

UNITED STATES PATENT OFFICE

JOHN E. HOY, OF MIDLAND, MICHIGAN, ASSIGNOR TO THE DOW CHEMICAL COMPANY,
OF MIDLAND, MICHIGAN, A CORPORATION OF MICHIGAN

METHOD OF FABRICATING METAL PARTS OF MAGNESIUM OR MAGNESIUM ALLOYS

No Drawing.

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The present invention relates, as indicated, to methods of fabricating magnesium and magnesium alloys and is concerned specifically with a method of sizing parts of such metals by rapidly reducing the thickness and weight thereof without machining.

It is frequently desirable or necessary to reduce the thickness of such metal parts, e. g. castings, forgings, or extruded shapes, for which purpose heretofore machining with a cutting tool of some description has been the practice.

I have found that by submerging such parts in a mineral acid bath the thickness thereof may be reduced very rapidly, either uniformly or selectively as to portions of the part, whereby the cost of sizing may be greatly decreased, the investment in machine tools avoided, and the desired size obtained at a fraction of the cost heretofore incurred.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the steps hereinafter fully described and particularly pointed out in the claims, the following description setting forth in detail one mode of carrying out the invention, such disclosed mode illustrating, however, but one of various ways in which the principle of the invention may be used.

In the practice of my invention I submerge the part to be reduced, either in whole or in part, in an acid bath for which I find a 25 per cent water solution of sulphuric acid admirably suited. The action in such a bath is violent and results in uniform dissolving off the metal from the surface of the part thus treated. When sufficient metal has been removed I withdraw the part and wash it to remove the adhering acid. I may, as indicated, vary the action by treating, as by dipping or otherwise, only a portion of the article or part to thereby restrict the sizing action to a definite or limited area as may be required. I may further coat portions of the surface with a protective material, such as wax or a commercial etching compound, to prevent removal of metal from the so coated portion of the surface. By these means I may control the sizing at will by so controlling the metal removal, or I may produce a

raised or etched pattern of any desired character upon such surface coincident with the sizing of the part. It is known that in the forging of such metal parts it is difficult to secure at once the final thickness desired, it being customary to form the dies to leave a greater thickness than required for the finished article and then to remove the excess metal by mechanical means, such as by machining or grinding. I have found, for instance, that a forged aeroplane propeller blade may first be trimmed to remove the excess metal fringes or "flash" and may then be treated by my process to reduce its thickness as much as $\frac{1}{8}$ inch in a very few minutes without changing the characteristic outlines, form, or shape. As stated hereinbefore the action of the acid bath is violent, causing rapid circulation of the bath over the surface of the metal, keeping all parts of the surface actively open to attack of the acid so that the removal of metal is substantially at a uniform rate and equal over equal areas. In the case of the propeller blade in question the saving in cost was about \$7.00 over the cost to machine in the customary manner and the surface of the finished propeller presented a uniform brilliant frosted appearance which would in many cases be satisfactory without further work thereon, but which may be readily and cheaply buffed in a few minutes to present a polished appearance.

I have built furniture from extruded tubes and other fabricated structural shapes by first bending the tubes, etc. and welding them together to form the frame-work of a chair, bench, table, or the like, and in order to attain a minimum or desired weight of the so-assembled frame I have dipped such frame into an acid bath and reduced it in weight to the desired point. Such reduction of weight I find to be substantially uniform over the entire surface, and the action of the acid serves to improve the appearance. Such a method of procedure is cheaper and simpler than any with which I am familiar and enables structures of various kinds to be built from a limited stock of structural shapes to have a final thickness of metal, weight, and strength only realizable otherwise by having at hand and

carrying in stock a wider variety of thicknesses and sizes. It is impracticable in the production of a large number of parts from a single set of dies to get all of such parts of a uniform thickness. They may be readily obtained of the same apparent general contour but will vary somewhat in thickness. By the removal of the surplus metal, which may or may not be substantially uniformly distributed, the article may be reduced to the desired thickness. To remove such surplus by grinding, milling, or in equivalent manner by a cutting tool, is laborious, difficult and expensive, but to remove such surplus by the aforesaid acid treatment is very expeditious and I find such removal to be so uniform and so controllable as to afford a cheap, desirable, and practicable method of supplanting the more expensive and laborious mechanical machining methods.

It will be observed that the use of master forms and of profiling machines may be in large part done away with by my method when the dies have been so prepared that by the removal of a uniform thickness of metal from the entire surface or from a selected portion thereof the desired final contour and thickness may be attained. It will be observed further that my method enables the removal of metal from a portion only of such a part, whereby variations in the thickness of finished parts may be readily and cheaply attained without the necessity to prepare other dies to so attain such results.

In machining operations the chips removed may in some instances have a very low value and in almost all instances they constitute a fire hazard. With my method the excess metal removed is converted to magnesium sulphate which may be recovered from the bath as epsom salt or in other forms as may be desired and there is no fire hazard introduced.

My method has general applicability to parts of pure magnesium and magnesium base alloys, and where in the following claims the term "magnesium" is used it is to be distinctly understood that it shall include magnesium base alloys. Although the use of a sulphuric acid bath has been described in detail, I may use any strong acid which will remove metal in a substantially equivalent manner, e. g. hydrochloric acid, nitric acid, etc. A 25 per

cent sulphuric acid solution gives satisfactory results.

Other modes of applying the principle of my invention may be employed instead of those explained, change being made as regards the process herein disclosed, provided the step or steps stated by any of the following claims or the equivalent of such stated step or steps be employed.

I therefore particularly point out and distinctly claim as my invention:

1. The method of sizing a metal article composed of magnesium or a magnesium base alloy which comprises immersing such article in a strong aqueous mineral acid solution to dissolve off surplus metal uniformly from the surface thereof, removing the article from the solution when the dimensions thereof have been reduced to the desired finished dimensions, washing off adhering acid solution and drying.

2. The method of sizing a metal article composed of magnesium or a magnesium base alloy which comprises immersing such article in a strong sulphuric acid solution containing up to approximately 25 per cent of said acid to dissolve off surplus metal uniformly from the surface thereof, removing the article from the solution when the dimensions thereof have been reduced to the desired finished dimensions, washing off adhering acid solution and drying.

3. The method of sizing a metal article composed of magnesium or a magnesium base alloy which comprises immersing such article in an approximately 25 per cent sulphuric acid solution to dissolve off surplus metal uniformly from the surface thereof, removing the article from the solution when the dimensions thereof have been reduced to the desired finished dimensions, washing off adhering acid solution and drying.

4. In a method of sizing a metal article composed of magnesium or a magnesium base alloy, the steps which consist in immersing such article in a strong aqueous mineral acid solution to dissolve off surplus metal substantially uniformly from the surface thereof, and removing the article from the solution when the dimensions thereof have been reduced to the desired dimension.

JOHN E. HOY.