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METHOD FOR BRIGHT METAL PLATING

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The invention relates to improvements in methods for bright metal plating of various articles without the use of electric current or molten metal.

The bright metal plating of objects consists essentially of tumbling the objects in a mill with finely divided metal and an oily liquid or other lubricating material, with or without balls, for impacting the finely divided coating metal on the object and converting the impacted coating metal into a continuous coating or covering on the object.

It has been found that small objects, such as bolts, nuts, screws and the like, may be satisfactorily plated with a continuous coating or covering of zinc, or other metal, without the use of balls, the small objects operating to impact the finely divided metal on the objects and produce a continuous coating or plating of such objects.

The suitability of this plating method is not the same for all metals but varies considerably. In some cases, such as, for example, brass powder plates on steel objects very satisfactorily, and the brass does not plate so well on itself, and the coating does not continue to increase in thickness as it does with other metals of which zinc is the best example. Of all the metals on which the present method has been tried, zinc is the most satisfactory for building up thick coatings; coatings exceeding 3.4 ounces of zinc per square foot being readily obtainable. Coatings of this weight are heavier than the normal heaviest electrolytic or hot-dip coatings.

Practically any small steel, ferrous, or other metallic object may be coated by the present method. The first step in the operation is to remove all rust, scale or loose material and to activate the surface of the metal. A satisfactory way of accomplishing this purpose is to pickle the objects in ordinary muriatic acid and wash.

The objects for plating are next placed in a ball mill. The mill is charged with small steel balls approximately $\frac{1}{8}$ inch to 1 inch in diameter. Finely powdered zinc dust is added to the grinding media, which consists of any volatile liquid, such as xylol, naphtha, mineral spirits or a hydrocarbon, and which contains a percentage of vegetable seed or marine oil or a fatty acid derived from an organic oil, such as clupanodonic or oleic acid or linoleic acid or other high molecular weight long carbon chain fatty acid, preferably with one or more double bonds.

The mill is then closed and rotated. A bright metallic zinc coating, which may be made mirror bright and which under the microscope shows a solid layer of metallic zinc is built up. Under these conditions the steel balls become heavily coated with zinc and the inside of the mill itself becomes completely lined with zinc. It is not necessary to apply any heat. The action is one

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of impacting or hammering the zinc into a solid metallic coating on the steel objects.

It has been found that large steel balls, say 1 inch in diameter, are satisfactory, but the desired result seems to be best accomplished by a great multiplicity of impacts from a tremendous number of small diameter balls.

Apparently the zinc coating of the balls does not have any effect on the coating of the objects other than of preventing contamination of the metal powder with iron. Were it not for this zinc coating of the balls which takes place automatically, the continued re-use of the zinc for coating purposes would lead to its heavy contamination with iron.

It has been found that when the vegetable oil or its equivalent is omitted from the charge, the method does not result in a continuous coating of the objects, nor is the metal deposited on the objects bright. It has been found that a major improvement over the plain use of oil is achieved by substituting for the oil a fatty acid derived from an organic oil. In particular it has been found that double distilled white linseed acids greatly enhance the plating action of the mill, and also increase the brightness of the deposited coating. It is rather remarkable that an oil or fatty acid which is an extremely slippery lubricating material should be effective in applying a metallic coating to a metal object. On the face of it, it would appear that if it were desired to apply a metal coating by hammering or rolling with small balls, the last thing for use to accomplish this end would be a lubricating oil.

For successful metal plating in the tumbling mill, it has been found that the volume of liquid to metal powder is extremely important. A large range is permissible and different effects result where the quantity of liquid used is small and where the liquid to metal ratio is large. If too little liquid is used, the mixture is pasty. The material may then pack loosely around the article being plated and it is then shielded from further action; on the other hand, if a large excess of liquid is used, the coating time is increased and the metal deposited on the articles tends to be more brittle and to chip more easily. Expressed as parts by weight, a very satisfactory mixture is 5 parts of powdered metal to 4 parts of liquid, the liquid being a mixture of fatty acid dissolved in some suitable carrier, such as naphtha, mineral spirits etc. The range which has been found advantageous is 7 parts powdered metal to 1 part liquid and 1 part powdered metal to 4 parts liquid. The proportion of 7 parts powdered metal to 1 part liquid gives a rather pasty mixture and the proportion of 1 part powdered metal to 4 parts liquid makes a very liquid medium.

It has been found that the most rapid plating occurs when the ball to metal ratio is 2 to 1. However, increasing this ratio has the effect of mak-

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ing the metal coat smoother and brighter. As the weight of balls to metal increases, so does the finish of the plating, but the weight of the coating deposited on the objects decreases. Satisfactory plating occurs if the ratio of balls to metal does not exceed 8 to 1, but plating will occur even when the ratio of balls to metal is 15 to 1. Actually the range of balls to metal may be 0 to 15 to 1. Where no balls are used, the small objects being plated serve the same purpose as balls. In other words, when plating a charge of small wood screws, for example, these screws are adapted to take the place of balls. This would simplify the process in that it would not be necessary to separate the screws or other small objects from any steel balls and the screw or other small objects would be very nearly as effective. When working on wood screw having screw threads with sharp edges or other objects having sharp edges, the ratio of the zinc coating powder to the metal of the objects being plated must be increased in order not to wear the sharp edges of the screw threads or sharp edges of other objects. The amount of metallic powder supplied to the ball tumbling mill is always in excess of that necessary to coat the objects being plated and a continued operation of the mill after the plating of the objects will convert the excess metallic powder into metal flakes having smooth, bright surfaces. The flakes which are simultaneously produced with the plating of the objects may be removed and used as a pigment.

The use of small balls is especially advantageous in the plating of irregular shaped objects having exterior and interior surfaces inaccessible with large balls of the size customarily employed in ball mills. By using shot or small balls a good coating of such irregular shaped objects, both exteriorly and interiorly thereof, is effected.

A very satisfactory temperature range in which to operate the plating mill is from 90° F. to 100° F. This refers to the ambient temperature around the mill. With decreasing temperatures it has been found that the character of the deposited plate or coating tends to change. When the temperature falls, the plating or coating is less homogeneous and may lose its character of a solid metal continuous deposit and become more an aggregate of particles cemented to the object being plated. Also as the temperature falls, plating is slower. The use of higher temperatures tends to promote the generation of pressures within the ball mill which may be fitted with a one-way pressure relief valve. The ball mill may be operated within a temperature range of from 50° F. to 150° F.

It has also been found more satisfactory to exclude air from the interior of the mill and operate with the mill sealed. The exclusion of air is not necessary for plating, but is highly desirable and permits bright metal plating.

The small steel shot or balls serve to hammer the metal on the objects being plated. The finished object looks as if it had been electrolytically deposited and then buffed or polished. The coating is completely adherent and will not rub or wash off or break or fracture under various strains and flexures.

The coating of the steel balls, besides preventing contamination of the metallic powder through continuous use, eliminates wear of the balls and the necessity of replacing the same. The coating of the balls is self-renewing and if removed or broken, it reforms. The surface of the steel balls may be activated through an acid pickle and wash, the same as the objects to be plated.

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It is not necessary that the balls be specially case hardened nor is it necessary that they receive a special bright or polished surface because a bright and polished surface is achieved by the processing of the metallic powder.

In the processing of these finely divided dusts, the use of very small balls is desirable because large balls lead to excessive grinding of the powder and do not provide sufficient surface unless present in excessive quantities. With large balls the steel grinding load usually exceeds that of the metal being processed, sometimes as much as 10 or 20 times. The use of such an excess of balls results in a heavy erosion of the grinding media with the resulting contamination of the product. The use of small balls or steel shot is normally not considered possible because the wear and tear on this type of grinding media would be excessive. Moreover, the high technical cost of the development of suitable surface characteristics, such as hardness, smoothness and luster on small balls would be excessive. This invention sets up conditions which coat the small steel balls with the metal being processed so that in effect the grinding or polishing is accomplished without the grinding medium coming in contact with the processed material at all. The use of ordinary steel shot such as is used in shot blasting operations is very much cheaper than any comparable material of the same size and permits processing of extremely fine dust which could not be accomplished if ball diameters such as are customarily used in ball mills are employed. No iron contamination will be found in the product.

What is claimed is:

1. A method of mechanically plating metal articles comprising intermixing metallic powder particles with an organic liquid containing dissolved therein a percentage of lubricating material selected from the group consisting of vegetable seed oils, marine oils, and fatty acids derived from organic oils, the metallic powder being in proportion between one-fourth and seven times the liquid by weight, and tumbling said mixture of said articles and powder particles and liquid at a temperature between 50° and 150° F. to impact the particles onto the surface of said articles into a solid metallic coating thereon.

2. A method of mechanically plating metal articles as set forth in claim 1 in which a charge of pieces of impacting material is added to the mixture in a proportion not exceeding eight to one parts by weight with relation to the weight of the metallic powder and metal articles.

3. A method of mechanically plating metal articles as set forth in claim 1 in which air is excluded from the mixture during the tumbling operation.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
745,224	Morton	Nov. 24, 1903
933,324	Mowry	Sept. 7, 1909
1,197,695	Watkins	Sept. 12, 1916
1,806,128	Stewart	May 19, 1931
2,075,518	Gettleman	Mar. 30, 1937
2,080,346	Tainton	May 11, 1937
2,378,588	Skehan et al.	June 19, 1945

FOREIGN PATENTS

Number	Country	Date
534,888	Great Britain	Mar. 21, 1941