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POLISHING COMPOUND FOR PLASTIC SURFACES

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## POLISHING COMPOUND FOR PLASTIC SURFACES

### 5 BACKGROUND OF THE INVENTION

#### 1. Field of the Invention:

The present invention relates to polishing compounds for plastic surfaces. The United States Government has rights in this invention  
10 pursuant to Contract No. DE-AC09-89SR18035 between the U.S. Department of Energy and Westinghouse Savannah River Company.

#### 2. Discussion of Background:

PLEXIGLAS™ and other plastic materials are difficult to polish because it is easy to scratch the relatively soft surface. Cut surfaces of  
15 clear plastics such as PLEXIGLAS™ have an opaque or translucent appearance due to a multitude of tiny scratches from the cutting tool even if the surface is smooth to the touch. Such cut surfaces are especially difficult to polish to a clear, transparent finish. Also, the cutting operation or act of polishing the cut surface can result in  
20 sufficient heat that the surface softens or melts, causing further optical distortion.

Rubbing and polishing compounds are used to facilitate polishing such cut surfaces. These compounds incorporate a powdered abrasive material for leveling and smoothing the surface. The  
25 abrasive is suspended in a suitable binder, which may include fatty substances, petroleum oils, surfactants, polishing accelerators,

sedimentation-preventing agents, alcohol, and water. Frequently-used abrasives include the oxides of aluminum, iron, chromium, tin, titanium, magnesium, zinc, manganese, and the rare earths. It should be noted that the term "compound", as used in the art, does not denote a compound in the chemical sense but rather a mixture of ingredients. It is in the latter sense that the term is used in this specification and the appended claims.

During polishing, the abrasive-containing compound is rubbed against the surface -- generating considerable friction and heat -- until the surface is level and the scratches left by cutting are too small to see. However, compounds intended for use on hard surfaces such as glass or metal can easily scratch softer, plastic materials. Some compounds do not effectively wet a roughly-finished plastic surface, so their polishing efficiency is reduced. Others do not lubricate the surface sufficiently, so the heat generated during polishing tends to soften and melt the plastic. Water-based compounds dry out during use, leaving a paste or powder residue that is difficult to work without causing excessive surface heating. The residue must frequently be removed from the surface of the plastic and the polishing pad, and fresh compound applied before polishing can be resumed.

A wide variety of cleaning and polishing compounds are available. Metal polishes contain an abrasive such as aluminum oxide suspended in a carrier. See, for example, Smith, U.S. Patent No. 4,952,240, and Potter, U.S. Patent No. 4,853,000. These compounds are designed for use on hard surfaces, and can easily scratch softer,

plastic materials such as PLEXIGLAS™, LEXAN™, LUCITE™, and polyvinyl chloride (PVC).

Other abrasive cleaners are designed for cleaning and conditioning hard ceramic surfaces such as range tops. For example,  
5 an abrasive powder mixture contains silicone oil absorbed in a water-soluble absorbent powder and a nonionic surfactant (McLaughlin et al., U.S. Patent No. 4,035,163).

Water-based polishing compounds for plastic lenses contain an aluminum oxalate or aluminum lactate abrasive (Miyazaki et al., U.S.  
10 Patent No. 4,935,0390), calcined alumina (Koshiyama et al., U.S. Patent No. 4,225,349), or powdered cerium oxide (Dauguet et al., U.S. Patent No. 4,222,747). Often, these and similar compounds do not wet and lubricate the surface effectively, so it tends to heat and melt while being worked. The compounds tend to dry out during use.

15 Presently available cleaners and polishers are often difficult to apply uniformly and tend to dry unevenly. The abrasive particles do not remain uniformly dispersed throughout the carrier, but settle out and form clumps. The clumped abrasive may produce scratches and other defects in the finished surface. Typically, long working times  
20 are required to produce a satisfactorily smooth and clear surface. It is especially difficult to produce surfaces which are suitable for use with optical equipment. Water-based compounds dry out during use, leading to excessive heat buildup and melting of a soft plastic surface. In addition, some compounds may contain substances which can  
25 irritate skin or corrode metal equipment.

A compound for polishing plastics to a condition of clarity or reflectivity suitable for optical equipment should contain a fine, uniformly dispersed abrasive in a lubricating and wetting medium that does not dry during polishing. It should also be economical and  
5 chemically stable, non-irritating to skin and non-corrosive.

### SUMMARY OF THE INVENTION

According to its major aspects and broadly stated, the present  
10 invention is an oil-based polishing compound. The compound contains a fine, uniformly-dispersed abrasive to avoid scratching and a lubricant to help prevent heat buildup and melting of the surface. The compound includes at least one petroleum distillate lubricant (preferably a blend of lubricants), mineral spirits, abrasive paste, and  
15 water. The compound includes by weight approximately 25 to 80 parts lubricant, 1 to 12 parts mineral spirits, 50 to 155 parts abrasive paste, and 15 to 60 parts water. The proportions of the ingredients are varied in accordance with the particular application. Thicker formulations containing relatively more abrasive paste are effective  
20 polishers, while thinner formulations containing relatively more liquid are useful as cleaners.

The compound remains in workable condition on the polishing pad and the workpiece, so the operator does not need to stop to clean dried material off the workpiece or polishing equipment, as with  
25 water-based polishes. When polishing is complete, the residue is easily

removed with a clean, lint-free cloth, leaving a smooth, clear surface without observable scratches.

An important feature of the present invention is the petroleum distillate lubricant. The lubricant facilitates uniform dispersion of the abrasive material, keeps the polishing compound workable, and ensures effective, continuous lubrication of the surface during polishing. Preferably, a blend of lubricants of different weights is used, however a single lubricant having the desired lubricating properties may be used if convenient.

Another feature of the present invention is the mineral spirits, which facilitates mixing and dispersion of the other ingredients. The mineral spirits penetrates to the surface of the workpiece, assuring complete wetting of the surface so the polishing compound readily spreads into small surface scratches and blemishes. It also dissolves surface grease and removes any dirt on the surface at the start of polishing.

Still another feature of the present invention is the abrasive paste. The paste preferably contains about 30 wt% to 60 wt% abrasive material in a suitable binder. Abrasives usable in accordance with the present invention include crystalline silica (quartz), alumina, and the oxides of iron, chromium, tin, titanium, and the rare earths. Binders may include a blend of mineral spirits and petroleum distillates as well as other substances such as hydrogenated animal fat, tallow fats and triglycerides. Coloring and fragrance agents may also be present if convenient in an application of the present compound intended for consumer use. The lubricant and mineral spirits dissolve and disperse

the abrasive paste to produce a smooth, uniformly blended mixture. Because the abrasive particles are uniformly dispersed throughout the compound, scratching due to settling or clumping is eliminated.

A further feature of the present invention is the combination of  
5 ingredients. The compound contains a fine-grained abrasive to avoid scratching, a lubricant (preferably a blend of lubricants of different weights) to help prevent heat buildup and melting of the surface, mineral spirits to facilitate mixing and dispersion of the other ingredients, and water. All the ingredients are readily available and  
10 inexpensive, and each contributes without countering or buffering the effect of the others. The combination of ingredients achieves a smooth, clear finish when used to polish a plastic surface.

Preferably, the polishing compound includes by weight approximately 37 to 42 parts lubricant, up to 8 parts mineral spirits,  
15 95 to 110 parts abrasive paste, and 50 to 55 parts water. Thus, one weight unit of the compound includes 18 wt% to 20 wt% petroleum distillate lubricants, up to 4 wt% mineral spirits, about 50 wt% abrasive paste, and about 25 wt% water. A compound with these proportions of ingredients has approximately the consistency of heavy  
20 cream. These proportions give a stable, easy-to-use compound for polishing plastic surfaces.

If convenient, the mineral spirits may be supplied in combination with a lubricant or lubricants, such as by providing a lubricant/mineral spirits combination and a lubricant of different  
25 weight such as machine oil or spindle oil. When so formulated, one unit of the polishing compound includes by volume 2 to 6 parts

lubricant/mineral spirits combination, 1 to 3 parts machine oil, 2 to 6 parts abrasive paste, and 2 to 7 parts water. Preferably, the compound includes by volume approximately 4 parts lubricant/mineral spirits, 1 part machine oil, 4 parts abrasive paste, and 6 parts water.

5 Other features and advantages of the present invention will be apparent to those skilled in the art from a careful reading of the Detailed Description of a Preferred Embodiment presented below and accompanied by the drawings.

## 10 DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The present invention is a noncorrosive, oil-based polishing compound for plastic surfaces. The compound includes at least one petroleum distillate lubricant (preferably a blend lubricants of  
15 different weights), mineral spirits, abrasive paste, and water. One unit of the compound includes these ingredients in approximately the following amounts by weight:

	<u>Ingredient</u>	<u>Weight (gm)</u>	<u>Parts (wt.)</u>
20	petroleum distillate		
	lubricant	120 - 390	25 - 80
	mineral spirits	5 - 60	1 - 12
	abrasive paste	250 - 750	50 - 155
	water	80 - 300	15 - 60

25

The lubricant facilitates uniform dispersion of the abrasive material and ensures effective, continuous lubrication of the surface during polishing. It keeps the polishing compound workable by helping to prevent drying of the compound as the water and mineral spirits evaporate during polishing.

Preferably, a blend of petroleum distillate lubricants of different molecular weights is used, including at least one of the following or similar compositions: heavy naphthenic petroleum distillates such as those contained in the composition having Chemical Abstracts Service Registry No. (hereinafter CAS No.) 64741-53-3, aliphatic petroleum distillates such as Stoddard solvent (CAS No. 8052-41-3), petroleum base oil such as Nujol (CAS No. 8012-95-1), and heavy aliphatic solvent naphtha (CAS No. 64742-96-7). If convenient, a single-weight composition having similar lubricating properties may be used. Preferably, the compound includes 50 to 160 gm heavy naphthenic distillates (at least 18 wt% of total lubricants) and 60 to 220 gm other lubricants (at least 27 wt% of total lubricants).

The mineral spirits facilitates mixing and dispersion of the other ingredients, including the abrasive material in the paste. It penetrates to the surface of the workpiece, assuring complete wetting of the surface so the compound readily spreads into small surface scratches and blemishes. It also dissolves surface grease and removes any dirt on the surface at the start of polishing. The mineral spirits preferably includes at least approximately 95 wt% hydrotreated petroleum distillates such as those in the compositions having CAS Nos. 64752-46-7, 64742-47-8, and 64742-53-6. However, any convenient mixture

of hydrotreated petroleum distillates having the desired wetting properties may be used.

The abrasive paste preferably contains about 30 wt% to 60 wt% abrasive material in a suitable binder. Abrasives usable in accordance  
5 with the present invention include crystalline silica (quartz), alumina, and the oxides of iron, chromium, tin, titanium, and the rare earths. Binders may include a blend of mineral spirits and petroleum distillates as well as other substances such as hydrogenated animal fat, tallow fats and triglycerides. The abrasive preferably has a particle  
10 size that is selected for the degree of polishing desired, finer particle size for a higher polishing state, coarser for the initial stages of polishing. Coloring and fragrance agents may also be present if convenient. Abrasive pastes usable in accordance with the present invention include automobile rubbing compounds such as those sold  
15 under the trademarks Speedy Rubbing Compound and White Speedy Rubbing Compound (Martin-Senour Automotive Sales, Countryside, IL), Heavy Duty Rubbing Compound (Turtle Wax, Inc., Chicago, IL), and Automobile Rubbing Compound (E. I. DuPont de Nemours & Co., Inc., Wilmington, DE). It will be evident that any convenient  
20 fine-grained abrasive paste having similar properties of abrasiveness, volatility, and viscosity may be used. If convenient, the equivalent amounts of abrasive and binder can be furnished separately.

The petroleum distillate lubricants and mineral spirits dissolve and disperse the abrasive paste to produce a smooth, uniformly  
25 blended mixture. Because the abrasive particles are uniformly

dispersed throughout the compound, scratching due to settling or clumping is eliminated.

The amount of abrasive paste may vary within the range given above (50 to 155 parts by weight). For any given amounts of the  
5 liquid ingredients, a lesser admixture of abrasive paste results in a thinner compound and more time required to polish a surface. Conversely, the more paste, the thicker the polishing compound and the less polishing time, since the polishing efficiency of the compound is reduced if the abrasive paste content is too low. However, if too  
10 much paste is used, the viscosity of the compound is too high and it is less easy to use. Scratching may result if a coarse-grained paste is used. Thicker formulations are generally more effective as polishers, while thinner formulations are favored as cleaners.

The water dilutes the compound to the desired consistency and  
15 serves as a carrier for the other ingredients. Although a compound having the above-listed ingredients outside the preferred ranges would have some cleaning and/or polishing action, the invention is based upon optimum results attained by following the preferred embodiment.

20 The polishing compound is prepared as follows:

1. In an appropriately-sized vessel, slowly add petroleum distillate lubricant to abrasive paste while stirring.
2. Stir until the paste has dispersed to form a smooth, uniform mixture.
- 25 3. Slowly add water while stirring the mixture. Agitate until the mixture forms a well-blended compound.

Preferably, the polishing compound includes by weight approximately 37 to 42 parts petroleum distillate lubricant (preferably a blend of lubricants of different weights, containing at least approximately 30% heavy naphthenic petroleum distillates), up to 8 parts mineral spirits, 95 to 110 parts abrasive paste, and 50 to 55 parts water. Alternatively, the compound includes approximately 18 wt% to 20 wt% petroleum distillate lubricants, up to 4 wt% mineral spirits, 50 wt% abrasive paste, and 25 wt% water. A compound with these proportions of ingredients has approximately the consistency of heavy cream. These proportions give a stable, easy-to-use compound for polishing plastic surfaces.

If not used immediately, the compound is stored in a covered container to prevent evaporation of the water and volatile components. The compound is chemically stable, however, the ingredients settle out during prolonged storage. If this occurs, the compound is easily restored to its original consistency by stirring or shaking.

As will be evident to one of ordinary skill, the proportions of the ingredients may readily be varied within the ranges set forth in accordance with the particular application. Thus, thicker formulations containing relatively more abrasive paste are generally more effective as polishers, while thinner formulations containing relatively more liquid are useful as cleaners. Coloring agents may be added to modify the appearance of the compound, or stabilizing agents to prolong its shelf life. Ingredients having similar wetting, lubricating, and abrasive properties may be substituted for or added to those listed above without departing from the spirit and scope of the invention.

In use, a convenient amount of the compound is applied and used according to well-known polishing methods. Since the compound remains in workable condition on the polishing pad and the workpiece, polishing action and efficiency are maintained. The operator does not  
5 need to stop to clean dried material off the workpiece or polishing equipment and apply fresh compound, as with water-based polishes. When polishing is complete, the residue is easily removed with a clean, lint-free cloth, leaving a smooth, clear surface without visible scratches.

10 It may be convenient to supply the mineral spirits in combination with a lubricant or lubricants. The polishing compound preferably includes a blend of lubricants of different weights, which is provided by combining a lubricant/mineral spirits combination with a  
15 lubricant of different weight such as machine oil or spindle oil. The oil preferably includes approximately 95 wt% or more heavy naphthenic petroleum distillates such as those contained in the composition having CAS No. 64741-53-3. Such an oil is sold under the trademark Three-In-One Household Oil by the Boyle Midway  
20 Division of American Home Products Corporation. Alternatively, any convenient machine oil or spindle oil with similar properties of volatility and viscosity may be used.

The lubricant/mineral spirits combination preferably includes about 5 wt% to 20 wt% mineral spirits (hydrotreated petroleum distillates) and 65 wt% to 75 wt% petroleum oils such as those  
25 contained in the compositions having CAS Nos. 8052-41-3 (Stoddard solvent), 8012-95-1 (Nujol), 64742-96-7, and 64742-96-7, or

compositions with similar viscosity, volatility, and lubricating properties. If desired, other ingredients such as corrosion inhibitors, and color and fragrance agents may be added without departing from the spirit of the present invention. Lubricant/mineral spirits

5 combinations usable in accordance with the present invention include those sold under the trademarks WD-40 (WD-40 Company, San Diego, CA), Kroil (Kano Laboratories, Inc., Nashville, TN), and LPS 2 (LPS Laboratories, Inc., Tucker, GA). However, it will be clear that any convenient mixture of petroleum distillates having similar

10 volatility, viscosity, and wetting and lubricating properties may be used.

When formulated with such a lubricant/mineral spirits combination, one unit of the polishing compound includes the following ingredients:

15

<u>Ingredient</u>	<u>Parts (vol.)</u>	<u>Parts (wt.)</u>
lubricant/mineral spirits		
combination	2 - 6	1.7 - 5.2
machine oil	1 - 3	1 - 3
20   abrasive paste	2 - 6	4.4 - 13.2
water	2 - 7	1.5 - 5.3

Preferably, the compound includes approximately:

25

<u>Ingredient</u>	<u>Parts (vol.)</u>	<u>Parts (wt.)</u>	<u>Weight (%)</u>
lubricant/mineral			

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spirits combination	4	3.5	19.5
machine oil	1	1	5.5
abrasive paste	4	8.8	50
water	6	4.5	25

5

The polishing compound of the present invention can be used on PLEXIGLAS™, LEXAN™, LUCITE™, polyvinyl chloride (PVC), and similar plastic materials whenever a smooth, clear polished surface is desired. It is especially useful in finishing cut plastic surfaces to a clear finish. It may also be used on glass, ceramic, and metal surfaces. The compound provides good lubricating action to help prevent heat build-up and melting of the surface during polishing operations. It is oil-based, so it does not dry excessively during use. It is noncorrosive and easy to clean off equipment and parts. It is easy to produce and use, and formulated of inexpensive, readily-available ingredients.

It will be apparent to those skilled in the art that many changes and substitutions can be made to the preferred embodiment herein described without departing from the spirit and scope of the present invention as defined by the appended claims.

## ABSTRACT OF THE DISCLOSURE

A polishing compound for plastic materials. The compound includes approximately by approximately by weight 25 to 80 parts at  
5 least one petroleum distillate lubricant, 1 to 12 parts mineral spirits, 50 to 155 parts abrasive paste, and 15 to 60 parts water. Preferably, the compound includes approximately 37 to 42 parts at least one petroleum distillate lubricant, up to 8 parts mineral spirits, 95 to 110 parts abrasive paste, and 50 to 55 parts water. The proportions of the  
10 ingredients are varied in accordance with the particular application. The compound is used on PLEXIGLAS™, LEXAN™, LUCITE™, polyvinyl chloride (PVC), and similar plastic materials whenever a smooth, clear polished surface is desired.

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