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METAL CLEANER

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The present invention relates to an improved method for treating metallic surfaces and to a material for use with the method, relating more particularly to a method and material for cleaning and at the same time coating a metallic surface with a metal, that is, of cleaning and also applying a fusible metal to the said metallic surface. Thus, the method and material may be used for soldering purposes.

It is well known that a metallic surface cannot be satisfactorily coated with a metal or the latter fused therewith unless the surface being treated is thoroughly and scrupulously cleaned. The presence of a film of metallic oxide or of oil, dirt, rust, paint, or other foreign substances on the treated surface will prevent or seriously hamper the said coating or fusing. Consequently, heretofore it has been necessary first to clean the surface to be treated and thereafter to coat it. For instance, a mechanical cleaning operation, such as treatment with a revolving wire wheel, sand blasting, or the like, or a chemical cleaning operation, such as pickling, the use of cleaning agents, such as hydrochloric acid, trisodium phosphate, emulsifying agents, or the like, have been utilized in this separate initial cleaning step. For instance, a cleaning agent of this general type called a flux has been employed to date in soldering operations, that is, for operations where metals are united or joined by means of another and more fusible metal or alloy.

It is, therefore, one object of the present invention to render unnecessary an initial cleaning operation of the type discussed above and to provide an improved method for cleaning and at the same time for coating a metallic surface with a metal.

It is another object of the invention to provide a method of the general character specified for fusing a metal with the metallic surface under treatment and thus to provide a soldering method which makes the use of a separate soldering flux or pre-cleaning operation unnecessary.

It is a further object of the invention to provide a material for use with the above referred to method which renders the same operative, capable of being put into practice and applied in a practical, useful manner. This material may be in a powdered or a stick form and, as suggested above, may be utilized as a solder.

It is a still further object of the invention to provide a method and material of the foregoing character which is economical and convenient in use; one which may be utilized readily and effectively with a surface having foreign material deposited thereon, such as dirt, oil, rust, paint, and the like, or with a clean surface; and one which may be so adapted that it may be used with any metallic surface.

Other objects of the invention will appear from the following description and appended claims.

In explaining in detail the present invention it is to be understood that the phraseology or terminology herein employed is for the purpose of description and not of limitation, that known equivalents of the ingredients herein specified may be substituted therefor, and that the invention is not expressly limited by the terms of the claims except as construed in view of the prior art.

My method for cleaning and at the same time coating a metallic surface with a metal is very simple and convenient. It is as follows: The surface to be treated is first heated to above the melting point of the material used with the method, which material is fully described hereinafter. This melting point is substantially the same as that of the fusible metal or fusible alloy which constitutes one ingredient of the same material and may be readily estimated inasmuch as this ingredient, as pointed out hereinafter, is a conventional one such, for example, as plumber's solder. Consequently, the melting point of this ingredient and, therefore, of my material is well known to one skilled in the arts relating to metal coating and in any event can be easily determined by a few simple experiments. For instance, this melting point for the examples of the present invention given in the latter passages of the present specification is at or about 320° F. It will be appreciated, however, that this melting point may vary depending upon the fusible material or alloy employed. Any suitable heating means may be employed for heating the surface to be treated although a soft flame has been found to be preferable in many cases.

To the heated surface is applied my material and this material may be so applied by any suitable means. However, where the surface to be treated has foreign substances deposited upon it such as dirt, paint, rust, oil, or others, it is desirable to apply the material by means of a wire brush, steel wool, or the like. But it should be expressly understood that under no circumstances is it necessary to first remove these foreign substances by an initial separate cleaning operation. The material is merely applied and spread over the surface to be treated through the aforesaid brush or the like as the applying means or implement. Moreover, the use of an applying

means of this character is simply preferable or desirable. It is not indispensable. Where the surface to be treated is clean, for example, where new or formerly unused metal surfaces are to be treated, my material may be applied and spread by means of a cloth which is preferably, although not necessarily, damp. However, in this instance also many suitable applying means may be employed.

The amount of my material which is applied to the surface to be treated depends upon several factors, notably the condition of the said surface, that is, the nature and amount of any foreign substances which may be deposited on it, the character of the surface, that is, what metal it is made up of, the depth of the coating which is desired, and the purpose of the coating, such for instance as whether or not it is to be utilized for soldering an additional element thereto or merely to cover a part of the surface. To illustrate: Where the surface to be treated is comparatively clean and a thin coating only is desired, a relatively small amount of material may be applied. On the other hand, where the surface has a comparatively large amount of foreign substances on it or where a relatively thick coating is desired, more of my material should be applied. It is, therefore, apparent that one skilled in the art keeping the foregoing factors in mind may readily determine how much of the material is necessary in order to suit his purposes satisfactorily.

After my material has been applied the surface is allowed to cool and will then be effectively coated or "tinned" as it is often called in the art. If desired, the treated surface may then be wiped clear or otherwise cleaned to remove any excess material or reaction products which might be present.

My material used with the above described method is as follows: It is made up of three ingredients or constituents which, generally speaking, are a fusible metal or alloy; one or more of the chemical group or family called ammoniates or ammines (not amines); and a soldering flux. By the term or expression "soldering flux" is meant for present purposes a conventional flux used for soldering purposes, that is, a substance capable of causing the aforementioned fusible metal or alloy to melt and/or flow more readily as well as to act as a cleaning agent for the surface under treatment and to protect the material applied thereto from the formation of oxides during the treatment. For example, zinc or ammonium chlorides, borax, various resins such as rosin, cryolite, and other substances too numerous and too varied in nature to mention expressly, are well known as soldering fluxes and are contemplated herein.

The above referred to ammoniates or ammines are not normally employed as soldering fluxes or thought of as falling within that classification and for present purposes are considered to constitute a separate and different class.

The proportions or percentages of each of the above referred to three ingredients or constituents of my material are given hereinafter as well as the way of forming this material from these ingredients. In addition, typical examples of particular materials are given.

Referring more particularly to the aforesaid fusible metal or alloy, this ingredient or constituent of my material may be any one of the well known metals or alloys answering this description. A solder, for instance, may be employed. As is well known, solders are of widely different compositions all of which are well known and familiar to one skilled in the art and are contemplated herein. To illustrate, ordinary plumber's solder, that is, an alloy consisting of approximately 70% lead and 30% tin by weight is satisfactory. However, this is but one illustration and the proportions may be varied. This alloy is particularly useful as an ingredient in my material where the present invention is to be used for coating iron, steel, aluminum and alloys made up chiefly of these materials although not necessarily restricted to surfaces of this nature. Other fusible metals or alloys which may be employed are the following: Five parts of tin to one part of aluminum, by weight, which is particularly useful for coating aluminum surfaces. The so-called copper or brass solders may be used especially, of course, where the material to be treated is formed of brass or copper. Typical of such alloys are copper 58 parts and zinc 42 parts, by weight; brass 7 parts and zinc 1 part, by weight; zinc 49 parts, copper 44 parts, tin 4 parts, lead 2 parts by weight; and others of a similar nature. German silver solders may also be used, such for example as silver 5 parts, zinc 5 parts; or copper 4.5 parts, zinc 7 parts and nickel 1 part, the aforesaid proportions being by weight. Alloys suitable for use with gold, silver and platinum are also well known and are suitable as an ingredient in my material where the present invention is to be used on the precious metals.

In view of the foregoing, it is apparent that a large variety of fusible metals or alloys may be used as an ingredient in my material, all of which are well known. This ingredient may be selected from these metals or alloys to suit the surface to be treated and a person skilled in the art can readily predict the most satisfactory one for his purposes or by a few simple experiments readily determine which substance to use.

Referring now to the second ingredient of my material, namely, an ammoniate or ammine, one or more of the chemicals of this group or family may be utilized. An ammine or ammoniate is one of a group of complex inorganic metal-ammonia compounds which may be regarded as metal salts with ammonia playing the role of the "water" of crystallization as $CoCl_3 \cdot 6NH_3$ which may also be written as $Co(NH_3)_6Cl_3$. Naturally, many of these compounds are known and practically any metallic salt will form them. The amount of ammonia present in these compounds varies somewhat, much as the amount of water varies in water of crystallization. The following are some typical examples:

$ZnCl_2 \cdot 5NH_3$	$Cu(NH_3)_4Cl_2$
$Zn(NH_3)_6(OH)_2$	$Fe(NH_3)_6(SO_4)_3$
$AgCl \cdot 2NH_3$	$Zn(NH_3)_4Cl_2 \cdot H_2O$
$CaCl_2 \cdot 8NH_3$	

While I have found that any one of these compounds is satisfactory for my purpose, zinc ammoniate also called zinc and ammonia chloride or zinc of ammonia, believed to be $ZnCl_2 \cdot 5NH_3$, has been found to work particularly well and is, therefore, recommended, although others of this group are also operative.

The third ingredient of my material, namely, a soldering flux has been fully discussed hereinbefore and any of the conventional fluxes used for soldering purposes, all of which are well known and are familiar to one skilled in the art, can be employed and are contemplated. I have found, however, that ammonium chloride and

zinc chloride give particularly good results and are, therefore, recommended.

An explanation of the way of forming my material from the aforesaid ingredients as well as the proportions or percentages of each of these ingredients follows: This material may be prepared, in general, in two forms, as a powder and as a stick. Referring to the powder, each of the ingredients is first prepared in powdered form which means that the fusible metal or alloy is first powdered while the other ingredients are used in their natural condition. Any suitable means may be employed for powdering the said fusible metal or alloy. For example, if plumber's solder is used one convenient way of powdering it is to melt the same, allow it to cool and while cooling to stir it so that it will crumble. It may then be beaten or shaken as in a bag whereupon it will become powdered. However, this is but one means of powdering this ingredient and, as stated, any suitable means for so doing may be employed. In forming my material in powdered form each of the ingredients described above is simply mixed together in preselected proportions. These proportions are critical only within very wide limits and 10 to 50% of each ingredient may be employed. For normal purposes 33⅓% of each is recommended. However, where a particularly heavy coating is desired or where the surface to be treated possesses an unusually large amount of foreign substances deposited upon it, it is recommended that 40% of the fusible metal or alloy be employed together with 30% of each of the other ingredients.

My material may also be prepared in stick form and any suitable means of providing the same may be employed. For instance, a powder prepared in the manner described above may be pressed so as to form a stick. Where that powder contains a deliquescent substance such as zinc chloride or zinc and ammonia chloride this powder may be placed in a form or mold whereupon it will become moist on exposure to the air and thereafter dry out so that the particles will adhere to each other to a sufficient extent to form a self-sustaining stick. If desired, water may be added to the powder in order to mold it whereupon it will form a stick on drying out. Another satisfactory way to prepare my material in stick form is to take a thin sheet of the fusible alloy or metal and spread the mixture of the other two ingredients upon the same in sufficient quantities to provide the correct proportion by weight thereof. These proportions should fall within the ranges given above. The said sheet of metal is then rolled tightly and crimped at each end. When used, the desired amount of the material thus prepared in stick form is melted off whereupon the end of the stick is self-sealing and ready for another operation.

Having thus defined my method and material, the following particular examples thereof are given. It is to be expressly understood, however, that these examples are presented by way of illustration and not of limitation.

Example I.—Ammonium chloride 30%, zinc and ammonia chloride 30%, plumber's solder 40%. This material is particularly useful where the surface to be treated possesses a relatively large amount of foreign substances upon it.

Example II.—Ammonium chloride 25%, zinc and ammonia chloride 25%, plumber's solder 50%. This compound is particularly useful where the surface to be treated is clean and is especially useful in uniting the free ends of wires for electrical wiring purposes.

Example III.—Borax 33⅓%, copper ammoniate, believed to be $Cu(NH_3)_4Cl_2$, 33⅓%, a copper solder 33⅓%.

I claim:

1. A material for treating metallic surfaces comprising a soldering flux, an ammoniate, and a material selected from a fusible metal or a fusible alloy.

2. A cleaning and soldering or metal coating material for metallic surfaces comprising 10 to 50% of a powdered solid soldering flux, 10 to 50% of an ammoniate, and 10 to 50% of a material selected from a powdered fusible metal or a powdered fusible alloy, the aforesaid percentages being by weight.

3. A cleaning and soldering powder for coating a metallic surface with a metal comprising a mixture of 10 to 50% of ammonium chloride, 10 to 50% of $ZnCl_2 \cdot 5NH_3$, and 10 to 50% of a powdered solder, the aforesaid percentages being by weight.

4. A cleaning and soldering powder for coating a metallic surface with a metal comprising a mixture of 30% of ammonium chloride, 30% of $ZnCl_2 \cdot 5NH_3$, and 40% of plumber's solder, the aforesaid percentages being by weight.

5. A cleaning and soldering powder for coating a metallic surface with a metal comprising a mixture of 25% of ammonium chloride, 25% $ZnCl_2 \cdot 5NH_3$, and 50% of plumber's solder, the aforesaid percentages being by weight.

6. A cleaning and soldering or metal coating material comprising a stick-like mass of adhered particles consisting of 10 to 50% of a powdered solid soldering flux, 10 to 50% of an ammoniate, and 10 to 50% of a material selected from a powdered fusible metal or a powdered fusible alloy, the aforesaid percentages being by weight.

7. A method of treating metallic surfaces which comprises the heating of the surface and thereafter the application thereupon of a material consisting of an ammoniate, a soldering flux, and a material selected from a fusible metal or a fusible alloy, the said heating being approximately to the melting point of the said fusible metal or fusible alloy.

8. A method of cleaning and at the same time metal coating or soldering a metallic surface which comprises the heating of the surface and thereafter the application thereupon of a material consisting of 10 to 50% of a powdered solid soldering flux, 10 to 50% of an ammoniate, and 10 to 50% of a material selected from a powdered fusible metal or a powdered fusible alloy, the aforesaid percentages being by weight, the said heating being approximately to the melting point of the said fusible metal or fusible alloy.

9. A method of cleaning and at the same time of coating or soldering a preselected metallic surface, which comprises the heating of the said surface and thereafter the application thereupon of a material consisting of 10 to 50% of a powdered solid soldering flux, 10 to 50% of an ammoniate, and 10 to 50% of a material selected from a powdered fusible metal or a powdered fusible alloy, the aforesaid percentages being by weight, the said flux and fusible metal or fusible alloy being selected to operate satisfactorily with the treated surface and the said material being applied in amounts sufficient to cover that surface evenly and to produce a metal coating of a desired thickness.

10. A method of cleaning and at the same time

of coating or soldering a preselected metallic surface, which comprises the heating of the said surface and thereafter the application upon the heated surface of a material consisting of 10 to 50% of ammonium chloride, 10 to 50% of $ZnCl_2 \cdot 5NH_3$, and 10 to 50% of plumber's solder, the aforesaid percentages being by weight, and the said material being applied in amounts sufficient to cover the said surface evenly and to produce a metal coating thereon of a desired thickness.

11. A method of cleaning and at the same time of coating or soldering iron, steel, aluminum or alloys thereof, which comprises heating a preselected one of the aforesaid metals to approximately 320° F., applying by means of a rough surfaced implement a material consisting of 30% of ammonium chloride, 30% of $ZnCl_2 \cdot 5NH_3$, and 40% of plumber's solder, the aforesaid percentages being by weight, and allowing the treated metal to cool, the amount of the said applied material being selected to coat the metal under treatment evenly and to produce a metal coating of a desired thickness.

12. A method of cleaning and at the same time of metal coating or soldering a metallic surface, which comprises the heating of the surface and thereafter the application thereupon of a material consisting of a stick-like mass of adhered particles which is made up of a material consisting of 10 to 50% of a powdered solid soldering flux, 10 to 50% of an ammoniate, and 10 to 50% of a material selected from a powdered fusible metal or a powdered fusible alloy, the aforesaid percentages being by weight, the said heating being approximately to the melting point of the said fusible metal or fusible alloy.

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