The present invention relates to dental alloys, and more particularly to alloys for making the so-called amalgam or silver fillings.

The invention also relates to the process of making the improved alloy. The usual alloy for making amalgam or silver fillings consists principally of silver and tin, together with a small percentage of copper and zinc. The alloy is furnished to the dentist in finely divided condition, and is mixed with mercury and applied to the tooth cavity, where the amalgam sets or hardens. The setting action of the amalgam is usually believed to be due to a secondary reaction by which the mercury forms a metallic crystalline compound with the silver. The hardened filling apparently consists of crystals of this mercury silver compound embedded in a matrix which consists principally of tin with possibly the copper and zinc.

The usual dental alloys of the better class follow rather approximately the so-called "Black" formula, which in its specific form is silver 67 parts, tin 27 parts, copper 5 parts, and zinc 1 part. Certain changes in these percentages are made by different manufacturers in making alloys in accordance with the "Black" formula, the term "Black" formula being used as a term of general description of this class of dental alloys.

We have discovered that the dental alloys of the above class may be considerably strengthened, both as to resistance to crushing and to shearing, by the addition to the alloy of nickel or cobalt. These two metals closely resemble each other physically and chemically. They are the two non-ferrous metals of the so-called iron or nickel group, which group consists of iron, nickel and cobalt. As far as the action on the amalgam is concerned, these two metals appear to be substantial equivalents.

In making up our improved alloy, we add a relatively small amount of nickel or cobalt, say up to about five per cent, preferably about three per cent. Either nickel or cobalt may be added alone, or a mixture of the two may be employed. The proportion of the silver is reduced by about the amount of added nickel or cobalt. A typical formula which we have found to be satisfactory is as follows:

<table>
<thead>
<tr>
<th>Metal</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver</td>
<td>63</td>
</tr>
<tr>
<td>Tin</td>
<td>28</td>
</tr>
<tr>
<td>Copper</td>
<td>5</td>
</tr>
<tr>
<td>Cobalt or nickel</td>
<td>3</td>
</tr>
<tr>
<td>Zinc</td>
<td>1 or 60</td>
</tr>
</tbody>
</table>

The action of these metals on the dental amalgam is a pronounced refining of grain, as well as a toughening and hardening action and an increase in the shearing strength. Tests have shown a decided increase in crushing and shearing strengths over the usual "Black" formula. The cobalt and nickel also tend toward the formation of an amalgam which is more resistant to discoloration in the mouth.

The cobalt and nickel are substantially insoluble in silver. In making the alloy, we prefer to melt the cobalt or nickel with the tin or tin and copper and add the silver to the alloy. The zinc is usually added just before pouring.

Since the cobalt and nickel are insoluble in silver, but form an alloy with tin, it is believed that the superior strength of the amalgam is due to increasing the strength of the tin matrix, the alloy of tin with cobalt or nickel being apparently stronger than tin without one of these alloying metals.

While we have described specifically the preferred proportions in our improved alloy for making amalgam fillings, and have described the preferred process of making such alloy, it is to be understood that the invention is not limited to the hereinbefore described details, but may be otherwise embodied within the scope of the following claims.

We claim:

1. A dental alloy containing silver and tin in amounts which will readily amalgamate with mercury to form a suitable hardening dental amalgam, together with a minor proportion of a non-ferrous metal of the nickel group.

2. A dental alloy containing major proportions of silver and tin and a minor proportion of a non-ferrous metal of the nickel group.
3. A dental alloy made in approximate accordance with the "Black" formula but containing a small proportion of a non-ferrous metal of the nickel group.

4. A dental alloy made in approximate accordance with the "Black" formula but containing not over five per cent of a non-ferrous metal of the nickel group.

5. A dental alloy containing silver 50 to 70%, tin 25 to 40%, copper 3 to 7% and a non-ferrous metal of the nickel group 1 to 10%.

6. The process of making the herein described dental alloy comprising alloying a non-ferrous metal of the nickel group with the tin and thereafter mixing the silver and tin.

7. The process of making the herein described dental alloy comprising alloying a non-ferrous metal of the nickel group with the tin and copper and thereafter mixing the silver with the tin and copper.

In testimony whereof we have hereunto set our hands.

CLARENCE C. VÖGT.
JOHN W. HARSCH.