TITANIUM CUTTING AND GRINDING LUBRICANT

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2 Claims. (Cl. 252--49.5)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to the cutting and grinding of titanium. It provides an improved lubricant which permits a higher speed of the cutting or grinding tool, and makes possible a higher ratio between the amount of material removed from the titanium and the amount removed from the grinding wheel.

Titanium cutting requires unusually high feed forces. Abnormally thin chips are formed and high unit pressures and temperatures are produced on the cutting tool. A serious difficulty is that the pressure of the cutting tool must be kept below a predetermined value to prevent welding of the tool to the titanium stock or workpiece.

With the commonly used extreme pressure lubricants, such as the sulfurized and/or chlorinated compounds, a given tool welds to the workpiece at pressures of 50 to 100 pounds. The lubricant of the present invention permits a pressure of 1500 pounds on this same tool without welding of the tool to the titanium workpiece. This represents an increase of 15 to 30 times in the permissible pressure of the cutting tool.

In connection with the grinding of titanium, there is evidence that the titanium acquires an abrasive grain by some sort of surface reaction with the grinding wheel just as titanium reacts with all known refractories. A reduction in the grinding wheel speed to one third the conventional value of 6000 surface feet per minute for steel, together with the use of conventional grinding fluids, has made it possible to increase the grinding ratio in surface grinding from 0.7 to approximately 20 times that figure. The term grinding ratio is herein utilized to indicate the relation between the amount of titanium stock removed and the amount lost from the grinding wheel.

The results achieved with conventional lubricants such as the soluble oils, the sulfonated oils and the nitrites leave something to be desired in the way of cutting and grinding speeds. Cutting and grinding speeds need to be increased to speed up production. Also there is a need for increasing the grinding ratio.

The present invention achieves these results by the provision of an improved lubricant containing fluorides and silicofluorides combined with a suitable corrosion inhibiting mixture of a high molecular weight imidazoline and a rosin amine ethylene oxide adduct as previously indicated, this lubricant permits a 15 to 30 fold increase in the pressure of the cutting tool. The best formulation from the standpoint of extreme pressure properties and lack of corrosion is as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium fluoride</td>
<td>3</td>
</tr>
<tr>
<td>Ammonium silicofluoride</td>
<td>1</td>
</tr>
<tr>
<td>Water</td>
<td>95.9</td>
</tr>
<tr>
<td>High molecular weight imidazoline</td>
<td>0.05</td>
</tr>
<tr>
<td>Rosin amine ethylene oxide adduct</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Other silicofluorides found to be effective in this formulation were those of morpholine, methylamine, dibutylamine and aniline.

Corrosion is greatly reduced by the mixture of the high molecular weight imidazoline and rosin amine ethylene oxide adduct, the extreme pressure properties of the lubricant being only slightly affected. Alkaline salts proved to be ineffective corrosion inhibitors and destroyed the extreme pressure properties of the lubricant.

The combination of 3% sodium fluoride, 1% ammonium silicofluoride with 96% water is most effective in preventing metal pickup during the grinding of titanium. Next best is a solution of 3% sodium fluoride and 97% water. While the most effective lubricants have been set forth in exact percentages, it is to be understood that these percentages may be varied over a limited range without seriously deteriorating the lubricant.

I claim:

1. A lubricant composition characterized by good extreme pressure and corrosion resistant properties for cutting and grinding titanium which comprises about: 3% sodium fluoride, 1% ammonium silicofluoride, 95.9% water, 0.05% high molecular weight imidazoline and 0.05% rosin amine ethylene oxide adduct.

2. A lubricant composition characterized by good extreme pressure and corrosion resistant properties for cutting and grinding titanium which comprises about: 3% sodium fluoride, 95.9% water, 0.05% high molecular weight imidazoline, 0.05% rosin amine ethylene oxide adduct and 1% of a silicofluoride selected from the group consisting of morpholine, methylamine, dibutylamine, aniline and ammonium silicofluoride.

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