

WASHINGTON

September 14, 1944.

(Supersedes
LC 388 and
LC 627)

THE CARE OF FLOORS

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Information Section
National Bureau of Standards
Washington, D. C.

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I. INTRODUCTION

This letter circular has been prepared in response to numerous requests from the public for information on the care of floors. It was first issued as Letter Circular 388, dated August 8, 1933; with minor changes it was reissued as Letter Circular 627, dated January 22, 1941. The present revision has been prepared in order to bring the subject matter in accord with more recent practices. Although the information was not gained by experimental studies, it was gathered from reliable sources and experience. The original circular was reviewed by various authorities on the maintenance of floorings.

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II. PRECAUTION

Gasoline, turpentine, volatile mineral spirits, acetone, and many other volatile organic solvents are very flammable. Care should be taken when using these solvents or preparations containing them to have good ventilation and to avoid open flames or smoking in the rooms or other spaces. Pilot lights should be turned off. Oily and greasy rags should be immediately destroyed after using or kept in closed metal containers. Animal and vegetable oils are the most likely to cause spontaneous combustion.

III. WOOD FLOORS

1. Cleaning Procedures

(a) Unfinished wood floors should be mopped or scrubbed with warm water and a mild soap. Scouring with powdered pumice or steel wool may be desirable in some cases. A solution of trisodium phosphate (about 1/2 oz. per gallon of water); sodium metasilicate (about 1/2 oz. per gallon of water); washing soda (about 2 oz. per gallon of water); or synthetic detergent (about 1/4 oz. per gallon), with or without smaller quantities of trisodium phosphate, sodium metasilicate, or a mild soap, may be used for cleaning oily or greasy floors. The synthetic (non-soap) detergents prevent the precipitation of the hardness constituents (calcium and magnesium compounds) of the water supply by soap or alkaline salts, such as trisodium phosphate, sodium metasilicate, washing soda, etc. The precipitation of hardness compounds may also be prevented by adding to the water, before introducing soap or alkaline salt, a sufficient amount, depending upon the hardness of the water supply, of a polyphosphate, such as sodium hexametaphosphate, sodium tetraphosphate, sodium tripolyphosphate, or tetrasodium pyrophosphate. After using soap or other cleaning agent, the floor should be thoroughly rinsed off with clear water and wiped (with a scrubbing action) as dry as possible. If the water supply is appreciably hard, the use of a small amount of synthetic detergent or polyphosphate in the first rinse water is advisable in order to insure the absence of a film on the floor surface. It is advisable to scrub a small area at one time and avoid flooding the floor with cleaning solution or rinse water. Strong solutions of soaps, alkalies, alkaline salts, and the too free use of water may darken wood and may in time soften it and raise the grain. Oak floors are readily darkened by strong alkaline solutions. Where wood is badly stained or discolored, bleaches, such as a hot saturated solution of oxalic acid (poison if taken internally) in water or a sodium hypochlorite solution ("javel water"), as sold in the stores, may be used, or the floor may be scraped or sanded.

(b) Varnished and shellacked floors, which are unwaxed, should be dusted clean with a soft brush or dry mop, and then rubbed with an oiled mop or a cloth slightly moistened with turpentine, floor oil, kerosine, or furniture polish. In general, varnished and shellacked surfaces should not be treated with water, but if badly soiled they may be wiped with a mop or cloth wrung out of warm, and slightly soapy water, then with a rag or mop moistened with clear water, wiped dry at once and polished with an oiled mop or cloth. The appearance of badly worn varnished wood may be improved by rubbing with a floor wax.

(c) Oiled floors and painted floors may be maintained by sweeping them with a soft brush and then rubbing them with an oiled mop or cloth. Occasionally, they may be washed with slightly soapy water, rinsed off with a wet cloth or mop, wiped dry and then polished with an oiled mop or cloth.

(d) Waxed floors should be cleaned with a soft brush or mop free from oil since oil softens the wax. The film of dirt and wax which darkens the surface may be removed with a cloth wrung out of warm soapy water. The use of a rag moistened with gasoline or turpentine would be a better and more rapid procedure; however, these liquids are very flammable and care should be taken to avoid having open flames in the rooms. Gasoline and turpentine brighten as well as clean the surface, whereas water dulls and whitens many waxes. If a water-cleaning method has already whitened a waxed floor, the luster and color may be restored by rubbing with a woolen cloth or a weighted brush; if necessary a little wax may be applied. Many kinds of spots on waxed floors may be removed by rubbing with a little turpentine or gasoline and refinishing with a very thin coat of wax.

2. Removing Old Finishes Preparatory to Refinishing.

Note.- Removing old finishes from wood floors and refinishing them is hard work and in most cases it would probably be more satisfactory and economical to have this work done by an expert, who has the proper tools and knows just how to treat different woods.

(a) Non-Drying Oils.- Where floor oil has been used, a large part of it may be removed by wetting about 100 square feet of the floor with a mop and warm water and sprinkling liberally with a mixture of one part soap powder and three parts trisodium phosphate. Then scrub with a scrubbing machine and stiff brush, using only as much water as may be needed to form an emulsion and float the oil to the surface. As the oil is loosened and comes to the top it may be removed with a squeegee and mop; the area is then rinsed with clean water and mopped as dry as possible. The next square is then similarly treated. After all of the floor has been cleaned and the surface appears to be free of oil and even in color, let the floor dry for at least 24 hours, and then machine sand it. The floor can then be refinished as outlined in section 3.

(b) Varnish or paint can be removed from a wood floor by machine sanding, by scraping and planing, or by applying a paint and varnish remover. Either of the first two methods is necessary if the floor has been stained. After a floor has been sanded, or scraped, planed, and sandpapered, it can be finished as though it were new.

Removing paint or varnish from floors with paint and varnish removers must be done carefully so as not to damage the finish on baseboards and moldings. The commercial nonflammable, "organic-solvent-type" of paint and varnish removers are satisfactory for this purpose and are labeled with instructions for using.

After the remover has been applied to the surface with a brush and allowed to stand for a few minutes, the paint or varnish will be soft so that it can be scraped off with a putty knife or rubbed off with steel wool or excelsior. When a putty knife is used as a scraper it will prove more effective if the end of the blade is ground to a sharp edge. By holding the putty knife in a vertical position and scraping across the grain of the wood, there is no danger of splintering the floor. Paint and varnish removers of this type should be used only where there is good ventilation.

Caustic soda or household lye solutions are also used for removing paint and varnish, but should not be used on oak floors. These solutions should be handled with care and not allowed to come in contact with the skin, clothing or surfaces other than the one being treated. Rubber gloves should be worn. The caustic soda or lye may be dissolved in plain water and the solution applied while hot, but better results will be obtained if the caustic soda is mixed with a starch solution, such as is used in starching clothes. About 3 or 4 tablespoons of caustic soda is generally added to one quart of the starch solution. This mixture is applied while hot to the floor, using a cotton swab, a fiber (not bristle) brush, or a long-handled scrubbing brush. After a few minutes the softened paint or varnish may be scraped or rubbed off. The floor should then be washed several times with clear water, allowed to dry thoroughly, sandpapered or rubbed smooth, and dusted before it is refinished.

Strong, hot solutions of trisodium phosphate (2 to 3 pounds of the salt dissolved in one gallon of water) are also used for removing paint and varnish coatings. This chemical is safer to handle than caustic soda.

(c) If shellac varnish alone has been used on a floor, it can be removed by flooding a small area at a time with denatured alcohol and, after a few minutes, rubbing with steel wool, or scraping as above.

(d) Waxes.- The wax coating from the volatile solvent type of floor waxes, and any dirt embedded in it, can be removed from wood floors by rubbing the surface first with 00 steel wool dipped in turpentine or gasoline and then with a soft cloth, after which the floor may be refinished. The wax coating from the water-emulsion type of floor waxes may be removed by scrubbing the surface with a warm (about 120 to 130° F) solution of soap in water, using a soft bristle brush or a rag.

3. Refinishing Old Wood Floors.

In refinishing an old wood floor, it is first made as tight, level, and smooth as possible. It may need to be planed, sanded, papered or rubbed down with steel wool. Any remnants of tacks must be drawn or driven below the surface. Then scrub the wood with hot water and soap or other detergent and rinse with clear water. If the wood is badly stained, spread over it a bleach solution made by dissolving a teaspoon of oxalic acid (poison) in a cup of hot water, and let stand overnight. Then thoroughly rinse the floor with clear water to remove all of the bleach (and cleaning agents) and let dry. After thoroughly drying, close-grained wood floors, such as maple or pine, may be stained if desired, and waxed; varnished or shellacked, and then waxed. If the wood has an open grain, such as oak, it should be first filled with a paste wood filler before staining, waxing, etc. Before applying the first coat of finish, it may be necessary to fill cracks and holes with a commercial "crack filler" colored to match the floors. Floor wax should be applied in very thin coats and thoroughly rubbed with a heavy waxing brush or motor-driven brush, or a heavy block wrapped in burlap or carpet.

Wax may be applied directly to filled or unfilled wood. This treatment requires more waxing, and therefore more labor, in the original job, but the finish is likely to be more durable. However, floors finished in this way often darken more readily than if the wax is applied over a thin coat of shellac or varnish.

With wood floors that have been treated for the removal of non-drying floor oil (see section 2 (a)), the sanded, dust-free surface should be sealed with a lacquer-type sealer, and finally waxed and buffed. In many cases, it may suffice to machine sand the floor, clean it of dust and dirt, and then apply the lacquer-type sealer. This type sealer is so designed as to seal the oil within the flooring, thus preventing any subsequent marring of the finished surface by a bleeding through of the oil. It is also intended as a material to smooth and integrate the surface of the flooring to which it is applied to produce a finished appearance, and to serve as a base for wax. All open-grain flooring should be treated with a wood filler before the application of the sealer. The sealer provides a satisfactory foundation for finishing materials, such as liquid or paste wax, water-emulsion wax, or varnish.

4. Finishing New Floors.

Unfinished wood floors are generally unsatisfactory from a maintenance standpoint. They should be lightly sanded or planed to produce a smooth, even surface, cleaned of dust, and all open-grained wood filled with a paste wood filler before applying the finishing materials, such as varnish-type sealer, varnish, or shellac. In applying fillers, sealers, and other finishing material, the directions on the label of the container should be followed. The sealer (varnish-type) should provide a satisfactory foundation for finishing materials such as the volatile-solvent type wax (liquid or paste), water-emulsion wax, or varnish. However, it is considered best practice to apply a paste wax and polish with an electric polishing machine designed for the purpose. The floor can then be maintained by the periodic application (to the cleaned surface) of light coats of volatile-solvent type waxes, followed by buffing. If desired, a water-emulsion wax may be used.

Varnish and shellac are also widely used for finishing wood floors. Shellac dries so rapidly that a floor may be finished or refinished and put back in service within 24 hours. Since varnishes require longer intervals between coats, the floor should be kept out of service for several days when this finish is being applied. Varnish is preferred to shellac because of its better resistance to water; varnish finishes are also tougher and less easily scratched than shellac. A finish in which shellac is applied as the first coat on bare wood and then covered with a varnish may be whitened by water affecting the shellac under the varnish. The durability of varnish and shellac coatings can be improved by keeping them waxed. However, wax over a substantial coating of shellac or varnish tends to make a floor slippery unless the coating of wax is kept very thin. In such cases it is advisable to limit the shellac or varnish to one or two coats and to sand or buff it before waxing.

Unless some special condition requires it, new wood floors should not be treated with a non-drying floor oil or painted.

IV. FLOOR WAXES OR POLISHES

Floor polishes or waxes in general use fall into two classes, as follows: Volatile organic solvent class, known in the trade as paste and liquid waxes; and water-base emulsion class, known as water-emulsion waxes.

(a) Paste and Liquid Waxes.— These waxes generally consist of a mixture of natural waxes or a synthetic wax in organic solvents, such as volatile mineral spirits or turpentine or a mixture of such solvents, to produce the desired consistency. The natural waxes commonly used are carnauba, candelilla,

beeswax, ceresin, ozokerite, and paraffin. The liquid waxes, which are in reality mainly suspensions or emulsions, are easier of application, as they have a larger proportion of solvent (volatile mineral spirits or turpentine). Ammonia, water and other substances have also been used in formulas for these products.

Formulas.- The National Bureau of Standards has not developed standard or recommended formulas for manufacturing various waxes or polishes. The formulas given in this section have been obtained from various sources, and are to be considered as suggestions to serve as a basis for experimentation.

(1) Material:	Parts (by weight)
Carnauba wax	2
Ceresin	2
Turpentine	3
Volatile mineral spirits	3

Melt the waxes by heating in a vessel placed in hot water, add the turpentine and volatile mineral spirits, and cool the mixture as rapidly as possible, while vigorously stirring to produce a smooth, creamy wax. This formula gives a paste wax. By increasing the amounts of turpentine and volatile mineral spirits (say to a combined total of about 12 to 15 parts by weight), a more fluid or a liquid wax may be obtained.

(2) Material:	Amounts
Turpentine pint	1
Beeswax ounces	4
Ammonia water (10-percent strength) ounces	3
Water pint/	1
	(about)

Mix the beeswax and turpentine and heat them by placing the vessel in hot water until the beeswax dissolves. Remove the mixture from the source of heat, add the ammonia and the water, and stir vigorously until the mass becomes creamy. This wax should be applied lightly on varnished or shellacked floors and any excess wiped off at once, as the ammonia may attack the varnish or shellac. When this wax is used on unfinished oak flooring, the ammonia may cause a slight darkening of the wood.

(b) Water-Emulsion Waxes.- These emulsions, commonly called nonrubbing, "self-polishing" or "dry-bright" polishes, or waxes, are now widely used on wood, cement, linoleum, rubber tile, cork, asphalt tile, mastic, and other floorings. Many of these preparations dry rapidly and require little or no polishing. These water-wax emulsions usually consist of carnauba wax (and other waxes) dispersed in a water solution of soap. Sometimes emulsifying agents other than soap are used. A small amount of resins is often used in preparing these emulsions. Synthetic as well as natural products may be used in some of these preparations. A simple carnauba wax-soap-water emulsion may be prepared for experimental purposes as follows:

Dissolve 1 part by weight of castile soap in 16 parts of clean, soft water, and heat the solution to boiling. Add to the boiling soap solution with constant stirring 4 parts by weight of a good grade of carnauba wax (cut into small pieces). When a smooth, homogeneous emulsion is obtained, cool to a temperature of 135° F by quickly adding, with constant stirring, the necessary quantity of cold water. (This should take about 14 to 16 parts more of water.) Let cool, filter through cheesecloth, and stir in about 0.5 percent of formaldehyde as a preservative. The product so obtained should be of the color and consistency of cream. A thicker or thinner product may be made by decreasing or increasing the quantity of water used, taking care to maintain the given ratio between soap and wax. This wax mixture may require polishing or buffing after drying in order to obtain a glossy surface.

The following information and formulas for the preparation of a triethanolamine-carnauba wax "dry-bright" polish were furnished some time ago by a manufacturer:

"Shellac has been incorporated in this polish to cut down the slipperiness of a straight carnauba wax emulsion. A dry-bright polish can also be made as directed by merely leaving out the shellac solution and adding the water used in it to the wax emulsion. The addition of the shellac seems to make it spread more evenly and, as stated, makes a film that is not quite so slippery. It is necessary to use a good grade of light-colored carnauba wax (known in the trade as 'No. 1'), and the directions for making the polish must be carried out as described. The temperature should never exceed 100° C (212° F)."

The polish is made as follows:

Material:	Trial batch	Large batch
Carnauba wax	72 g	13.2 lb.
Oleic acid	9.1 ml*	1.6 pt, or 1.5 lb
Triethanolamine	10.6 ml	1.9 pt, or 2.1 lb
Borax	5.4 g	1.0 lb
Water (boiling)	500 ml	11.5 gal
Shellac (dry flakes)	10.0 g	2.2 lb
Ammonia (28 percent)	1.75 ml	0.35 pt, or 165 ml
Water (room temperature)	100 ml	2.0 gal

*Milliliters.

Trial Batch: (1) Melt the wax and add the oleic acid. Temperature should be about 194° F. Placing the container in boiling water keeps the polish at a suitable temperature.

(2) Add the triethanolamine slowly, stirring constantly. This should make a clear solution.

(3) Dissolve the borax in about 5 ml of the boiling water and add to (2). Stir for about 5 minutes. This gives a clear, jelly-like mass.

(4) Add the rest of the boiling water, slowly with constant stirring. An opaque solution should be obtained. Cool.

(5) Add the 100 ml of cool water to the shellac and then the ammonia, and heat until the shellac is in solution. Cool.

(6) Add the shellac solution to the wax solution and stir well. The resulting solution should give a clear film when applied to linoleum, mastic floors, etc.

Glickman¹ discusses at length the preparation of water-emul-

¹ Charles S. Glickman, Water emulsion waxes, Soap, 12, No. 5, 97, Emulsion floor waxes, Soap 12, No. 12, 121 (1936).

sion waxes, giving a number of suggested formulas. He suggests the following modification of the above formula and procedure:

Material:	Pounds
Carnauba wax	13.2
Oleic acid	1.5
Triethanolamine	2.2
Borax	1.0
Water	131.2

This formula gives a wax with about 12 percent of total solids.

(1) Heat the wax and oleic acid together in a kettle until a uniform mixture is obtained, and most of the mechanically inclosed water is driven off - until there is no, or very little, foam on the surface. The temperature should be kept close to 212° F.

(2) Add the triethanolamine slowly, with agitation, to the oleic acid-wax mixture. In order to insure the addition of all of the triethanolamine, the latter may be heated in a separate container until it is very thin (fluid) and then added; the container is then rinsed with some of the borax solution, or, if conditions prevent, with the water used for dilution after the addition of the borax solution. The rinsings should be added to the borax solution, which is preferable, or to the boiling water. The solution after mixing should assume a clear brown color.

(3) Raise the temperature of the mixture obtained in step (2) to about 216° to 218° F; add the boiling borax solution (borax dissolved in an equal weight of water) slowly in intermittent batches, if done by hand, and in a very thin stream, if added from another and smaller kettle. The agitation must be continued and the temperature carefully controlled. The mixture, during the addition of the borax solution, should not suddenly become of a pasty yellow color; should this happen, stop adding the borax, and stir and heat the mixture until it becomes clear brown in color. After the borax has been added, the mixture should be stirred until practically all bubbles have disappeared.

(4) Again raise the temperature of the mixture to 216° to 218° F, and add the water (heated to boiling) slowly, with rapid and thorough agitation. The color of the mixture should remain clear brown. The mixture gradually increases in viscosity, and care should be taken that additions of water are absorbed before further portions are added. When about 60 percent of the total amount of water has been added, the clear brown and viscous mixture suddenly changes in viscosity, showing streaks of the clear brown mass in a milky solution. When all of the water (boiling hot) has been added with rapid and thorough agitation, the emulsion should be grayish, fluorescent, and translucent in appearance.

(5) Cool the mixture rapidly with the agitation continued. Filter before packaging.

The addition of a material such as shellac to the finished wax dispersion is mainly for the purpose of increasing the gloss of the film. Bleached, dewaxed shellac should be used, if shellac is to be incorporated. The shellac dissolved in ammonia and water or borax solution may be mixed (with stirring) with the cold wax dispersion or the warm mixture, but should not be added to the hot wax mixture. In making water-emulsion waxes, care must always be exercised that all of the wax be treated alike with alkali (triethanolamine or other alkali) and acid (oleic acid, etc.) as well as borax, to insure uniformity of dispersion. Robertson and Wilson² suggest the use of the organic amine, morpholine, in the

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H. F. Robertson and A. L. Wilson, Comments on morpholine in wax polishes, Soap 14, No. 8, 99 (1938).

preparation of water-emulsion waxes. The reader is referred to the original paper for a discussion of the properties of this compound and suggested formulas in which it is used.

The preparation of water-emulsion waxes on a large scale requires special equipment, such as jacketed kettles for heating with steam and cooling with cold water (separate kettles for hot water, for borax solution, and for the wax), stirring devices, and special thermometers.

Water-emulsion waxes are usually applied with a lamb's wool applicator or a cotton cloth mop. These waxes should be applied to clean, dry surfaces and should be spread as thinly as possible. It is common practice to treat the flooring with a suitable sealer before waxing. Sometimes two coats of wax are applied, the first coat serving as a sealer or undercoater. A water-emulsion wax, when properly applied should dry to a hard, lustrous film in less than 30 minutes. The gloss of the dried film may be increased by a slight buffing.

An important problem in the use of paste and liquid as well as water-emulsion waxes is the slipperiness of the dry film. Many manufacturers claim to have some ingredient in their products that will give a so-called "nonskid" or "nonslip" wax. However, it is doubtful if there is such a thing as an absolutely skid-proof waxed surface. Small amounts of natural or synthetic resins, rubber, and probably gums have been incorporated in waxes to reduce the slipperiness of the dry film. The product used must be compatible with the other ingredients of the wax and should not impair the polishing or wearing properties of the finished wax. In general the water-emulsion type waxes give less slippery films than those produced by the volatile solvent type waxes.

V. CEMENT (CONCRETE) FLOORS

Unpainted cement floors may be scrubbed with hot water and a synthetic detergent, with hot water and a scouring powder, or with hot water and washing soda (laundry soda, or "modified soda"), sodium metasilicate or trisodium phosphate followed by scouring powder. The floor should first be wetted with clear water and then with the hot solution of washing soda (about 2 to 2 1/2 oz. per gallon of water), sodium metasilicate or trisodium phosphate (about 1/2 oz. per gallon of water), sprinkled uniformly with the scouring powder, rubbed or mopped, and then rinsed thoroughly with clear water to remove alkaline salts and scouring powder. If the water supply is appreciably hard, it would be advisable to add some synthetic detergent or polyphosphate to the alkaline salt solution (see par. 1 of Section III). The use of straight soap on unpainted or untreated cement floors is not recommended, as a scum of lime soap may be formed on or in the surface of the floor; however, a soap solution containing some polyphosphate or synthetic detergent has been successfully used.

Painted cement floors should be washed or mopped with plain water. If very dirty, a slightly soapy water might be used, followed by thorough rinsing with clear water, but such treatment should not be used as a general or frequent procedure.

Occasionally cement or concrete floors are waxed. The waxes commonly used on wood floors can be used on painted or unpainted cement floors. As these waxes generally vary in color from yellow to brown, they should be used sparingly, as any wax or oil that may penetrate into the floor will tend to darken it. Either the water-emulsion type or the solid waxes in molten condition can be applied to unpainted or untreated cement floors. Wax treatments make the floors water repellent.

Concrete or cement surfaces with deposits of oil or grease, such as driveways and the floors of garages, shops and engine rooms, may be cleaned with sodium metasilicate powder (about 4 oz. per gallon of water), trisodium phosphate (about 4 oz. per gallon of water), or a mixture of 60 percent trisodium phosphate and 40 percent soda ash (about 1/2 to 1 lb. of the mixture per gallon of water). The use of sulfated oils has also been found satisfactory. An abrasive powder (scouring powder) may be mixed with the above solutions. These detergents should be used with very hot water and the surface might be rubbed with a wire brush, or an abrasive powder and a mop. If the deposits are thick and of long standing, the powdered detergents may be sprinkled over them and moistened with a little water; after standing about 1/2 hour the surface should then be scrubbed, using very hot water. After scrubbing, the surfaces should in all cases be thoroughly rinsed with plain water. The following procedure has been found effective in removing old oil stains: first scrub the surface with a hot solution of trisodium phosphate (about 3 to 4 ounces per gallon of water), using an abrasive powder with the solution if there is a dark-colored film on the surface. Then mix whitening with some of the hot trisodium phosphate solution to form a thick paste; cover the stained area with the paste and leave until dry; scrape off the dried paste and rinse the surface with clear, hot water. Repeat this poultice treatment if necessary. In the case of badly soiled concrete or cement floors the appearance may also be improved by sprinkling over the scrubbed floor a layer (about 1/4 inch thick) of dry hydrated lime, allowing to stand for several hours, and then removing the covering layer. In some cases it may be desirable to repeat the washing and the treatment with lime several times. Fine, dry coal ashes may be used instead of the hydrated lime. Solvents, such as carbon tetrachloride or a mixture of carbon tetrachloride (2/3) and volatile mineral spirits (1/3) could be effectively used on the washed and dried floor in conjunction with the hydrated lime or ashes, but this would be quite expensive.

VI. CERAMIC TILE AND TERRAZZO FLOORS

It is good practice to clean these floorings periodically with a vacuum cleaner. The routine washing of these floors is usually carried out by first wetting them with clear water and then mopping with hot water containing a small quantity of an alkaline cleaner, such as washing soda (about 2 oz. per gallon of water), trisodium phosphate, or sodium metasilicate (about 1/2 oz. per gallon of water). Badly soiled areas on the floor

may be cleaned with a scouring powder or a little scouring powder may be sprinkled over the soiled areas before applying the alkaline cleaning solution. If the water supply is hard, the addition of a sufficient amount of a polyphosphate to the alkaline-salt solutions will prevent the precipitation of hardness compounds (see par. 1 of Section III). Occasionally, the entire floor should be scrubbed with a scouring powder or with an alkaline cleaner and the scouring powder. Instead of the alkaline salts, synthetic detergents are frequently used for cleaning these floorings, especially when the water supply is hard. A motor-driven scrubbing machine is the most satisfactory appliance for cleaning large areas. After cleaning the floors should be thoroughly rinsed with plain water and wiped dry. If water is left standing on a tile floor it might loosen the cement that holds the tiles in place. Soaps are not generally used on these floors owing to the tendency to "build-up" slippery films, especially if the water is not soft or the rinsing has not been thorough. However, such floors are sometimes wiped up with a cloth wrung out of hot, soapy water, rinsed off, and wiped dry. If soft water is used and the surfaces are thoroughly rinsed after cleaning, it is believed that soap would be satisfactory, but more expensive, for the routine cleaning of these floors.

VII. MARBLE AND TRAVERTINE FLOORS

Travertine floors should be first cleaned with a vacuum cleaner and then treated in the same manner as terrazzo floors. It is good practice to clean marble floors periodically with a vacuum cleaner. In cooperation with the National Association of Marble Dealers, the National Bureau of Standards has made a study of the maintenance of interior marble. A report of this work was published in 1927 as Bureau of Standards Technologic Paper No. 350, entitled "A Study of Problems Relating to the Maintenance of Interior Marble". This paper can be consulted in many libraries. The following conclusions are reported in the paper: (References to polished marble do not apply to floor tiles).

"1. Various cleaning preparations have been studied with a view of determining the effects on marble of certain ingredients from a long period of use. The laboratory experiments, as well as an examination of actual installations of marble, have indicated that injury may result from injudicious use of harsh grits or from such salts as sodium carbonate, sodium bicarbonate, and trisodium phosphate.

"2. The usual type of grit employed in trade cleaning preparations is not appreciably injurious to marble floors or other unpolished marble. Polished marble should rarely be cleaned with preparations containing a scouring agent or abrasive which is harder than the marble.

"3. As a rule, the volcanic ash grits are less severe in their abrading action than crushed quartz. This is evidently due to the difference in shape of the particles.

"4. While it is seldom if ever necessary to use a cleaning preparation of the scouring type on polished marble, when it is in stock for cleaning the floors of a building it is apt to be wrongly used on the polished marblework. For this reason a preparation of the type is desirable which has a grit that will not injure polished marble. Available minerals which seem to meet this requirement are soapstone and talc.

"5. A trial preparation consisting of 90 percent powdered soapstone and 10 percent soap powder appeared to be as effective in cleaning marble floors as any of the present trade preparations. Such a composition can be used on polished marble without appreciable injury.

"6. Injury which may result from the frequent use of such detergents as sodium carbonate, sodium bicarbonate, or trisodium phosphate is mainly a physical effect due to these salts crystallizing in the pores. This action has been demonstrated to be severe enough to cause disintegration of marble when such salts are employed without proper precautions.

"7. Experiments have indicated that marble work may be safely cleaned with such detergents if the surface is rinsed with clear water before applying the cleaning solution.

"8. Although soap has been found objectionable for use on marble in certain instances, the present study has indicated that if used with soft water it will give entirely satisfactory results and prove to be the safest detergent for general service.

"9. Preparations containing a coloring ingredient of different color than the marble may gradually impart their color to the marble. This, however, may be prevented by a preliminary rinsing, as described in conclusion 7.

"10. Ammonia water has been used to some extent in cleaning polished marble, but a limited number of tests in this investigation have indicated that it may cause yellow discolorations.

"11. Acids dissolve marble, and even the use of such weak acids as oxalic will prove injurious. Although cleaning of interior marble with acids has been practiced to some extent, it is usually done through ignorance of the real effects.

"12. Stains which have penetrated the marble usually have to be removed by means of a poultice treatment. Several types of stain demand special treatment, and there is no single cure for all cases. Methods have been found for eradicating practically all of the common stains occurring on interior marble."

An abstract of Technologic Paper No. 350 has been published as a booklet, "Maintenance of Interior Marble", by National Association of Marble Dealers, 721 Rockefeller Building, Cleveland, Ohio.

VIII. LINOLEUM FLOORINGS

Untreated linoleum should be swept daily with a soft floor brush or an oil-treated mop. Anything spilled on the flooring should be wiped up as soon as possible with a damp cloth; and occasionally, as the flooring needs it, it should be washed. Care should be exercised in washing these surfaces. Preparations containing free alkali, alkaline salts, or abrasives should not be used indiscriminately. The safest procedure is to use a lukewarm solution (soft water) of a mild or neutral soap and to rinse all soapy water off with plain soft water after washing; or synthetic detergent, or dilute trisodium phosphate (1/2 oz. per gallon). If soft water is not available, the use of a synthetic detergent, or the addition of a polyphosphate to the soap or trisodium phosphate solution will be advantageous. The surface should be finally wiped dry with mops or cloths. Care should be taken not to flood the surfaces with water, since any water that seeps through the edges of seams may affect the cementing material and may cause the burlap backing to mildew or rot.

For proper maintenance, the clean, dry linoleum should be waxed and polished. Any good floor wax is suitable for linoleum. A wax prepared according to formula (1) (Section IV, a) is satisfactory. Paste wax can be used but "liquid" wax is easier and more economical to apply. The newer water-wax emulsions (Section IV, b) are also used. Care should be taken not to put the wax on too thickly as it is likely to smear and give a greasy appearance to the floor. Too much wax may cause the floor to be slippery. After applying the wax, it should be polished for some time with a weighted floor brush or an electric polishing machine. Daily care of a well-waxed and polished floor should consist in going over it with a dry dust-mop. Washing is seldom necessary - perhaps two or three times a year. Waxing not only adds to the appearance of the linoleum but provides a wearing surface and protects the floor. An occasional polishing may be necessary on the main traveled areas. Rewaxing will be required from time to time depending upon the amount of traffic. Depending upon the service conditions, the floor may require scrubbing at times, after which a coat of new wax should be applied.

Floor oils and sweeping compounds containing oil should not be used on linoleum, as these materials may leave a film of oil on the surface to collect dust and dirt.

IX. RUBBER FLOORS

To clean unpolished floors, brush off loose dirt with a soft push-broom and wash a small section of the floor with a clean mop wrung out of a solution of washing soda ("modified soda" or laundry soda) or trisodium phosphate (about a quarter of a cupful of the cleaner dissolved in 12 to 16 quarts of clear, cold water). Synthetic detergents are also used and are desirable if the water supply is not soft. A polyphosphate might be used with the washing soda or trisodium phosphate if the water supply is hard. Cleaning may also be done by mopping with clear, cold water containing 2 to 4 ounces of ordinary household ammonia per gallon. Rinse the mop in a second pail of clear, cold water, wring the mop, and wipe the section of floor clean of solution. Continue this process until the entire floor is cleaned. After the floor has dried, buff it thoroughly with a rotary electric buffing machine (for large areas) or a weighted hand buffer to which a piece of rough carpet or similar material is attached as a buffing surface. Daily cleaning can often be satisfactorily done by sweeping with a soft, dry brush, or with a soft push-broom, and an occasional washing with a clean mop wrung out of clear, cold water. When very dirty, the floors should be cleaned with a washing solution as outlined above. Frequent systematic buffing of unpolished floors materially reduces the number of washings required. Owing to the development of the bright-drying wax-water emulsions (polishes) free from oils, fats and organic solvents, it is now general practice to polish rubber floors. The wax or polish enhances the appearance of the floors and prolongs their life. After cleaning, drying, and buffing as outlined above, the floor is ready to polish if all dirt and marks have been removed. Pour the polish into a shallow receptacle, dip the applicator* into the polish and

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Made of lamb's wool, soft absorbent cloth, or felt. The felt applicator, made of 4 or 5 strips of felt 1/2-inch thick stood on edge and bound together, is very satisfactory. Applicators are generally furnished by polish manufacturers.

apply a thin coat over a small area with a wiping motion. Do not rub hard. Repeat until the entire floor is covered. Let dry until hard (about 30 minutes) and then buff. Immediately apply a second thin coat, let dry, and again buff thoroughly. The polish should be applied in as thin coats as possible to avoid streaking and at least two coats should be applied. If the polish wears off in certain sections of the floor, clean and repolish only these sections rather than the entire floor. Systematic buffing keeps the polished floor in good condition and reduces the number of washings required. When the polished floor becomes soiled, remove the loose dirt with a soft brush or a soft push-broom and wipe the floor with a clean mop dampened with clear, cold water. This treatment should not remove the

polish. If this procedure does not clean the floor, it should be treated as outlined above, using a washing solution. When necessary, the wax or polish can be removed from rubber floors with a solution of trisodium phosphate in warm water (about 2 ounces per gallon) with the aid of 00 steel wool. The addition of a small quantity of household ammonia to the solution will hasten the removal of the wax (and dirt).

Stains may be removed from rubber floors by rubbing the stained area with a fine abrasive powder or with number 00 steel wool. If this is ineffective, the spot may be rubbed carefully with a clean cloth dampened with acetone (flammable), gasoline (flammable), or carbon tetrachloride (non-flammable). Gasoline, acetone, and carbon tetrachloride have a softening action on rubber if in contact with it long, but the softening is not permanent.

Cleaning materials containing oil (certain sweeping compounds and other detergents) and coarse abrasives, or caustic alkali should not be used on rubber floors. Soap may soften and swell rubber flooring. Although this effect is minimized with careful rinsing, the safest procedure is to avoid the use of any soap. Waxes or polishes containing oils, fats, or organic solvents should not be used. Do not use hot water or excessive amounts of water when cleaning rubber floors. The floor should not be flooded with water. Avoid using more of the cleaning compound than specified and thoroughly mop or rinse the surface in order to remove all of the cleaning solution. Rubber floors should not be varnished. Buffing machines should not be used for scrubbing with water and cleaning agents. The advice or recommendation of the manufacturer of the rubber flooring should be secured before using unknown cleaning preparations or applying untried methods.

X. CORK TILE AND CORK CARPET FLOORINGS

Many cork floorings are installed without any surface treatment other than sanding to a smooth surface. These floorings are commonly referred to as "natural" cork and often may be cleaned by dry sweeping with a hair floor brush. The entire surface is then buffed or polished with suitable pads, a polishing machine or floor-polishing brush. Care should be taken to overlap the polished sections. If the floor can not be cleaned in this manner, it should be swept with a soft brush and then mopped with a lukewarm soapy solution made with a mild or neutral soap and clean, soft water. A separate container of clean, lukewarm, soft water and a separate mop should be used for rinsing. The rinse water should be changed frequently, so that both rinsing water and mop are always clean. Only a small area (say about 50 sq. ft.) of flooring should be washed at one time and it should be thoroughly rinsed with clean water and wiped dry. Water should not be left on the floor.

Where cork flooring is subjected to much heavy and dirty traffic, it should be sealed with a varnish-type sealer, and then waxed and polished. This treatment forms a protective coating, but the treated floors require careful and frequent attention. The floors should be washed clean and allowed to dry thoroughly before applying sealer, or wax. The waxes used for linoleum may be used on cork floors. Liquid floor wax is generally used and is applied in a thin, even coat and rubbed in. When the wax is nearly dry (tacky), apply a second coat of wax in the same manner. When the second coat becomes tacky, polish thoroughly with a polishing machine, a weighted brush, or a clean soft cloth. The appearance of the surface improves with frequent polishing. Water-emulsion waxes that dry rapidly and require little or no polishing are also widely used for waxing cork floors.

Waxed cork floors are cleaned by rubbing with a dry mop or polishing brush, followed by sweeping with a brush or a vacuum cleaner.

A polishing machine is a useful appliance for large areas. Cork floors should be polished or buffed with a brush or machine whenever they appear dull or dingy. The floors should be rewaxed from time to time, depending on traffic conditions and exposure to dirt. The floors should be rewaxed before the old wax is worn off. Areas (doorways, traffic lanes, etc.) subjected to the most wear may be rewaxed when necessary without going over the entire floor.

Before rewaxing the entire floor surface all old wax must be removed by rubbing the surface with a cloth dampened with gasoline (flammable), followed by vigorous scrubbing with warm water and soap, rinsing with clean water and drying. If this does not remove the wax, the dried surface should be resanded.

Stains and spots may be removed from cork floors by rubbing with fine emery paper or number 00 steel wool. In some cases the spot or stain may be rubbed with a cloth dampened with acetone (flammable) or with carbon tetrachloride. The cleaned areas should then be buffed and waxed.

XI. ASPHALT TILE AND MASTIC FLOORS

These "soft composition" floors are sold under various trade names and, in general, have a base of asphalt, bitumen or resin. Cleaners and polishes containing abrasives, oils or organic solvents (gasoline, turpentine, carbon tetrachloride, etc.) should not be used. These floors should be washed by mopping with a neutral soap and lukewarm soft water. Scrubbing machines with soft polishing brushes have been used for large areas. After cleaning and drying, these floorings (especially the asphalt tile) are generally waxed in order to cover the surface with a protective film. The water emulsion waxes free from oils and volatile organic solvents are the safest waxes to use on these floorings. This type of wax can be applied with a cotton cloth mop or wool applicator. The wax should be spread as thinly as possible on the

surface of the floor, using the mop or applicator in one direction only. In a short time the wax should dry to a hard, lustrous finish.

Asphalt tile floors should not be buffed or burnished until the wax or other treatment is completely dry. The treated floors may be maintained by sweeping with a brush, a dry mop, or by buffing with mechanical buffers. Scrubbing with water and a neutral soap may be required at times (probably two or three times a year). Oils, soaps or other detergents containing abrasives, and sweeping compounds containing free oil should not be used on the untreated or the treated floors. The floor treatments should be renewed at intervals, depending upon the severity of wear.

Before treating an asphalt tile floor with an unknown preparation, moisten a white cloth with the preparation and rub over the surface of one tile. If the color of the tile shows on the cloth it indicates that the solvent in the preparation has dissolved part of the surface of the tile and shows conclusively that the preparation would not be safe to use. It would be safer to get the advice of the manufacturer of the flooring before using unknown cleaning preparations.

XII. PLASTIC MAGNESIA CEMENT FLOORS

These floors contain magnesium oxychloride as the cementing material and are known by various names ("Sorel cement", "Hard Composition", "Magnesite", "Woodstone", etc.). These floors may be cleaned by first wetting with clear water and then mopping with a neutral soap and warm soft water (a soft soap, such as a linseed oil-potash soap is often used). After cleaning and drying, the floors may be given a protective coating of wax (water-emulsion wax) or of special sealers. The treated floor may be cleaned by sweeping with a dry mop or soft brush, and occasional washing, and buffing with a weighted brush or polishing machine. The waxing or other treatment is renewed as conditions require.

XIII. SLATE TILE FLOORS

These floors may be cleaned by mopping with a neutral soap (a paste soap is often used) and warm soft water. After cleaning and drying, the floors may be waxed with a water-emulsion wax. The treated floor can be kept in good condition by sweeping with a dry mop or soft brush, and an occasional buffing with a weighted brush or polishing machine.

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FF-W-566, Wool; steel.

JJJ-W-141, Wax; carnauba.

LLL-C-96, Carpet; cork.

LLL-L-351a, Linoleum; battleship.

LLL-L-359, Linoleum; inlaid and molded.

LLL-L-367, Linoleum; plain, jaspe and marbled.

LLL-T-431, Tile; cork.

LLL-T-791b, Turpentine; gum spirits and wood (steam-distilled
and sulphate), (for) paint.

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- O-A-91, Acid; oxalic (technical).
- O-A-451, Ammonia, aqua (ammonium-hydroxide), technical.
- O-B-441a, Bleaching-material (chlorinating agents).
- O-P-106, Paste; linoleum.
- O-S-571a, Soda-ash.
- O-S-581a, Sodium-carbonate; granular (monohydrate crystals).
- O-S-604, Sodium-metasilicate, pentahydrate.
- O-T-671a, Trisodium-phosphate; technical (phosphate cleaner).
- P-C-591a, Compound; sweeping.
- P-O-361, Oil, floor, mineral.
- P-P-591, Powder; scouring (for) floors.
- P-S-598, Soap; liquid and paste, (for) automobile, floor, and general cleaning.
- P-S-603, Soap, potash-linseed-oil; liquid and paste, (for) floor and general cleaning.
- P-S-606a, Soap-powder.
- P-S-631a, Soda, caustic (lye); (for cleaning purposes).
- P-S-641a, Soda, laundry; modified (washing soda).
- P-W-134, Wax, floor; solvent-type, liquid (with resins).
- P-W-151a, Wax, floor; water-emulsion.
- P-W-158, Wax, general-purpose; solvent-type, liquid and paste (for floors, furniture, etc.).
- SS-B-611, Borax (sodium-borate).
- SS-T-306, Tile; asphalt.
- SS-T-321, Tile, structural, clay, floor.
- TT-F-336a, Filler; wood, paste.
- TT-P-91, Paint; rubber-base, (for) cement floors.

- TT-P-146, Paint; varnish base (for concrete and wood floors).
- TT-R-251a, Remover; paint and varnish (organic-solvent type).
- TT-S-171, Sealer, floor; lacquer-type (for oiled wood floors).
- TT-S-176a, Sealer, floor; varnish-type (for wood and cork).
- TT-S-271, Shellac; orange.
- TT-T-291, Thinner; paint, volatile mineral spirits.
- TT-V-71a, Varnish; interior.
- TT-V-91a, Varnish; shellac.
- TT-V-121a, Varnish; spar, water-resisting.
- VV-P-121, Paraffin (wax).
- W-C-421a, Cleaners, vacuum; electric, portable.
- W-M-46a, Machines, floor-polishing and scrubbing; electric.
- ZZ-F-461, Floor-covering; rubber, sheet.
- ZZ-H-46, Mats, floor; rubber, link-type.
- ZZ-M-71, Matting; rubber.