Application of Electrolytic-Polishing to Restore Obliterated Letters on Metal

Shigeo Arai
THE APPLICATION OF ELECTROLYTIC-POLISHING TO
RESTORE OBLITERATED LETTERS ON METAL

Shigeo Arai

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Crime Detection Laboratory, National Rural Police Headquarters, Tokyo, Japan,
where he is particularly interested in the application of electrical engineering to
identification problems. In 1944 he completed a course in physics at Tohoku Univer-
sity and has devoted time to research problems related to vacuum tubes. Mr. Arai is
a member of the Japanese Physical Society.—Editor.

The restoration of obliterated letters stamped on metal surfaces is
generally accomplished by treating the area with a solution of cupric
ammonium chloride and other reagents. The restored letters may not
be so distinct, and the operations are troublesome. This author has
therefore experimented with the application of an electrolytic-polishing
method and has obtained successful restorations.

The method is applicable to various metals, and the operation can be
completed in a short time (about five minutes).

METHOD

The electric circuit diagram and the apparatus for the operation are
shown in Figure 1. First the obliterated area is polished with sand
paper and then cleaned up with acetone. Next the area (anode) is
rubbed with absorbent cotton (cathode) dipped in the electrolyte. The
composition of the electrolyte is described in the following paragraph.

The voltage needs to be slightly higher than a critical voltage which
depends upon the property of the particular metal, for otherwise the
current does not flow. If the voltage is gradually increased while rub-
bing the area with the cathode, the current begins to flow when the
critical voltage is reached. Increasing the voltage about 0.5 volts more,
the rubbing is continued. Generally after three minutes of treatment, the letters appear on the surface. At this point the electrolytic-polishing is stopped, and the surface is immediately cleaned by washing with water for a minute, followed by a neutralizing solution. The surface is lightly covered with machine oil and photographed. In washing and neutralizing one must be careful not to rub the area too much, lest the restored letters should be erased.

Table I shows the composition of the electrolyte, and Table II, the condition of electrolytic-polishing. It is not necessary to follow these exactly.

![Figure 2](image)

**Letters Restored in Brass**

Table I  
**THE COMPOSITION OF THE ELECTROLYTE**  
<table>
<thead>
<tr>
<th>Component</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distilled water</td>
<td>500 cc</td>
</tr>
<tr>
<td>Sulphuric acid (conc.)</td>
<td>15 cc</td>
</tr>
<tr>
<td>Gelatine</td>
<td>1 gram</td>
</tr>
<tr>
<td>Cupric sulfate</td>
<td>1 gram</td>
</tr>
</tbody>
</table>

Cupric sulfate is used when the metal is a ferro-alloy and also when the letters are restored with difficulty.

Table II  
**THE CONDITION OF ELECTROLYTIC-POLISHING**  
<table>
<thead>
<tr>
<th>Metal</th>
<th>Voltage</th>
<th>Approximate current density (ampere/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon steel</td>
<td>6.0</td>
<td>0.19</td>
</tr>
<tr>
<td>Brass</td>
<td>7.0</td>
<td>0.70</td>
</tr>
<tr>
<td>Copper</td>
<td>6.5</td>
<td>1.9</td>
</tr>
</tbody>
</table>

**CONCLUSIONS**

The reason why the letters are restored by this method is not exactly understood. The author believes that the following theory may be the explanation. The anode (obliterated area) is oxidized and dissolved by the electrolytic-polishing. So the growth of rust and its dissolution occur on the anode surface. The stamped parts of the metal have a permanent set. Therefore, the energy required to take one atom of metal from the surface and to oxidize it (rust it) differs at those parts where a letter has been stamped than where there was none. In this way the letters are restored.
Figures 2 and 3 show examples of restored letters in experimental cases. The author had erased the letters by filing with a rasp. The photographs were made after restoration.