of effective removers on the market which are available for this, but it must be remembered that they are for the most part highly inflammable and contain chemicals with slight toxic effect, so they should be used in full conformity with directions on the label.

In applying the remover, fill the brush and flow the material on liberally without brushing any more than is absolutely necessary. After the remover has been applied do not break the wax film which forms as this causes the liquids to soften the paint or varnish and if broken allows the gasses to escape without performing their duty.

Let the remover stand until the finish begins to blister or wrinkle, usually from ten to twenty minutes. Sometimes it may be advisable to apply the second coat of remover in order to accomplish this feature. After the finish has dissolved or wrinkled, use a broad knife or scraper to remove the material, depositing it in a metal container for disposal. If any trace of the coating remains apply a coat of remover and rub lengthside of the grain with coarse steel wool.

After the removal operation, wash with turpentine, benzine or alcohol to remove all trace of the remover. Water and washing powder may also be used but the water may cause the wood to darken, and the grain to raise.

Paint remover should always be kept in a sealed container away from heat and flame hazards. Do not smoke or allow any type of fire where remover is being used.

Varnish remover will work faster on surfaces which can be placed in a horizontal position. Remove doors and other pieces of work and place on a bench or saw horses for faster and better results.

Points in Review on Practical Painting Procedure

1. *What is the first operation in any painting job and why is it so vitally important to do it right?*
2. *Give a general statement on preparation of the surface for new work, both wood and metal.*
3. *Can you outline three specifications for painting, staining and varnishing new exterior wood?*
4. *Write a brief specification for enameling a new interior wood surface.*
5. *How many types of material are available for finishing new interior concrete, cement or brick (except floors)?*
6. *Describe the method for a stippled finish for a new interior plaster wall surface.*

7. *How many coats would you apply in refinishing a previously painted exterior wood surface? And a previously enameled interior wood surface? A varnished surface?*
8. *What woods are commonly used for the interior?*
9. *What are close grained woods and what open grained, and on which type do you require the use of paste filler?*
10. *What is creeping and crawling? Crows footing? What are "lap time" difficulties?*
11. *What is the priming coat and what are the new special exterior house primers?*
12. *Describe briefly the several methods of sealing knots.*
13. *Describe the types of materials usable on exterior porous masonry surfaces; on cement-asbestos shingles.*
14. *What is the special need in painting exterior aluminum?*
15. *In painting interior surfaces, would you say it is harder to paint plaster than to paint woodwork?*
16. *What troublesome conditions are you likely to confront in painting interior plaster?*
17. *Describe the necessary steps in putting a plaster surface in good shape for painting.*
18. *What is Wall Glazing and how is it done? What is stippling?*
19. *Describe the application of stencil decoration.*
20. *What is the principal objective in Marbleizing and Graining?*
21. *What stains are used in the finishing of woods?*
22. *Describe the several standard methods of finishing woods.*

Book Four

PAINT FAILURES—AND THEIR REMEDIES

Foreword

THE PROTECTIVE properties of paint were outlined in Book One of this volume and they should be re-emphasized here, because painting is an essential in protecting any type of surface from the action of the various elements, and thereby preventing exterior and interior structural damage which annually results in hundreds of millions of dollars in loss to American property-owners.

Good quality paint wears away by the process of chalking, previously described in the Chapter on Paint Formulations. This is normal and is not in itself a sign of poor paint or poor workmanship. But all paints can fail—and fail badly, due chiefly to four factors:

1. Improper preparation of the surface.
2. Improper application of the material, which includes selection of the wrong type of coating for a given surface; the use of a type of paint which in its composition is "incompatible" with the paint already on the surface; the failure to follow manufacturers' specific directions in mixing or application.
3. Use of poor quality paint—but we will not dwell on that point, because the whole burden of this book is to emphasize the necessity for employing good materials and good tools.

be a louver in the gable which may measure only 2 feet by 3 feet—quite a simple little operation—BUT it may require the use of a forty-foot extension ladder and the time of two men to reach it, which changes the picture entirely.

The whole question of what rigging must be used is one that must be carefully considered always when working with the blueprints if is something that may be inadvertently overlooked, to the disadvantage of the bidder.

In other words, a contractor who is making an estimate cannot afford to miss any detail. Overlooking a single note on the plans or a single specification requirement may be an oversight that will prove costly.

Points in Review on Estimating

1. *What are the fundaments a man must know and do in order to properly estimate a painting job?*
2. *In addition to materials and labor, there are two vital cost factors: Job Expense and General Overhead. Give a brief explanation of each.*
3. *What is Gross Profit and what is Net Profit?*
4. *What are the standards of measurement?*
5. *What are the chief things to be borne in mind in taking measurements for a job?*
6. *Review briefly the methods for determining a fair cost for exterior trim and windows.*
7. *How do you figure sanding and puttying on interior trim?*
8. *With regard to materials, what are the factors to be considered in arriving at an estimate?*
9. *How does the amount of work an average painter can do in one hour affect your figuring?*
10. *What is the difference between estimating work out on the job and estimating from blueprints and specifications?*

Book Eight

DICTIONARY OF PAINTING INDUSTRY TRADE TERMS

A

Abrasive. A material used for wearing away a surface by rubbing. Examples of abrasives are: powdered pumice, rottenstone, silica, sandpaper, steel wool. These materials are used for smoothing rough surfaces before painting. They also are used for producing "rubbed" finishes on fine furniture and woodwork.

Acid Stain. A water-soluble stain made with an organic dye.

Adhesion. The property which makes a paint film stick to a surface.

Adulteration. The substitution of inferior materials for those accepted as standard.

Agricultural Varnishes. Varnishes designed especially to protect and beautify farm implements and machinery. Such materials are exposed to severe conditions and must be highly resistant to moisture, dust, friction, intense sunlight and high temperature.

Air Dry. To dry a coating at ordinary room conditions. Ordinary room temperature is 60 degrees to 80 degrees Fahrenheit with 40 to 60 percent relative humidity.

Alizarine Lake. A red pigment made from the organic coal tar dyestuff, alizarine. Its color is dark bluish-red. Purple pigments are also marketed under this name.

Alkali. A substance that neutralizes acids, such as lye, soda, lime, etc. Alkalis or strong alkaline solutions are highly destructive to oil paint films.

Alkyd. A synthetic resin, made usually with phthalic anhydride, glycerol and fatty acids from vegetable oils.

Alligatoring. This term is used to refer to a painted surface on which cracks, resembling the hide of an alligator, have formed. Common cause of this condition is the application of thick films which prevent the under surface from becoming thoroughly dry and hard, or from drying the paint in poorly ventilated rooms.

Aluminum Paint. A mixture of finely divided aluminum particles, in flake form, combined with a vehicle such as thin varnish.

American Process Zinc Oxide. Zinc oxide pigment made directly from zinc ores. Sometimes called "direct" process. See French process zinc oxide.

American Vermilion. Chrome orange pigment, usually a basic lead chromate.

Anchorage. The mechanical effect of paint "keying" itself into the surface of wood or other materials to which it has been applied. This effect is similar to the "clinch" of plaster anchorage between the lath.

Aniline Colors. A term loosely used to indicate coal tar dyes or derivatives.

Anti-Corrosive Paint. Metal paint designed to inhibit corrosion and rusting. Applied directly to the metal, usually as a primer for finish coats.

Anti-Fouling Paint. The final coat of paint applied to the hull of a ship below the water line. Contains poisonous substances, such as red or yellow mercuric oxide, red cuprous oxide, or metallic soaps containing mercury, copper or the like. Its purpose is to prevent the growth of marine life, such as barnacles, which greatly retard the speed of a ship.

Antimony Oxide. A white pigment no longer much used in enamels except for fire-retardant paints.

Antique Finish. A finish usually applied to furniture to give the appearance of age.

Apprentice Painter. One engaged in learning the painting trade who is covered by a written agreement with an employer, association of employers or other responsible agency. Such an agreement provides for a certain number of years of reasonably continuous employment and for participation in an approved program of training in related technical and general subjects.

Asbestine. Trade name of the natural fibrous magnesium silicate which is white in color. Used as an extender pigment in paints.

Asphalt. Black solid bitumen found naturally. Also the residue from distillation of petroleum.

B

Back Priming. When a coat of paint is applied to the back of woodwork and exterior siding to prevent moisture from getting into the wood and causing the grain to swell it is said to be "back primed".

Baking Finishes. Baking at elevated temperatures improves certain types of coatings used on metal articles, such as automobiles and refrigerators, etc. Baking may be done in an oven, under infra-red lamps, or by induction heating according to the demands of shape, space and other requirements. The article that is coated must, of course, be able to withstand the temperature required for the proper baking of the finish. Baking is usually employed to speed drying and step up production.

Baking Japan. An enamel to which the artificial heat of an oven is usually applied in order to attain the maximum hardness or toughness of film.

Barytes. Natural barium sulfate. Used extensively as an extender pigment in paint and as a base for diluted colors.

Barium Sulfate (barite, barytes, sulfate of barium, blanc fixe). A heavy, white crystalline extender pigment, sometimes substituted for more expensive heavy pigments.

Basic Carbonate White Lead. See White Lead.

Basic Lead Sulfate (basic sulfate white lead). A white opaque pigment made by subliming lead sulfide, which is oxidized to the basic sulfate.

Batavia. Short for Batavia damar. See Damar.

Benzene. Sometimes called Benzol. Often confused with Benzine due to similarity in pronunciation. Benzene is a very powerful solvent for many materials. Its use is restricted, however, due to its toxicity and also due to the fact that it is a fire hazard. Its use is generally restricted to industrial finishes for spray application.

Benzine. A highly volatile petroleum product often used as a lacquer diluent. Highly flammable and a fire hazard both in shipping and storage and when used in the home by an inexperienced person. It has low solvent power, and is fast evaporating.

Benzol. See Benzene.

Binder. The non-volatile portion of a paint which serves to bind or cement the pigment particles together. Oils, varnishes and proteins are examples of binders. See Vehicle.

Bitumen. Originally asphalt. Now any mineral hydrocarbon, but usually black pitchy material.

Blanc Fixe. Artificially prepared barium sulfate.

Bleaching. Restoring discolored or stained wood to its normal color or making it lighter by using an acid or other bleaching agents.

Bleeding. Migration of a dye or stain from stained wood or an undercoat into subsequent coats. This usually occurs as the result of solubility in the vehicle portion of the top coat. It can often be prevented or reduced by the application of an intermediate coat of shellac, aluminum paint, or emulsion paint. For example, a white enamel applied over mahogany woodwork or over a brilliant red enamel will develop pink spots in a few weeks.

Blending. The word blending is often used synonymously with the word mixing. When two materials are blended they are intimately mixed together. At other times blending refers more particularly to gradually shading off from one color to another, as in glazing.

Blistering. Caused usually by applying paint to a surface containing excessive moisture. Blistering may also occur when moisture enters painted wood through some indirect source such as poor joints or careless carpentry work. It may also be caused by excessive heat.

Bloom. A fluorescence or deposit on a varnished or lacquered surface. Sometimes caused by a thin film of foreign material, such as smoke, dust or oil, or by allowing the finish to dry in a poorly ventilated atmosphere.

Blown oil. A vegetable or fish oil which has been thickened (bodied) by air blown through it while heated.

Blow Torch. An instrument used in burning off paint film. Should be used only by experienced operators. It is a dangerous fire hazard when used by amateurs.

Blue Lead. A basic sulfate of lead containing small amounts of lead sulfide and carbon that impart a bluish-gray color. Used primarily for its rust-preventive property.

Blushing. Cloudiness in the surface of a film. Usually caused by drying under improper conditions. Frequently used in the trade as synonymous with Blooming.

Bodied Oil. Made from alkali-refined linseed oil, which is kettle-bodied under heat.

Body. Thickness of a fluid. Becoming obsolete. More suitable words are Consistency or Viscosity.

Boiled Oil. Drying oil treated with driers to shorten the drying time.

Bone Black. A black pigment made by roasting animal bones in closed vessels. Sometimes known as "drop black".

Boxing. Mixing paint by pouring from one bucket to another several times to assure most uniform consistency and smoothness.

Bronzing Liquid. A vehicle especially formulated for use as binder for aluminum or gold bronze powder.

Brush Marks. Marks of the bristles of a brush left on a dried paint film.

Brushability. The ability or ease with which a paint can be brushed under practical conditions.

Bulking. Indicating the number of gallons per pound of pigment.

Burnt Sienna. Sienna that has been roasted. Reddish brown in color.

Burnt Umber. Umber that has been roasted. Dark brown in color.

C

Cadmium Red. A non-fading red pigment, alkali and heat resistant. Manufactured from cadmium and selenium metals. Used in special cases for coloring paint. Lower in hiding power than organic red toners of the same general color.

Calcium Carbonate (calcite, marble dust, carbonate of lime, English whiting, limestone, cliffstone whiting). A white crystalline substance used as an extender pigment and as a putty ingredient.

Calcimine. A water thinned paint composed essentially of calcium carbonate or clay, and glue. Sometimes spelled kalsomine.

Carbon Black. A black pigment made by burning natural gas in an insufficient supply of air, causing a deposit of carbon black smoke.

Carbonate of Lead. See White Lead.

Casein. The protein of milk and the principal constituent of cheese. Casein is used extensively in the manufacture of water paints.

Castor Oil. Oil obtained from the castor bean. Non-drying. May be converted to a drying oil by chemical treatment, and is then known as dehydrated castor oil.

Caulking Compound. A semi-drying or slow-drying plastic material used to seal joints or fill crevices around windows, chimneys, etc. Usually made in two grades, the gun type for application by use of a special gun; and the knife type for use with a putty knife.

Cellulose Acetate. A binder ingredient made by chemical reaction of acetic acid on cellulose (cotton linters).

Cellulose Nitrate. A binder ingredient made by chemical reaction of nitric acid on cellulose (cotton linters). Also known as nitrocellulose and pyroxylin.

Cement Base Paint. A paint composed of Portland cement, lime, pigment and other modifying ingredients. Sold as dry powder. Mixed with water for application.

Chalk. A form of natural calcium carbonate. See Whiting.

Chalking. The decomposition of a paint film by lesion into a loose powder on the film surface. Mild chalking, accompanied by satisfactory color retention in tinted paint, is considered a desirable characteristic. Heavy chalking which washes off to leave an unprotected surface is highly undesirable. Before recoating a heavily chalked surface, all of the chalk should be removed. This is usually accomplished by vigorous brushing.

Checking. The formation of short narrow cracks in the surface of a paint film. These cracks may assume many patterns, but the usual ones resemble the print of a bird's foot or small squares. These cracks usually curl up and flake off as the paint film ages.

China Clay. A mineral used as extender pigment mostly aluminum silicate.

Chinawood Oil. See Tung Oil.

Chinese Blue. A form of iron blue.

Chinese Red. Chrome orange deep—a basic lead chromate.

Chroma. Intensity or depth of color. The quality of a color that relates to its concentration.

Chrome Green. A green pigment composed of iron blue and chrome yellow.

Chrome Orange. An orange pigment composed principally of basic lead chromate.

Chrome Yellow. A yellow pigment composed primarily of lead chromate.

Chromium Oxide Green. A dark green pigment. Should not be confused with Chrome Green.

Coal Tar Solvent. Derived from the distillation of coal tar. Four main products for the paint industry are benzol, toluol, xylol and solvent naphtha.

Cobalt Blue. A blue pigment composed of the oxides of aluminum and cobalt.

Cold Water Paint. The paint in which the binder or vehicle portion is composed of casein, glue or other protein material dissolved in water. Usually employed on concrete, masonry or plaster surfaces.

Color. A term used variously to designate the colors of the spectrum; to denote the pigments used to produce various colors in paints, enamels and

lacquers; and to express the act of applying color to an object by means of paint, lacquer, stain, etc. See Book Five.

Color-in-Japan. A paste formed by mixing a color pigment with japan. Used principally for tinting.

Color-in-Oil. A paste formed by mixing a color pigment in linseed or other vegetable oil. Used principally for tinting.

Complementary Colors. Two contrasting or opposite colors which combine the use of three primary colors.

Copal. A type of natural resin widely distributed throughout the World and used principally with oils to make varnishes, although most varnishes are now made with synthetic resins rather than natural resins.

Coverage. A term employed to indicate the amount of area over which a given amount of paint will spread, and completely hide the surface.

Cracking. A form of paint failure in which cracks or breaks in the paint film extend through all coats down to the building material itself. This defect is caused by the use of paint which, because of its composition, becomes hard and brittle.

Crazing. Hairline cracks in a paint film.

Creeping. Also known as Crawling. When the paint finish as it is brushed on, runs together in little drops and does not wet the surface properly.

Creosote. A product made from coal tar and used as a wood preservative. It should not be used on wood if painting over it is contemplated at a later time.

Crows Feeting. A surface appearance caused by the film drying in a gas-polluted atmosphere or in a draft..

Crow Steps or Cat Ladders. Long boards to which short cross pieces have been nailed at intervals to be used as steps. Used on a roof when staining or painting.

Cutting In. An operation calling for most careful workmanship to keep a clean edge, as for example "cutting in" on a window sash with a sash tool.

D

Damar. A gum once used extensively in the preparation of varnishes and lacquers. Usually classified according to the place from which it is shipped to market. Sometimes spelled with two "dammar".

Dead Flat. Having no gloss or sheen.

Decalcomania. Paint films in the form of pictures or other decorations which can be transferred from a temporary paper background to other surfaces.

Dehydrated Caster Oil. A drying oil prepared from castor oil.

Dioxide. An oxide in which two atoms of oxygen are combined with one atom of the metal to form an oxide molecule. Example: titanium dioxide.

Distemper. A water paint in which the vehicle contains casein, glue, egg white, etc. Term used principally in England.

Driers. Compounds of certain metals which hasten the drying action of paints and varnishes. Most of these are solutions of metallic soaps in oils and volatile solvents, the most commonly used being lead, manganese and cobalt salts of organic acids.

Drop Black. Same as Bone Black.

Drop Cloth. A large piece of fabric used by a journeyman painter to protect furniture, rugs and other articles from damage; also used over bushes and shrubs.

Drying Oils. Oils which are converted to solid films when exposed to oxygen in the air. Linseed, tung, perilla oils are the three principal vegetable oils of the drying class. Fish oil is the only animal oil of the drying class suited for use by the paint industry.

Dry to handle. A film of paint or varnish is "dry to handle" when it is hardened sufficiently so that it may be handled without marring.

Dry to touch. A film of paint is "dry to touch" when it is hardened sufficiently so that it may be touched lightly without any of it adhering to the fingers.

Dull Finish. Almost a dead flat.

Dull Rubbing. Act of rubbing a dried film of finishing material to a dull finish, usually with abrasive materials such as pumice, rotten stone or steel wool moistened with oil or water.

Dust Free. A film of paint is "dust free" when dust no longer adheres to it.

Dutch Metal. Thin leaves of bright brass which are used for over-laying in the same manner in which gold leaf is applied.

Dye. A material used for dyeing or staining, usually dissolved in oil, water, or alcohol.

E

Earth Pigments. Pigments found in the earth such as ochre, umber, sienna, Van Dyke brown, chalk, barytes and graphite.

East India Gum. A resin in two grades: pale and black.

Efflorescence. A deposit of water soluble salts on the surface of masonry or plaster caused by the dissolving of salts present in masonry, migration of the solution to the surface and deposition of the salts when the water evaporates.

Egg Shell Lustre. Lustre closely resembling that of an egg shell.

Emulsion. The suspension of very small particles of oil in water, or water in oil, by the aid of an emulsifying agent. Both types of these emulsions are used in making water paints.

Enamel. A special type of paint made with varnish or lacquer as the vehicle. The line of distinction between enamel and oil paints is very indefinite. An enamel is usually high in gloss and pigmented with high hiding pigments only. It has a low pigment volume.

End Seal. Paint applied to the ends of boards in order to seal the pores to prevent the entrance of moisture which would cause decay and affect the paint film.

Ester Gum. A synthetic resin made by a combination of rosin and glycerine.

Extender. A pigment of low hiding power. When used properly, extenders may contribute desirable properties to paint products, such as durability and porosity.

F

Feel. A journeyman's term for the working qualities of a paint.

Ferric Oxide (Iron oxide). A pigment of varying shades of red obtained in its natural form from mines in different parts of the world. Available in dry and paste form. Considerable amounts of synthetic iron oxide are now in use.

Filler. A composition used to fill the pores of wood before applying paint or varnish.

Fish Oil. Oil from marine animals such as menhaden, sardines, whales, etc.

Film. A layer or coat of material applied to a surface.

Flaking. Detachment of small pieces of paint film.

Flashing. The non-uniform appearance on walls or other surfaces in which a coating dries with spotty differences in color or gloss, usually due to improper sealing of the porous surface.

Flatting Agent. An ingredient used in lacquers and varnishes to reduce the gloss or give a rubbed effect.

Flatting Oil. A varnish-like composition, made of heavy bodied oil dissolved in a thinner, used to reduce paste paint to a flat paint.

Flat Wall Paint. A type of interior paint which is designed to produce a lusterless finish.

Floor Varnish. A varnish made specifically for floors formulated to have good toughness, flexibility, and abrasion or wear resistance.

Flowing Varnish. A varnish which has been designed to produce a smooth lustrous surface without rubbing or polishing.

Foots. Matter which separates from linseed oil and settles to bottom of container.

Fossil Resin. Any of the natural or earth type resins, which derive their characteristics through aging in the ground.

French Process Zinc Oxide. Zinc oxide pigment made from metallic zinc; sometimes called "indirect" process.

G

Ghosting. A coating with a skippy appearance. See Skippy.

Glazing. A process of applying transparent or translucent coatings over a painted surface to produce blended effects.

Gloss Oil. A varnish composed primarily of limed rosin dissolved in petroleum thinner such as mineral spirits.

Glycerine. A polyhydric alcohol used in manufacture of alkyd resins, ester gum and various resins for varnish making.

Graininess. Roughness of a protective film resembling grains of sand.

Graining. Simulating the grain of wood by means of specially prepared colors or stain and graining tools.

Grain Raising. Swelling of the fibres of wood by water, producing an undesirable rough surface.

Ground Coat. The coating material which is applied before the graining colors, glazing, or other finish coat.

Gum. A natural mucilaginous material derived from certain trees. Sometimes erroneously applied to resins.

Gum Arabic. The dry exudation of Acacia Senegal. This white powdered resin is sometimes used in cold water paint and in show card colors.

Gypsum. An extending pigment, not much used in oil paints, but used extensively in cement water paints.

H

Hair Lines. Very narrow cracks in paint or varnish film.

Hard Oil Finish. A varnish giving the effect of a rubbed-in-oil finish, but producing a hard surface. The term has gradually been extended to cover all sorts of architectural varnishes with a moderate luster.

Heavy Bodied Oil. A high viscosity oil.

Hiding Power. The capacity to obliterate colors that lie beneath a coat of paint, completely hiding the surface to which the paint is applied.

Holidays. Areas of surface missed by the painter.

Hot Spots. Spots in plaster due to improper mixing of the plaster. If paint is applied over them, a chemical reaction causes "burning" and this damages the paint film. Such spots must be specially primer coated before painting.

Hue. Used to designate the name of a color—such as red, blue or orange.

I

Inert. See Extender.

Insulating Varnish. A varnish specifically designed for insulation of electrical appliances formulated to have a high resistance to electrical passage.

Iron Blue. A blue ferro ferricyanide pigment.

Iron Oxide. Pigment available in three forms: red, brown and yellow, and of high iron content.

Ivory Black. A high grade bone black pigment, formerly made by burning ivory.

J

Japan. A type of varnish.

Japan Color. Color ground in japan varnish.

Journeyman Painter. One who has had at least three years' experience and schooling as an apprentice.

K

Kauri Gum. A fossil copal found in New Zealand.

Kettle Boiled Oil. Boiled linseed oil in which the driers have been incorporated by heat.

L

Lac. A natural resin secreted by insects which live on the sap of certain trees in Oriental countries. Base for shellac.

Lacquer. A material of cellulose base. It dries by evaporation of the thinner or solvent and has a low solids content making it necessary to apply several coats for a good full finish.

Lake. A colored pigment produced by precipitating a dye on a base, such as aluminum or calcium insoluble salts.

Lampblack. A pigment consisting of finely ground carbon.

Lap. The point on a wall at which two brush-outs meet.

Lead Carbonate, Basic. A type of White Lead.

Lead Drier. A compound of lead and an organic acid for hastening the drying of paint.

Lead Oxide. A combination of lead and oxygen, such as red lead.

Lead Sulfate, Basic. A type of White Lead.

Leaded Zinc. A mixture of zinc oxide and basic sulfate white lead.

Leafing. Action peculiar to aluminum paints, in which the flat flakes in the pigment overlap each other.

Leveling. The formation of a smooth film on either a horizontal or vertical surface. A film which has good leveling characteristics is free from brush marks.

Lifting. Buckling of a finish coat when it is applied over a previous coat, which is not yet dry, or when solvents in the second coat are too strong.

Linseed Oil. Oil obtained from flaxseed (linseed).

Litharge. Lead monoxide of brownish color used as a source of lead for driers and for red lead.

Lithopone. A mixture of zinc sulfide and blanc fixe. Widely used as a paint pigment.

Livering. An abnormal increase in the consistency of paint or enamel which results in a liver-like mass.

Liquid Driers. Solution of driers in paint thinners.

Liquid Wood Filler. Varnishes of low viscosity, usually containing extending pigment, for use as a first coater on open grain woods.

Long Oil Varnish. One made with a relatively high proportion of oil to resin. Generally slower drying, tougher and more elastic than short oil varnishes, primarily intended for exterior use.

M

Madder. Coloring matter originally derived from the roots of a plant cultivated in Europe, now made synthetically.

Manila Resin. A copal resin found in the East Indies, used in the manufacture of varnish.

Marine Varnishes. Varnishes especially designed for immersion in water and exposure to marine atmosphere.

Masking Tape. A strip of paper or cloth similar to adhesive tape which can easily be removed. It is used to protect small surfaces which the painter does not want to get smeared with paint.

Mildew. A fungus growth which "feeds" on paint and other materials. It disfigures paint through discoloration.

Mill White. White paint with vehicle of varnish type, used to augment illumination on interior of industrial plants.

Milori Blue. An iron blue pigment.

Mineral Black. A natural black pigment based on graphite.

Mineral Spirits. A petroleum solvent used as a replacement for turpentine.

Mobility. The degree to which a material flows.

N

Naphtha. Hydrocarbons suitable for use as a paint thinner.

Natural Resins. Bush resins made from the exudation of trees, or fossil resins taken from fossilized vegetable matter in the earth. Examples are dammar, elemi and the copal resins.

Naval Stores. A group of products derived from the pine tree such as turpentine, rosin and pine oil.

Nitrocellulose. A binder ingredient widely used in lacquer manufacturing.

O

Ochre. A natural yellow iron oxide mixed with siliceous matter, occurring in certain parts of the earth.

Oil Color. See color in oil.

Oil Stain. Solutions of dyes in blends of oil or varnish and aromatic solvents.

Oiticica Oil. Oil secured from the oiticica nut, similar in properties to tung oil.

Oleoresinous. Said of a varnish made of oil and resin.

Opacity. The property in a paint which enables it to hide and color a surface.

Orange Mineral. Red lead prepared by roasting basic carbonate white lead.

Organic Colors. Pigments of animal, vegetable or dyestuff origin.

Oxide. The chemical compound formed by the reaction of oxygen on a metal such as lead, zinc, iron, titanium. Some oxides occur in nature and are mined, others are made synthetically. Examples: iron oxide, zinc oxide.

Oxidize. To unite with oxygen.

P

Paint. A mixture or dispersion of pigments or powders in a liquid or vehicle. See Book One.

Paint Remover. A compound which softens old paint or varnish and permits the scraping off of the loosened material.

Patching Plaster. A special plaster made for repairing plaster walls.

Peeling. Detachment of a paint film in relatively large pieces. Paint applied to a damp, or greasy, surface usually "peels". Sometimes it is due to moisture back of the painted surface.

Perilla Oil. Drying oil from the seed of the perilla plant.

Phthalic Anhydride. A white powder made from naphthalene (same substance as moth balls) and used in the manufacture of alkyd resins.

Phthalocyanine Blue. An organic blue pigment made synthetically from phthalic anhydride; outstanding in fade resistance and tint retention.

Pigment. Material in the form of fine powders substantially insoluble in oils, varnishes, lacquers, thinners and the like. Used to impart color, opacity, certain consistency characteristics and other effects.

Plasticizer. An organic ester or resinous material of low vapor pressure, either liquid or semi-solid, used to blend with brittle materials to produce a lacquer or vehicle having good flexibility.

Polishing. Said of wall paints where shiny spots or surfaces have resulted from washing or wiping.

Polymerization. The uniting of two or more molecules (as of an oil) to form one larger molecule. This effect takes place by oxidation when paints or varnishes dry to form a film, or when oil is heated in a kettle to make it heavier. Oils and resins are often heated together forming polymers.

Primer. The first coat in any painting operation.

Primary Color. A primary color is a color which cannot be produced by mixing any other two colors. The three true primary colors are red, yellow, and blue. See Book Five.

Prussian Blue. Iron blue.

Putty. A dough-like mixture of pigment and oil (usually whiting and linseed oil—sometimes mixed with white lead). Used to set glass in window frames, fill nail holes and cracks.

Putty Coat. Final smooth coat of plaster.

Pyroxylin. See cellulose nitrate.

Q

Quick Drying. A material with a relatively short drying time.

R

Raw Oil. Oil as received from the press or separated from the solvent in the solvent extraction process.

Red Lead. An oxide of lead—red in color—used as a rust-inhibiting pigment and as a source of lead in some driers.

Refined Shellac. A grade of orange or white shellac from which the wax has been removed.

Refractive Index. Refraction is the degree to which a ray of light passing through a material is bent. The Refractive Index of a material is measured on an instrument called a Refractometer. The higher the Refractive Index of a pigment, the higher is its hiding power when used in paint or enamel.

Removers. See Paint Removers.

Resin. A solid or semi-solid organic material, chiefly of vegetable origin or synthetic derivation. The color is usually yellow or amber to dark brown. Usually transparent or translucent. Examples of natural resins are Congo, rosin and damar. Synthetic resins include alkyds and phenolics.

Ride the Brush. Bearing down on the brush to the extent that the paint is applied with the side of the bristles instead of the flag ends.

Rosin. A resin obtained from pine trees containing principally isomers of abietic acid. Wood rosin is obtained from stump or dead wood, using steam distillation. Gum rosin is obtained from the living tree.

Rottenstone. A brown siliceous stone used as an abrasive. Similar in nature to pumice stone, though softer in texture.

Rubbing Varnish. A hard-drying varnish which may be rubbed with an abrasive and water or oil to a uniform leveled surface.

Runs. Also known as "sags" or "curtains". Irregularities of a surface due to uneven flow, frequently due to application of a coat that is too heavy, and not brushed out well.

S

Sags. See Runs.

Sal Soda. Crystallized sodium carbonate. It is used for making cleaning solutions to remove grease and grime from old painted surfaces.

Sand Finish. Rough finish plaster wall.

Sanding. Smoothing of a surface, by hand or machine, to enable production of a better final finish.

Saponification. The reaction of basic materials such as metal oxides or hydroxides with organic acids (as in oils and fats) to form soaps.

Satin Finish. When a dried paint film does not have a full luster, but has one resembling the luster of satin, it is said to have a satin finish.

Scaling. An evidence of paint failure which is the last stage of cracking. Moisture entering the cracks in the paint film destroys its adhesive property, and results in the breaking or scaling of paint.

Sealer. A coat of paint, or the like, intended to close or seal the pores in a surface.

Semi-Drying Oils. Oils which possess the drying properties of drying oils to a lesser extent. Principal semi-drying oil used in the paint industry is soybean oil.

Set Up. A film that has dried so that it is firm is said to have "set up".

Shellac. Derived from a resinous substance called Lac. Used as a sealer and finish for floors, for sealing knots and other purposes.

Shadowing. When preceding coats show through the last coat, the finish is said to be "shadowing".

Ship Bottom Paint. Special product designed to prevent corrosion and fouling with marine life on the bottom of ships.

Short Oil Varnish. One made with a relatively low proportion of oil to resin. See long oil varnish.

Sienna. An earth pigment of a brownish yellow color when raw; orange red or reddish brown when burnt. The color comes from the oxides of iron and manganese.

Silica. Ground quartz. Used as an extender pigment.

Singapore Damar. A damar found in the Malay states and adjacent islands, exported from Singapore.

Size. A sealer.

Skin. A tough layer or skin formed on the surface of a paint or varnish in the container. Caused by exposure to air.

Skippy. Said of paint too heavy-bodied for uniform application which causes the brush to skip on the surface, leaving some spots insufficiently coated and others with too heavy a coating.

Skips. Places where the journeyman painter has failed to cover with paint, or the brush has been too dry to apply the proper thickness of film.

Slip. Said of a paint which is easy to apply.

Solvents. Volatile liquids, usually of low boiling points, used in paints and similar materials to dissolve the various compounds of the vehicle. Some of them are used to dissolve the nitrocellulose used in making lacquer.

Soybean Oil. A semi-drying oil obtained from soybeans.

Spotting Compound. A powder which is mixed with water and used as a crack filler, for building up rough surfaces preparatory to painting and for other purposes.

Spar Varnish. A very durable varnish designed for severe service on exterior surfaces. It must be resistant to rain, sunlight and heat. Named from its original use on the spars of ships.

Spirit Stain. One made by dissolving a dye in an alcohol.

Spirit Varnish. A varnish made by dissolving a resin in a solvent. It dries primarily by evaporation rather than by oxidation.

Stand Oil. Heat-thickened vegetable oil (or combination of vegetable oils, such as linseed and tung).

Starch Solution. A solution for starching newly painted walls so that they can be more easily washed.

Stippling. A finish made by using a stippling brush or roller stippler on a newly painted surface before the paint is dry.

Stretch. A term used to describe the width of a section of a wall that is painted before moving the ladders or scaffolding.

Suction Spotting. Due to the absorption of oil in a new coat by porous areas in a previously painted surface.

Sulfate. A chemical compound in which sulphur and oxygen are combined with a metal or other substance in a certain ratio. Example: lead sulfate.

Sulfide. A chemical compound in which sulphur is combined with a metal or other substance, but no oxygen is present. Example: zinc sulfide.

T

Tack. The degree of stickiness of a paint or varnish film during the drying period. Oil paints and spar varnishes may retain an after-tack for several weeks after they are considered dry.

Talc. A hydrous magnesium aluminum silicate used as an extender in paints. It is also known as talcum powder and soapstone.

Tall Oil. A blend of resin and oil acids obtained as a by-product from the sulfate process for making paper.

Tar. A thick brown or black liquid with a characteristic odor—a residue from the distillation of wood, peat, coal, shale or other vegetable or mineral material.

Tempera. A water-thinned or water-emulsion paint.

Texture Paint. One which may be manipulated by brush, trowel or other tool to produce various effects.

Thinners. Volatile liquids used to lower or otherwise regulate the consistency of paint and varnish.

Tint. A color thinned or let down with white. Tints are made by blending a full strength color with a white paint.

Titanium Dioxide. Compound of titanium. White in color. Used as a pigment in paints and enamels.

Toner. A non-extended pure organic pigment usually, although some toners are bases on such metals as copper, molybdenum, and tungsten.

Tooth. A term sometimes used by journeymen painters to describe the characteristics of a paint which provide good anchorage or adhesion for succeeding coats. They say it gives "tooth" to the surface.

Tung Oil. A drying oil obtained from the nut of the tung tree; also called Chinawood oil.

Turpentine. A colorless, volatile liquid obtained by distillation of the oleo-resinous secretions found in living and dead pine trees; used as a paint thinner.

Tuscan Red. A red pigment consisting of a combination of iron oxides and a lake.

U

Ultramarine. Artificial lapis lazuli used as a blue pigment.

Umber. A hydrated iron manganese ore running from olive shades in raw condition to dark rich brown shades in the burnt state. Used extensively as a pigment.

Undercoater. In a multicoat system, any intermediate coat.

Undertone. The color of a paint observed by transmitted light.

V

Vacations. The uncoated portion of a finished object. Also known as "skips" and "holidays".

Value. The lightness or darkness of a color.

Van Dyke Brown. A brown pigment which consists of decomposed vegetable matter that has almost approached the coal state.

Varnish. A liquid composition which is converted to a translucent or transparent solid film after application in a thin layer.

Varnish Stain. A varnish containing a stain.

Vegetable Oils. Oils obtained from the seeds or nuts of vegetable growth. Included are linseed, soybean, perilla, hempseed, tung, castor, etc.

Vehicle. Liquid portion of a paint. See Binder.

Venetian Red. A pigment consisting usually of calcium sulfate and red iron oxide.

Vermilion. Sulfide of mercury used as a pigment.

Viscosity. The fluid thickness of an oil, varnish, paint or enamel.

Volatile. Said of a liquid that evaporates.

W

Washing. Rapid dissolution or emulsification of a paint film when wet with water.

Water Spotting. Spotty changes in the color or gloss of a paint film. May be caused by various factors, such as emulsification or the solution of water soluble components.

Water-thinned Paint. A paint whose thinner is mainly water. The binder may be a material that (1) requires water for setting, e.g., Portland cement; (2) which is soluble in water, e.g., casein; (3) which is emulsifiable in water, e.g., flat wall paint binders.

White Lead. Compounds of lead used as white pigments in many types of paint. There are two types: basic lead carbonate and basic lead sulfate.

White Spirit. British term for mineral spirits, or petroleum thinner.

Whiting. Calcium carbonate, limestone or chalk in pigment form. Used as an extender in paints and for making putty.

Wood Turpentine. Turpentine that has been made by steam distilling Southern pine chips and stumps rather than distilling the pure gum gathered from live trees.

Wood Fillers. Fillers are of two kinds—paste and liquid. Paste fillers are something like a very thick paint and are composed of some solid powdered substance, usually silica or powdered quartz, mixed with linseed oil or varnish thinned with turpentine or benzine.

Wrinkle Finish. A varnish or enamel film which exhibits fine wrinkles or ridges. Used largely for its novelty effect on manufactured articles.

Z

Zinc Chromate. See Zinc Yellow.

Zinc Dust. Finely divided zinc metal, gray in color. Used chiefly in meta primers, especially for galvanized iron.

Zinc Oxide. A compound of zinc used as a white pigment in many types o paint.

Zinc Sulfide. A compound of zinc used as a white pigment in many types o paint. See Lithopone.

Zinc Yellow. A yellow pigment, primarily Zinc Chromate. Used in metal primers for its rust inhibiting property.