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ELECTROLYTIC SMOOTHING OF METALS

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1 Claim. (Cl. 204—140)

This application is a continuation of application Serial No. 360,637, filed October 10, 1940.

This invention relates to the process of brightening, smoothing, and the finishing to size of metal objects by electrolytic means, and relates more particularly to a novel electrolyte and its use.

The novel electrolyte and process disclosed herein are particularly well suited for manufacturing purposes where it is desired to remove burrs, machining marks, and other roughnesses, whether natural or caused from manufacturing processes, from metal objects that have been stamped, machined, heat treated, or subjected to other processes that corrode or roughen the surface of the object.

The invention is also useful for the symmetrical removing of surface material from metal objects whose shape makes reduction in size difficult or impossible by use of machines or tools.

The process disclosed herein is also particularly well adapted to prepare bearing surfaces and to bring within the limits of tolerance a machined part that is oversized, or to enlarge an aperture to receive an oversize object. For instance, an annularly-shaped object may be made to slip on an oversized cylinder by reducing the diameter of the cylinder by removing metal from its surface uniformly by this electrolytic process, or by removing metal from the annulus by the same method. In such sizing operations, it is also desirable to maintain or to brighten and smooth the surfaces resulting from previous manufacturing processes.

Therefore, it is the principal object of this invention to provide a novel electrolyte for the brightening and smoothing of metal surfaces by electrolytic means.

Another object of the invention is to provide an electrolytic process for the accurate sizing of manufactured metal objects.

Another object of the invention is to provide an electrolytic process and electrolyte for the removal of burrs and machine marks from metal objects.

Another object of the invention is to provide a process for the electrolytic polishing of metal, using the novel electrolyte.

Another object of the invention is to provide a method of electrolytically brightening and smoothing metal objects that are manufactured to certain size specifications, whereby metal in excess of the limits of tolerance is not removed before a smooth bright surface results.

Another object of the invention is to provide an electrolytic process for symmetrically removing surface material from and brightening the inaccessible parts of metal objects.

Another object of the invention is to provide means to rejuvenate such an electrolyte after it has been degenerated by use.

With these and incidental objects in view, the invention includes certain novel features, the essential elements of which are set forth in appended claim and a preferred form of embodiment of which is hereinafter described.

The novel electrolyte consists of commercial hydrochloric acid and glycerine, preferably in the proportions of 25 per cent. hydrochloric acid and 75 per cent. glycerine by volume. The cathode immersed in the electrolyte is preferably of an area equal to or larger than the area of the anode, which consists of the objects to be treated, and for best results should surround the anode as nearly equi-distantly as possible, but such placement is not necessary where equal smoothing or metal-removing action on all parts of the anode is not essential. With the electrolyte of the preferred acid concentration mentioned, a current density of .1 ampere per square inch of anode surface is best for use with steel or iron objects. The current density mentioned is quite critical for the best results with steel and iron, but other current densities between .1 and 1 ampere per square inch of anode surface will give a brightening effect to other metals than steel and iron. The amperages per square inch which are considered best for typical industrial metals are: stainless steel, .5 ampere; aluminum, 1 ampere; brass, .25 ampere; copper, .25 ampere; other ferrous metals including iron, from .1 ampere to .5 ampere.

When the process begins and before the anode builds up a coating of salt to form a resistance in the circuit, the current density may be temporarily higher than the amperages mentioned. However, the high current ceases after a few minutes' operation. This initial high current may, if desired, be avoided by placing a resistance in the supply circuit for a short time.

One particular advantage of the use of this electrolyte is that its conductivity is very high, and therefore, as the electrolyte does not rise in temperature appreciably at the current densities required, no artificial cooling is necessary, the process being carried on at normal room temperature.

Agitation of the electrolyte during the process is desirable to prevent pitting and spotting of the surface of the anode.

The described electrolyte and process are especially adapted to the brightening, smoothing, and sizing of machined parts where a rather slow and controlled effect is desired to remove burrs and machining marks, and to render bearing surfaces smooth without overstepping the tolerance limits of accurately sized parts. With the particular electrolyte described and the current density of .1 ampere per square inch, approximately .001 inch is removed in an hour from a steel object.

Glycerine and hydrochloric acid electrolytes having as low a concentration of hydrochloric acid as 15 per cent. and as high as 30 per cent. will give a brightening result, but are not so effective in giving a perfect surface as the 25 per cent. hydrochloric acid electrolyte. The low and high acid content electrolytes require an increased current density, which causes the electrolyte to become hot, thus changing its conductivity, therefore rendering control of the current density difficult.

After use for a considerable time, the electrolyte becomes less effective as a brightener and less conductive to current. To rejuvenate the electrolyte, the adding of acetone up to 10 per cent. of the total volume of the electrolyte has been found satisfactory and effective. A slightly greater current density must be used with the rejuvenated electrolyte, but, as it is more conductive, no appreciable heating of the electrolyte results.

By this process, oversized convexities and undersized concavities of metal objects may be corrected. Metal is removed in a symmertical manner over the entire surface of the objects to bring them to proper dimensions. Surfaces which are inaccessible for hand or machine working are readily given proper dimensions and brightened by this method. The objects are smoothed and brightened at the same time, as the process is selective in removing the metal from microscopic ridges first, reducing roughnesses and giving the surface a bright appearance.

This electrolyte may be used where a high degree of control and constancy of action is required. It is possible to accurately determine the amount of metal removed by leaving it in the bath a given time, and the slowness and perfect smoothing action of the electrolyte make it well adapted for precision work. Metal objects intended to be finished by this process may be produced in the rough form to an oversize dimension which, when treated in the electrolytic bath for the desired time, will be reduced to the proper final size, and the surface will be given a bright, smooth finish.

While the electrolyte and the processes herein set forth and described are admirably adapted to fulfill the objects primarily stated, it is to be understood that it is not intended to confine the invention to the embodiment herein disclosed, for it is susceptible of embodiment in many forms all coming within the scope of the claim which follows.

What is claimed is:

A rejuvenation process for an electrolytic smoothing bath consisting initially of hydrochloric acid and glycerine, which bath has been degenerated by use, which process consists in the adding of acetone to the bath not to exceed 10 per cent. by volume.

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