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PROCESS FOR TREATING POROUS METALLIC PARTS

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This invention relates generally to a process for treating metallic parts and particularly to a process for treating extremely porous metal parts made by fusing powdered iron under pressure.

In machine manufacturing industries and others, the saving that can be achieved by using parts made by the powdered metal process is well known as is also the difficulties that are encountered when it is attempted to harden and plate such parts. Insofar as we are aware, the successful plating of hardened powdered metal parts has not heretofore been accomplished. The difficulty stems basically from the high degree of porosity of the metal, and the unusually deep and varied shaped pores. When such a part is heat treated and quenched, for example, in oil, the oil impregnates the deep pores of the metal and cannot be entirely removed by any known practical method. As a consequence, not only does the oil impede successful plating of the parts, but contaminates the plating solution to the extent that the cost of the frequent change requirements of the solution is prohibitive. Further, some of the plating solution is trapped in the pores and the acids of the solution soon bleed through the plating bringing discoloration thereto and initiating breakthrough points for the beginnings of corrosion or rust. It has been suggested that some quenching medium other than oil, such as hydrogen, could be used, but all such substitutes insofar as we are aware contaminate the atmosphere of the heat treat or carbonitride oven and thus are equally objectionable, if not more so, than quenching oil.

Accordingly, it is an object of our invention to provide an improved process for treating a powdered metal part to obviate the above mentioned objections.

Another object of the invention is to close off the pores of a powdered metal part with carbonized resin filler prior to the heat treat operation to prevent impregnation of the pores with oil and thereby making it practical to remove all of the oil from the part prior to the plating of the part.

Another object of the invention is to provide an improved process for treating a powdered metal part for successful plating thereof without contaminating either the plating solution or the atmosphere of the heat treat oven.

Another object of the invention is to provide an economical, production process for treating powdered metal parts so that they will take an approved plating finish.

As is well known, the process of making a part from powdered iron consists generally of pressing the powdered metal into the desired shape of the part and then sintering the compact for about an hour at a temperature of about 2250° F. to fuse the granules together. In accordance with our invention, we treat the powdered metal part, first by impregnating it with a resin, such as a styrene modified polyester system. The styrene is added to the polyester resin to obtain a reduction in viscosity which permits a more ready penetration of the deep voids and pores in the part. This is preferably augmented by use of the well known vacuum method of impregnation in which the air in the impregnation tank is withdrawn by a vacuum pump to effect flow of the sealing material into the pores and to the bottoms of the voids in the part.

The part is then baked at about 275° F. for about thirty minutes to metacure the resin.

After the resin has been cured, the impregnated part is rebaked at a relatively high temperature at about 850° F. for about 45 minutes, preferably in a vented air circulated furnace. This carbonizes the resin, reducing it to the state in which it is chemically inactive and resistant to higher temperatures such as the temperatures reached in a heat treat operation. Next, the carbon impregnated part is heat treated by carbonitriding the part in a closed furnace at a temperature of about 1550° F. for about 12 minutes followed by quenching of the part in oil. At this stage of the carrying out of the process, carbonaceous material has been added to fill and seal the pores of the compact; the subsequent carbonitriding and quenching steps serve to case harden the compact. The part is then cleaned of substantially all of the oil by washing the part in an oil solvent such as trichloroethylene. This leaches the oil from the pores of the part by abstraction and requires no provision for drying of the part since, as is well known, trichloroethylene vaporizes rapidly at room temperation. To insure that no film of oil remains on the part, the part is now baked at 300° F. for about 30 minutes to vaporize and drive off any oil film that may have been left on the part, this bake-off being done in a vented oven.

Following the bake-off, the finish of the part is removed, such as by a tumbling operation to remove all burrs and any foreign matter, such as exudations from the pores of the part of organic matter from the resin. Finally, the part is plated by submergence in the usual plating bath.

From the foregoing description of our process of treating powdered metal parts for plating, it will now be appreciated that by sealing the pores of the part with carbonized resin prior to heat treating the part, neither the quenching oil nor the plating solution is trapped appreciably below the outer surface of the part with the result that a successful plating of the part is made possible. Further, since the pores of the part are sealed by the carbonized resin, oil will be retained only in shallow pores, present by reason of the contraction of the resin when carbonized, but this oil can be readily removed by the practical method of merely submerging the part in a bath of trichloroethylene or other oil solvent. In addition, it will be appreciated that by removing the oil, there will be no contamination of the plating solution and accompanying expense of frequent replacement, and that by preventing the trapping of any appreciable amount of the plating solution in the pores of the metal, it is possible to obtain a satisfactory plating of the part without danger of early discoloration and erosion through the finish.

While we have described our improved process for treating powdered metal parts in considerable detail, it will be understood by those skilled in the art that many changes may be made without deviating from the spirit and scope of our invention.

What is claimed is:

1. A process for treating a sintered powdered metal compact preparatory to plating the compact comprising, impregnating the compact with an organic resin to seal the pores, subjecting the compact to heat at a temperature and for an interval sufficient to carbonize the resin to render it chemically inactive to oil and to plating solutions, carbonitriding the compact to add carbon thereto in a closed furnace, and then quenching the compact in oil to harden the powdered metal of the compact.

2. A process for treating a sintered powdered metal compact preparatory to plating it comprising impregnating the compact with an organic resin of the polyester group to fill the pores of the compact, subjecting the resin

impregnated compact to heat at a predetermined temperature and for an interval sufficient to drive off substantially all of the organic matter of the resin leaving substantially only carbon in the pores of the compact, carbonitriding the compact to add carbon to the powdered metal compact at a temperature higher than said first temperature, and then quenching the compact in oil to harden the powdered metal.

3. A process for treating a sintered powdered metal compact preparatory to plating the compact comprising the steps of impregnating the compact with an organic resin of the polyester group including styrene modified polyester, subjecting the resin impregnated compact to a temperature of about 850° F. for an interval of approximately 45 minutes to drive off substantially all of the organic matter of the resin to provide a carbonized residue sealing the pores of the compact, subjecting the compact to heat in a carbonitriding atmosphere at a temperature of about 1550° F. for an interval of about 12 minutes to add carbon to the powdered metal, and then quenching the compact in oil to harden the powdered metal.

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