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CLEANING PROCESS ESPECIALLY ADAPTED TO REMOVE BUFFING DIRT AND/OR DRAWING COMPOUNDS FROM METAL PREPARATORY TO PLATING OPERATIONS

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This invention relates to metal cleaning processes and materials, particularly such as are applicable in the removal of buffing dirt and drawing compounds from metal parts.

In the past it has been a difficult matter to satisfactorily clean buffing and drawing compounds from metal parts prior to other operations such as electroplating, etc. The primary object of the invention is to provide an improved cleaning process and cleaner material that is particularly suited to difficult metal cleaning operations such as those involving removal of buffing dirt and drawing compounds from metals.

In accordance with the present invention there is provided a metal cleaning process which involves a novel combination of steps. The first essential step of the process consists of immersing and soaking the work to be cleaned in a solvent-emulsion cleaning bath of the type having an oil solvent upper layer and an oil in water emulsion under layer. The second essential step consists in spraying the work with a novel cleaning material. The third essential step consists in degreasing the parts after the spraying treatment by use of a hot chlorinated solvent, preferably in vapor form. In order to avoid too rapid contamination of the spray solution it is desirable to allow the work removed from the soaking bath to drain thoroughly before subjecting the same to the spray. Following the spray treatment the work is thoroughly drained before being given the vapor degreasing.

Preferred conditions in accordance with the invention employed in such cleaning operations as cleaning buffing dirt from electroplated work, for example, copper, nickel, or chromium electrodeposits, are to immerse and soak the parts having the buffing dirt thereon in the solvent-emulsion bath. The work enters the soaking bath through the solvent upper layer and is then immersed and soaked in the oil in water emulsion underneath the upper layer. Oftentimes it is desirable to agitate this layer. In one application of the invention in which buffing dirt is removed from buffed copper plated parts, the work is subjected to the action of the solvent-emulsion cleaning bath at a temperature of about 180° F. for a time of about two minutes. The kind and amount of buffing dirt will have an effect on the temperature and time of soak required and where conditions are less severe a lower bath temperature and/or a shorter time of immersion may be used. For example, in some cases temperatures as low as 140° F. may be sufficient to soften the buffing dirt. Under the same conditions with respect

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to the kind and amount of buffing dirt, a lower temperature of the soaking bath will require a longer time of immersion and vice versa. Where the work is exceptionally dirty, higher temperatures and/or longer times of immersion may be necessary. The exact time and/or temperature to be employed in any particular application may be determined by experiment. At this time the kind and amount of agitation is established. Higher temperatures may tend to cause excessive evaporation of the solvent of the upper layer and if so should be avoided. The immersion and soaking treatment thoroughly softens the buffing compound and other foreign matter and conditions the plated parts for the subsequent spray treatment.

Illustrative examples of suitable solvent-emulsion cleaners of the two-phase type which may be employed for the soaking step are as follows:

Example 1.—A mixture is prepared consisting of thirty-five parts by volume of kerosene and three parts by volume of sulphated sperm oil. This mixture is added to water in the proportion of one part by volume to twenty parts by volume of water. Addition of a sodium silicate (for example sodium metasilicate) to the emulsion or water employed is usually beneficial. This is especially so after the soaking bath has been in use for a time. When sodium metasilicate pentahydrate is used as the sodium silicate a concentration of about one to one and a half oz. per gallon is desirable. Other mineral spirits or mixtures thereof may be employed in place of or in combination with kerosene in the above formula. As an illustrative example of this, mineral seal oil may replace in whole or in part the kerosene in the above formula.

Example 2.—A material consisting of ninety percent kerosene, five percent triethanolamine and five percent oleic acid (all percentages by volume) is added to water in the proportion of one part to twenty parts water (by volume). A sodium silicate may be added the same as in Example 1. Other mineral spirits may be employed in place of or in combination with kerosene the same as in Example 1.

Example 3.—A material consisting of eighty percent mineral seal oil, ten percent kerosene, eight percent pine oil, one percent butyl carbitol (diethylene glycol mono-butyl ether) and one percent of a sodium salt of a sulfated higher alcohol (all percentages by volume) is added to water in the proportion of one part to twenty parts water by volume. A sodium silicate may be added as in Example 1. Other mineral spirits, as in Examples

1 and 2 may be employed in place of the eighty percent mineral seal oil and ten percent kerosene mentioned above.

The spraying operation consists in vigorously spraying the work with a novel liquid cleaner consisting of water, an alkali-metal silicate, mineral spirits such as, for example, kerosene or mineral seal oil (or combinations thereof), and a chlorinated solvent such as trichlorethylene, perchlorethylene, amyl chlorides, etc. In making up the spray cleaner the alkali-metal silicate is dissolved in water and to this solution is added a second solution consisting of fluid hydrocarbons, for example, kerosene, mineral seal oil, other mineral spirits or mixtures of these, and the chlorinated solvent such as trichlorethylene, perchlorethylene, amyl chlorides, etc. A specific example of a very satisfactory spray cleaner is one made by dissolving two to three ounces of sodium metasilicate pentahydrate in a gallon of water and adding to this solution one pint of a solution consisting of ninety-five parts by volume of kerosene and five parts by volume of trichlorethylene. Mineral seal oil or other mineral spirits may be substituted in whole or in part for the kerosene in the foregoing formula. The amount of chlorinated solvent such as trichlorethylene, perchlorethylene, amyl chlorides, etc., may vary from the proportion given in the foregoing examples. In general about two and one-half to fifteen percent by volume of chlorinated solvent and the balance mineral spirits may be employed. The amount of sodium metasilicate in general may vary within the range of about one-half oz. per gallon up to five or six ounces per gallon.

The supply of spray cleaner as made up consists of an aqueous solution of sodium metasilicate on which is an upper layer consisting of the solution of mineral spirits and chlorinated solvent. In carrying out the spraying operation the inlet side of the pump is fed from a point in the supply tank near the interface between the two layers so that some of the oil upper layer is always drawn into the pump. The separate materials are thus mechanically mixed by the pump and spray nozzles so that an intimate mixture of the two solutions is sprayed onto the work. After the pump is in operation there is no sharp line between the oil and aqueous parts of the spray cleaner in the supply tank. However, the conditions are such that at all times an intimate mechanical mixture of the two solutions making up the spray cleaner is sprayed onto the work.

In one commercial application of the invention best results are obtained when the spray cleaner is employed at a temperature of 160° to 180° F. However, a temperature as low as about 140° F. is contemplated, as well as higher temperatures up to about 190° F. The less volatile mineral spirits and less volatile chlorinated solvents, permit even higher temperatures with the advantages resulting therefrom.

The time necessary to remove the softened buffing compound and other dirt by the spray cleaner will vary somewhat depending on the nature and arrangement of the spray nozzles, the amount of foreign matter, temperature of the spray cleaner, composition of the spray cleaner, etc. A time of about one minute has proven sufficient in most instances. Longer times, of course, may be employed. For economic reasons it is desirable in large scale operations to employ the least time necessary to produce the desired results. In one large scale commercial application it has been found of value to add a water spray at the exit end of the spray cleaner chamber to rinse the work before the vapor degreasing stage. This rinse water is not allowed to drain into the spray cleaner supply tank or chamber.

After being sprayed the work is allowed to drain thoroughly. A time of about two minutes or more is provided in one large scale commercial application to permit removal of water by drainage and evaporation. Spray racks are preferably designed to minimize entrapment of spray solution.

The parts are then given the degreasing treatment by means of a hot chlorinated solvent such as trichlorethylene, perchlorethylene, amyl chlorides, etc. This treatment preferably consists of subjecting the work to the hot chlorinated solvent vapor for a time on the order of about one-half to three minutes; about one minute being employed as an average. In order to obtain the vapor in the degreaser it is necessary to operate at the boiling point of the chlorinated solvent. The perchlorethylene has the advantage that the higher boiling point does not permit water to stay in the degreaser. In some cases the hot chlorinated solvent may be sprayed onto the work. After the degreasing treatment the cleaned parts are allowed to dry. The cleaned parts are then ready for inspection and subsequent operations such as plating, etc.

Regardless of the care in draining after the soaking step, a certain amount of the solvent-emulsion cleaning material is carried over into the spray cleaner. This tends to cause a somewhat stable but undesired emulsion between the mineral spirits (kerosene, mineral seal oil, etc.) and water which the trichlorethylene, perchlorethylene or other chlorinated solvent of the spray material tends to prevent and/or reduce the effect on the work of this condition. The chlorinated solvent also causes a desirable spreading or wetting effect on the surface of the work. In addition the emulsifying agent and oils used in the soak solution adhere tenaciously to the surface of the work after the spray treatment. In order to remove the last of this emulsifying agent and oil completely and to assist in drying without staining the work, it is essential to employ the degreasing step employing hot chlorinated solvent in the final cleaning step of the process.

I claim:

1. A process of cleaning metal parts which comprises providing a bath consisting essentially of a solvent-emulsion cleaner having an oil solvent upper layer and an oil in water emulsion under layer, passing the metal parts into said bath through the oil solvent upper layer, then immersing and soaking the metal parts in the oil in water emulsion under layer, then removing the parts from the solvent-emulsion bath, thereafter spraying the parts with an intimate mechanical mixture of two solutions, the first of which solutions consists essentially of an aqueous solution of an alkali metal silicate and the second of which consists essentially of a solution consisting largely of mineral spirits and a smaller proportion of a chlorinated solvent, and thereafter subjecting the parts to hot chlorinated solvent.

2. A process as in claim 1 in which the first solution of the spray mixture consists of an aqueous solution containing about one-half to six ounces of sodium silicate per gallon and the second solution consists of a solution of mineral spirits containing about two and one-half to fifteen percent by volume of a chlorinated solvent.

3. A process as in claim 1 in which the first solution of the spray mixture consists essentially of

an aqueous solution containing two to three ounces of sodium metasilicate pentahydrate per gallon and the second solution consists of about ninety-five parts by volume of at least one of a material of the class consisting of kerosene and mineral seal oil and about five parts by volume of a chlorinated solvent of the class consisting of trichlorethylene, perchlorethylene and amyl chlorides.

4. A process as in claim 3 in which the chlorinated solvent of the spray is trichlorethylene.

5. A process as in claim 3 in which the chlorinated solvent of the spray is perchlorethylene.

6. A process as in claim 3 in which the chlorinated solvent of the spray is amyl chloride.

7. A process as in claim 3 in which the solvent-emulsion cleaner is maintained at a temperature within the range of about 140° F. to 190° F. and the spray material is maintained at a temperature within the range of about 140° F. to 190° F.

8. A process of cleaning metal parts which comprises providing a bath consisting essentially of a solvent-emulsion cleaner having an oil solvent upper layer and an oil in water emulsion under layer containing about one to one and a half ounces of sodium silicate pentahydrate per gallon, said solvent-emulsion cleaner being maintained at a temperature within the range of about 140° F. to 190° F., passing the metal parts into said heated cleaning bath through the oil solvent upper layer, then immersing and soaking the metal parts in the oil in water emulsion under layer containing said silicate, removing the parts from said solvent-emulsion cleaning bath, thereafter spraying the parts with an intimate mechanical mixture of two solutions heated to a temperature of about 140 to 190° F., the first of which consists essentially of an aqueous solution containing about one-half to six ounces of sodium silicate pentahydrate per gallon and the second solution consists of a solution of mineral spirits containing about two and one-half to fifteen per cent by volume of a chlorinated solvent of the class consisting of trichlorethylene, perchlorethylene and amyl chloride, and thereafter subjecting said parts to hot vapors of chlorinated solvent.

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