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PROCESS FOR CLEANING METAL SURFACES

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My invention relates to a process for cleaning surfaces of metal objects, especially objects still in the process of manufacture, and more particularly for removing "carbon smut" from cold rolled steel.

It is often desirable to produce an absolutely clean metallic surface. This is very important if the metal is to be electroplated, enameled, painted, or otherwise coated. There are also many other reasons for which proper cleaning is necessary.

It is quite easy to remove oils and greases, for example those used as lubricants or protective coatings, from metallic surfaces. This may be accomplished by dipping or spraying the metallic objects with a hydrocarbon or chlorinated hydrocarbon solvent. Satisfactory results may also be obtained by the use of alkalies or soaps or combinations of alkalies and soaps which saponify or emulsify the oils, these being applied in any suitable manner.

However, the oils and greases present on the surfaces of such metallic objects usually contain minute solid particles of dust, grit, carbon residues, abrasives, metal chips or the like which accumulate on the objects during the manufacture or fabrication thereof. These particles are hardly removed at all by the usual processes just described. These particles are generally unevenly distributed, as for instance they may appear where the metal has been touched by workers. These particles, particularly the smaller ones adhere tenaciously, even when all the oil has been removed from the metal and even from the particles themselves.

The particles cannot be dissolved, emulsified or saponified, and are not dislodged even by sprays of water. The only process heretofore known for removing such particles involves the wiping of every portion of the surface of the metal. This involves considerable labor and expense, whether it is done by hand as in the case of large objects or by tumbling with wiping materials for small articles.

A particular difficulty arises in the removal of particles of "carbon smut" from cold rolled steel. This metal always has a film of solid matter which is believed to be very small particles of carbon left on the surface after the removal by an acid bath of the scale produced by hot rolling and annealing. As the particles are part of the steel converted into scale or dissolved by the acid, they are of extremely small size and, being unaffected by the acid, adhere very closely to the surface.

These particles cause the steel to smudge when it is handled. Furthermore, they show up when the steel is plated and prevent proper adhesion of the deposited coating. Any smudges are easily visible through enamel or lacquer coatings.

The primary object of my invention is to provide a simple and inexpensive method for removing such solid particles from metallic surfaces. More particularly, I disclose a process for achieving this result without rubbing or wiping the metal. The preferred use of my procedure is for the removal of "carbon smut" from cold rolled steel.

I have discovered that metallic surfaces can be completely cleaned by first treating the surfaces with a solvent mixture which emulsifies readily in water, washing off this solvent, and then removing oil and grease in any well known manner. The solvent must be used before the oil and grease are removed, as otherwise the solid particles will not be completely washed off.

The essential requirement of the solvent mixture is that it must be such as to emulsify readily in water, and preferably in cold water. The solvent mixture should contain as its principal ingredient a solvent which will dissolve or be miscible with the oils and greases present on the surface to be cleaned. It should also include a soap, and preferably a blending agent which makes the soap soluble in the solvent. Water is usually employed in amounts sufficient to produce blending of the other ingredients.

More specifically, my preferred solvent mixture comprises:

1. A solvent which will be miscible with or will dissolve the greases, oils or the like present on the surfaces. This will be called hereafter a "grease solvent". It may consist of hydrocarbons, as kerosene, toluene or xylene; of chlorinated aliphatic hydrocarbons as carbon tetrachloride, ethylene dichloride; chlorinated aromatic hydrocarbons, as orthodichlorobenzene; or other suitable materials.

2. A soap; this may be ordinary soaps made from fats or oils and caustic potash or soda, or other soaps produced by neutralizing fatty acids with caustic soda or potash or their carbonates, ammonia, or amines such as triethanolamine, amylamine and ethylene diamine. Sulphonated oils may also be used as soaps. I prefer soaps which dissolve readily in cold water, as this prevents the mixture from forming a jelly and permits it to be washed off quickly and easily in cold water.

3. A blending agent which will cause the soap

to dissolve in the solvent. Cyclohexanol, pine oil, phenol, cresol, cresylic acid, or methyl, ethyl, butyl and other alcohols will give the desired results. Any material which acts as a mutual solvent for the soap and the "grease solvent" may be used, provided the resulting product is readily emulsified by water.

4. Water in an amount sufficient to produce a blending of the other three ingredients, giving a solvent mixture which forms an emulsion readily when poured into or gently mixed with cold water.

While the quantities of the different ingredients may vary greatly, I prefer to have the "grease solvent" make up from 85% to 95% of the total solvent mixture. A very efficient solvent mixture is composed of kerosene, soap made from oleic acid and caustic potash, cresylic acid and water. Preferably, enough alkali is included both to react with the oleic acid and to neutralize a substantial part of the cresylic acid so as to secure a mixture which emulsifies readily. It is quite obvious that mixtures of the various substances mentioned in each group or similar substances may be used instead of selecting only a single substance.

According to the process, the articles or surfaces to be cleaned are first coated with a solvent mixture of the type described. The solvent mixture is then washed off with water. The solid matter is thus removed, and the remaining grease and oil can then be cleaned off in any well known manner. It is necessary to use this solvent mixture before the grease and oil is removed, as otherwise the solid particles cannot be completely removed.

The solvent mixture can be applied by immersion, spraying or in any other manner. It is allowed to remain in contact with the metal long enough to saturate the grease and oil on the surface completely. From 5 to 30 seconds is usually sufficient, this time depending on the quantity and nature of the solid particles and oils present and the method of applying the solvent mixture.

The solvent is then washed off with water by immersion and agitation, by spraying, or in some other fashion. Care should be taken that none of this water is allowed to get into the supply of solvent mixture, as too much water will destroy its emulsifying properties. The solvent mixture is emulsified and completely washed off by the water.

For some reason, the emulsified solvent mixture carries off with it all the solid particles and leaves only the film of grease and oil on the metal. My theory is that the solvent mixture brings the soap into intimate contact with the solid particles, which are thus coated with soap. When the soap is dissolved by the water, the solid particles appear to be deflocculated and are thus carried away with the water.

After the solvent mixture is removed, the metal is cleaned of grease and oil in any suitable manner. This may be accomplished by means of an alkaline solution which will saponify and emulsify the oils, or by suitable hydrocarbon solvents in liquid or vapor form. Any further well known cleaning steps necessary to put the metal surfaces in condition for any particular purpose may then be carried out.

While I have spoken of metals and metal surfaces, it will be clear that I mean to include in these terms alloys as well as pure metals. Furthermore, where the term "grease" is used in the claims, I wish it to be understood that this lan-

guage is intended to cover greasy materials, including both greases and oils.

My invention broadly then consists in the step of removing the solid particles by applying a solvent mixture which is readily emulsified in water and washing the mixture off with water; particularly where this step is carried out before the removal of oils and greases in the usual manner.

While I have described herein some embodiments of my invention, I wish it to be understood that I do not intend to limit myself thereby except within the scope of the appended claims.

I claim:

1. A method of removing from the surface of metal objects, which are still in the process of manufacture, grease containing minute solid particles which accumulate on such surfaces during manufacture and fabrication of the objects, which comprises applying to such surfaces a solvent mixture which is readily emulsified in water, said mixture comprising substantially 85% to 95% grease solvent, a soap, a blending agent and water, washing off such mixture with water, thereby removing solid particles from the surface while leaving a thin film of grease thereon, and then removing such film of grease from the surface.

2. A method of removing from the surface of metal objects, which are still in the process of manufacture, grease containing minute solid particles which accumulate on such surfaces during manufacture and fabrication of the objects, which comprises applying to such surfaces a solvent mixture which is readily emulsified in water, said mixture comprising substantially 85% to 95% grease solvent, a soap, a blending agent and water, leaving such solvent mixture in contact with the surface long enough to saturate the grease thereon, washing off such mixture with water, thereby removing solid particles from the surface while leaving a thin film of grease thereon, and then removing such film of grease from the surface.

3. A method of removing from the surface of metal objects, which are still in the process of manufacture, grease containing minute solid particles which accumulate on such surfaces during manufacture and fabrication of the objects, which comprises applying to such surfaces a solvent mixture which is readily emulsified in water, said mixture comprising substantially 85% to 95% hydrocarbon grease solvent, a water-soluble soap, a blending agent and water, washing off such mixture with water, thereby removing solid particles from the surface while leaving a thin film of grease thereon, and then removing such film of grease from the surface.

4. A method of removing from the surface of metal objects, which are still in the process of manufacture, grease containing minute solid particles which accumulate on such surfaces during manufacture and fabrication of the objects, which comprises applying to such surfaces a solvent mixture which is readily emulsified in water, said mixture comprising substantially 85% to 95% kerosene, an oleic acid soap, cresylic acid and water, washing off such mixture with water, thereby removing solid particles from the surface while leaving a thin film of grease thereon, and then removing such film of grease from the surface.

5. A method for cleaning cold rolled steel the surface of which is coated with grease and solid

particles of "carbon smut", which comprises applying to the surface of the steel a solvent mixture which is easily emulsified in water, said mixture comprising 85% to 95% hydrocarbon grease solvent and the balance principally a soap, a blending agent and water, washing off said mix-

ture with water, thereby removing the solid particles of carbon smut from the surface of the steel while leaving a thin film of grease on said surface, and then removing such film of grease from the surface of the steel.

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