Patented Dec. 23, 1930

1,785,774

UNITED STATES PATENT OFFICE

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PLASTIC HEAT-TREATED ALUMINUM ALLOY

No Drawing. Application filed May 18, 1929. Serial No. 364,330.

This invention relates to aluminum alloys and particularly to a plastic heat treated alloy having improved properties and characteristics.

In my United States Patent No. 1,704,253, granted March 5, 1929, I have described a process of keeping the ductility and plasticity in a heat treated alloy of aluminum by reducing the addition of heavy metals to a comparatively low figure and by quenching from a comparatively low temperature and finally by alternate aging and rolling in several steps. The present invention is the result of further studies in this line.

I have found that inter-crystalline corrosion, which constitutes the greatest drawback with heat treated aluminum alloys, is a function of the amount of heavy metals present in the alloy. In other words, copper, which has heretofore been considered as the metal which causes inter-crystalline corrosion is only to a certain degree worse than other heavy metals, and I find that other heavy metals cause such inter-crystalline corrosion if present in sufficiently large quantities. It is then evident that it is more advantageous to use only such metals as will produce the greatest strength with the smallest amount of addition.

I find that an alloy of aluminum with about .50% zinc, about .50% magnesium and no other metals can be heat treated to give a yield point of 35,000 pounds per square inch and an ultimate strength of 48,000 pounds per square inch with 20% elongation and that such alloy is to all practical purposes free from inter-crystalline corrosion. This alloy has such unusual plasticity after aging that a sheet thereof can be reduced in thickness 50% and more without losing its perfect bending quality. Such reduction raises the yield point to a great extent and also raises the ultimate strength to a certain smaller degree. I find that by a reduction of 20% of the thickness of the sheet after aging I obtain a yield point of 48,000 pounds and an ultimate strength of 52,000 pounds with 3% elongation and perfect bending quality. I also find that sheets of this alloy can be drawn or stamped into fabricated articles such as cooking utensils after having been quenched and aged in the form of sheets. The amount of zinc and magnesium can be raised to 1.0% respectively without seriously affecting the quality of the alloy.

Very small quantities of other heavy metals can be introduced in this alloy to increase its strength but such additions will always cause an increased inter-crystalline corrosion. I may, for instance, have present .25 to .50% of iron which is nearly always present in commercial aluminum and in addition I may have .10 to .20% of copper or nickel or even about .10% of some other chromium group metals such as molybdenum and tungsten. It is not desirable to add more than .25% of any of the heavy metals such as copper, nickel, manganese, tungsten or molybdenum or a total of more than .50% of these metals to the alloy. The additional strength imparted by such very small additions amounts to approximately an increase of 10% in the strength of the alloy.

I find that the metal cadmium is the most strengthening addition with the least amount of inter-crystalline corrosion. It is a well known fact that cadmium added to aluminum in large quantities causes brittleness and in the presence of other heavy metals a very small amount of cadmium causes hot shortness. In this particular alloy I may have from .05 to .15% cadmium without causing such brittleness, provided however that I limit the amount of zinc to about .50% and the other heavy metals to not to exceed .50%, not counting the iron which is present as an impurity.

The preferred composition of the alloy is, therefore, .50% zinc, .75% magnesium, .20% copper, .10% cadmium, the balance being commercially pure aluminum. This alloy has a very slight inter-crystalline corrosion and is extremely ductile so that fully heat treated sheets may be used for stamping purposes. If, however, the additional strength is not of great moment I prefer to use the first above mentioned alloy with only zinc and magnesium.

I claim:

1. A highly ductile, fully heat treated

aluminum alloy, commercially free from inter-crystalline corrosion, composed of approximately .50% zinc, .50% magnesium and the remainder commercially pure aluminum.

2. A highly ductile, fully heat treated aluminum alloy, commercially free from inter-crystalline corrosion, composed of from .50 to 1.0% zinc, .50 to 1.0% magnesium, and the remainder commercially pure aluminum.

3. In the alloy of claim 2, the addition of copper, nickel, cobalt, manganese, chromium, tungsten and molybdenum in quantities not to exceed .25% of each and in total not to exceed .50%.

4. A highly ductile, fully heat-treated aluminum alloy commercially free from inter-crystalline corrosion, composed of approximately .50% zinc, .50% magnesium and .05% to .15% cadmium.

5. A highly ductile, fully heat-treated aluminum alloy commercially free from inter-crystalline corrosion, composed of from .50% to 1.0% zinc, .50% to 1.0% magnesium, and .05% to .15% cadmium.

6. A highly ductile, fully heat-treated aluminum alloy commercially free from inter-crystalline corrosion, composed of from .50% to 1.0% zinc, .50% to 1.0% magnesium, .05% to .15% cadmium, and copper, nickel, cobalt, manganese, chromium, tungsten and molybdenum in quantities not exceeding .25% of each and in total not exceeding .50%.

7. A highly ductile, fully heat-treated aluminum alloy commercially free from inter-crystalline corrosion, comprising 98.0% to 99.0% commercially pure aluminum, .05% to 1.0% zinc and .50% to 1.0% magnesium.

In testimony whereof I affix my signature.

NOAK VICTOR HYBINETTE.