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METHOD OF REMOVING FOREIGN MATTER
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poration of OhioNo Drawing, Application September 3, 1938,
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This invention relates to a method of removing foreign matter from metal articles and particularly to a method of removing from metal articles superficial films of carbon, dust, and films such as stearates of lead, zinc, magnesium and lime, and other oil and grease films with which metal articles become coated during forming, drawing, buffing and other manufacturing operations.

One of the principal objects of the present invention is to provide a simple and inexpensive method for removing such foreign matter quickly and efficiently without scrubbing.

A more specific object is to provide a method whereby both the films and superficial carbon can be removed at the same time from the articles without scrubbing.

Other objects and advantages will become apparent from the following specification:

In the manufacture of metal articles from steel or other metal stock in the form of wire, rod, or other blanks, the stock usually is formed into the desired shape by drawing, stamping, folding and like operations and in all of these operations, the stock must be lubricated. Many articles, though formed by other operations and without lubrication, are often subjected to buffing operations preparatory to plating, enameling and the like.

The lubricants and compounds used in drawing, forming, buffing, burnishing and polishing and the like include oils, greases, and waxes, which, during operations on the metal to form the articles, adhere to the surface of the articles in the form of very tenacious films. These films must be removed preparatory to any plating operations.

Again, due to the mechanical action of the forming and drawing dies, a certain amount of carbon is freed from the metal or dies or both and becomes mixed with the lubricant and thereby is held on the article in the form of superficial carbon films or granules. The same is true of pigments in the compounds, dust, and other foreign matter.

In the case of ordinary plating of metal articles, the article is subjected to a buffing or burnishing operation after plating. These operations cause the plating material to flow and consequently any superficial carbon, pigment, and dust films which otherwise would cause discoloration of the finished plated surface are obscured so that they do not deleteriously affect the appearance of the finished surface.

In the case of "bright" plating, however, the

article is not subjected to any buffing or burnishing operation after plating. Consequently, if any superficial carbon, pigment, dust and like films remain on the article when it is introduced into the plating bath, such films show through the plated surface, giving it a very undesirable blotched appearance.

In cyanide plating, a cyanide plating bath, such as copper cyanide, zinc cyanide and the like is used. In this type of plating the removal of the carbon, pigment, dust and like films is not so necessary in many instances because if the article is subjected to the cyanide plating bath for a sufficient period, the cyanide bath will deoxydize or remove such superficial foreign matter. However, it often is desirable that the finished article have a very accurate finished dimension and that the plating coat be in excess of a predetermined minimum thickness for purposes of durability, and allowance must be made for the thickness of the plating material. The thickness of the plating coat can be controlled accurately only by controlling the time of exposure of the article to the bath. If superficial foreign matter is present on the article or any appreciable amount of grease, wax, or oil is present on the article, part of the time of exposure of the article in the cyanide bath is lost due to the fact that the bath first removes the films and foreign matter and only when they are removed does the plating actually begin. Consequently, even in the case of cyanide plating, when accurate dimensions are required in the finished article or when a predetermined minimum thickness of plating coat is required for durability, it is necessary to remove the films and other superficial foreign matter so that the thickness of the coating can be accurately determined from the length of time of the exposure of the article in the bath.

Therefore, it is necessary in all types of plating that the films of grease, oil, wax, and like foreign matter be removed, and in most types of plating, it is necessary, or at least desirable, that the foreign matter such as the superficial carbon, dust, pigment and other films also be removed. In all instances it is desirable that this removal be effected preparatory to the introduction of the article into the plating bath.

Generally, the lubricants and compounds mentioned include stearates, such as stearates of lead, zinc, magnesium, lime and other metals. Such stearates have a high melting point and consequently become firmly attached to the metal stock during the drawing, forming, buff-

ing and burnishing operations so that when the article is formed and ready for plating and enameling, its surface is usually coated with a very tenacious film of the stearate or other greases and waxes present. Likewise the superficial carbon, pigments, dust and other films, above mentioned, adhere to the lubricant films but even if the latter are removed, the carbon and other foreign matter mechanically cling to the article and must be removed in some manner.

At present there is coming into use a steel known as "lead steel" which, in its composition, includes lead as a lubricant for subsequent forming and drawing operations. This particular type of steel is especially difficult to free from foreign matter.

Removal of such foreign matter by scrubbing with chemical cleaning agents has not been entirely satisfactory because of the time and expense required for the scrubbing operation.

Solvents for stearates, alkali cleaning baths and the like have been used but these have not accomplished the desired result efficiently.

Again, some prior cleaners capable of removing the stearate and other grease films to a degree permitting certain types of plating and enameling of the articles do not remove the other foreign matter, such as the superficial films of carbon, pigment, dust, and the like.

All such foreign matter can be removed by the present method which comprises heating the article for a predetermined interval or period of time by subjecting it to a heated bath or spray of liquid, such as oils and oil derivatives, waxes and other materials, which are liquid at the temperature required, and then withdrawing the article from the heating liquid bath or spray and subjecting it, in heated condition, to a bath or spray of liquid detergent cleaner, such as an aqueous alkali cleaning solution, which is at a temperature below that of the heating liquid, and preferably just below the boiling point of the liquid cleaner. The temperatures of the baths preferably are such that the added heat of the article causes violent, localized boiling action of the liquid cleaner at the surface of the article. No other operations are necessary to remove the stearate films and superficial carbon completely.

Preferably, the temperature of the heating spray or bath always is higher than the temperature of the liquid cleaner as this results in quicker and more effective cleaning action and even removes the superficial carbon, dust, pigment, and the like as well as foreign matter, such as the oil, grease and wax films.

Very desirable results are obtained by subjecting the article to oil as a heating liquid, the oil preferably being at about 250° F., though the oil may be heated to just below its flashing point, if desired, and then quenching the article, while it is in heated condition, in a heated liquid cleaner such as an aqueous alkali cleaner which is between 212° and 220° F., that is, about the boiling point of the particular cleaning solution and sufficient to prevent congealing of the oil or heating liquid which is on the article from the preceding operation. The higher the temperature of the heating liquid relative to the quenching and cleaning liquid, the more rapid is the removal of all foreign matter.

The time during which the article is subjected to the heating bath is dependent upon the thickness and volume of the metal, the thicker requiring greater time of exposure to the heating

oil or bath. For very small articles, a two-minute period of exposure to the heating bath is entirely adequate.

Generally it is desirable to subject the article to the heating bath for a sufficient period to bring the temperature of the article substantially up to the temperature of the heating bath or to a temperature such that, even after the loss of heat during transfer of the article from the heating bath to the liquid cleaner, the article is sufficiently heated to cause the violent, localized, boiling of the detergent cleaner at the surface of the article. The localized boiling action of the cleaner is much more rapid and violent than can be obtained by heating the cleaner by extraneous means in any manner suitable for commercial production. Furthermore, the transfer of heat from the article to the cleaner, instead of from the cleaner to the article, appears to accelerate the cleaning action by effecting a mechanical removal of any superficial foreign matter.

Exactly how the removal of the films, superficial carbon, and such foreign matter is effected so quickly is not fully understood but it is known that when the articles are removed from the heating bath and placed in the relatively less heated cleaning bath, the reaction is somewhat explosive in character and is accompanied by excessive localized bubbling and steaming at the surface of the article and a blowing off of all foreign matter, such as the films, superficial carbon, pigments, stearates, and the like.

The heating liquid is preferably one having a high boiling and volatilization point. Mineral, vegetable or animal oils or derivatives and mixtures thereof are preferred as a heating liquid and appear to have a very beneficial effect on the surface of the article. Mineral oil is very desirable because it is less expensive than other available liquids having the necessary characteristics. Comparative tests of animal oils, fish oils, cotton seed oil and ordinary paraffine lubricating oils indicate that the ordinary paraffine oil is as satisfactory as the other oils. The heating liquid may be a material which is not technically a liquid but which liquefies at the temperature required herein.

If desired, some volatile, high vaporizing solvents for grease, such as are well known and available on the market may be included with the oil but are not necessary and it does not appear that the additional cost is warranted.

For the aqueous cleaning bath any of the well known alkali commercial cleaners may be used. For example, cleaners which are primarily caustic soda or soda ash, trisodium phosphate or combinations thereof, with emulsifying agents, are quite satisfactory.

The maintenance of the temperature of the oil greater than that of the aqueous alkali cleaning solution, while assisting in the eventual removal of the grease films, is more important in effecting removal of superficial carbons, pigments and such foreign matter, in the same subsequent dipping operation so that the one two-step cleaning operation is all that is necessary for removing both the films and the superficial foreign matter.

After the cleaning operation herein described, if the article is to be plated, it may, before plating, be subjected to the usual well known practice of rinsing with cold or lukewarm water, then, if desired, pickling or cleaning electrolyti-

cally in an alkali bath, and finally rinsing with water.

I claim:

1. The method of removing foreign matter such as greasy substances, superficial carbon, wax and soaps, from metal articles, comprising heating the article to a temperature materially above the boiling point of water by subjection of the article to hot oil, and then, before the article has lost an appreciable portion of the heat so imparted, immersing the article in an aqueous alkaline cleaning solution having a boiling point materially below the temperature of the article when immersed and which solution is heated to nearly the boiling point thereof and which is

adapted for removing from metal such foreign matter as mentioned.

2. The method of removing foreign matter such as greasy substances, superficial carbon, wax and soaps from a metal article comprising heating the article for a predetermined period by immersion in a bath of oil for a sufficient time to raise the surface of the article to a temperature materially above the boiling point of water, and immediately thereafter quenching the article by dipping the article in an aqueous alkaline detergent bath heated to about the boiling point of said bath.

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