This invention relates to the cleaning and chemical coating of metallic surfaces. It has for an object the cleaning of metallic surfaces prior to the application of a chemically applied phosphate coating. Other objects will appear hereinafter.

It is well known that to obtain best results, metallic surfaces must be cleaned before the application of chemically applied phosphate coatings or coatings of lacquer, paint, enamel, etc., if a uniform and satisfactory coating is to be obtained on the metal. Various types of cleaning have been employed heretofore, including hot water, alkali, solvent, and acid cleaners. Alkali cleaners have comprised sodium silicates, tertiary alkali phosphates, and caustic alkanes or combination of other water soluble alkali compounds. Acid cleaners have comprised mineral acids and without organic wetting agents, grease solvents and inhibitors.

We have discovered a cleaning composition which is highly advantageous for metallic surfaces prior to application of a processing solution which combines with a metallic surface to form a phosphate coating thereon.

Generally speaking, our cleaning composition comprises a mixture of a water soluble soap, a hydrocarbon solvent such as kerosene, and water. These are mixed to form an emulsion and the resulting composition is applied to the metallic surfaces. The composition may be applied hot or cold, preferably hot for best results. Spraying or immersing may be employed. Following the action by immersion or spraying of a phosphate coating solution to obtain a coating integral with the metal which is corrosion resistant and to which inactivating coatings such as primers, lacquers, paints, enamels, etc., can be applied, the chemical coat serving to bind the inactivating coat to the metal.

We have found that in many cases an absolutely chemically clean surface does not take a phosphate coating as readily as a surface containing a thin film of oil such as left by kerosene or naphtha. For instance, electro-cleaning such as used prior to piecing produces an absolutely chemically clean surface but phosphate coatings such as are used to render metallic surfaces corrosion-resistant and to serve as a bond for inactivative coatings are in many cases less satisfactory when obtained on such chemically clean surfaces than on surfaces cleaned so as to leave therein a thin film of oil. We have further found that alkali cleaning prior to processing metallic surfaces in some phosphate solutions is unsatisfactory unless used in extreme dilution, probably because it is practically impossible to remove the last traces of alkali in the rinsing operation.

In view of this knowledge it seemed desirable to make up a cleaning composition containing a material which would leave a thin film of oil on the metallic surface and would rinse free of alkali. It has been common practice to employ a solvent wipe such as kerosene or naphtha prior to processing with a phosphate solution. We discovered that a composition containing a soap, even though an alkali soap, together with kerosene, an oil in some cases, and water, constitutes an excellent cleaning composition for metallic surfaces for use prior to the application of a phosphate coating solution. The composition may consist of, for example, a triethanolamine soap, kerosene and water. However, when heat is used there is a tendency for the emulsion to break with a consequent loss of kerosene. A more stable cleaning composition can be prepared by the addition of a water soluble alkali to the cleaning composition described above.

An emulsion made up of about 7.5% triethanolamine oleate soap, 59.3% kerosene, and 33.2% water is a good cleaning composition. The stability of the emulsion can be improved by increasing the ratio of the soap to the kerosene. A formula of 9% triethanolamine oleate soap, 59% kerosene and 32% water is a good cleaner and more stable than the other. A formula containing 15% soap is also a good cleaner.

This formula provides a concentrated composition which is easily shipped and may be used as such or diluted to any suitable strength. The amount of dilution is not important, as good cleaning results up to 98% water. What is important is to have enough soap or emulsifying agent to keep the kerosene from separating out of the emulsion.

A marked improvement in the stability of the cleaning composition on the application of heat is obtained if an alkali is used with the emulsion. The alkali apparently tends to prevent the break-up of the emulsion and thus cuts down kerosene loss. This is the preferred form of the invention. Any of the alkali cleaners ordinarily used for the cleaning of metallic surfaces can be used in conjunction with our kerosene emulsion cleaner.

These include sodium silicates, trisodium phosphate and mixtures of other water soluble alkali compounds.

It is advantageous to add some alkali cleaner to the water in the tank which is to be used for the cleaning and then add the emulsion cleaner. The alkali is added to the water in the cleaning tank, preferably to produce a 0.01 N alkaline solution and then the emulsion cleaner is added. The alkalinity of the water may vary considerably up or down but about the figure given gives optimum results. The emulsion cleaner is added in the approximate ratio of one gallon emulsion cleaner to approximately 75 gallons of solution.
in the washer. Again these proportions may vary but those given are preferred.

The triethanolamine soap referred to herein comprises a mixture of triethanolamine and oleic acid or other fatty acid or oil. As indicated hereinafter, other substances may be used in place of the amine to emulsify kerosene and water and other oils and fatty acids may be used in place of oleic.

10 The following examples are given by way of illustration and not limitation; it being understood that wide deviations are possible in ingredients, proportions, temperatures, etc., without departing from the spirit of the invention.

15 Example 1. An emulsion is made up of kerosene 59.3% by weight, oleic acid 5.33%, triethanolamine 2.3% and water 33.24% by mixing first separately the kerosene and oleic acid, and the triethanolamine and water and pouring the first mixture into the second with stirring. One gallon of this mixture is diluted to 60 gallons with water and objects with greasy steel surfaces are dipped in a tank containing this cleaning composition or the composition is sprayed on the greasy steel surfaces at temperatures ranging from 130° to 150°. A good cleaning of the surfaces is obtained. The soiled objects are then processed by dipping into or spraying with an acid phosphate solution, such solution to which has been added for example, zinc dihydrogen phosphate, copper carbonate, sodium nitrate, and nitric acid of the preferred proportions for 2,000 gallons of water, 313 lbs. sodium nitrate, 150 lbs. zinc dihydrogen phosphate, ½ lb. copper carbonate and 22 lbs. 42° Bé. nitric acid. The solution is preferably sprayed for about one minute on the iron or steel objects at a temperature of about 175°. Uniform and satisfactory Bondurite (registered trade-mark) coatings are obtained suitable for the application of siccatives coats of lacquer, paint, enamel, etc.

In the above example, in place of the cleaning compositions described, compositions of the type following may be used:

45

#2

Fuel oil.................................................119.0
Oleic acid...........................................10.5
Triethanolamine.................................4.26
Water..................................................67.0

#3

Kerosene.............................................119.0
Oleic acid...........................................10.5
NH₄OH..................................................6.0
Water..................................................67.0

#4

Fuel oil.................................................120.0
Oleic acid...........................................10.5
NH₄OH..................................................6.0
Water..................................................67.0

#5

Kerosene.............................................119.0
Stearic acid.........................................6
Triethanolamine.................................3
Water..................................................32

The emulsions shown in Examples 2, 3 and 4 above are prepared by just mixing the ingredients together, the proportions being such that an emulsion will form readily. The resulting mixture may be diluted with water to any suitable strength.

In Example 5 the percentages given are by weight and are such that when the ingredients are mixed together an emulsion will form readily. When this is done the resulting mixture may be diluted to any desired concentration. It is recommended that one gallon of the mixture be diluted to 60 gallons with water for use in a tank for immersion of article to be cleaned or 10 for use in a spraying machine.

A mechanical stirring machine is recommended for mixing the ingredients and forming the emulsion.

It is important that the ingredients be mixed together at a concentration at which emulsification is readily obtained before diluting for use. For example, if each ingredient is put into a tank before mixing so that 99% of the composition is water, efforts to create an emulsion are not very successful for the solution is too dilute. However, if the ingredients are mixed when, for example, only 32% water is present the emulsion can be readily obtained and thereafter the emulsion can be diluted so as to contain 99% water without a break-down of the emulsion.

It should be noted that in place of the kerosene other petroleum derivatives may be used such as various fuel oils and the like. In place of the triethanolamine, other bases may be employed such as ammonium hydroxide and the like. In place of oleic acid, other oils and fatty acids may be used which, in combination with alkali form water soluble soaps and emulsify kerosene, including stearates, linseed oil, oleates and the like.

The essence of the invention is the use of a water soluble soap which will keep kerosene in emulsion with water, and the use of the emulsion thus obtained for cleaning metallic surfaces, prior to the processing with acid phosphate solutions to obtain chemical coatings on the metals.

What we claim is:

1. A process which comprises subjecting metallic surfaces to the action of a cleaning emulsion containing a petroleum derivative, an alkali soap and water, and thereafter applying to the metallic surfaces a chemical coating composition comprising dilute acid phosphates and oxidizing agents, to produce thereon corrosion-resistant, and paint-holding coatings integral with the metallic surfaces.

2. A process which comprises subjecting metallic surfaces to the action of a cleaning emulsion containing kerosene, triethanolamine oleate and water, and thereafter applying to the metallic surfaces a chemical coating composition comprising dilute acid phosphates, and oxidizing agents to produce thereon corrosion-resistant, and paint-holding coatings integral with the metallic surfaces.

3. A process which comprises subjecting metallic surfaces to the action of a cleaning emulsion containing petroleum derivative, alkali soap, soluble alkali and water and thereafter applying to the metal surface a chemical coating composition comprising dilute acid phosphates and oxidizing agents to produce thereon corrosion-resistant and paint-holding coatings.

4. A process which comprises subjecting metallic surfaces to the action of a cleaning emulsion containing petroleum derivative, an alkali soap and water, and thereafter applying to the metallic surfaces a chemical coating composition comprising acid phosphates to produce thereon corrosion-resistant and paint-holding coatings.
5. A process which comprises subjecting iron or steel surfaces to the action of a cleaning emulsion containing kerosene, triethanolamine oleate, and water and thereafter applying to the surfaces a chemical coating composition comprising acid phosphates to produce thereon corrosion-resistant and paint-holding coatings integral with the metallic surfaces.

6. A process which comprises subjecting iron or steel surfaces to the action of a cleaning emulsion containing a petroleum derivative, alkali soap, a soluble alkali and water, and thereafter applying to the surfaces a chemical coating composition comprising acid phosphates to produce thereon corrosion-resistant and paint-holding coatings integral with the metallic surfaces.

7. A process as described in claim 4 in which kerosene emulsion is sprayed on the iron or steel surfaces and thereafter a corrosion resistant paint-holding coating is obtained on said surfaces by spraying thereon an acid zinc phosphate coating solution containing an oxidizing agent, which will produce said coating in one minute.

VAN M. DARSEY.

HAROLD J. McVEY.