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PROCESS OF IMPROVING ALUMINUM ALLOYS.

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This invention relates to processes of improving aluminum alloys.

It is known that certain aluminum alloys are unstable in the solid form and undergo molecular internal changes for a time after casting. Their mechanical properties automatically improve by storage for a time at the ordinary temperature after annealing at a high and glowing temperature and sudden quenching insofar as, on being thereafter left at room temperature for several days they exhibit a considerable increase in strength whilst the elongation remains at least the same. It is also known that the automatic improvement at room temperature which may be termed natural ageing can be replaced by ageing at higher temperatures, in which case a still more marked increase in the strength frequently occurs.

Prolonged investigations have now demonstrated that the duration of the period of rest in natural ageing is a material factor; that the time when the artificial ageing after the annealing and quenching operations is begun is of great importance. It is possible to control thereby at will the strength and elongation values as well as the malleability and workability of the material in the cold state to a considerable extent if this period is ascertained by preliminary empirical experiments. Thus for example the artificial ageing or heat treatment can be commenced either immediately after quenching or after an intermediate storage, that is to say at a time during the ordinary ageing at room temperature, when the alloy has not attained its maximum strength values. Finally the heat treatment can also be commenced after completion of the ageing at room temperature, i. e., after the alloy has attained its maximum strength values.

By suitably selecting the aforementioned conditions, it is possible to obtain aluminum alloys containing about 88 to about 98 per cent aluminum which exhibit strength values of 36 to 55 kilograms per square millimeter at elongations of 18 to 26 per cent, values which have not hitherto been obtained by other processes.

Example.

An alloy consisting of 97 per cent aluminum, 1.3 per cent magnesium silicide, 1.2 per cent copper and 0.5 per cent titanium was annealed at a glowing heat, quenched and subjected to storage at room temperature. The strength was 35 kilograms per square millimeter and the elongation 15 per cent.

The same alloy was annealed, quenched, stored 24 hours at room temperature and thereupon for 30 hours at a temperature of 125° C. The strength was found to be 37 kilograms per square millimeter and the elongation 25 per cent.

Finally the same alloy, after the same preliminary treatment, was aged immediately after quenching, for 20 hours at 145° C. The strength was found to be 39–40 kilograms per square millimeter and the elongation 20–22 per cent.

The present process is applicable to all aluminum alloys which are capable of undergoing internal changes at the ordinary temperature with improvement in their quality and moreover to such other aluminum alloys capable of undergoing similar internal changes although they may not be noticeably improved in mechanical qualities by storage at room temperature. Experience has shown that the invention is especially applicable to aluminum-zinc, aluminum-copper, aluminum-magnesium, aluminum-beryllium, aluminum-silicon, aluminum-magnesium-silicide and similar alloys, that is to say aluminum alloys which contain crystallizable components adapted to form solid solutions. The process is also applicable to ternary, quaternary and multiple alloys of aluminum with the above-mentioned components. Moreover these alloys may contain other components, particularly difficultly fusible elements such as for example, iron, titanium, molybdenum, tungsten and the like for the purpose of increasing their strength and resistance to corrosion.

The above described method of treating the quenched alloy can also be carried out by combining the ageing at ordinary room temperature with an ageing at elevated temperatures in suitable manner. These operations can be carried on alternatively and in a suitable sequence.

What I claim is:

1. The process of improving aluminum alloys containing crystallizable constituents capable of forming solid solutions with aluminum which comprises quenching such an alloy from a high and glowing temperature,

ageing to a substantial degree by storage at the ordinary temperature and heat treating at a somewhat higher temperature.

2. The process of improving aluminum alloys containing crystallizable constituents capable of forming solid solutions with aluminum which comprises quenching such an alloy from a high and glowing temperature, ageing at room temperature and heat treating at a somewhat higher temperature, the ageing being substantially complete prior to the heat treatment.

3. The process of improving aluminum alloys containing 88 to 98 per cent aluminum and also containing crystallizable constituents capable of forming solid solutions with aluminum which comprises quenching such an alloy from a high and glowing temperature, ageing at the ordinary temperature for a substantial length of time and thereafter ageing at a temperature in the neighborhood of 145° C.

4. In the improvement of aluminum alloys containing 88 to 98 per cent aluminum and also containing crystallizable constituents capable of forming solid solutions with aluminum the process which comprises heat treating a quenched and completely aged alloy at a temperature of the order of 125° to 145° C.

5. The process of improving improvable aluminum alloys by annealing, sudden quenching and heating, which consists in subjecting said alloys to ageing at room temperature and ageing at a somewhat more elevated temperature alternatively and in a suitable sequence.

In testimony whereof I affix my signature.

WILHELM SANDER.