

THE CHEMICAL FORMULARY

The Chemical Formulary

*A Collection of Valuable, Timely, Practical
Commercial Formulae and Recipes for
Making Thousands of Products in
Many Fields of Industry*

VOLUME VII

Editor-in-Chief

H. BENNETT



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H. BENNETT

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PREFACE

Chemistry as taught in our schools and colleges is confined to synthesis, analysis and engineering—and rightly so. It is part of the proper foundation for the education of the chemist.

Many a chemist on entering an industry soon finds that the bulk of the products manufactured by his concern are not synthetic or definite chemical compounds but are mixtures, blends or highly complex compounds of which he knows little or nothing. The literature in this field, if any, may be meager, scattered or antiquated.

Even chemists, with years of experience in one or more industries, spend considerable time and effort in acquainting themselves on entering a new field. Consulting chemists, similarly, have problems brought to them from industries foreign to them. A definite need has existed for an up-to-date compilation of formulae for chemical compounding and treatment. Since the fields to be covered are many and varied, an editorial board was formed, composed of chemists and engineers in many industries.

Many publications, laboratories, manufacturing companies and individuals have been drawn upon to obtain the latest and best information. It is felt that the formulae given in this volume will save chemists and allied workers much time and effort.

Manufacturers and sellers of chemicals will find in these formulae new uses for their products. Non-chemical executives, professional men and others, who may be interested, will gain from this volume a "speaking acquaintance" with products which they may be using, trying, or with which they are in contact.

It often happens that two individuals using the same ingredients in the same formula get different results. This may be the result of slight deviations or unfamiliarity with the intricacies of a new technique. Accordingly, repeated experiments may be necessary to get the best results. Although many of the formulae given are being used commercially, many have been taken from patent specifications and the literature. Since these sources are often subject to various errors and omissions, due regard must be given to this factor. Wherever possible it is advisable to consult with other chemists or technical workers regarding commercial production. This will save time and money and avoid "headaches."

It is seldom that any formula will give exactly the results which one requires. Formulae are useful as starting points from which to work out one's own ideas. Formulae very often give us ideas which may help us in our specific problems. In a compilation of this kind, errors of omission, commission and printing may occur. We shall be glad to receive any constructive criticism.

To the layman, it is suggested that he arranges for the services of a chemist or technical worker familiar with the specific field in which he is interested. Although this involves an expense, it will insure quicker and better formulation without waste of time and materials.

H. BENNETT

PREFACE TO VOLUME VII

Additional new formulae have been gathered to compile a seventh volume of the *Chemical Formulary*—an addition which will broaden and bring up-to-date the contents of volumes I, II, III, IV, V and VI.

Schools and colleges in increasing numbers seem to find it advisable to use the *Chemical Formulary* as an aid in promoting a practical interest in chemistry. By its use, students learn to make cosmetics, inks, polishes, insecticides, paints and countless other products. The result is that chemistry becomes an extremely interesting practical and useful subject. This interest often continues even when the students reach the theoretical or more difficult phases of chemistry.

Since some mature users of this book have not had the good fortune to have had previous training or experience in the art of chemical compounding, the simple introductory chapter of directions and advice has been repeated. This chapter should be studied carefully by all beginners (and some more experienced workers) and some of the preparations given in it should be made before attempting to duplicate the more complex formulae in the succeeding chapters.

An enlarged directory of sources of chemicals and supplies is included. This should prove useful in locating new as well as old materials and products.

It is a sincere pleasure to acknowledge the valuable assistance of the members of the board of editors and others who have given of their time and knowledge in contributing the special formulae which have made this volume possible.

H. BENNETT

NOTE

All the formulae in volumes I, II, III, IV, V, VI and VII (except in the introduction) are different. Thus, if you do not find what you are looking for in this volume, you may find it in one of the others.

A *cumulative index* for the first six volumes is now available. Many will find this a useful, time-saving adjunct.

TABLE OF CONTENTS

	PAGE
PREFACE	vii
PREFACE TO VOLUME VII	ix
ABBREVIATIONS	xxxii
I. INTRODUCTION	1
II. ADHESIVES	17
Water-Soluble or Dispersible	
Labeling; Non-Warping; Billposter's; Cold Water;	
Envelope; Wall Paper; Water-Resistant; "Iceproof";	
Sizes; Non-Warping Paper; Binder for Cork; Tin	
Labeling; Starch; Veneer; Potato Starch; Sweet Po-	
tato; Dextrin; Gummed Paper; Paper to Metal;	
Powdered; Casein; Laminating; Dried Blood; Soy-	
bean; Sodium Silicate; Ceramics; High Temperature;	
Marble and Alabaster; Bonding for Abrasive Wheel;	
Gum Arabic; Waxed Paper; Mucilage; Magazine and	
Catalog; Bookbinders'; Moistureproof Cellophane;	
Wood; Plywood; Paper Board; Calcium Sucrate;	
Synthetic Resin; "Protectoid"; Decalcomania; Tire	
Tube Air Seal; Latex; Paper.	
Water-Insoluble Adhesives	
Synthetic Rubber; Neoprene; Buna N; Buna S;	
Thiokol; Photo Mounting; Mixed; Rubber to Metal;	
Leather Driving Belts; Insole; Metal to Metal; Cel-	
luloid to Hard Rubber; Rosin; Sticky Rubber-Rosin;	
Permanently Tacky-Pressure; Non-Webbing Rubber;	
Crockery; Rosin Linoleum; Electrical Sealing; Rub-	
ber-Resin; Bakelite Coated Cloth; Polyvinyl Chloride	
Plastics; Coating; Ethyl Cellulose; Cellulose Acetate;	
Cellulose Acetate Foil; Wood Ply Lamination; Lam-	
inated Wood; Laminating; Plywood; Veneer; Ther-	
moplastic; Flexible Thermoplastic; Thermoplastic	
High-Melting; Transparent Resin; Stainless Steel	
Pipe; Pipe Joint; Plastic Heatproof; Pipe Joint	
Lute; Pipe Joint Calking; Metal Joint Seal; Plastic	
Sealing; Can Seam Seal; Container Joint Thermo-	
setting; Aluminum Thread Joint; Thermosetting;	

	PAGE
Crack Sealer; Plate Glass Setting; Lantern Slide; Lens; Glass Sealing; Glass to Metal; Glass; High-Vacuum; Universal; Quick-Setting Waterproof; Pettman; Lacquer; Asphalt Emulsion; Sound-Deadening Pads; Pressure-Sensitive; Tape; Masking; Removing Surgical Tape; Strapping; Surgical Waterproof; Grafting Wax; Wood Filler; Furniture Filler; Metal to Glass; Metal to Wood; Metal to China; Metal to Horn; Rubber to Glass; Rubber to Stone; Rubber to Metal; Metal to Linoleum; Metal to Stone; Brass to Marble; Metal to China; Glass to Glass; Glass to Wood; Marine; Metal to Celluloid; Stone to Stone; Stone to Horn; Stone to Hard Rubber; China to China; White Lead; Alberene Stone Filler; Stoneware; Refractory; Metal Filler and Calking; Calking; Boat Calking; Heat-Sealable; Rectifier; Denture; Preparation of Surfaces for Cementing Leather with Gutta-Percha; Leak-Sealing; Refrigerator; Oil-Well Water; Bonding Aluminum to Steel.	
III. FLAVORS AND BEVERAGES	51
<i>Pure Fruit Concentrates:</i> Strawberry; Raspberry; Grape; Cherry. <i>Nectars:</i> Orange; Lime. <i>Imitation Nectars:</i> Grape; Cherry; Strawberry; Raspberry; Walnut Extract; Pineapple Extract; Almond Extract; Spearmint Extract; Lemon Extract. <i>Imitation Spices:</i> Allspice; Nutmeg; Sage Oil; Root Beer Extract; Quick Dissolving Syrup; Sugarless Syrup Substitutes; Hop Extract Emulsion; Emulsifier and Stabilizer; Marmalade from Orange Peels; Rye Bread; Chocolate Syrup; Lemon Oil; Orange Oil; Orangeade Syrup; Orange Juice Syrup; Ice Cream or Soda Fountain Crushed Fruits; Prepared Lemon Beverage.	
IV. COSMETIC AND DRUG PRODUCTS	59
<i>Creams:</i> Cleansing; Hydrogenated Vegetable Oil; Liquid; Emulsifying Base; Toilet; Ointment Base; Washable Ointment Base; Emulsifier; Sulfathiazole Urea; Hormone; Camouflage; Glycerin; Acid; Four-Purpose; Concentrated; Cosmetic Base; Tissue; Modern Tissue; Cold; Suntan Oil; Suntan Lotion; Sunburn Ointment; Suntan Cream; Anti-Sunburn Ointment; Milky Suntan Oil; Milk of Almond; Face Lotion; Hand Lotion; Vanishing, Hand, Founda-	

tion; Alginate Hand Lotion Base; Invisible Glove; Lithographers' Protective Hand Wash; Hand Protective; Oil-Resistant; Nail; Non-fatty; Honey-Gel; Vitamin F.

Nail Polish; Solvents; Oily Nail Polish Remover; Antiseptic Dusting Powder; Astringent Dusting Powder; Douche Powder; Face Powder; Solid Perfume; Cream Cologne; Eau de Cologne; Spanish "Paste"; Mouth Wash; Glycerin Thymol; Germicidal; Gargle Powder; Antiseptic Dentifrice; Pumice-Bentonite Dental Paste; Salt-Lime Dentifrice; Sodium Oleate Dentifrice; Epithelial Solvent; Trench Mouth Treatment; Toothache Drops; Dental Desensitizer; Topical Anesthetics; Cavity Cement Lining; Denture Adhesive; Styptic Dental Cotton; Dental Instruments Sterilizing Fluid; Dental Pulp Devitalizer; Dental Antiseptic; Denture-Cleaner; Hair Tonic; Hair Lotion; Permanent-Waving Compositions; Chemical-Heating Powder; Hair-Waving Self-Heating Composition; Cold Hair-Waving Solution; Wave Set (Hair-Waving) Fluid; Bandoline; Wavy Hair Pomade; Hair Creams; Washing and Bathing Composition; Soapless Shampoo; "Crude" Oil for Shampoo; Head Lice Lotion; Bluing for White Hair; Electric Shaving Aid; Brushless Shaving Cream; After-Shaving Lotion; Throat and Nasal Spray; Nasal Inhalant; Vapor Inhalant; Nasal Constrictor; Ephedrine Nose Drops; Isotonic Nose Drops; Asthma Spray; Hay-Fever Treatment; Asthma Nose Drops; Asthma Smoke Powder; Hay-Fever Asthma Inhalants; Non-Irritating Eye Drops; Hay-Fever Eye Wash; Cake Mascara; Kohl (Eye-Brow Black) Neutral Eye Wash; Treating Hives on Eyelids; Eye-Burn Treatment; Ointment Bases; Absorption Base; Healing Salve; Stainless Ointment Base; Analgesic Ointment; Cod-Liver Oil Ointments; Lanolin Substitute; Disinfectant; Germicidal Cream; Germicidal Bombs; (Aerosols) Germicide; Antiseptic Solution; Disinfecting Shoes; Silver Fluoride Soap; Antiseptic Hand Soap; Aluminum Chloride Soap; Anti-Perspirant Liquid; Under-Arm Cream; Anti-Perspirant and Body Deodorant; Control of Foot Perspiration; Deodorant Cream; Deodorant-Fungicide; Liniment; Bay Rum; Menthol Liniment; Athlete's Rub Liniment; Isopropyl Rubbing Alcohol; Foot Bath; Antiseptic

Military Foot Powder; Athlete's Foot Powder; Soaking Bath for Athlete's Foot; Athlete's Food Remedy; Callous Softener and Remover; Corn Remover; Corn Collodion; Callous Skin Remover; Antacid Mixture; Colloidal Aluminum Hydroxide; Anti-Acid Powder; "Acetic" Acid Tablets; Medicinal Barium Sulfate Suspension; Acne Lotions; Chloracne Treatment; Waterproofing Skin Cream; Skin Treatment Cream; Stable Zinc Peroxide Ointment; Coal-Tar Skin Ointment; Ulcer Ointment; Dermatitis Lotions; Cable Rash Ointment; Mucilage of Quince Seed; Sulfathiazole Suspension; Medicine and Salves for Chronic Acid Skin Injuries; Dermatitis Salve for Metal Poisoning; Metal Poisoning Salve; Poison Ivy and Oak Remedies; Poison Ivy Treatment; Scabies Preparations; Antipruritic Lotion; Itch Remedy; Chlorophyll Impetigo Ointment; Impetigo and Wound Powder; Sulfa-Zinc Peroxide Ointments; Sulfa-Drug Surgical Film; Wound and Burn Film Treatment; Burn Ointment; Mustard-Gas Ointment; Anaerobic Wound-Infection Germicide; Aseptic Wax; Tannic Acid Burn Emulsion; Burn Cream; Insect-Repellent Cream; Treatment of Chigger Bites; Cedar Chest Compound; Hemorrhoidal Suppository; Vaginitis Suppository; "Sulfa" Vaginal Suppository; Rectal Suppository; Cocoa-Butter Suppository; Suppository Mold Lubricant. *Sulfa Drug Compositions*: Foot Fungus Ointment; Vaginal Ointment; Washable Jelly; Ointment Emulsion. Medicinal-Vanishing Creams; Ophthalmic-Ointment Base; Sugarless-Pharmaceutical Syrups; Drug-Penetrating Aid; Anthelmintic Tablet; Sedative; Non-Toxic Bitter-Tasting Product; Elixir of Raspberry; Vitamin B Elixir; Pharmaceutical-Flavoring Vehicles; Surgical-Lubricating Jelly; Flexible-Adhesive Surgical Dressing; Surgical-Cast Plaster; Capsule-Filling Hints; Pharmaceutical-Tablet Coating; Enteric-Pill Coating; Pill Excipient; Liquid-Petrolatum Emulsion; Methyl Cellulose; Vegetable Physic; Cod-Liver Oil, Orange Juice, Malt Extract, Emulsion. Substitutes for Glycerin; Depilatory; Cosmetic Stocking; Feminine-Hygiene Preparations; Embalming Fluid; Chapped Lip Stick; Mustache Wax; Bubble Bath; Air Odor-Neutralizer; Air Deodorant; Air Sterilization; Telephone-Mouthpiece Antiseptic.

	PAGE
V. EMULSIONS AND COLLOIDS	111
Paraffin Wax; Ceresin Wax; Ouricury Wax; Cetyl Alcohol; Dichloroethyl Ether Spray; Benzyl Benzoate; Neat's Foot Oil; Castor Oil; Cod-Liver Oil; Peppermint Oil; Polyvinyl Chloride Polymerization; Cumar; Polyisobutylene Polymer; Pentaerythritol Abietate; "Staybelite" Ester; Colloidal Sulphur; Oleoresin Capsicum; Sulfur; Cottonseed Pitch; Asphalt; Aqueous Colloidal Graphite; Breaking Emulsions; Fluorspar Flotation Frother.	
VI. FARM AND GARDEN SPECIALTIES	115
Soilless-Growth Plant Foods; Tomato-Plant Nutrient; Plant-Growth Regulator; Root-Growth Stimulant; Indolebutyric Acid; Granulated Fertilizer; Conserving Agent for Plants; Cut-Flower Preservative; Preventing Dropping of Apples; Protecting Potatoes against Decay; Grafting Wax; Tree Gall Treatment. <i>General Insecticides</i> : Mosquito Larvicide; Insecticidal Aerosol; D.D.T. Fly Spray; D.D.T. Insect Powder; Vermin Exterminator; Silver-Fish Poison; Roach Powder; Powdered Pyrethrum; Sowbug Poison Bait; Dry Insecticide; Rotenone Derris Substitutes; Disinfectant Spray. <i>Agricultural Insecticides</i> : Cutworm; Lawn Grub and Japanese Beetle Larvae; Subterranean Grass Caterpillar; Slug; Tomato Moth; Tomato Pinworm; Boxwood Leaf Miner; Potato Leafhopper; Cherry Fruit Fly; Parasiticide Spray; Control of Pea Aphids; Codling Moth Spray; Codling Moth Ovicide and Larvicide; Water Hyacinth Spray; Horticultural Spray Base; Thrip, Aphid, Mite and Mealy Bug Control; Gladiolus Thrip Spray; Paris Green Sprays; Ornamental Plant Insecticide Spray; Shade Tree Insecticides; General Agricultural Spray; Kerosene Spray Emulsion; Agricultural Spray Spreader; Dry Agricultural Spray; Bordeaux Mixture; Nicotine Bentonite Insecticide; Nicotine Decoctions; Nicotine Dust; Tobacco Blue Mold Control; Rust-Fungus Disinfectant Dust; Disinfecting Seeds; Control of Potato Ring Rot and Scab; Poultry Louse Powder; Disinfectant and Insecticide for Poultry Houses; Tetrachlorethylene Anthelmintic Emulsion; Phenothiazine Suspension; Sheep Anthelmintic; Sheep Tick Dip; Cattle Louse Dust; Cattle Grub Control; Control of Hide Beetles; Cattle Horn Fly Spray;	

	PAGE
Treating Fungous Diseases in Pet Fish; Weed Killers; Honeysuckle-Weed Killer; Poison-Ivy Killer; Mole-Cricket Poison Bait; Solution for Cleaning Eggs; Feather and Animal Hair Depilatory; Dehusking Carob Beans; Artificial Honeycomb. <i>Poultry Mash</i> : Broiler Feed; Chick Starting and Growing; Chick Starters. Poultry Feed; Grain and Mash; Broiler All-Mash; Breeding Mash; Turkey Starters; Turkey-Growing Mash; Calf Meal Feed; Dry Calf Feed; Reinforced Calf-Starter Mixture; Preserving Green Feed (Fodder); Cattle Salt Iodine Blocks.	
VII. FOOD PRODUCTS	139
Canned Fruit Salad; Canned Tomato Aspic; New Fruit Desserts; Syrup for Pickling Fruits; Preventing Discoloration of Cut Fruit; Grape Shipment Protection; Fruit Protective Coatings; Non-Discoloring Peeled Potatoes; Vegetable Preservation; Pea-Soup Cubes; Bleaching Nut Shells; Removing Nut Skins; Orange Marmalade; Strawberry Jam or Preserves; Grape Jelly; Wine Jelly; Cocoa Jelly; Pectin Solution; Pectin Candy Formula. <i>Jelly Candy</i> : Tart Fruit Flavors; Mildly Tart Pieces; Pieces with Chocolate Flavor; High-Grade Licorice Flavored Piece; Pieces with Orange Pulp and Juice; Pieces with Grapefruit Pulp and Juice; Pieces with Fig Pulp; Apple Confection. Apple Leather Candy; Turkish Paste; Fondant Icing Sugar; Butterscotch Sauce; Starch-Albumen Marshmallow; Reducing Viscosity of Chocolate; Glycerin-Gelatin Bases. Heat-Resistant Candy and Cake Cocoa Coating. <i>Bakers' Icings, Glazes and Washes</i> : Pectin Syrup; Coffee Cakes, Danish Pastry, Sweet Rolls, etc.; Icing; Glazed Topping for Nut Butter Coffee Cake; Fruit and Berry Glazes; Strawberry and Other Short Cakes; Pecan Bun Glaze; Piping Jelly. <i>Icings</i> : Cream; Chocolate; Boiled Chocolate; Pineapple Fluff or Fruit; Fondant Type; White; Coffee Cake; Marshmallow; Peach Fluff; Peach Base; Malted Chocolate; Egg Whip. Whipped Cream; Buttercream Filling; Cookie Flat; Buttercream Icing; "Buttercream"; Doughnut Icing and Glaze; Boiled Icing; Chocolate Fudge. <i>Biscuit Coatings</i> : Lemon; Malt Milk; Orange; Dark Chocolate; White; Custard Icing; Boiled Icing or Base; Orange Crumb Topping; Spe-	

cial Icing; French Custard Cream Filling; Lemon Cream Pie. Bakers' Flavored Pectin Jelly Powder; Powdered Pie Fillings; Pectin Solutions; Lemon Cheese; Meringue; Custard-Pie Base; Chocolate-Pie Filler; Fruit-Flavor Pie Filler. Spreading Jelly for Bakers; Lemon-Pie Filler; Fig Slab Jellies; Firm Jelly for Bakers; Orange-Jelly Paste; Yeast-Raised Doughnuts with Potatoes; Non-Staling Baked Products; Sugar Wafers; Filler for Sugar Wafers; Sugar-Wafer Shell; Frankfurter Roll; Prepared Pancake Flour; Prepared Biscuit Flours; Prepared Waffle Flours; Bleaching and Maturing Flour; Baking Powder; Dry Lecithin Shortening; Malto-Dextrin; Liquid Red Food Color; Liquid Green Food Color; Liquid Yellow Food Color; Substitute for Coconut Oil in Chocolate Icing. Soft Curd Milk; Artificial Cream; Substitute for Coffee Cream; Cream Whipping Aids; Vanilla Ice Cream; Chocolate Ice Cream; Water Ice; Sherbet; Tangerine Water Ice; Stabilizer for Sherbets and Water Ices; Pineapple Sherbet; Ice-Cream Bar Coating; Reducing Churning Time in Butter; Non-Melting Butter; Fat-Free Butter Substitute; Non-Weeping Oleomargarine; Stabilized Homogenized Butter Spread; Cultured Buttermilk; Reducing the Tendency of Blowing in Cheese; Non-Molding Cheese Coating; Cheese Coating Wax; French Dressing; Composition of Dry Mixed Flavoring Material for French Dressing; Mayonnaise; Curry Powder; Celery Salt; Red Pepper Substitute; Capsicine-Free Red Pepper. New-England-Style Pressed Ham; Pork Luncheon Loaf; Blood and Tongue Loaf; Baked Hamburger Loaf; Pro-Lac Sandwich Special; Hamburger Style Patties; Roast-Beef Loaf; Cooked-Ham Loaf; Corned-Beef Loaf; Cooked Corned-Beef and Spaghetti Loaf; Liver and Bacon Loaf; Baked-Veal and Pork Loaf; Luncheon Meat Loaf; Utility Meat Loaf; Defense Meat Loaf; Luxury Meat Loaf; Southern Meat Loaf; Corsica-Style Meat Loaf; Cumberland-Style Meat Loaf; Meat, Pickle and Pimento Loaf; Celery Meat Loaf; Dutch Meat Loaf; Southern Peanut Meat Loaf; Delectable Meat Loaf; Mosaic Liver Loaf; Barbecue-Style Pork Loaf; Liver Loaf; Translucent Liver Loaf; Minced Luncheon Loaf; Skim-Milk Meat Loaf; Tongue and Cheese Loaf; Liver and Cheese Loaf; Meat, Macaroni

	PAGE
and Cheese Loaf; Hamburger and Cheese Loaf; Glaze for Meat Loaves; Barbecue Sauce for Hams; Scrapple; Breakfast Pork and Apple Patties; Chili Con Carne; Smoked Roast Chicken; Nutrition Sausage; Cervelate Sausage; Marbled Sausage; Mortadella-Style Sausage, etc.; Salami Cotto; Skinless Frankfurters; High-Grade Frankfurter; Vienna-Style Sausage; Mayence-Style Sausage; Liver Sausage; Braunschweiger-Style Liver Sausage; Marble Liverwurst; Smoked Metwurst; Bockwurst; Blood Pudding; Liver Pudding; Liverwurst; Ring Bologna; Bologna with Soya Flour; Cure for Sausage Meat; Meat Curing Salt; Meat Preservative; Pork-Sausage Seasoning; Preserving Lard; Dried Salted Meat; Protein Food; Oxtail-Type Soup Cubes; Preservation of Crab Meat; Fish-Preserving Ice; Fish Deodorizer.	
VIII. INKS AND MARKING SUBSTANCES	215
Fluorescent; Sympathetic; Detecting Invisible-Ink Messages; Black Writing; Semi-Gallate Writing; Hectograph; Duplicating; Quick-Drying Printing; Black Stencil; Black Marking; Printing; Printing Offset Composition; Clock Numeral; Glass Marking; China and Glass; Glass Etch; Marking Porcelain; Ceramic Stenciling; Laboratory; India-Ink Thinner; Erasing Fluid for Tracing Cloth; Rejuvenating Typewriter Ribbons; Transfer Carbon Paper; Red Marking Crayon; Luminous Crayon; Hot-Metal Marking Crayon.	
IX. SKINS—LEATHER AND FUR	218
Egg-Yolk Substitute for Use in Tanning; Tanning Extract; Softening Dry Hides; Control of Hide and Skin Beetles; Dehairing Hides; Waterproofing Leather Emulsion; Sole Leather Waterproofing; Preventing Mold Growth on Leather; Oil for Softening Leather Goods; Leather Belt Stuffing; Box Calf Oil; Fine-Leather Dressing; Shoe-Bottom Filler; Wax for Leather Strips; Shoe Box Toe Stiffening; Shoe Stiffener; Coloring Used Shoes; Black Leather Dye Solution; Shoe-Sole Stain; Bactericidal Bristles; Washing Sheepskins; Curing Hairy Sheepskins; Fur Carrotting Solution; After-Chrome for Fur Felt Hats; Dyeing Fur without Dyeing Skin; Wax Finish for Furs.	

	PAGE
X. LUBRICANTS AND OILS	229
Wire Drawing; Metal Can; Powder-Metallurgy Die; Gasoline Line and Airplane Parts; Gun; Corrosionless Bearing; Non-Rusting Turbine; Air-Pump; Anti-Seize Thread; Anti-Seize Paste; Solid; Lubricating-Oil Corrosion Inhibitor; Anti-Corrosive Spindle; Clock; Non-Flowing; Oil-Base Well-Drilling Fluid; Plastic-Molding; Rubber-Mold; Ethyl Cellulose Molding; Soluble; Metal-Cutting; Forging Tool and Die; Emulsive; Metal-Quenching; Leather-Packing and Gasket; Belt-Dressing; Leather-Belt; GR-S Rubber-Belt Dressing; Penetrating Oil; Stopcock Lubricant; High-Temperature Stopcock Grease; Hydrocarbon-Resistant Stopcock Lubricant; Extracting Fish Liver Oil; Bleaching Oils and Fats; Preventing Discoloration of Higher Fatty Acids.	
XI. MATERIALS OF CONSTRUCTION	234
Plasticizing Concrete; Concrete Made with Sea Water; Concrete Road Protective; Hydraulic Cement; Plastic Building Cement; Building Cement; Oxychloride Cement; Increasing Fluidity of Cement Mix; Masons' Mortar; Artificial Building Stone; Preparing Cement Floors for Painting; Waterproofing Cement Flooring; Cement Floor Hardener; White "Black"-Board; Gasoline- and Kerosene-Resistant Plaster; Waterproofing Cast Gypsum; Catalyst for Quick-Setting Anhydride Plaster; Retarding the Hardening of Plaster of Paris; Separating Fluid for Dental Plaster of Paris; High-Strength Brick Tile; Fireproof Thermal Insulation; Sound Insulation; Refractory; Clay Refractory; Zircon Refractory; Fusion Cast Refractory; Refractory Crucible; Hard Refractory Non-Acid Brick; Refractory; Dental Investment; Refractory Coating for Metal or Ceramics; Electric Furnace Luting Lining; Firebrick; Steatite Body; Ceramic Switch Composition; Electrical Ceramic Insulator; High-Frequency Ceramic Insulation; Ceramic Binder Lubricants; Multiple Ceramic Flux; Form for Slip Casting Ceramics; Ceramic Pigment; High-Temperature-Resistant Ceramic Glaze; Pink Ceramic Underglaze Stain; Clear Vitreous Enamel for Metal; Vitreous Undercoat for Enamelled Iron; Permanent Marking of Mica; Ceramic Denture Base; Clear, Colorless Glass Batch; Low-Expansion Glass;	

	PAGE
Optical Glass Batch; Ruby Glass; High-Silica Glass Batch; Boro-Silicate Enamel; Cork Substitute; Asbestos Roofing Paper; Light-Weight Asphalt Aggregate; Improving Adhesion of Asphalt to Wet Surfaces; Salt-Water Pit Lining; Wood Preservative; Fireproofing Wood.	
XII. METALS AND ALLOYS	242
Iron and Steel Pickling; Stainless Steel Pickling Solution; Pickling Solution for Chrome; Pickling Agent for Copper-Beryllium; Passivation of Stainless Steel Wire; Pickling Corrosion Inhibitor; After-Treatment of Pickled Metals; Rust Inhibitor or Re-inhibitor for Internal Combustion Engines; Rendering Stainless Steel Resistant to Sea Water; Prevention of Corrosive Effect of Brine; Cleaning and Protecting Metal; Rustproofing; Phosphatizing Bath; Purification of Phosphating Baths; Prevention of Corrosion of Metal in Contact with Chloroform; Preventing Moisture Absorption and Corrosion; Weight of Silica Gel Required to Prevent Corrosion; Corrosionproofing Magnesium Alloys; Bright Magnesium Finish; Gray Finish for Magnesium; Pre-Painting Treatment for Magnesium; Non-Aqueous Metal Cleaning Bath; Stripping Oxide Film from Aluminum; Pre-Galvanizing Coating; Aluminum Pre-Painting Treatment; Silver Tarnish Inhibitor; Repairing Damaged Galvanized Coatings; Tinplate Protective Coating; Coloring Cadmium Brown; Coloring Stainless Steel; Black Coating of Stainless Steel; Bluing Steel; Cold Tinning Compounds; Hot Tinning; Tinning Copper; Hot Lead Coating Alloy; Lead Alloy for Hot Coating Steel; Hot Metal Coating on One Side Only; Metallic Spray Coating; Immersion Tin-Plating of Cast Iron; Chromium-Plating Cast Iron; Chromium-Plating Bath; Palladium-Plating Bath; Aluminum-Plating; Coating Aluminum; Nickel-Plating Bath; Nickel-Plating on Magnesium; Rhenium-Plating; Bright Zinc-Plating; Brush Electroplating; Manganese-Plating; Simple Copper-Plating; Silver Mirrors on Glass; Stainless Steel Anodic Polishing; Electrolytic Metal Polishing; Electropolishing Steel; Metal Electrocleaning Bath; Copper-Deplating of Steel; Stereotype Surfacing; Recovering Silver from Stripping Solutions; Silver-	

Plating Magnesium; Silver-Plating without Electricity; Macroscopic Brass Etching; Metallographic Etchant for Silver Solders; Etching Solution for Beryllium; Non-Ferrous Metallographic Etch; Etching Magnesium Metallographic Specimens; Acid Etching Resist; Testing for Traces of Grease or Finger Prints on Metals; Identifying Cadmium, Tin and Zinc Coatings; Powdered Lead Coated Iron; Powdered Iron; Powdered Metals; Sponge Iron Reducing Agent; Metal Carbides; Pulverizing Cemented Tungsten Carbide; Diamond Embedding Composition; Calorizing Metal; Case-Hardening Iron or Steel; Case-Hardening Compound; High-Speed Steel-Hardening Bath; Metal-Tempering Compound; Case-Hardening Small Articles; Resurfacing Cold-Rolled Low-Carbon Steel; Hardened Aluminum Alloy Casting; Permanent Magnet Alloy; Non-Corrosive Bearing; Hardened Lead Bearing Alloy; Cadmium Bearing Alloy; Iron Bearing Alloy; Lead Alloy; Non-Corrosive Lead Alloy; Non-Discoloring Tin Foil; Casting and Rolling Magnesium Alloy; Electric Thermostat; Electric Fuse Alloy; Electrical Contact Alloy; Spark Plug Electrode Alloy; Resistor Alloy; Electric Resistance Alloy; Electric Wire Resistance Alloy; Heat-Hardenable Copper Alloy; Hardening Copper; Corrosion-Resisting Coating for Copper; Cleaning and Covering for Molten Copper Alloys; Tin-Free Gear Bronze; Refining White Metal Alloys; Hard Platinum Alloy; Hard Non-Corrosive Gold Jewelry Alloy; Dental Copper Amalgam; Dental Filling Alloy; Dental Casting Alloy; Dental Model Alloy; Dental Inlay Alloy; Corrosion-Resistant Denture Alloy; Dental Clasp Alloy; Solder for Zinc-Aluminum Alloys; Solder for Aluminum Bronze; Solder for Aluminum Foil; Powdered Solder for Aluminum and Stainless Steels; Aluminum Solders; Hard Solder; Brazing Solder; Gas Meter Solder; Soft Solder for Tinsplate; Tinless Soft Solder; Low-Tin Solder; Soft Solder; Soldering Flux; Hard Soldering Flux; Soldering Flux for Galvanized Iron; Foundry Mold Composition; Foundry Mold and Core; Magnesium Alloy Foundry Sand; Mold-Facing Sand; Casting Mold Coating; Ingot Mold Coating; Insulating Compounds for Molten Cast Steel; Dental Investment; Foundry Mold Wash; Mold

	PAGE
Composition for Making Complicated Precision Castings of Aluminum or Brass; Parting Compound to Be Sprayed on Patterns before Pouring Plaster; Non-Slip Stair Tread Coating; Welding Rod; Brazing Alloy; Brazing Alloy for Brass, Copper and Steel; Brazing Alloy for Welding to Iron; Copper Brazing Wire; Welding Rod for Red Brass; White Metal Welding Composition; Welding Electrode Coating; Aluminum Welding Rod Coating; Welding Rod Flux Coating; Brazing Flux; Nickel-Chrome Alloy Welding Flux; Gold Melting Flux; Copper Welding Flux; Flux for No. 3 Welding Copper-Base Materials; Aluminum or Magnesium Welding Flux; Flux for Welding Steel Contaminated with Sulfur; Flux for Welding Iron-Base Alloys; Non-Adhering Weld Spatter Coating; Flux for Melting Non-Ferrous Metals; Non-Corrosive Magnesium Flux; Magnesium-Refining Flux; Aluminum Scrap Melting Flux.	
XIII. PAINT, VARNISH, LACQUER AND OTHER COATINGS . . .	271
<i>Exterior House Paints:</i> Outside White House; White Primer-Undercoat; House Base for Tints; Brick and Stucco; Brick and Stucco Primer; White Brick and Stucco Paint; Brick and Stucco Paint Base for Tints; Exterior Trim and Trellis Paints; Black Trim and Trellis; Wagon and Tractor Enamels; Traffic Paints; Congo Resin Traffic Paints; Exterior Metal Paints; Metal Protection; Pickling and Rustproofing for Iron; Red Lead Primer; Galvanized Iron Primer; Zinc Dust-Zinc Oxide Primer; Zinc Chromate Primer; Zinc Tetroxy Chromate-Iron Oxide Primer; Zinc Chromate Primer; Alkyd Resin Primer; Transparent Flexible Metal Primer; Red Lead Paint for Structural Steel; Carbon Black Paint for Steel; Heat-Resistant Black Enamel; Black Bridge Paint; Metal-Protective Synthetic Coating; Anti-Corrosive Paint for Structural Steel; Black Coating Steel; Black Baking Enamel; Enamel Liquid. <i>Marine Paints:</i> Anti-Corrosive Shipbottom; Anti-Fouling Shipbottom; Light-Gray Deck; Red Deck; Hull Black; Hull Light-Gray; Marine Outside White; Navy Chromate Primer; Fire-Resisting Canvas Preservative; Marine Interior Flat; Marine Interior Enamel. <i>Camouflage Coatings:</i> Quick-Drying Enamel; Lusterless Sanding Enamel; Lusterless Olive Drab Enamel; Congo	

Resin Ammunition Paint; Congo Resin Vehicle for Gasoline-Soluble and Gasoline-Removable Paint. *Waterproof Coatings*: Thermosetting for Raincoats, Hospital Sheeting and Tents; Vinylite Cement; Flexible Coating for Cloth; Awning; Moistureproof Coating; Flame-Resisting Paints; Water Emulsion Paints for Exterior Use; Emulsion Stone Paint; Waterproofing for Cement and Stucco; Sealing and Waterproofing Porous Masonry; Water Paint; Cement-Water Paint; Congo Resin Camouflage Paints; Oleo-Resinous Emulsifiable Paint; Congo Resin Fire-Retardant Paint. *Exterior Varnishes*: Spar; Chemical-Resistant Spar; Clear Automobile; Traffic Paint; Synthetic Resin. *Aluminum Vehicles*: Ready-Mixed Aluminum Alkyd for Brush, Spray or Dip; Clear Varnish for Heat-Resistant Aluminum Paint; Wall Coating Vehicle; Congo Resin Treatment and Congo Vehicles; "Slack Melt" Congo Resin; "Fine Melt" Congo Resin; Congo Resin Varnishes and Vehicles for Paints and Enamels; Congo Linseed Oil; Congo Resin Sealer; Interior Flat Wall Finishes; Sealer; Undercoater; Flat Wall Paint; Interior Semi-Gloss Finish; Semi-Gloss White Enamel and Base for Tints. *Interior Gloss Paints*: Varnish KV-91; Interior Quick-Dry Enamels; Non-Yellowing White Quick-Dry Enamel; Quick-Dry Enamel Base for Tints; Quick-Dry Red Enamel; Quick-Dry Green Enamel; Black Enamel; Blue Quick-Dry Enamel. *Floor Enamels*: Liquid Wood Sealer; Green; Brown; Gray; Interior Emulsion-Type Finishes; Water-Reducible Oil-Type Paste Paint; Congo Resin Emulsion Paint. *Interior Varnishes*: High-Grade General-Purpose; Floor and Deck; Low-Cost Floor and Trim; Penetrating Sealer for Floors; Pale-Gloss for Art Work; Furniture-Rubbing; Synthetic Rubbing; Wall-Sizing; Insulating Impregnating; White Architectural Enamel Liquid; Alkyd Blending Varnish; General-Purpose Grinding Oil, Mixing Varnish and Paint Oil. *Special Paints and Coatings*: Cold Wall Glaze; Foundry-Mold; Asphalt Drums; for Iron Pipes; Protective for Aluminum; Acoustic Sound-Deadening; Protective for Lithographic Plates; Corrosion and Abrasionproof for Petroleum Refinery Equipment; Non-Leafing Aluminum Paste Paint; for Ice Trays; Hot-Melt; Moistureproof; Paint or

Lacquer "Stop-Off"; Oilproof Barrel; Oilproof for Paper Containers; Gilder's Size; Semi-Gloss Polishing Paint; Non-Stick for Asphalt Containers; Asphalt Drum Lining; Fusible Coating Composition; Wine Tank Coating; Protective Coatings for Stone Top Tables; Casein Powder Paints; Protective Fruit Coatings; Cleaning Paint Brushes; Filling Scratches on Varnished Furniture; Preventing Skinning of Paint in Cans; Fire-Resistant Coating; Wood Filler; Wax Wood Filler; Wax Furniture Filler; Painting Glazed Tile; Olive Drab Enamel; Black Enamel; Phosphorescent Paints; Clear Protective Coat for Phosphorescent Paint; Wood Stains. *Lacquers*: White Automobile or Refrigerator; Clear Furniture; Flat; for Metal or Glass; Transparent Silver; Clear Metal; Artificial Leather Coating; Book; Brushing Linoleum; Wood; Cellulose Acetate; Cheese-Wrapper Foil; Avoiding Stickiness of Lacquer-Coated Paper. For Moistureproofing Cellophane; Gold; Flat; Lacquer Thinner; Crystallizing; Frosting Glass; Filling and Binding; Flame-Resistant Coating; Perspirationproof Lacquer Base; Protective Lacquer for Lenses; Dipping Lacquers for Glass Identification; Clear, Transparent Metal Lacquer for Exterior Exposure; Stable Zein-Rosin Solution. Prolamine Plastic Lacquers; Imitation Shellac Lacquer; Adhesive Scratch-Resisting Primer; Paint Remover; Finish for Laboratory Table Tops.

XIV. PAPER 325

Tub Sizing for Paper; Rosin Size; Alumina Sol; Lime in Making Paper Size; Defoamer for Pulp and Paper Stock; Pest-Resistant Paper; Anti-Mist Paper for Glass; Paper Transparentizing Solution; Non-Tarnish Paper; Paper Softening; Paper Glaze Coating; Non-Slip, Non-Hygroscopic Adhesive-Coated Paper; Coating or Laminating Paper; Paper Pulp Oilproofing; Grease-Resistant Paper; Grease-Resistant Glue Coatings; Oilproofing Paper Containers; Moistureproofing for Cellulose Foil; Paraffin Wax Sizing and Waterproofing; Wetproof Cigarette Paper; Heat-Sealable Waxed Paper; Waxed Paper; Improving Transparency of Waxed Paper; Milk Bottle Cap Coating; De-inking Newspapers.

	PAGE
XV. PHOTOGRAPHY.	329
Sensitized Photographic Paper; Gelatin Composition for True-to-Scale Prints; Universal Developer; Low-Contrast Developer; Stable Developer; Economical Photographic Developing; Non-Dichroic Fog Developer; Fine-Grain Developer; Copper Sulfide Intensification of Film or Prints; Intensifying Baths for Negatives; Intensifiers; Gelatin-Hardening Solutions; Photographic Hardener; Photographic Fixing and Hardening Bath; Acid Hardening Fixer; Removal of Yellow Spots on Prints; Restoring Yellow Prints; Photographic Bleaching Solution; Normalizing Over-Developed Negatives; Reduction of Over-Developed Films; Photographic Resist; Eliminating Abrasion Fog on Photographs; Rapid Drying of Negatives; Non-Curling Photographic Negatives; Preventing Drying Spots on Negatives; Preventing Curl in Photographic Prints; Restoring Shrunken Photographic Film; Anti-Foam in Photo Solutions; Fog Prevention; Fog Removal; Improving X-Ray Photographs; Photographic Etching Bath; Photographic Print-Out Emulsion; Kallitype Silver Printing; Toning Agents; Reddish-Tone Developer; Blue-Tone and Blue-Black-Tone Developer; Lithographic Plate Desensitizing Etch; Lithographic Image Coating; Photoengraver's Cold Enamel; Albumin Substitute; Lithographic Paper Coating; Lithographic Printing Plate Treatments; Photographic Prints on Oxidized Aluminum; Photographic Substitutes; Restoring Faded Documents or Detecting Falsified Documents; Preventing Silver Nitrate Stains; Blueprint Paper; Lacquer for Blueprints, Direct Prints, Maps, etc.; Correction Fluid for Blueprints; Red Writing Fluid for Blueprints; Correction Fluid for Vandyke Prints; Developer for B. W. Prints; Recovery of Silver from Fixing Baths; Photographic Flashlight Powder.	
XVI. POLISHES.	341
Paste Wax; Liquid Wax; Auto; Windshield Glass and Cleaner; Glass; Oven; Silver; Gold and Soft Metal; Metal Polishing Cloth; Chromium; Leather; Liquid Leather; Paste Leather; Shoe Paste (for Tubing); Wax Shoe; Colorless Shoe; Shoe Creams; Furniture; "Two-Tone" Furniture; Liquid Floor	

	PAGE
and Furniture; Floor Wax Remover; Bright Drying Floor Emulsion; Floor Wax; Diamond Abrasive; Synthetic Abrasive; Auto-Rubbing Compound; Buffing Compounds; Cream Buffing Wax.	
XVII. PYROTECHNICS AND EXPLOSIVES	349
Ammunition Primer; Non-Combustible Blasting Primer; Stable Explosive Powder; Blasting Powder; Oil-Well Explosive Charge; Demolition Explosive; Torpedo Explosive; Pyrotechnic Flare; Green Pyrotechnic Torch; Colored Rocket Smoke Flares; Colored Smokes.	
XVIII. PLASTICS, RESINS, RUBBER, WAX	351
<i>Waxes:</i> Cartridge; Cheese Coating; Ski; Batik; Coopers'; Modelling; Ironing (Laundry); Gilders'; Copper Engraving; Cable; Grafting; Gravure; Shoemaker's Thread; Saddler's; Inhibiting Discoloration of Paraffin; Carnauba Substitute; Lanette SX Substitute; Modifiers for Paraffin; Penetration of Modified Paraffin; Dental Basic Plate; Dental Inlay; Dental Adhesive; Dental Carving; Dental Investment; Dental Duplicating and Impression Compound; Electrolytic Wax Plating. <i>Plastics:</i> Sulfur; Self-Hardening; Molded Cork and Cane Stalk; Acrylic Molding Composition; Polymerization Inhibitor for Methacrylates; Melamine Resin; Ethyl Cellulose; Injection Molding Powder; Polystyrene Sponge; Stabilizing Polystyrene; Inhibiting Polymerization of Styrene; Single Stage Phenol-Formaldehyde Resin; Cast Phenolic Dye; Molding Powder; Emulsion Polymerization of Vinyl Acetate; Moistureproof Coating for Acetate Sheet; Tough Bituminous Composition; Improving Stretch of Cellulose Acetate; Polymerizing Butadiene; Injection Molding Shellac Compound; Shellac Substitute for Records; Flexible Plastic Piping; Thermoplastic, Tailor's Dummy; Moistureproof Coating for "Cellophane"; Milk Bottle Cap Coating; Electrical Insulating Filling Compound; Electrical Insulation; Chemically-Resistant Packing Gasket; Plastic Stuffing Box Packing; Resin-impregnated Wood; Bow Rosins; Flesh-Colored Latex Compound; Preserving Latex; Heat-Sterilizing Fresh Latex; Solvent for Chlorinated Rubber; Surgeon's Gloves Dusting Powder; Tire-Puncture Sealing Com-	

position; Gasolineproof Synthetic Rubber Composition; Vulcanization of Butadiene Polymers; Emulsion Polymerization; Gas-Expanded Rubber; Reviving "Dead" Rubber Balls; Reclaiming Scrap Rubber; Non-Sticking Rubber; Preventing Adhesion of Rubber; Reducing Viscosity of Rubber Solutions; Gelling Neoprene Latex; GR"S"—Olive Drab Raincoat Material; Self-Curing Lean Cement for Cured GR"S" Coating; Thermosetting Polyvinyl Butyral Coatings for Raincoats; 100% Rubber Reclaim Compounds; Code Wire Insulation; Non-Swelling Thiokol Compound; General-Utility Neoprene Compound; Calendered Raincoat Material; GR"I" Compound for Laminating Fabrics; GR"S" Heel Compound; Highly-Loaded GR"S" for Mechanical Goods; Self-Curing 100% Reclaim Compound; Neoprene Olive Drab Coating; Neoprene Latex Coating; Buna N Oil-Resistant Coating; Men's Rubber Belts; Artificial Sponge; Heat Paper Transfer; Nitrocellulose Coatings; Oil-Resistant Sponge; Ceramic Made without Heat; Molding Clay; Glueless Printers' Roller; Coloring Gelatin Masses.

XIX. SOAP AND CLEANERS 368

Soaps: Home-Made; Rosin; Rosin-Tallow; Non-Efflorescing Bar; Substitute; Lemon; Transparent Glycerin; Fungicidal Borax Soap Washing Mixture; Powdered Cleaner; Detergent Cake; Cleaning Paste; Industrial Hand Soaps and Cleaners; Abrasive Hand Cleaning Powder; Hand Cleaner Requiring No Water; Scouring Powder; Bleaching Soap; Mercury Fulminate Detector; Antiseptic Liquid; Disinfecting Detergent; Detergent Paper Towel; Laundry Blue; Laundry Sour and Bluing; Stabilized Laundry Sour; Spectacle Lens Cleaner and Mist Preventer; Cleaning Solution for Lenses; Fish and Cannery Factory Antiseptic Wash; Cleaning Bottles; Non-Corrosive Laboratory Glass Cleaning Solution; Window and Glassware Cleaners; Saddle Soap; Substitute for Household Ammonia; Leather Cleaners; Antiseptic Dry Cleaning Fluid; Dry Cleaners' Soap; Rug Dry Cleaner; Pile Fabric Cleanser; Rug and Textile Cleaning Powder; Jewelry Cleaning Fluid; Drawing Pen Cleaner; Non-Corrosive Tin Plate Cleaner; Aluminum Cleaner; Pre-Anodizing Metal Cleaner; Uni-

	PAGE
versal Cleaner; Metal-Degreasing Compound; Metal-Machinery Cleaner; Cylinder Cleaner; Type Cleaner; Printing-Plate Cleaner; Linotype Matrix Cleaner; Rust Remover; Brass Cleaner; Brass and Bronze Cleaner; Removing Dye Stains from the Hands. <i>Stain Removers:</i> Coffee or Beer; Burnt Sugar; Blood; Cadmium, Cobalt, Mercury or Nickel Stains; Chromium; Copper; Manganese; Milk; Mildew; Picric Acid; Urine; Scorch; Egg Yolk; Grass Stains; Iodine; Iron; Lead. Floor Sweeping Compound; Coloring Sweeping Compound.	
XX. TEXTILES AND FIBERS	379
Chlorinating Wool; Lusterizing Wool; Textile Dullers for Hosiery; Delustering Shiny Fabric; Delustering Acetate Silk; Boil-Off of Nylon Fabrics; Thin Boiling Starch; Textile Finish and Size; Sizing Viscose Ribbon; Sizing Glazed Cotton Yarn; Rayon Size; Rayon Warp Sizing; Setting Twist in Rayon Knitting Yarns; Creping Fabrics; Scrooping Mercerized Cotton; Silky-Scroop on Bleached Cotton Yarn; Scroop on Cotton Yarn; Scroop Effect on Wool; Wool Finish; Emulsion for Finishing Dyed Rayon; Thickening Satin Finish for Calicos; Mercerizing Bath; Unkinking Natural Wool; Softener and Lubricant for Artificial Fibres; Softening and Lubricating Wool; Stearic Acid Textile Softener; Textile Weighter; Wool Oiling Emulsions; Textile-Softening Cream; Textile Scouring Agents; Prefabricating Silk Treatment; Improving the Wearing Qualities of Silk Stockings; Bleaching Jute; White Bleach on Union Goods; Bleaching Textiles; Heat-Stabilization of Yarn; Crease-Preserving Composition; Jute Twine Polishing Size; Jute Yarn Dressing; Wool-Like Jute; Dyeing Sisal and Manila Hemp; Dyeing Straw Hat Plaits; Dyeing Brush Bristles; Dyeing Grass; Mordanting Rayon; Aged Black on Loose Cotton; Dyeing Wool Bunting Cloth for Flags; Dyeing Aralac; Basic Chrome Nitrate-Acetate; Printing Calico with Catechu; Textile-Printing Paste; Silk-Printing Discharge; Textile-Printing Resist; Improved Textile Dyeing; Brightening Black Dyeings; Acetate Rayon "Burnt-Out" Fabrics; Zinc-Dust Resist for Wool; Reserve for Wool Yarn; Stripping Dye from Wool; Stripping Dyed Cotton; Flameproof, Waterproof and	

Mildewproof Textile Coating; Textile Flameproofing; Fireproof Cloth; Fireproofing Cotton Goods; Nitrated Non-Inflammable Lace Fabrics; Wetting and Conditioning Agent for Yarns; Mothproofing Solution; Mothproofing Emulsion; Rotproofing Fibres; Rotproofing Fabrics; Improving Absorbency of Towels; Porous Waterproofing for Textiles; Waterproofing Cotton Duck; Textile Waterproofing; Water-Repellent Finish for Ribbons; Making Casein Fibre Resistant to Hot Water; Waterproofing Surgical Dressings; Increasing Wet Strength of Yarn; Manufacture of Organdie Cloth; Metallized Yarn; Drum Head and Banjo Cloth; Asbestos Cloth Substitute.

XXI. MISCELLANEOUS 406

Separation of Butadiene; Non-Caking Cracking Catalyst; Refinery Gas Polymerization Catalyst; Deodorizing Sulfurous Petroleum; Aviation Fuel; Anti-Knock Motor Fuel; Stabilizing Tetra Ethyl Lead Gasoline; Colloidal Fuel; Improving Fuel Oil; Easily Inflammable Coke; Engine Carbon Solvent; Motor Gum Solvent; Plugging of Brine Bearing Earth; Petroleum Desalting and Demulsifying; Removing Metal Obstructions from Oil Wells; Brine Cooling Fluid; Preserving Gelatin Solutions; Deodorizing Isopropyl Alcohol; Filter Aids; Heat-Generating Composition; Solid Dielectric; Electrical Capacitator; Temperature Compensating Resistor; Fluorescent Lamp Coating; Vacuum Tube Getter; Hydraulic Fluid; Door Check Fluid; Magnetizable Fluid; Manometer Fluid; Anti-Incendiary Material; Magnesium and Aluminum Powder; Dry Fire Extinguisher; Fire Foam Extinguisher; Fire Extinguisher Foam Stabilizer; Bonded Fibrous Insulation; Heat-Exchange Medium; Diamond-Dust Brooch; Clutch Plate Studs; Brake and Clutch Frictional Material; Sewage Treatment; Water Disinfectant; Carbonaceous Zeolite; Cation-Exchange Water Softener; Water-Impurity Coagulant; Coagulant for Hard Water; Water Purifying Compound; Water Softener Briquette; Water Corrective; Boiler Scale Compound; Processing Tannin for Boiler Water Treatment; Locating Leaks in Pipe Lines Under Water; Radiator Rusting Inhibitor; Radiator and Water Boiler "Stop Leak"; Auto Anti-Freeze; Non-Foaming Anti-Freeze; Airplane

	PAGE
De-Icing Coating; Windshield Defroster; Cathode or X-Ray Tube Screen Coating; X-Ray Protective Composition; Animal Tissue Fixative; Regenerating Cuprous Chloride Solution; Solvent-Resistant Pump Packings; Settling Fumes; Activated Carbon; Alpha Cellulose; Lycopodium Substitute; Extracting Saponin from Soap Bark; Cuprous Oxide; Hydrogen Peroxide; Potassium Chlorate; Glass Syringe Aids; Restoring Fraudulent or Faded Documents; Electrochemical Recording Solution; Dyestuffs Recommended for the Coloring of Trichlor-ethylene.	
TABLES	420
REFERENCES AND ACKNOWLEDGMENTS	427
TRADE NAME CHEMICALS	429
CHEMICALS AND SUPPLIES: WHERE TO BUY THEM	430
SELLERS OF CHEMICALS AND SUPPLIES	444
WHERE TO BUY CHEMICALS OUTSIDE OF THE UNITED STATES	454
INDEX	455

ABBREVIATIONS

amp.	ampere
amp./dm ²	amperes per square decimeter
amp./sq. ft.	amperes per square foot
anhydr.	anhydrous
avoir.	avoirdupois
Bé.	Baumé
b.p.	boiling point
C.	Centigrade
°C.	degrees Centigrade
cc.	cubic centimeter
c.d.	current density
cm.	centimeter
cm ³	cubic centimeter
conc.	concentrated
c.p.	chemically pure
cps.	centipoises
cu. ft.	cubic foot
cu. in.	cubic inch
cwt.	hundredweight
d.	density
dil.	dilute
dm.	decimeter
dm ²	square decimeter
dr.	dram
E.	Engler
F.	Fahrenheit
°F.	degrees Fahrenheit
f.f.c.	free from chlorine
f.f.p.a.	free from prussic acid
fl. dr.	fluid dram
fl. oz.	fluid ounce
f.p.	freezing point
ft.	foot
ft. ²	square foot
g.	gram
gal.	gallon
gr.	grain
hl.	hectoliter
hr.	hour
in.	inch
kg.	kilogram
l.	liter
lb.	pound
liq.	liquid
m.	meter
min.	minim, minute
ml.	milliliter—cubic centimeter
mm.	millimeter
m.p.	melting point
N.	normal
N.F.	National Formulary
oz.	ounce
pH	hydrogen-ion concentration
p.p.m.	parts per million

pt.	pint
pwt.	pennyweight
q.s.	a quantity sufficient to make
qt.	quart
r.p.m.	revolutions per minute
S.A.E.	Society of Automotive Engineers
sec.	second
sp.	spirits
sp. gr.	specific gravity
sq. dm.	square decimeter
tech.	technical
tinc.	tincture
tr.	tincture
Tw.	Twaddell
U.S.P.	United States Pharmacopeia
v.	volt
visc.	viscosity
vol.	volume
wt.	weight
x.	extra

CHAPTER I

INTRODUCTION

At the suggestion of a number of teachers of chemistry and home economics the following introductory matter has been included.

The contents of this section are written in a simple way so that anyone, regardless of technical education or experience, can start making simple products without any complicated or expensive machinery. For commercial productions, however, suitable equipment is necessary.

Chemical specialties en masse are composed of pigments, gums, resins, solvents, oils, greases, fats, waxes, emulsifying agents, water, chemicals of great diversity, dyestuffs, and perfumes. To compound certain of these with some of the others requires certain definite and well-studied procedure, any departure from which will inevitably result in failure. The successful steps are given with the formulas. Follow them explicitly. If the directions require that A should be added to B, carry this out literally, and not in reverse fashion. In making an emulsion, the job is often quite as tricky as the making of mayonnaise. In making mayonnaise, you add the oil to the egg, *slowly*, with constant and even and regular stirring. If you do it correctly, you get mayonnaise. If you depart from any of these details: if you add the egg to the oil, or pour the oil in too quickly, or fail to stir regularly, the result is a complete disappointment. The same disappointment may be expected if the prescribed procedure of any other formula is violated.

The next point in importance is the scrupulous use of the proper ingredients. Substitutions are sure to result in inferior quality, if not in complete failure. Use what the formula calls for. If a cheaper product is desired, do not obtain it by substituting a cheaper material for the one prescribed: resort to a different formula. Not infrequently a formula will call for some ingredient which is difficult to obtain: in such cases, either reject the formula or substitute a similar material only after preliminary experiment demonstrates its usability. There is a limit to which this rule may reasonably be extended. In some instances the substitution of an equivalent ingredient may legitimately be made. For example: when the formula calls for *white wax* (beeswax), yellow wax can be used, if the color of the finished product is a matter of secondary importance. Yellow beeswax can often replace white beeswax, making due allowance for color: but paraffin will *not* replace beeswax, even though its light color recommends it above yellow beeswax.

And this leads to the third point: the use of good quality ingredients, and ingredients of the correct quality. Ordinary lanolin is not the same thing as *anhydrous* lanolin: the replacement of one for the other, weight for weight, will give discouragingly different results. Use exactly what the formula calls for: if you are unacquainted with the material and a doubt arises as to just what is meant, discard the formula and use one that you understand. Buy your materials from reliable sources. Many ingredients are obtainable in a number of different grades: if the formula does not designate the grade, it is understood that the best grade is to be used. Remember that a formula and the directions can tell you only a part of the story. Some skill is often required to attain success. Practice with a small batch in such cases until you are sure of your technique. Many instances can be cited. If the formula calls for steeping quince seed for 30 minutes in cold water, your duplication of this procedure may produce a mucilage of too thin a consistency. The originator of the formula may have used a fresher grade of seed, or his conception of what "cold" water means may be different from yours. You should have a feeling for the right degree of mucilaginousness, and if steeping the seed for 30 minutes fails to produce it, steep them longer until you get the right kind of mucilage. If you do not know what the right kind is, you will have to experiment until

you find out. Hence the recommendation to make small experimental batches until successful results are arrived at. Another case is the use of dyestuffs for coloring lotions, and the like. Dyes vary in strength: they are all very powerful in tinting value: it is not always easy to state in quantitative terms how much to use. You must establish the quantity by carefully adding minute quantities until you have the desired tint. Gum tragacanth is one of those products which can give much trouble. It varies widely in solubility and bodying power: the quantity prescribed in the formula may be entirely unsuitable for *your* grade of tragacanth. Hence a correction is necessary, which can only be made after experiments to determine *how much* to correct.

In short, if you are completely inexperienced, you can profit greatly by gaining some experience through recourse to experiment. Such products as mouth washes, hair tonics, astringent lotions, need little or no experience, because they are as a rule merely mixtures of simple liquid and solid ingredients, the latter dissolving without difficulty and the whole being a clear solution that is ready for use when mixed. On the other hand, face creams, tooth pastes, lubricating greases, wax polishes, etc., which require relatively elaborate procedure and which depend for their usability on a definite final viscosity, must be made with the exercise of some skill, and not infrequently some experience.

Figuring

Some prefer proportions expressed by weight, volume or in terms of percentages. In different industries and foreign countries various systems of weights and measures are used. For this reason no one set of units could be satisfactory for everyone. Thus diverse formulae appear with different units in accordance with their sources. In some cases, parts instead of percentages or weight or volume is designated. On the pages preceding the index, tables of weights and measures are given. These are of use in changing from one system to another. The following examples illustrate typical units:

Ink for Marking Glass			
Glycerin	40	Ammonium Sulfate	10
Barium Sulfate	15	Oxalic Acid	8
Ammonium Bifluoride	15	Water	12

Here no units are mentioned. When such is the case it is standard practice to use parts by weight, using the same system throughout. Thus here we may use ounces or grams as desired. But if ounces are used for one item then ounces must be the unit for all the other items in the particular formula.

Flexible Glue

Glue, Powdered	30.9 %	Glycerin	5.15%
Sorbitol (85%)	15.45%	Water	48.5 %

Where no units of weight or volume but percentages are given then forget the percentages and use the same instructions as given under Example No. 1, Example No. 3

Antiseptic Ointment

Petrolatum	16 parts	Benzoic Acid	1 part
Coconut Oil	12 parts	Chlorthymol	1 part
Salicylic Acid	1 part		

The same instructions as given under Example No. 1 apply to Example No. 3.

It is not wise in many cases to make up too large a quantity of material until one has first made a number of small batches to first master the necessary technique and also to see whether it is suitable for the particular outlet for which it is intended. Since, in many cases, a formula may be given in proportions as made up on a commercial factory scale, it is advisable to reduce the proportions accordingly. Thus, taking the following formula:

Example No. 4

Neutral Cleansing Cream

Mineral Oil	80 lb.	Water	90 lb.
Spermaceti	30 lb.	Glycerin	10 lb.
Glyceryl Monostearate	24 lb.	Perfume	to suit

Here, instead of pounds, grams may be used. Thus this formula would then read:

Mineral Oil	80 g.	Water	90 g.
Spermaceti	30 g.	Glycerin	10 g.
Glyceryl Monosterate	24 g.	Perfume	to suit

Reduction in bulk may also be obtained by taking the same fractional part or portion of each ingredient in a formula. Thus in the following formula:

Example No. 5

	Vinegar Face Lotion		
Acetic Acid (80%)	20	Alcohol	440
Glycerin	20	Water	500
Perfume	20		

We can divide each amount by ten and the finished bulk is only 1/10th of the original formula. Thus it becomes:

Acetic Acid (80%)	2	Alcohol	44
Glycerin	2	Water	50
Perfume	2		

Apparatus

For most preparations, pots, pans, china and glassware, such as are used in every household, will be satisfactory. For making fine mixtures and emulsions a "malted-milk" mixer or egg-beater is necessary. For weighing, a small, low priced scale should be purchased from a laboratory supply house. For measuring of fluids, glass graduates or measuring glasses may be purchased from your local druggist. Where a thermometer is necessary a chemical thermometer should be obtained from a druggist or chemical supply house.

Methods

To better understand the products which you intend making, it is advisable that you read the complete section covering such products. Very often an important idea is thus obtained. You may learn different methods that may be used and also avoid errors which many beginners are prone to make.

Containers for Compounding

Where discoloration or contamination is to be avoided (as in light-colored, or food and drug products) it is best to use enameled or earthenware vessels. Aluminum is also highly desirable in such cases, but it should not be used with alkalis which dissolve and corrode this metal.

Heating

To avoid overheating, it is advisable to use a double boiler when temperatures below 212° F. (temperature of boiling water) will suffice. If a double boiler is not at hand, any pot may be filled with water and the vessel containing the ingredients to be heated is placed in it. The pot may then be heated by any flame without fear of overheating. The water in the pot, however, should be replenished from time to time as necessary—it must not be allowed to "go dry." To get uniform higher temperatures, oil, grease or wax is used in the outer container in place of water. Here of course care must be taken to stop heating when thick fumes are given off as these are inflammable. When higher uniform temperatures are necessary, molten lead may be used as a heating medium. Of course, where materials melt uniformly and stirring is possible, direct heating over an open flame is permissible.

Where instructions indicate working at a certain temperature, it is important that the proper temperature be attained—not by guesswork, but by the use of a thermometer. Deviations from indicated temperatures will usually result in spoiled preparations.

Temperature Measurements

In Great Britain and the United States, the Fahrenheit scale of temperature measurement is used. The temperature of boiling water is 212° Fahrenheit (212° F.); the temperature of melting ice is 32° Fahrenheit (32° F.).

In scientific work and in most foreign countries the Centigrade scale is used. On this scale of temperature measurement, the temperature of boiling water is 100 degrees Centigrade (100° C.) and the temperature of melting ice is 0 degrees Centigrade (0° C.).

The temperature of liquids is measured by a glass thermometer. The latter is inserted as deeply as possible in the liquid and is moved about until the temperature remains steady. It takes a little time for the glass of the thermometer to come to the temperatures of the liquid. The thermometer should not be placed against the bottom or side of the container, but near the center of the liquid in the vessel. Since the glass of the bulb of the thermometer is very thin, it can be broken easily by striking it against any hard surface. A cold thermometer

should be warmed gradually (by holding over the surface of a hot liquid) before immersion. Similarly the hot thermometer when taken out should not be put into cold water suddenly. A sharp change in temperature will often crack the glass.

Mixing and Dissolving

Ordinary solution (e.g. sugar in water) is hastened by stirring and warming. Where the ingredients are not corrosive, a clean stick, bone or composition fork or spoon is used as a mixing device. These may also be used for mixing thick creams or pastes. In cases where most efficient stirring is necessary (as in making mayonnaise, milky polishes, etc.) an egg-beater or a malted-milk mixer is necessary.

Filtering and Clarification

When dirt or undissolved particles are present in a liquid, they are removed by settling or filtering. In the former the solution is allowed to stand and if the particles are heavier than the liquid they will gradually sink to the bottom. The upper liquid may be poured or siphoned off carefully and in some cases is then of sufficient clarity to be used. If, however, the particles do not settle out, then they must be filtered off. If the particles are coarse they may be filtered or strained through muslin or other cloth. If they are very small, then filter paper is used. Filter papers may be obtained in various degrees of fineness. Coarse filter paper filters rapidly but will not, of course, take out extremely fine particles. For the latter, it is necessary to use a very fine grade of filter paper. In extreme cases even this paper may not be fine enough. Here it will be necessary to add to the liquid 1-3% of infusorial earth or magnesium carbonate. The latter clog up the pores of the filter paper and thus reduce their size and hold back undissolved material of extreme fineness. In all such filtering, it is advisable to take the first portions of the filtered liquid and pour them through the filter again as they may develop cloudiness in standing.

Decolorizing

The most commonly used decolorizer is decolorizing carbon. The latter is added to the liquid to the extent of 1-5% and heated with stirring for $\frac{1}{2}$ hour to as high a temperature as is feasible. It is then allowed to stand for a while and filtered. In some cases bleaching must be resorted to. Examples of this are given in this book.

Pulverizing and Grinding

Large masses or lumps are first broken up by wrapping in a clean cloth and placing between two boards and pounding with a hammer. The smaller pieces are then pounded again to reduce their size. Finer grinding is done in a mortar with a pestle.

Spoilage and Loss

All containers should be closed when not in use to prevent evaporation or contamination by dust; also because, in some cases, air affects the material adversely. Many materials attack or corrode the metal containers in which they are received. This is particularly true of liquids. The latter, therefore, should be transferred to glass bottles which should be as full as possible. Corks should be covered with aluminum foil (or dipped in melted paraffin wax when alkalis are present).

Materials such as glue, gums, olive oil or other vegetable or animal products may ferment or become rancid. This produces discoloration or unpleasant odors. To avoid this, suitable antiseptics or preservatives must be used. Too great stress cannot be placed on cleanliness. All containers must be cleaned thoroughly before use to avoid various complications.

Weighing and Measuring

Since, in most cases, small quantities are to be weighed, it is necessary to get a light scale. Heavy scales should not be used for weighing small amounts as they are not accurate for this type of weighing.

For measuring volume (liquids) measuring glasses or cylinders (graduates) should be used. Since this glassware cracks when heated or cooled suddenly it should not be subjected to sudden changes of temperature.

Caution

Some chemicals are corrosive and poisonous. In many cases they are labeled as such. As a precautionary measure, it is advised not to smell bottles directly,

but only to sniff a few inches from the cork or stopper. Always work in a well ventilated room when handling poisonous or unknown chemicals. If anything is spilled, it should be wiped off and washed away at once.

Where to Buy Chemicals and Apparatus

Many chemicals and most glassware can be purchased from your druggist. A list of suppliers of all products will be found at the end of this book.

Advice

This book is the result of cooperation of many chemists and engineers who have given freely of their time and knowledge. It is their business to act as consultants and, for a fee, to give advice on technical matters. As publishers, we do not maintain a laboratory or consulting service to compete with them.

Please, therefore, do not ask us for advice or opinions, but confer with a chemist in your vicinity.

Extra Reading

Keep up with new developments of new materials and methods by reading technical magazines. Many technical publications are listed under references in the back section of this book.

Calculating Costs

Purchases of raw materials, in small quantities, are naturally higher in price than when bought in large quantities. Commercial prices, as given in the trade papers and catalogs of manufacturers, are for quantities such as barrels, drums or sacks. For example, a pound of epsom salts, bought at retail, may cost 10 or 15 cents. In barrel lots its price today is about 2 to 3 cents per pound.

Typical Cost Calculation

Formula for Beer or Milk Pipe Cleaner

Soda Ash	25 lb. @	.02½ per lb. =	\$0.63
Sodium Perborate	75 lb. @	.16 per lb. =	12.00

Total 100 lb.

Total \$12.63

If 100 lb. cost \$12.63, 1 lb. will cost \$12.63 divided by 100 or about \$0.126 per lb. for raw materials, assuming no loss.

Always weigh the amount of finished product and use *this* weight in calculating costs. Most compounding results in some loss of material because of spillage, sticking to apparatus, evaporation, etc. Costs of making experimental lots are always high and should not be used for figuring costs. To meet competition, it is necessary to buy in larger units and costs should be based on the latter.

ELEMENTARY PREPARATIONS

The recipes that follow have been formulated in a very simple way. Only one of each type is given to avoid confusion. These have been selected because of their importance and because they can be made readily.

The succeeding chapters go into greater detail and give many different types and modifications of these and other recipes for home and commercial use.

Cleansing Creams

Cleansing creams as the name implies serve as skin cleaners. Their basic ingredients are oils and waxes which are rubbed into the skin. When wiped off they carry off dirt and dead skin. The liquefying type of cleansing cream contains no water and melts or liquefies when rubbed on the skin. To suit different climates and likes and dislikes harder or softer products can be made.

Cleansing Cream (Liquefying)

Liquid Petrolatum (White Mineral Oil)	5½ oz.
Paraffin Wax	2½ oz.
Petrolatum	2 oz.

Melt together with stirring in an aluminum or enamelled dish and allow to cool. Then stir in a dash of perfume oil. Allow to stand until a haziness appears and then pour into jars, which should be allowed to stand *undisturbed* overnight.

Cold Creams

The most important facial cream is cold cream. This type of cream consists of a mineral oil and wax which are emulsified in water with a little borax or glycoesterin. The function of a cold cream is to furnish a greasy film which takes up dirt and waste tissue which are removed when the skin is wiped thoroughly. Many modifications of this basic cream are encountered in stores. They vary in color, odor, and

in claims but, essentially, they are not more useful than this simple cream. The latest type of cold cream is the non-greasy cold cream which is of particular interest because it is non-alkaline and, therefore, non-irritating to sensitive skins.

Cold Cream

Liquid Petrolatum (White Mineral Oil)	52 g.
White Beeswax	14 g.

Heat the above in an aluminum or enamelled double boiler (the water in the outer pot should be brought to a boil). In a separate aluminum or enamelled pot dissolve:

Borax	1 g.
Water	33 cc.

and bring this to a boil. Add it in a thin stream, to the melted wax, while stirring vigorously in one direction only. Use a fork for stirring. When the mixture turns to a smooth thin cream, immerse the bottom of the thermometer in it from time to time, stirring continuously. When the temperature drops to 140° F. add ½ cc. of perfume oil and continue stirring until the temperature drops to 120° F. At this point pour into jars where the cream will "set" after a while. If a harder cream is desired, reduce the amount of liquid petrolatum. If a softer cream is wanted increase it.

Cold Cream (Non-Greasy)

White Paraffin Wax	1¼
Petrolatum	1½
Glycoesterin or Glyceryl Monostearate	2¼
Liquid Petrolatum (White Mineral Oil)	3

Heat the above in an aluminum or enamelled double boiler (the water in the outer pot should be boiling). Stir until clear. To this slowly add, while stirring vigorously with a fork,

Water (boiling)	10
-----------------	----

Continue stirring until smooth and then add, with stirring, a little perfume oil. Pour into jars at 110–130° F. and cover the jars as soon as possible.

Vanishing Creams

Vanishing creams are non-greasy creams, soapy in nature. Some are white and others have a very beautiful pearly appearance. This type of cream depends on the soapiness for its cleansing character and is useful as a powder base.

Vanishing Cream

Stearic Acid	18 oz.
--------------	--------

Melt the above in an aluminum or enamelled double boiler (the water in the outer pot must be boiling). To the above add, in a thin stream, while stirring vigorously with a fork, the following boiling solution made in an aluminum or enamelled pot:

Potassium Carbonate	¼ oz.
Glycerin	6½ oz.
Water	5 lb.

Continue stirring until the temperature falls to 135° F., then stir in a little perfume oil and stir from time to time until cold. Allow to stand overnight and stir again the next day. Pack into jars which should be closed tightly.

Hand Lotions

Hand lotions are usually clear or milky liquids or salves which are useful in protecting the skin from roughness and redness because of exposure to cold, hot water, soap and other materials. "Chapped" hands are a common occurrence. The use of a good hand lotion keeps the skin smooth, soft, and in a normally healthy condition. The lotion is best applied at night, rather freely, and cotton gloves may be worn to prevent soiling. During the day it should be put on sparingly and the excess wiped off.

Hand Lotion (Salve)

Boric Acid	1
Glycerin	6

Warm the above in an aluminum or enamelled dish and stir with a clean wooden stick until dissolved (clear). Then allow to cool and work into the following mixture with a potato masher, or rounded stick, adding only a little of the above liquid at a time to the mixture below and not adding a further portion until it is fully absorbed.

Lanolin	6
Petrolatum	8

If it is desired to impart a pleasant odor to this lotion a little perfume may be added and worked in.

Hand Lotion (Milky Liquid)

Lanolin	¼ teaspoonful
Glycoesterin or Glyceryl Monostearate	1 oz.
Tincture of Benzoin	2 oz.
Witch Hazel	25 oz.

Melt the first two items together in an aluminum or enamelled double boiler. If no double boiler is at hand

INDEX

A

Abrasive, Diamond	347
Synthetic	347
Wheel, Bonding Adhesive for....	30
Absorbent Solution, Regenerating	
Cuprous Chloride	416
Absorption Base	85
Acetic Acid Tablets	91
Acknowledgments	427
Acne Lotion	92
Adhesive (see also Agglutinant,	
Calking, Cement, Glue, Muci-	
lage, Paste, Putty, Seal)....	12, 19
for Abrasive Wheel, Bonding....	30
Calcium Sucrate	33
Casein	25
Celluloid to Hard Rubber	38
for Cellulose Acetate	40
Cellulose Acetate Foil	40
Cheap Starch	21
China	47
Container-Joint Thermosetting ..	42
Decalomania	34
Denture	48, 75
Dextrin	23
Envelope	18
Ethyl Cellulose	40
Flexible Thermoplastic	41
Glass to Metal	43
High-Melting Thermoplastic	41
Laminating	27, 41
Lantern Slide	43
Latex	34
Light Polyvinyl	40
Millboard	44
Moistureproof Cellophane	32
Neutral Starch	21
Non-Setting	27
Paper	34
Paper Board	33
Permanently Tacky Pressure	38
Plywood	33
for Polyvinyl Chloride Plastics..	40
Potato-Starch	23
Pressure-Sensitive	45
for Rectifiers, Conductive	48
Rubber-Resin	39
Sodium Silicate	28
Solution, Rosin	38
for Sound-Deadening Pads	44
Starch	20
Stoneware	47
Surgical Strapping	45

Adhesive—Continued

Synthetic Resin	33
Tape	45
Tape, Pressure-Sensitive	45
Thermoplastic	41
Thermosetting	43
Transparent Resin	41
Veneer	21
Wall-Paper	18
Water-Insoluble	34
Waterproof Surgical	45
Waxed-Paper	30
Wood Glue	33
Agglutinant, Water-Soluble	33
Agricultural Insecticide (see also	
Insecticide)	121
Air Deodorant	110
Odor Neutralizer	109
Sterilization	110
Alberene Cement	47
Alcohol Proof and Percentage Table.	425
Alloy for Brass, Brazing	268
Brazing	268
Brazing, for Welding to Iron....	268
Cadmium Bearing	261
Cleaning and Covering for Molten	
Copper	262
Corrosion-Resistant Denture....	264
Dental Casting	263
Dental Clasp	264
Dental Filling	263
Dental Inlay	264
Dental Model	264
Electric Contact	262
Electric Fuse	261
Electric Resistance	262
Electric Wire Resistance	262
Hard Platinum	263
Hardened-Lead Bearing	261
Heat-Hardenable Copper	262
Iron Bearing	261
Jewelry	263
Lead	261
Non-Corrosive Lead	261
Refining White Metal	263
Resistor	262
Spark Plug Electrode	262
Allspice, Imitation	54
Almond Extract	54
Alumina Sol	325
Aluminum Alkyd, Ready Mixed....	292
Alloy Casting, Hardened	260
Coating	252
Plating	252

Aluminum—Continued	Barbecue Sauce for Pumping Barbe-
Pre-Painting Treatment249	cue Hams199
Stripping Oxide Film from249	Barium Sulfate Suspension, Medic-
Vehicle292	inal 91
Ammonia, Substitute for Household.373	Basic Chrome Nitrate—Acetate ...396
Ammunition Primer349	Bath, Bubble109
Animal Tissue Fixative416	Bathing Composition 79
Ant Poison 8	Bay Rum 89
Antacid Mixture 91	Bearing, Non-Corrosive260
Anthelmintic Emulsion, Tetrachloro-	Bedbug Exterminator 8
ethylene129	Beetles, Control of Hide and Skin..218
Sheep129	Beverage, Prepared Lemon 58
Tablet104	Syrup, Quick-Dissolving 54
Anti-Acid Powder 91	Flavors and 51
Anti-Freeze 15	Bird Food, Canary 9
Auto414	Bitter-Tasting Product, Non-Toxic..105
Liquid 16	Bituminous Composition, Tough...358
Non-Foaming414	Blackboard, White235
Anti-Incendiary Material410	Blasting Powder349
Anti-Mist Paper for Glass326	Primer, Non-Combustible349
Anti-Perspirant 87	Bleach on Union Goods387
Liquid 87	Wood Floor 12
Anti-Perspiration Soap 87	Bleaching Jute387
Antipruritic Lotion 95	Nut Shells143
Antiseptic 86	Textiles387
Dental 76	Blueing Steel250
Dusting Powder 70	Blueprint, Correction Fluid for ...340
Dye 93	Lacquer for340
Hand Soap 87	Paper339, 340
Military Foot Powder 89	Red Writing Fluid for340
Soap 87	Bockwurst209
Solution 86	Boiler Compound 15
Telephone Mouthpiece110	Scale Compound412
Wash 93	Water Treatment, Processing Tan-
Wash, Fish and Cannery Factory.372	nin412
Apparatus 3	Bologna, Ring211
Where to Buy 5	with Soya Flour212
Apple Confection150	Bonding Aluminum to Steel 49
Leather, Old-Fashioned151	Bordeaux Mixture127
Preventing Dropping of118	Bow Rosins359
Asbestos Cloth Substitute405	Boxwood Leaf Miner Spray122
Roofing Paper240	Brake and Clutch Frictional Mate-
Aseptic Wax 97	rial411
Asphalt Aggregate, Light-Weight..240	Brazing Wire, Copper268
Emulsion 44	Breaking Emulsion114
Improving Adhesion of240	Brick, Hard Refractory Non-Acid..237
Asthma Cigarette 83	Tile, High-Strength236
Inhalant, Hay-Fever 83	Brine Bearing Earth, Plugging of..407
Nose Drops 83	Brine Cooling Fluid407
Smoke Powder 83	Bristle, Bactericidal221
Spray 82	Broiler All-Mash132
Astringent Dusting Powder 70	Feed132
Athlete's Foot Powder 89	Bronze, Tin-Free Gear262
Foot Remedy 90	Bubble Bath109
Foot, Soaking Bath for 90	Buffing Compound347, 348
Rub 89	Wax, Cream348
Auto Rubbing Compound347	Bug Control124
	Bunan Oil-Resistant Coating.....365
	Burn Cream 97
	Emulsion, Tannic Acid 97
	Film Treatment, Wound and.... 96
	Ointment 97
	Butadiene, Polymerizing358
B	
Baking Powder174	
Randoline 78	

- | | |
|---|--|
| Butadiene Polymers, Vulcanization
of360 | Cedar Chest Compound 98 |
| Butadiene, Separation of406 | Celery Salt184 |
| Butter, Non-Melting181 | Cellulose Acetate, Improving Stretch
of358 |
| Production, Reducing Churning
Time in181 | Alpha417 |
| Spread, Stabilized Homogenized..181 | Foil, Moistureproofing for328 |
| Substitute, Fat-Free181 | Cement. See also Adhesive, Agglu-
tant, Calking, Glue, Mucilage,
Paste, Putty, Seal. |
| Buttercream161 | Alberene 47 |
| Buttermilk, Cultured182 | Aquarium 12 |
| Butterscotch Sauce152 | Brown 38 |
| Buyer's Guide430 | Building234 |
| Buying Chemicals and Apparatus... 5 | Buna N 35 |
| | Buna S 35 |
| | Butyl 35 |
| | for Ceramics 30 |
| | Chlorinated Rubber 37 |
| | for Crockery, Hard 39 |
| | for Cured GR"S" Coatings, Self-
Curing Lean362 |
| | Fine Plastic Building234 |
| | Floor Hardener12, 235 |
| | Floor, Preparing for Painting...235 |
| | Flooring, Waterproofing235 |
| | for Glass, Rubber 38 |
| | for High Temperatures, Iron ... 30 |
| | High-Vacuum 43 |
| | Hycar 35 |
| | Hycar O.R. 37 |
| | Hydraulic234 |
| | Insole 37 |
| | Lacquer 44 |
| | for Leather Driving Belts 37 |
| | Lens 43 |
| | Low-Temperature-Curing 35 |
| | for Marble and Alabaster 30 |
| | Metal to Metal 38 |
| | Mix, Increasing Fluidity of234 |
| | Mixed 36 |
| | Neoprene 35 |
| | Oil-Well Water-Sealing 49 |
| | Oxychloride234 |
| | Pettman 44 |
| | Photo-Mounting 35 |
| | Pipe-Joint 42 |
| | Quick-Setting Waterproof 44 |
| | Red Ebonite 36 |
| | Refractory 48 |
| | Rosin Linoleum 39 |
| | Rubber to Metal 37 |
| | Rubber Resin 39 |
| | Semi-Active Black 35 |
| | Soft, Black, Stable 36 |
| | Stainless-Steel Pipe-Joint 41 |
| | Stoneware 47 |
| | and Stucco, Waterproofing for ...287 |
| | Synthetic Rubber 34 |
| | Tacky Channel Black 35 |
| | Thiokol 35 |
| | for Uncured Vinylite-Bakelite
Coated Cloth 39 |
| | Universal 44 |

C

- | |
|--|
| Cadmium, Zinc and Tin Coating,
Identifying257 |
| Cake, Coffee155 |
| Strawberry and Other Short ...155 |
| Calculating Costs 5 |
| Calf Feed, Dry137 |
| Meal136 |
| Starter Mixture, Reinforced138 |
| Calking Compound 48 |
| Compound, Metal Filler and.... 48 |
| Wax, Boat 48 |
| Callous Skin Remover 91 |
| Softener and Remover 90 |
| Calorizing Metal259 |
| Camouflage Coating281 |
| Face Cream 61 |
| Can Joint Seal 34 |
| Seal 32 |
| Canary Bird Food 9 |
| Candle 12 |
| Coating353 |
| Candy with Chocolate Flavor148 |
| Fig-Flavored150 |
| Grapefruit-Flavored149 |
| Jellied Tart147 |
| Jelly147 |
| Licorice-Flavored148 |
| Orange-Flavored149 |
| Pectin146 |
| Canned Fruit Salad139 |
| Jellied Consommé140 |
| Tomato Aspic141 |
| Canning, Precautions in139 |
| Canvas, Fireproofing 15 |
| Capsule Filling Hints106 |
| Caramel Wafer Shell173 |
| Carbon, Activated417 |
| Paper, Transfer217 |
| Carob Beans, Dehusking132 |
| Case-Hardening Compound259 |
| Iron or Steel259 |
| Small Articles259 |
| Casein Fiber Resistant to Water,
Making404 |
| Cattle Grub Control129 |
| Louse Dust129 |
| Salt Iodine Blocks138 |

Cement—Continued	Cleaning—Continued
Vinylite	Eggs, Solution for
Vistanex	Fluid, Antiseptic Dry
Watch Crystal	Fluid, Dry
Waterproofing	Fluid, Jewelry
White	Paste
Cementing Leather with Gutta-Percha	Powder, Rug and Textile
Form for Slip Casting	and Protecting Metal
Ceramic Made with Heat	Solution, Non-Corrosive Labora-
Switch Composition	tory Glass
Chapped Lip Stick	Cleanser, Liquid Skin
Charcoal, Activated	Pile Fabric
Cheese Coating, Non-Molding	Cloth, Drum Head and Banjo
Coating Wax	Fireproof
Reducing Blowing in	Manufacture of Organdie
Chemicals and Supplies, Sellers of	Substitute, Asbestos
and Supplies, Where to Buy	Clutch Frictional Material, Brake
Cherry Fruit Fly Control	and
with Other Natural Flavors	Plate Stud
Chest Rub	Coal-Tar Skin Treatment
Rub Salve	Coating. See also Lacquer, Paint,
Chick Starter	Varnish.
Starting and Growing Mash	for Acetate Sheet, Moistureproof
Chicken, Smoked Roast	Acoustic Sound-Deadening
Chigger Bites Treatment	Airplane Deicing
Chili Con Carne	for Aluminum, Protective
Chloracne Treatment	for Asphalt Containers, Non-Stick
Chocolate, Reducing Viscosity of	for Asphalt Drums
Chromate Skin Injuries, Salve for	Base, Artificial Leather
Chromium-Plating Bath	Biscuit
Cast Iron	Bunan Oil-Resistant
Clarification, Filtering and	Candle
Clay, Molding	Cathode or X-Ray Tube Screen
Cleaner (see also Detergent, Soap,	for Cellophane, Moistureproof
Spot Remover, Stain Remover)	for Cloth, Flexible
Aluminum	Composition, Fusible
Brass	Composition for Ice Trays
Drawing Pen	Dark Chocolate
Household	Fire-Resistant
Leather	Flameproof, Waterproof and Mil-
Linotype Matrix	dewproof Textile
Metal Machinery	Fluorescent Lamp
and Mist Preventer, Spectacle	Foundry Mold
Lens	Fruit Protective
Motor Cylinder	Lemon
Non-Corrosive Tin Plate	or Lining for Iron Pipes
Paint-Brush	for Lithographic Plates, Protec-
Powdered	tive
Pre-Anodizing Metal	Malt Milk
Printing Plate	Milk Bottle Cap
Rug Dry	Moistureproof
Straw-Hat	Moistureproof Hot Melt
Type	Neoprene Latex
Universal	Neoprene Olive Drab
Wall-Paper	Nitrocellulose
Window	Oilproof Barrel
Window and Glassware	Orange
Cleaners' Soap, Dry	Paint or Lacquer "Stop-Off"
Cleaning Bath, Electrolytic Metal	for Paper Containers, Oilproof
Bath, Non-Aqueous Metal	for Petroleum Refinery Equip-
Bottles	ment
	Special

- Coating—Continued
of Stainless Steel, Black250
Steel, Black278
for Stone Top Tables, Protective.312
Vehicle, Wall292
White163
Wine Tank312
Cocoa Coating, Heat-Resistant.....154
Coating, Heat-Resistant Candy
and Cake153
Malt Powder 9
Powder, Sweet 9
Codling Moth Ovicide and Larvi-
cide123
Moth Spray123
Cod-Liver Oil, Orange Juice, Malt
Extract Emulsion107
Coke, Easily Inflammable407
Colloid111
Colloidal Graphite, Aqueous114
Sulfur113
Cologne, Cream 72
Eau de 72
Coloring. See also Dyeing.
Cadmium Brown250
Stainless Steel250
Compounding, Containers for 3
Concrete. See also Cement.
Made with Sea Water234
Plasticizing234
Road Protective234
Consultants 5
Containers for Compounding 3
Conversion Table422, 423
of Thermometer Readings424
Copper, Antique Coloring for 9
Deplating of Steel254
Plating, Simple253
Powdered258
Cork, Glue Binder for 20
Substitute240
Corn Collodion 90
Remover 90
Corrosion Inhibitor, Lubricating
Oil230
Inhibitor, Pickling244
of Metal in Contact with Chloro-
form, Preventing246
Preventing Moisture Absorption
and246
Resisting Coating for Copper.....262
Silica Gel for Preventing246
Corrosionproofing Magnesium Al-
loys247
Corrosive Chemicals 4
Effect of Brine on Refrigerating
Machinery, Preventing244
Cosmetic Stocking108
and Drug Products 59
Costs, Calculating 5
Cotton Duck, Waterproofing403
Crab Meat, Preservation of213
Crayon, Hot Metal Marking217
Luminous217
Marking 9
Red Marking217
Cream, Acid 62
Artificial175
Brushless Shaving7, 80
Burn 97
Camouflage Face 61
Cleansing5, 59
Cold5, 6, 63
Cologne 72
Concentrated Day 62
Cosmetic Base 63
Deodorant 88
Four-Purpose 62
Germicidal 86
Hair 79
Hand 67
Hand Protective 67
Hormone 61
Insect-Repellent 98
Medicinal Vanishing103
with Milk, Diluting176
Modern Tissue 63
Nail 67
Neutral Cleansing 2
Non-Greasy Cold 6
Shoe343, 344
Skin-Treatment 92
Substitute for Coffee175
Sulfathiazole—Urea 61
Suntan 64
Tissue 63
Toilet 60
Under Arm 87
Vanishing6, 67
Waterproofing Skin 92
Whipped160
Whipping Aid176
Crease Preserving Composition.....388
Crucible, Refractory237
Cuprous Oxide417
Curd Milk, Soft175
Curry Powder184
Cut-Flower Preservative118
- D**
- Decalomania366
Adhesive 34
Decolorizing 4
Defoamer for Pulp and Paper
Stock325
Defroster, Windshield414
Dehusking Carob Beans132
Deicing Coating, Airplane414
Deinking Newspaper328
Delustering Acetate Silk380
Shiny Fabric380
Delustrant. See Duller.

Dental Anesthetics, Topical	75	Dressing—Continued	
Antiseptic	76	French	183
Casting Alloy	263	GR“S” Rubber Belt	232
Cavity Cement Lining	75	Drug Penetrating Aid	104
Clasp Alloy	264	Products, Cosmetics and	59
Copper Amalgam	263	Dry Cleaning. See Cleaning.	
Cotton, Styptic	75	Duller for Hosiery	380
Desensitizer	74	Dyeing Aged Black on Loose Cot-	
Duplicating and Impression Com-		ton	391
pound	354, 355	Aralac	302-396
Epithelial Solvent	74	Aralac and Cellulose Fiber Mix-	
Filling Alloy	263	tures	394
Inlay Alloy	264	Aralac-Rayon-Wool-Cotton	396
Instrument Sterilizing Fluid	75	Brightening Black	397
Investment	237, 267	Brush Bristles	390
Model Alloy	264	Casein Fibers	392-396
Paste, Pumice-Bentonite	73	Grass	390
Plaster of Paris Cast, Separating		Improved Textile	397
Fluid for	236	Logwood and Acid Colors in Same	
Pulp Devitalizer	75	Bath	391
Dentifrice, Antiseptic	73	Sisal and Manila Hemp	389
Salt-Lime	74	Straw Hat Plaits	389
Sodium Oleate	74	Wool Bunting Cloth	391
Dentin	74	Dyestuff for the Coloring of Tri-	
Denture Alloy, Corrosion-Resistant.	264	chloroethylene	419
Base, Ceramic	238		
Cleaner	76	E	
Deodorant, Air	109, 110	Eau de Cologne	72
Body	87	Eggs, Solution for Cleaning	130
Cream	88	Electric Capacitor	409
Fungicide	88	Insulation. See Insulation.	
Spray	8	Joint, Filler for Taped	409
Deodorizer, Cooking (Fish)	214	Shaving Aid	80
Depilatory	108	Electrical Insulating Filling Com-	
Feather and Animal Hair	130	pound	358
Dermatitis Lotion	93	Sealing Compound	39
Salve for Metal Poisoning	94	Electroplating, Brush	253
Detergent. See also Cleaner.		Elementary Preparations	5
Cake	369	Elixir, Vitamin B	105
Disinfecting	372	Embalming Fluid	109
Paper Towel	372	Emulsion	111
Developer. See Photographic.		Asphalt	114
Diamond Dust Brooch	411	Breaking	114
Embedding Composition	258	Castor Oil	111
Dielectric, Solid	409	Ceresin Wax	111
Disinfectant	86	Cetyl Alcohol	111
Cresol	8	Cod-Liver Oil	112
Pine Oil	121	Cod-Liver Oil, Orange Juice Malt	
Poultry House	129	Extract	107
Spray	120	Cottonseed Pitch	114
Water	411	Cumar	112
Disinfecting Detergent	372	for Finishing Dyed Rayon	384
Seeds	128	Fruit Protective	142
Shoes	86	Hop Extract	55
Dissolving, Mixing and	4	Kerosene Spray	126
Document, Detecting Falsified	339	Lemon Oil	56
Restoring Faded	339, 419	Liquid Petrolatum	106
Dope, Airplane	323	Mothproofing	402
Doughnuts with Potatoes	171	Neat's Foot Oil	111
Dressing, Belt	232	Ointment	100
Fine Leather	219	Orange Oil	56
Flavor for French	183	Ouricury Wax	111

- Emulsion—Continued
- Paint, Congo Resin303
- Paint for Exterior Use, Water...285
- Paint Paste303
- Paint Tint304
- Paraffin Wax111
- Pentaerithritol Abietate113
- Peppermint Oil112
- Polyisobutylene112
- Polymerization, Synthetic Rubber360
- Polymerization of Vinyl Acetate...357
- Polyvinyl Chloride Polymerization112
- Spray, Dichloroethylether111
- "Stabelite" Ester113
- Stone Paint286
- Sulfur114
- Tetrachloroethylene Anthelmintic.129
- Type Finish, Interior300
- Waterproofing Leather218
- Wool Oiling385
- Enamel. See also Paint.
- Architectural White308
- Base for Tints, Quick Dry298
- Black Baking279
- Black Wrinkle316
- Boro-Silicate240
- Brown Floor300
- Floor300
- Four-Hour Brushing Black.....299
- Gray Floor300
- Green Floor300
- Heat-Resisting Black278
- Interior Quick-Dry298
- Liquid279
- Liquid, White Architectural....308
- Lusterless Olive Drab281
- Lusterless Sanding281
- Marine Interior281
- for Metal, Clear Vitreous239
- Non-Yellowing White Quick-Dry..298
- Olive Drab Wrinkle316
- Quick-Dry Blue299
- Quick-Dry Green299
- Quick-Dry Red299
- Quick-Drying281
- Wagon and Tractor274
- Enamelled Iron, Vitreous Undercoat for239
- Enteric-Fill Coating106
- Erasing Fluid for Tracing Cloth...217
- Etch, Glass216
- Non-Ferrous Metallographic256
- Etchant for Silver Solders, Metallographic256
- Etching Fluid, Glass10
- Macroscopic Brass256
- Magnesium Metallographic Specimens257
- Resist, Acid257
- Solution for Beryllium256
- Ethyl Cellulose356
- Experiments2
- Explosive Black Powder, Stable...349
- Charge, Oil Well349
- Demolition349
- Exterminator, Bedbug8
- Vermin120
- Extra Reading5
- Extract, Pure Lemon9
- Eye Burn Treatment84
- Drops93
- Drops, Non-Irritating83
- Wash93
- Wash, Hay Fever84
- Wash, Neutral84
- Eyebrow Black84
- Dressing80
- Eyelids, Treating Hives on84
- F**
- Fabric, Acetate Rayon "Burn-Out"397, 398
- Crêping382
- Fireproofing Light15
- GR"1" Compound for Laminating364
- Rotproofing402
- False Teeth Plate. See Denture.
- Farm Specialties115
- Fatty Acids, Preventing Discoloration of Higher233
- Feed, Calf136
- Dry Calf137
- Poultry132
- Preserving Green138
- Feminine-Hygiene Preparation ...108
- Fertilizer, Granulated118
- Fiber379
- Rotproofing402
- Softener and Lubricant for Artificial385
- Fiberboard, Oilproofing15
- Figuring2
- Filling, Buttercream161
- Chocolate Pie168
- French Custard Cream164
- Fruit-Flavor Pie168
- Lemon Pie169
- Powdered Pie165
- for Sugar Wafer172
- Film or Prints, Copper Sulfide Intensification of331
- Filter Aid408
- Filtering and Clarification4
- Finish for Calicos, Thickening Satin384
- Interior Emulsion Type300
- Interior Flat Wall295
- Interior Semi-Gloss296
- for Laboratory Table Tops324

- Fire Extinguisher, Dry15, 410
 Extinguisher, Foam410
 Extinguisher Foam Stabilizer....410
 Extinguisher, Magnesium Alumi-
 num Powder 410
 Extinguishing Liquid 15
 Kindler 15
 Firebrick237
 Fireproof Paper 15
 Fireproofing Canvas 15
 Light Fabrics 15
 Fish Preserving Ice213
 Flavor and Beverages 51
 Emulsifier and Stabilizer for.... 55
 Rye-Bread 55
 Vanilla (Artificial) 9
 Flavoring from Orange Peels, Mar-
 malade 55
 Vehicle, Pharmaceutical105
 Floor Sweeping Compound378
 Flotation Frother, Fluorspar114
 Reagent for Oxide Ores114
 Flour, Bleaching and Maturing....174
 Prepared Biscuit173
 Prepared Pancake173
 Prepared Waffle174
 Flower Preservative, Cut118
 Fluid, Door Check410
 Hydraulic409
 Magnetizable410
 Manometer410
 Fluorescent Lamp Coating409
 Flux, Aluminum or Magnesium
 Welding270
 Aluminum Scrap Melting270
 Brazing269
 Copper Welding269
 for Galvanized Iron, Soldering...266
 Gold Melting269
 Hard Soldering266
 Magnesium Refining270
 for Melting Non-Ferrous Metals..270
 Multiple Ceramic238
 Nickel Chrome Alloy Welding....269
 Non-Corrosive Magnesium270
 Soldering16, 265
 for Welding Aluminum269
 for Welding Iron Base Alloys....270
 for Welding Steel Contaminated
 with Sulfur270
 Fly Control, Cherry Fruit122
 Paper 8
 Spray 8
 Spray, D.D.T.120
 Fondant Icing Sugar152
 Food, Canary Bird 9
 Color, Liquid Green175
 Color, Liquid Red175
 Color, Liquid Yellow175
 Products139
 Protein213
 Foot Bath 89
 Perspiration, Control of 87
 Powder, Antiseptic Military 89
 Foundry Mold Coating310
 Sand, Magnesium Alloy266
 Frankfurter, High-Grade207
 Skinless207
 Fruit Concentrates, Pure 51
 Dessert, New141
 Ice Cream or Soda Fountain
 Crushed 57
 Preventing Discoloration of Cut..142
 Protective Coating142
 Syrup for Pickling142
 Fuel, Anti-Knock Motor406
 Colloidal407
 Non-Clouding Aviation406
 Oil, Improving407
 Fudge, Chocolate162
 Fumes, Settling417
 Fungicide, Deodorant 88
 Fungous Diseases in Pet Fish,
 Treating130
 Fur Bleaching223, 226
 Carrotting Solution222
 Dyeing223
 Felt Hat, After-Chrome for223
 Wax Finish for223
 Furnace Luting Lining, Electric...237
 Furniture Filler, Wax46, 315
 Filling Scratches on Varnished...315
- ### G
- Galvanized Coating, Repairing Dam-
 aged249
 Garden Specialties115
 Gargle Powder 73
 Gasoline, Solidified 15
 Stabilizing Tetraethyl Lead407
 Gel, Glycerin Face 62
 Gelatin Composition for True-to-
 Scale Prints329
 Masses, Coloring366
 Solution, Preserving408
 Germicidal Bombs 86
 Cream 86
 Germicide 86
 Anaerobic Wound Infection 97
 Getter, Vacuum Tube409
 Gilder's Size311
 Gingivitis Mouth Wash 74
 Glass Batch, Clear Colorless239
 Batch, High-Silica240
 Batch, Optical239
 Etching Fluid 10
 Frosting322
 Low-Expansion239
 Ruby239
 Setting Composition, Plate 43
 Silver Mirror on253
 "Glassine" Paper 14
 Glaze. See also Icing.
 Bakers'154
 Fruit and Berry155
 High-Temperature-Resistant Ce-
 ramic238
 Pecan Bun156

- Glazed Topping for Coffee Cake....155
 Glove, Invisible 67
 Glue. See also Adhesive, Agglutinant, Calking, Cement, Mucilage, Paste, Putty, Seal.
 Binder for Cork 20
 Bookbinders' Flexible 32
 Coating, Grease-Resistant327
 Dried-Blood 28
 Flexible 2
 Gum Arabic 30
 "Iceproof" 18
 Magazine and Catalog 31
 Marine 46
 Non-Warping Paper 19
 Plywood 41
 Size 19
 Soybean 28
 from Sweet Potatoes, Salt 23
 Veneer 41
 Water-Resistant 18
 Glycerin Gelatin Base153
 Substitute in Cosmetics107
 Grafting Wax11, 45, 119
 Wax Salve119
 Grain and Mash132
 Grape with Other Natural Flavors. 52
 Shipment Protection142
 Graphite, Aqueous Colloidal114
 Grease 11
 Grease, High-Temperature Stopcock232
 Greaseproofing Paper and Fiberboard 15
 Grinding, Pulverizing and 4
 Wheel. See Abrasive Wheel.
 GR"S" Compounds362, 364
 Gum. See Adhesive, Agglutinant, Calking, Cement, Glue, Mucilage, Paste, Putty, Seal.
 Gypsum, Waterproofing Cast235
- H**
- Hair. See also Permanent.
 Bluing for White 80
 Cream 79
 Gloss 78
 Lotion 76
 Pomade 78
 Pomade, Wavy 79
 "Tonic" 76
 Waving Fluid 77
 Waving Solutions, Cold 77
 Ham, New England Style Pressed..185
 Hamburger Style Patties186
 Hand Cleaner without Water371
 Cleaning Powder, Abrasive370
 Lotion 65
 Wash, Lithographer's Protective. 67
 Hardening Bath, High Speed.259
 Copper262
 Hay-Fever Asthma Inhalant 83
 Eye Wash 84
 Treatment 83
- Head Cheese, Country Style201
 Lice Lotion 80
 Heat Exchange Medium410
 Generating Composition....408, 409
 Paper Transfer366
 Heating 3
 Powder, Chemical 77
 Heel Compound, GR"S"364
 Hemorrhoidal Suppository 99
 Hide Beetle Control129
 Dehairing218
 and Skin Beetles, Control of....218
 Softening Dry218
 Hives on Eyelids, Treating 84
 Honeycomb, Artificial132
 Hop Extract Emulsion 55
 Horticulture. See Garden.
 Household Products 8
 Hydrogen Peroxide417
 Hygiene Preparation, Feminine108
- I**
- Ice Cream Bar Coating180
 Cream, Chocolate178
 Cream or Soda Fountain Crushed
 Fruit 57
 Cream, Vanilla178
 Stabilizer for Water179
 Tangerine Water179
 Water178
 Icing155
 Bakers'154
 or Base, Boiled163
 Boiled Chocolate157
 Buttercream161
 Chocolate156
 Coffee Cake158
 Cookie Flat161
 Cream156
 Custard163
 Doughnut161
 Fondant-Type157
 Fruit, Nut, etc.157
 Home-Made Boiled162
 Malted Chocolate160
 Marshmallow158
 Peach Fluff160
 Pineapple Fluff or Fruit157
 Special163
 White158
 Impetigo and Wound Powder 96
 Ingredients 1
 Inhalant, Hay-Fever Asthma 83
 Nasal 81
 Vapor 82
 Ink, Black Marking215
 Black Stencil215
 Black Writing215
 Blue-Black Writing 9
 Ceramic Stenciling216
 China and Glass216
 for Clock Numerals216
 Duplicating215

Ink—Continued	Ketchup, Spice for	184
Fluorescent	Killing Bath	224
Hectograph	Killing, Brush	225
Invisible, Detecting	Killing with Catalyst	225
Laboratory	Kohl	84
Laundry-Marking		
for Marking Glass	L	
Printing	Label Base, Heat-Sealable	48
for Ruling on Glass	Lace Fabric, Nitrated Non-Inflam-	
Semi-Gallate Writing	mable	401
for Stamp Pads	Lacquer	317
Sympathetic	Base, Perspirationproof	322
Thinner, India	for Blueprint, Direct Print, Map,	
Insect Powder, D.D.T.	etc.	340
Repellent	Book	320
Repellent Cream	Brushing Linoleum	320
Insecticidal Aerosol	Cellulose Acetate	320
Insecticide (see also Larvicide)	Cheese Wrapper Foil	320
Agricultural	Clear Furniture	318
Dry	Coated Paper, Avoiding Stickiness	
Nicotine Bentonite	of	320
for Poultry Houses	Coating, Flame Resistant	322
Shade Tree	Crystallizing	322
Slug	Exterior Clear Transparent	
Insulating Compound for Molten	Metal	323
Cast Steel	Filling and Binding	322
Filling Compound, Electrical	Flat	321
Insulation, Bonded Fibrous	for Glass Identification, Dipping	322
Code Wire	Gold	321
Electrical	Imitation Shellac	324
Fireproof Thermal	for Lenses, Protective	322
High-Frequency Ceramic	for Moistureproofing Cellophane	321
Sound	Prolamine (Zein) Plastic	323
Insulator, Ceramic Electrical	Thinner	321, 322
Ion Exchange Composition	White Automobile or Refrigera-	
Iron, Powdered	tor	318
Itch Lotion, Grain	Wood	320
Remedy	Laminated Wood	41
	Lanolin Substitute	85
J	Lard, Preserving	213
Jam, Strawberry	Larvicide, Codling Moth	123
Japanese Beetle Larvae Control	Mosquito	119
Javelle Water	Latex, Heat-Sterilizing Fresh	360
Jelly for Bakers, Firm	Preserving	360
for Bakers, Spreading	Laundry Bleach (Javelle Water)	14
Candy	Blue	14, 372
Cocoa	Sour and Bluing	372
Fig Slab	Sour, Stabilized	372
Grape	Lawn Grub Control	121
Paste, Orange	Laxative, Vegetable	107
Piping	Lead Coated Iron, Powdered	258
Powder, Bakers' Flavored Pectin	Coating Alloy, Hot	251
Surgical Lubricating	Leak Sealer. See also Anti-Leak.	
Washable	Leak-Sealing Composition	49
Wine	Leather Belt Stuffing	219
Jointing Compound, Plastic Heat-	Coating for Artificial	318, 319, 320
proof	Dressing, Fine	219
	Dye Solution, Black	220
K	Emulsion, Waterproofing	218
Kallitype Silver Printing	Goods, Oil for Softening	219
Kerosene, Stabilized	Preservative	10
	Preventing Mold Growth on	219

- | | |
|---------------------------------------|---|
| Leather—Continued | Lotion—Continued |
| Strips, Wax for220 | Hand6, 65 |
| Waterproofing Sole218 | Head Lice 80 |
| Lemon Beverage, Prepared 58 | Suntan 64 |
| Cheese167 | Vinegar Face 3 |
| Extract 54 | Lubricant (see also Grease) 11 |
| Extract, Pure 9 | Airplane Parts229 |
| Oil Emulsion 56 | Air-Pump230 |
| Lining, Asphalt Drum312 | Anti-Corrosive Spindle230 |
| Liniment 89 | Anti-Size Thread230 |
| Methol 89 | Ceramic Binder238 |
| Sore Muscle 7 | Clock230 |
| Lip Stick, Chapped100 | Corrosionless Bearing230 |
| Lithographer's Protective Hand | Emulsive231 |
| Wash 67 | Ethyl Cellulose Molding231 |
| Lithographic Albumin Substitute...337 | Forging Tool and Die231 |
| Image Coating337 | Gasoline Line229 |
| Paper Coating338 | Gun11, 229 |
| Plate Desensitizing Etch337 | Hydrocarbon Resistant Stopcock...232 |
| Printing Plate Treatment338 | Leather Belt232 |
| Liverwurst210 | Leather Packing and Gasket ...231 |
| Marble209 | Metal Can229 |
| Loaf, Baked Hamburger186 | Non-Flowing230 |
| Baked Veal and Pork189 | Organic Vapor Resistant Stop- |
| Barbecue-Style Pork195 | cock232 |
| Blood and Tongue185 | Plastic Molding230 |
| Celery Meat193 | Rubber Mold231 |
| Cooked Corn Beef and Spaghetti...188 | Solid230 |
| Cooked Ham187 | Stopcock232 |
| Corned Beef187 | Wire Drawing229 |
| Corsica-Style Meat192 | Lubricating Oil Corrosion Inhibitor...230 |
| Defense Meat190 | Paste, Anti-Size230 |
| Delectable Meat194 | Lubrication, Powder Metallurgy |
| Dutch Meat193 | Die229 |
| Glaze for Meat199 | Lute, Pipe-Joint 42 |
| Hamburger and Cheese199 | Lycopodium Substitute417 |
| Liver195 | |
| Liver and Bacon189 | M |
| Liver and Cheese198 | Magnesium Alloy, Casting and Roll- |
| Luncheon Meat189 | ing261 |
| Luxury Meat191 | Finish, Bright248 |
| Meat, Macaroni and Cheese.....198 | Gray Finish for248 |
| Meat, Pickle and Pimento192 | Pre-Painting Treatment for.....248 |
| Minced Luncheon196 | Magnet Alloy, Permanent260 |
| Mosaic Liver194 | Malt Powder, Cocoa 9 |
| Pork Luncheon185 | Malted Milk Powder 9 |
| Roast-Beef186 | Malto-Dextrin174 |
| Skim-Milk Meat197 | Manganese-Plating253 |
| Southern Meat191 | Marking. See also Ink. |
| Southern Peanut Meat194 | Glass216 |
| Tongue and Cheese197 | Porcelain216 |
| Translucent Liver196 | Marmalade, Orange143 |
| Utility Meat190 | Marshmallow, Starch-Albumen ...152 |
| Veal188 | Mascara, Cake 84 |
| Loss, Spoilage and 4 | Mash, Breeding133 |
| Lotion, Acne 92 | Chick Starting and Growing...132 |
| After-Shaving 81 | Grain and132 |
| Antipruritic 95 | Poultry131 |
| Base, Alginate Hand 67 | Turkey136 |
| Dermatitis 93 | Turkey Growing135 |
| Face 65 | Masking Tape 45 |
| Grain Itch 96 | Mayonnaise183 |
| Hair183 | |

Measures	420	Nasal—Continued	
Measuring, Weighing and	4	Spray, Benzedrine	81
Meat, Cure for Sausage	212	Spray, Throat and	81
Curing Salt	212	Nectar, Imitation Cherry	53
Dried Salted	213	Imitation Grape	53
Preservative	212	Imitation Raspberry	53
Meatwurst, Smoked	209	Imitation Strawberry	53
Mechanical Goods, Highly Loaded		Lime	52
GR“S” for	364	Orange	52
Melamine Resin	356	Neoprene Compound, General Util-	
Mercerizing Bath	384	ity	363
Meringue	167	Latex Coating	365
Metal Carbide	258	Latex, Gelling	361
Cleaning and Protecting	244	Olive Drab Coating	364
Coating on One Side, Hot	251	Newspaper, Deinking	328
Degreasing Compound	374	Nickel-Plating Bath	252
Filler and Calking Compound	48	on Magnesium	252
Protection	276	Nicotine Bentonite Insecticide	127
Protective Synthetic Coating	278	Decoction	128
Metallic Spray Coating	251	Dust	128
Methods	3	Nitrocellulose Coating	366
Metol Poisoning Salve	94	Non-Staling Baked Products	172
Metric Equivalents	420	Non-Toxic Bitter-Tasting Product	105
Mica, Permanent Marking of	239	Nose Drops, Asthma	83
Milk of Almond	65	Drops, Isotonic	82
Bottle Cap Coating	328, 358	Nut Shells, Bleaching	143
Mixing and Dissolving	4	Skins, Removal of Filbert	143
Mold Coating, Casting	266	Skins, Removing	143
Coating, Ingot	266	Nutmeg, Imitation	54
Composition, Foundry	266	Nylon Fabric, Boil-Off of	380
Composition for Precision Cast-			
ings	267		
and Core, Foundry	266		
Facing Sand	266		
Wash, Foundry	267		
Molded Cork and Cane Stalk Prod-			
uct	355		
Molding Clay	366		
Material	11		
Mordanting Rayon	390		
Mortar, Mason's	235		
Mosquito-Repelling Oil	8		
Mothproofing Emulsion	402		
Fluid	8		
for Piano Key Felts	402		
Solution	402		
Mouth Rinse, Germicidal Dental	73		
Treatment, Trench	74		
Wash	7, 73		
Wash, Gingivitis	74		
Wash, Glycerin Thymol	73		
Mucilage (see also Adhesive, Agglu-			
tinant, Calking, Cement, Glue,			
Paste, Putty, Seal)	31		
of Quince Seed	93		
Mustache Wax	109		
N			
Nasal Constrictor	82	Nasal—Continued	
Inhalant	81	Spray, Benzedrine	81
Ointment	93	Spray, Throat and	81
Spray	81	Nectar, Imitation Cherry	53
		Imitation Grape	53
		Imitation Raspberry	53
		Imitation Strawberry	53
		Lime	52
		Orange	52
		Neoprene Compound, General Util-	
		ity	363
		Latex Coating	365
		Latex, Gelling	361
		Olive Drab Coating	364
		Newspaper, Deinking	328
		Nickel-Plating Bath	252
		on Magnesium	252
		Nicotine Bentonite Insecticide	127
		Decoction	128
		Dust	128
		Nitrocellulose Coating	366
		Non-Staling Baked Products	172
		Non-Toxic Bitter-Tasting Product	105
		Nose Drops, Asthma	83
		Drops, Isotonic	82
		Nut Shells, Bleaching	143
		Skins, Removal of Filbert	143
		Skins, Removing	143
		Nutmeg, Imitation	54
		Nylon Fabric, Boil-Off of	380
O			
		Offset Composition, Printing	216
		Oil, Baby Skin	97
		Base Well Drilling Fluid	230
		Box Calf	219
		Extracting Fish Liver	233
		and Fat, Bleaching	233
		Floor	11
		Flushing	231
		General-Purpose Grinding	309
		Metal-Cutting	231
		Metal-Quenching	231
		Milky Suntan	65
		Mixing Varnish and Paint	309
		Mosquito-Repelling	8
		Non-Rusting Turbin	230
		Penetrating	11, 232
		for Shampoo, Crude	80
		Soluble	231
		Substitute for Coconut	175
		Suntan	64
		Well, Freeing Stuck Tools in	408
		Well, Removing Metal Obstruct-	
		tions from	408
		Oilproofing Paper and Fiberboard ..	15
		Ointment. See also Salve	
		Analgesic	85
		Antiseptic	2
		Anti-Sunburn	65
		Base	60, 84
		Base, Ophthalmic	108

Ointment—Continued

Base, Stainless	85
Base, Washable	60
Burn	97
Cable Rash	93
Chlorophyll Impetigo	96
Cod-Liver Oil	85
Emulsion	100
Eye	93
Mustard-Gas	97
Skin	93
Stable Zinc Peroxide	92
Sulfa—Zinc Peroxide	96
Sunburn	64
Ulcer	92
Vaginal	100
Oleomargarine, Non-Weeping	181
Orange Oil Emulsion	56
Ovicide, Codling-Moth	123

P

Packing Gasket, Chemically Resistant	359
Plastic Stuffing Box	359
Solvent-Resistant Pump	417
Paint. See also Enamel.	
Anti-Fouling Shipbottom	279
Base for Tints, Brick and Stucco	173
Base for Tints, House	272
Black Bridge	278
Black Hull	280
Brick and Stucco	172
Brick and Stucco White	172
Brushes, Cleaning	314
in Cans, Preventing Skinning of	315
Casein Powder	312
Cement Water	287
Clear Protective Coat for Phosphorescent	317
Clear Varnish for Heat Resistant Aluminum	292
Congo Resin Camouflage	287
Congo Resin Emulsion	303
Congo Resin Fire-Retardant	289
Congo Resin Traffic	275
Congo Resin Vehicle for Gasoline-Soluble	282
Emulsion Stone	286
Exterior House	271
Exterior Metal	275
Exterior Trim and Trellis	273
for Exterior Use, Water Emulsion	285
Fire-Resisting Canvas Preservative	280
Flame-Resisting	285
Flat Wall	295
Interior Gloss	296, 297
Light Gray Deck	279
Light Gray Hull	280
Lusterless Congo Resin Ammunition	282

Paint—Continued

Marine	279
Marine Interior Flat	281
Marine Outside White	280
Non-Leafing Aluminum Paste	310
Oleo-Resinous Emulsifiable	288
Outside White House	271
Paste, Emulsion	303
Phosphorescent	316
Red Deck	280
Remover	12, 324
Semi-Gloss Polishing	311
Special	309
for Steel, Carbon Black	278
for Structural Steel, Anti-Corrosive	278
for Structural Steel, Red Lead	278
Tint, Emulsion	304
Traffic	274
Water	287
Waterproof Awning	285
Water-Reducible Oil Type Paste	301, 302
for Wooden Vessels, Anti-Fouling Copperbottom	279
Painting Glazed Tile	316
Palladium Plating Bath	251
Paper, Avoiding Stickiness of Lacquered-Coated	320
Blueprint	339, 340
Containers, Oilproofing	327
Fireproof	15
for Glass, Anti-Mist	326
"Glassine"	14
Glaze Coating	326
Grease-Resistant	327
Grease-Resistant Glue Coating for	327
Heat-Sealable Waxed	328
Improving Transparency of Waxed	328
Laminating	327
Non-Slip, Non-Hygroscopic, Adhesive-Coated	326
Non-Tarnish	326
Oilproofing	15
Polarity Test	416
Pulp Oilproofing	327
Size, Lime in Place of Caustic Soda in	325
Softening	326
Stock, Defomar for Pulp and	325
Towel, Detergent	372
Transparentizing Solution	326
Tub Sizing for	325
Waterproof Cigarette	328
Waxed	328
Parasiticide. See also Insecticide.	
Spray	123
Paste. See also Adhesive, Agglutinant, Calking, Cement, Glue, Muclage, Putty, Seal.	
Billposter's	18

- Paste—Continued
 Cold-Water 18
 Labeling 17
 Non-Warping 17
 Paperhanger's 12
 Textile Printing 396
 Tin-Labeling 20
 Pastry. See Cake.
 Pea Aphid Control 123
 Soup Cubes 143
 Peach Base 160
 Pectin Candy 146
 Solution 146, 165
 Penetrating Aid, Drug 104
 Perfume, Solid 71
 Spanish "Paste" Leather 72
 Permanent Magnet Alloy 260
 Waving Composition 76
 Waving, Heating Powder for 77
 Perspiration, Control of Foot 87
 Petrolatum Emulsion, Liquid 106
 Petroleum, Deodorizing Sulfurous 406
 pH Values 420, 421
 Pharmaceutical Tablet Coating 106
 Phenothiazine Suspension 129
 Phosphatizing 276
 Photoengraver's Cold Enamel 337
 Cold Enamel Lacquer 337
 Photograph, Eliminating Abrasion
 Fog on 334
 Photographic Acid Hardening Fixer
 16, 333
 Bleaching Solution 334
 Developer, Blue Tone and Blue-
 Black Tone 337
 Developer, Fine Grain 330
 Developer, Hard 330
 Developer, Low-Contrast 329
 Developer, Non-Dichroic Fog 330
 Developer, Reddish-Tone 337
 Developer, Soft 330
 Developer without Speed Loss,
 Fine Grain 331
 Developer, Stable 329
 Developer, Two-Solution Type 330
 Developer, Universal 329
 Developing, Economical 330
 Developing Solution 16
 Etching Bath 336
 Film, Reduction of Overdevel-
 oped 334
 Film, Restoring Shrunken 335
 Fixing Bath, Recovery of Silver
 from 340
 Fixing and Hardening Bath 333
 Flashlight Powder 340
 Gas Light Paper, Developing 336
 Gelatin Hardening Solution 332
 Intensifiers 332
 Negative, Fog Prevention in 335
 Negative, Fog Removal from 335
 Negative, Intensifying Bath for 331
- Photographic—Continued
 Negative, Non-Curling 335
 Negative, Normalizing Overdevel-
 oped 334
 Negative, Preventing Drying Spots
 on 335
 Negative, Rapid Drying of 335
 Paper, Home-Sensitized 329
 Paper, Sensitized 329
 Print-Out Emulsion 336
 Print-Out Paper 336
 Print on Oxidized Aluminum 338
 Print, Preventing Curl in 335
 Resist 334
 Solution 16
 Substitutes 339
 Toning Agent 336
 Physic (see also Laxative) 107
 Pickled Metals, After-Treatment of 244
 Pickling Agent for Copper Beryl-
 lium 243
 Corrosion Inhibitor 244
 Fruit, Syrup for 142
 Iron and Steel 242
 and Rustproofing for Iron 276
 Solution for Chrome and Chrome
 Nickel Steel 243
 Solution, Stainless Steel 243
 Stainless Steel 243
 Steel 243
 Pie Base, Custard 167
 Lemon Cream 164
 Pigment, Ceramic 238
 Pill Coating, Enteric 106
 Excipient 106
 Pineapple Extract, Imitation 53
 Pipe Joint Calking 42
 Pipe Lines under Water, Locating
 Leaks in 413
 Plant Food, Soilless Growth 115
 Growth Regulator 117
 Nutrient, Tomato 117
 Plaster, Catalyst for Quick-Setting
 Anhydride 236
 Gasoline-Resistant 235
 of Paris, Retarding the Harden-
 ing of 236
 Parting Compound for Pouring 267
 Surgical-Cast 106
 Wall-Patching 12
 Plastics 351
 Injection Molding Powder 356
 Molding Composition, Acrylic 355
 Molding Powder 357
 Piping, Flexible 358
 Polymerization Inhibitor for
 Methacrylate 355
 Self-Hardening 355
 Sulfur 355
 Wood Dough 12
 Plate Glass Setting Composition .. 43
 Poison, Ant 8

- Poison—Continued
 Bait, Mole Cricket130
 Bait, Sowbug120
 Ivy Killer130
 Ivy Treatment 94
 Oak Remedy 94
 Silver-Fish120
 Subterranean Grass Caterpillar...121
 Tomato Moth122
 Poisonous Chemicals 4
 Polish 10
 Auto341, 342
 Auto Paste 11
 Black Shoe 10
 Bright-Drying Floor345, 346
 Chromium342
 and Cleaner, Windshield Glass...342
 Colorless Shoe343
 Floor Paste 11
 Furniture11, 344
 Glass342
 for Gold and Soft Metals342
 Leather343
 Liquid Furniture and Floor344
 Liquid Leather343
 Liquid Wax341
 Metal 10
 Nail 70
 Oven342
 Paste Leather343
 Paste, Shoe343
 Paste Wax341
 Remover, Oily Nail 70
 Silver342
 Two-Tone Furniture344
 Wax Shoe343
 Polishing Cloth, Metal342
 Electrolytic Metal254
 Electrolytic Steel254
 Stainless Steel Anodic254
 Wax 11
 Polystyrene Sponge356
 Stabilizing356
 Pork and Apple Patties, Breakfast...201
 Potassium Chlorate418
 Potato Leafhopper Dust122
 Non-Discoloring Peeled143
 Protecting against Decay119
 Ring Rot and Scab Control128
 Poultry Mash131
 Powder, Anti-Acid 91
 Antiseptic Dusting 70
 Antiseptic Military Foot 89
 Astringent Dusting 70
 Athlete's Foot 89
 Baking174
 Curry184
 D.D.T. Insect120
 Douche 70
 Face 70
 Foot 7
 Gargle 73
 Powder—Continued
 Impetigo and Wound 96
 Potato Leafhopper122
 Roach120
 Rug and Textile Cleaning374
 Scouring371
 Surgeon's Gloves Dusting360
 Tooth 7
 Pre-Galvanizing Coating249
 Preparations, Elementary 5
 Preserve, Strawberry144
 Primer, Adhesive Scratch Resist-
 ing324
 Alkyd Resin277
 Galvanized Iron276
 Navy Chromate280
 Red Lead276
 Transparent Flexible Metal278
 Undercoat, White272
 Zinc Chromate276, 277
 Zinc Chromate—Iron Oxide Al-
 kyd277
 Zinc Dust—Zinc Oxide276
 Zinc Tetroxochromate277
 Zinc Tetroxochromate—Iron Ox-
 ide277
 Print, Copper Sulfide Intensification
 of Film or331
 Correction Fluid for Vandyke ...340
 Developer for B W340
 Removal of Yellow Spots on ...333
 Restoring Yellow333
 Printer's Roller, Glueless366
 Protein Food213
 Pudding, Blood210
 Liver210
 Pulverizing and Grinding 4
 Putty (see also Adhesive, Agglu-
 tinant, Calking, Cement, Glue,
 Mucilage, Paste, Seal)12, 47
 Brass to Marble 46
 China to China 47
 Glass to Glass 46
 Glass to Wood 46
 for Knife Handles 47
 Metal to Celluloid 47
 Metal to China 46
 Metal to Glass 46
 Metal to Horn 46
 Metal to Linoleum 46
 Metal to Stone 46
 Metal to Wood 46
 Rubber to Glass 46
 Rubber to Metal 46
 Rubber to Stone 46
 Sticking to Hand, Preventing ... 47
 Stone to Hard Rubber 47
 Stone to Horn 47
 Stone to Stone 47
 White Lead 47
 Pyrotechnic Flare349
 Torch, Green349

Q	
Quality of Ingredients	1
Quince Seed Muclage	93
R	
Raincoat Material, Calendered ...	363
Material, Olive Drab	362, 364
Thermosetting Polyvinyl Butyral Coating for	362
Thermosetting Waterproof Coat- ing for	282
Raspberry with Other Natural Fla- vors	52
Rayon Knitting Yarn, Setting Twist in	382
Recording Solution, Electrochemi- cal	419
Rectal Suppository	99
Red Pepper, Capsicine-Free	184
Pepper Substitute	184
References	427
Refinery Gas Polymerization Cat- alyst	407
Refractory (see also Firebrick)	
	236, 237
Clay	236
Coating for Metal or Ceramics...	237
Fusion Cast	237
Non-Acid Brick, Hard	237
Zircon	237
Resin	351
Fine-Melt Congo	293
Treatment, Congo	292
Resistor, Temperature Compensat- ing	409
Resurfacing Cold-Rolled Low-Car- bon Steel	260
Rhenium-Plating	252
Ribbons, Water-Repellent Finish for	404
Roach Powder	120
Roll, Frankfurter	173
Roofing Paper, Asbestos	240
Root Beer Extract, Concentrated..	54
Rotenone-Derris Substitute	120
Rub, Athlete's	89
Rubber	351
Ball, Reviving Dead	361
Belt, Men's	365
Compound, 100% Reclaim Self- Curing	364
Emulsion Polymerization, Syn- thetic	360
Gas-Expanded	360
Non-Sticking	361
Preventing Adhesion of	361
Reclaim Compound, 100%	363
Reclaiming Scrap	361
Solution, Reducing Viscosity of..	361
Solvent for Chlorinated	360
Rubbing Alcohol, Isopropyl	89
Rust Inhibitor for Engines	244
Prevention Compound	10
Remover	376
Rusting Inhibitor, Radiator	413
Rustproofing	245
for Iron, Pickling and	276
S	
Sage Oil, Imitation	54
Salami Cotto (Cooked)	206
Salt, Celery	184
Salt-Water Pit Lining	240
Salve. See also Ointment.	
for Chromate Skin Injuries	93
Grafting-Wax	119
Healing	85
Metol Poisoning	94
for Metol Poisoning, Dermatitis.	94
Sandwich Special, Pro-Lac	186
Saponin from Soap, Extracting ...	417
Sausage, Braunschweiger Style	
Liver	208
Cervelate	203
Farmer-Style	204
Liver	208
Marbled	203
Mayence-Style	208
Meat, Cure for	212
Mortadella-Style	206
Nutrition	203
Polish-Style	205
Seasoning, Pork	212
Summer	204
Thueringer-Style	205
Vienna Style	207
Scabies Preparation	95
Scouring Powder	371
Scrapple	200
Scroop on Bleached Cotton Yarn,	
Silky	383
on Cotton Yarn	383
Effect on Wool	384
Scrooping, Mercerized Cotton	382
Seal, Aluminum Thread-Joint Seal.	42
Can	32
Can Joint	34
Can Seam	42
Elastic Refrigerator	49
Metal-Joint	42
Sealer, Crack	42
for Floors, Penetrating	306
Sealing Composition, Leak	49
Compound, Electrical	39
Compound, Glass	43
Expansion Joint Plastic	42
Tire Puncture	360
Sedative	104
Sellers of Chemicals and Supplies..	344
Sewage Treatment	411
Shampoo, Crude Oil for	80
Soapless	79

- Shaving Aid, Electric 80
 Sheep Anthelmintic 129
 Tick Dip 129
 Sheepskin, Curing Hairy 222
 Washing 221
 Sheeting, Thermosetting Waterproof
 Coating for 282
 Shellac Compound, Injection Mold-
 ing 358
 Substitute for Records 358
 Sherbet 179
 Mix, Pineapple 179
 Stabilizer for 179
 Shoe Bottom Filler 219
 Box Toe Stiffening 220
 Coloring Used 220
 Disinfecting 86
 Dressing, White 10
 Sole Stain 220
 Stiffener 220
 Waterproofing for 10
 Shortening, Dry Lecithin 174
 Silk Printing Discharge 397
 Stocking, Improving the Wearing
 Quality of 387
 Treatment, Prefabricating 387
 Silver Fish Poison 120
 Mirror on Glass 253
 Plating without Electricity 256
 Plating Magnesium 255
 Printing, Kallitype 336
 from Stripping Solution, Recover-
 ing 255
 Tarnish Inhibitor 249
 Size, Bookbinders' 32
 Gilder's 311
 Glue 19
 Jute Twine Polishing 388
 Lime in Place of Caustic Soda in
 Paper 325
 Rayon 382
 Rosin 325
 Textile Finish and 381
 Sizing Glazed Cotton Yarn 381
 for Paper, Tub 325
 Rayon Warp 382
 Viscose Ribbon 381
 and Waterproofing, Paraffin Wax 328
 Skin Cleanser, Liquid 59
 Protective 67
 Treatment, Coal-Tar 92
 Smoke, Colored 350
 Flare, Colored Rocket 350
 Soap (see also Cleaner) 13
 Aluminum Chloride 87
 Anti-Perspiration 87
 Antiseptic Hand 87
 Antiseptic Liquid 371
 Bleaching 371
 Fungicidal Borax 369
 Home-Made 368
 Industrial Hand 370
 Lemon 369
 Soap—Continued
 Liquid 13
 Mercury Fulminate Detector 371
 Non-Efflorescing Bar 368
 Paste, Mechanic's Hand 13
 Rosin 368
 Rosin—Tallow 368
 Saddle 13
 Silver Fluoride 87
 Substitute 369
 Transparent Glycerin 369
 Softener and Lubricant for Arti-
 ficial Fibers 385
 Stearic Acid Textile 385
 Softening Cream, Textile 386
 and Lubricating Wool 385
 Soilless-Growth Plant Food 115
 Solder, Aluminum 264
 for Aluminum Foil 264
 for Aluminum and Stainless Steel,
 Powdered 264
 Brazing 265
 Gas Meter 265
 Hard 265
 Low-Tin 265
 Soft 265
 Tinless Soft 265
 for Tinsplate, Soft 265
 for Zinc-Aluminum Alloys 264
 Soldering Flux 16
 Solvent, Engine Carbon 407
 Motor Gum 407
 Sound-Deadening Pads, Adhesive for 44
 Soup Cubes, Oxtail-Type 213
 Cubes, Pea 143
 Sowbug Poison Bait 120
 Spearmint Extract 54
 Spice, Imitation 54
 Spoilage and Loss 4
 Sponge, Artificial 365
 Iron Reducing Agent 258
 Oil-Resistant 366
 Polystyrene 356
 Spot Remover, Grease, Oil, Paint
 and Lacquer 13
 Remover, Rust and Ink 14
 Spray, Asthma 82
 Base, Horticultural 124
 Benzedrine Nasal 81
 Boxwood Leaf Miner 122
 Cattle Horn Fly 130
 Codling Moth 123
 Dry Agricultural 127
 Emulsion, Kerosene 126
 General Agricultural 126
 Gladiolus Thrip 124, 125
 Nasal 81
 Ornamental Plant Insecticide .. 124
 Parasiticide 123
 Paris Green 124
 Rotenone 123
 Spreader, Agricultural 127
 Thrip 124

- Spray—Continued
 Throat and Nasal 81
 Water Hyacinth123
Stain from Hand, Removing Dye ..376
 Pink Ceramic Underglaze238
 Preventing Silver Nitrate339
Remover. See Cleaner, Spot Re-
 mover.
 Removing Beer376
 Removing Blood377
 Removing Burnt Sugar376
 Removing Chromium377
 Removing Cobalt377
 Removing Coffee376
 Removing Copper377
 Removing Egg Yolk377
 Removing Grass377
 Removing Iodine377
 Removing Iron377
 Removing Lead378
 Removing Manganese377
 Removing Mercury377
 Removing Mildew377
 Removing Milk377
 Removing Nickel377
 Removing Picric Acid377
 Removing Scorch377
 Removing Urine377
 from Wall Paper, Removing Ink.376
 Wood317
Stainless Steel, Sea-Water-Resist-
 ant244
Stair Tread Coating, Non-Slip268
Starch, Thin-Boiling381
Steel, Blue-Black Finish on 9
Stereotype Surfacing254
Sterilization, Air110
Stocking, Cosmetic108
Stone, Artificial Building235
 Filler, Alberene 47
"Stop Leak," Radiator and Water
 Boiler413, 414
Stoppers and Ground Glass Joints,
 Removing Frozen418
 Removing Glass Tubes and Rods
 from Rubber418
Strawberry with Other Natural
 Flavors 51
Stripping Dyed Cotton399
 Oxide Film from Aluminum249
Stud, Clutch Plate411
Styrene, Inhibiting Polymerization
 of356
Sugar Wafer172
 Wafer, Filler for172
 Wafer Shell173
Sugarless Syrup Substitute 54
Sulfa Drug Compositions 99
 Drug Surgical Film 96
 Vaginal Suppository 99
Sulfathiazole Suspension 93
Sulfur, Colloidal113
Sunburn Ointment 64
Suntan Cream 64
 Lotion 64
 Oil 64
 Oil, Milky 65
Suppository, Cocoa-Butter 99
 Hemorrhoidal 99
 Mold Lubricant 99
 Rectal 99
 "Sulfa" Vaginal 99
 Vaginitis 99
Surgical Cast Plaster106
 Dressing, Flexible Adhesive106
 Dressing, Waterproofing404
 Film, Sulfa-Drug 96
 Lubricating Jelly105
Suspension, Phenothiazine129
Sweeping Compound, Coloring ...378
 Compound, Floor378
Sweet Cocoa Powder 9
Synthetic Rubber Composition, Gas-
 olineproof360
Syringe Aids, Glass418
Syrup, Chocolate 55
 Orange Juice 57
 Orangeade 56
 Pectin154
 for Pickling Fruit142
 Quick-Dissolving Beverage 54
 Substitute, Sugarless 54
 Sugarless Pharmaceutical104
- T**
- Tablet Coating, Pharmaceutical106
Tannic Acid Burn Emulsion 97
Tanning, Egg-Yolk Substitute for ..218
 Extract218
Tape, Masking 45
Taylor's Dummy, Thermoplastic....358
Temperature Compensating Re-
 sistor409
 Measurements 3
Tempering Compound, Metal259
Tent, Thermosetting Waterproof
 Coating for282
Textile379
 Bleaching387
 Coating, Flameproof, Waterproof
 and Mildewproof399
 Duller380
 Dyeing, Improved397
 Finish and Size381
 Flameproofing400
 Printing Paste396
 Printing Resist397
 Scouring Agent386
 Softener, Stearic Acid385
 Softening Cream386
 Waterproofing403, 404
 Weighter385
Thermometer Readings, Conversion
 of424
Thermostat, Electric261

Thiokol Compound, Non-Swelling...363
 Throat and Nasal Spray 81
 Tin Foil, Non-Discoloring261
 Tinning Compound, Cold250
 Copper250
 Hot250
 Tinplate Protective Coating250
 Tin-Plating of Cast Iron, Immer-
 sion251
 Tire Puncture Sealing360
 Tobacco Blue Mold Control128
 Toilet Water. See Cologne.
 Tomato Aspic, Canned141
 Pinworm Control122
 Plant Nutrient117
 Toothache Drops 74
 Topping, Orange Crumb163
 Towels, Improving Absorbency of..402
 Trade Name Chemicals429
 Tree Gall Treatment119
 Trench Mouth Treatment 74
 True-to-Scale Prints, Gelatin Com-
 position for329
 Tungsten Carbide, Pulverizing Ce-
 mented258
 Turkey Growing Mash135
 Mash136
 Starter134
 Turkish Paste151
 Typewriter Ribbon, Rejuvenating..217

V

Vacuum Tube Getter409
 Vaginal Ointment100
 Suppository, "Sulfa" 99
 Vaginitis Suppository 99
 Vapor Inhalant 82
 Varnish, Alkyd Blending309
 for Art Work, Pale Gloss306
 Chemical-Resistant Spar290
 Clear Automobile291
 Congo Resin293, 294
 Exterior289
 Floor and Deck305
 Furniture Rubbing307
 Insulating Impregnating308
 Interior304
 Low-Cost Floor and Trim305
 Mopping306
 Sealer, Congo Resin295
 Spar289
 Synthetic Resin291
 Synthetic Rubbing307
 Traffic Paint291
 Wall Sizing308
 Vegetable Preservation143
 Vinyl Acetate, Emulsion Polymeriza-
 tion of357
 Vitamin B Elixir105
 Vulcanization Accelerator, Fast Cur-
 ing362

W

Walnut Extract, Imitation 53
 Wash, Bakers'154
 Washable Jelly100
 Washing Composition 79
 Water, Coagulant for Hard.....411
 Corrective412
 Disinfectant411
 Impurity Coagulant411
 Purifying Compound412
 Repellent Finish for Ribbons...404
 Resistant Casein Fiber404
 Softener Briquette412
 Softener, Cation Exchange411
 Soluble Adhesives 17
 Waterproof Coating282
 Waterproofing Cement 14
 Cement and Stucco287
 Heavy Canvas 14
 Liquid 14
 Paper and Fiberboard 14
 Wave Set Fluid 77
 Wax351
 Aseptic 97
 Batik351
 Cable352
 Cartridge351
 Cheese Coating183, 351
 Coopers'351
 Copper Engraving352
 Cream Buffing348
 Dental Adhesive354
 Dental Base Plate354
 Dental Carving354
 Dental Inlay354
 Dental Investment354
 Finish for Fur223
 for Fire-Gilding352
 Floor346, 347
 Furniture Filler46, 315
 Grafting11, 45, 119, 352
 Gravure352
 Inhibiting Discoloration of Par-
 affin353
 Ironing352
 Laundry352
 for Leather Strips220
 Modelling351, 352
 Modifier for Paraffin353
 Mustache109
 Penetration of Modified 125°F
 M.P. Paraffin353
 Plating, Electrolytic355
 Polishing 11
 Remover, Floor345
 Saddler's353
 Salve, Grafting119
 Shoemakers' Thread352, 353
 Ski351
 Substitute, Carnauba353
 Substitute, Lanette353
 Wood Filler46, 315

Weed Killer	130	Wool—Continued	
Weighing and Measuring	4	Unkinking Natural	385
Weights and Measures	420	Yarn, Reserve for	398
Weld Spatter Coating, Non-Adher- ing	270	Zinc Dust Resist for	398
Welding Composition, White Metal.	268	Wool-like Jute	388
Electrode Coating	268	Wound and Burn Film Treatment..	96
Rod	268		
Rod Coating, Aluminum	269	X	
Rod Flux Coating	269	X-Ray Photographs, Improving	335
Rod for Red Brass	268	Protective Composition	415
Well Drilling Fluid, Oil-Base	230	Y	
Whipped Cream	160	Yarn Dressing, Jute	388
Wood Dough Plastic	12	Heat Stabilization of	388
Filler	46, 315	Increasing Wet Strength of	404
Filler, Wax	46, 315	Metallized	405
Fireproofing	241	Wetting and Conditioning Agent for	401
Floor Bleach	12	Z	
Ply Lamination	41	Zein-Rosin Solution, Stable	323
Preservative	240	Zeolite, Carbonaceous	411
Resin-Impregnated	359	Zinc-Plating, Bright	253
Wool, Chlorinating	379		
Lusterizing	379		
Oiling Emulsion	385		
Softening and Lubricating	385		
Stripping Dye from	399		

