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METHOD OF HANDLING HEAT-TREATED RIVETS

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This invention relates to a method for the heat treatment of aluminum alloy rivets, particularly the rivets known commercially as A17S and 24S.

The chemical analysis of 24S aluminum alloy, which is the alloy used most extensively in aircraft production is as follows:

	Per cent
Aluminum	93.4
Copper	4.5
Manganese	0.6
Magnesium	1.5

The analysis of the A17S aluminum alloy is as follows:

	Per cent
Aluminum	97.2
Copper	2.5
Magnesium	.3

These alloys are but little heavier than aluminum, and in the soft or annealed state, are only slightly stronger but after suitable heat treatment, develop physical properties somewhat in excess of low carbon steel. Heat treatment consists of raising to a certain temperature, a metal or alloy, and then rapidly cooling the material, by quenching in water. The time between the heating to the predetermined temperature and the quenching operation should be as short as possible. The material in the 24S alloy is soft after quenching but attains 90% of its maximum hardness and strength after aging for 24 hours at room temperature, and full strength after 4 to 6 days. This age hardening is very rapid in the first four hours, for which reason, it is essential that any bending or forming operation be carried out in as short a time as possible after the heat treatment. In no case, should the interval exceed one hour.

Aluminum alloy rivets have the same characteristics as the material in other forms and should undergo similar heat treatment before use. Unless the 24S rivets, after heat treatment, are stored at very low temperatures, they must be used within twenty minutes.

The A17S rivets can be used at anytime after the initial heat treatment, as they are of a modified chemical analysis.

In the fabrication of aircraft, where many pounds of these rivets are used, it is necessary to heat treat quantities of these rivets at a time. Both rivets are heat treated and dried to prevent corrosion. The A17S are stored at room temperature but the 24S rivets must be stored at very low temperatures after heat treatment, to delay the age hardening described above.

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The heat treatment of these rivets does not differ essentially from the heat treatment of other products. There are the two common steps of heating and quenching the rivets. The novelty in this method for heat treatment of rivets resides in the quenching and handling of the rivets during and after quenching.

The heat treatment of the above rivets is carried out by means of a container of stainless steel into which the rivets are loaded.

The loaded container is placed in a furnace for the required time to ensure satisfactory heat treatment of the rivets. The container is then removed from the furnace and placed over the wire quench basket. The quench basket is about the same size and capacity as the heating container, and the rivets are dumped into the wire quench basket. The wire quench basket is in a tank of water at about 32° F. which is kept cooled and rapidly circulated. The dumping from one container to the other, protects the containers from injury in the process and tumbles the rivets while being quenched which ensures a more rapid and uniform quenching. The time between the removal from the furnace to the quenching should be as short as possible.

The heating basket is then returned to the loading table. The quench basket is removed from the water tank and transferred to an alcohol bath. While alcohol is used in the preferred form, any highly volatile solvent having a high affinity for water may be used, such as a ketone. For best results, the solvent must have a vapor pressure of the same order as ordinary commercial alcohol, that is, ethyl, methyl and propyl alcohols, all of which have vapor pressures greater than 1 mm. of mercury for the range of temperatures involved in the method of this invention. Ketones such as dimethyl ketone (acetone) and methyl ethyl ketone also have vapor pressures in this range and are miscible with water. Solvents which can be satisfactorily used in this method may also be characterized by having boiling points of less than 90° C. The alcohol bath is held at about 5° to 15° F. The rivets are removed from the alcohol bath and transferred to small tubular containers which are placed in cold storage.

The rivet containers are placed in master storage boxes immediately after heat treating. Traveling storage boxes which are also refrigerated are provided to take the rivets from the master storage box to station storage boxes from which they are secured by the men using the rivets.

While the heat treatment is the same, the A17S rivets need not be stored in refrigerated cabinets but the alcohol bath is necessary to dry the rivets properly, before storage, to prevent corrosion.

The 24S rivets, as above described must be kept at about —20° F. The alcohol bath does two things, it removes water and quickly dries the rivets, thus preventing corrosion, and it prevents the rivets from freezing in clusters and sticking in the small tubular container in which they are stored at —20° F. Evaporation of the water or alcohol after the bath aids in the prevention of detrimental temperature rise.

It has always been a problem with the 24S rivets, to quench, dry and store without having the temperature of the rivets rise during the process. The only near successful expedient known up to the time of applicant's invention, is the centrifugal drier. The difficulty with the centrifugal drier is that if the rivets are whirled long enough to dry properly so they won't corrode or stick together at —20° F., they will undergo a temperature rise. If the whirling time is limited so that there will not be an injurious temperature rise, it will not be sufficient to dry the rivets, and they will corrode and freeze together in the containers.

It will be noted in applicant's invention that from the quench tank (32° F.) to the alcohol bath (5° to 15° F.) to the cold storage cabinets (—20° F.) the time-temperature relationship is continuously downward. It will also be noted that the alcohol bath insures removal of the water so the rivets will not corrode or freeze together in the container at —20° F.

Rivets treated by applicant's method will not shear off or develop cracks or otherwise fail after aging.

It is to be understood that certain changes, alterations, modifications and substitutions can be made without departing from the spirit and scope of the appended claims.

I claim as my invention:

1. The method of treating age-hardening aluminum alloy rivets, the hardening of whch may be arrested by refrigeration, which comprises heating the rivets, quenching said rivets in cold water, at about 32° F. rinsing said rivets in an alcohol bath kept at a lower temperature than the water, and storing said rivets in refrigerated storage cabinets.

2. The method of treating age-hardening aluminum alloy rivets, the hardening of which may be arrested by refrigeration, which comprises heating the rivets, quenching said rivets in water, at about 32° F. rinsing said rivets in a bath of a liquid having a boiling point below 90° C. and miscible with water kept at a lower temperature than the water and storing said rivets in refrigerated storage cabinets.

3. The method of treating age-hardening aluminum alloy rivets, the hardening of which may be arrested by refrigeration, which comprises the steps of heating, quenching in water at about 32° F., rinsing in alcohol, and storing in refrigerated cabinets, the temperature of the rivets being positively reduced at each step.

4. The method of treating age-hardening aluminum alloy rivets, the hardening of which may be arrested by refrigeration, which comprises the steps of heating, quenching in water at about 32° F. rinsing in a liquid having a boiling point below 90° C. and miscible with water, and storing in refrigerated cabinets, the temperature of the rivets being positively reduced at each step.

5. The method of treating age-hardening aluminum alloy rivets, the hardening of which may be arrested by refrigeration, preparatory to storage in refrigerated cabinets, which comprises the steps of heating said rivets, quenching in water at about 32° F., and displacing the water from said rivets by a liquid having a boiling point below 90° C. and miscible with water, the rivets in each step undergoing a reduction of temperature.

6. The method of treating age-hardening aluminum alloy rivets, the hardening of which may be arrested by refrigeration, preparatory to storage in refrigerated cabinets, which comprises the steps of heating said rivets, quenching in water at about 32° F. displacing the water from said rivets by a liquid having a boiling point below 90° C. and miscible with water, the temperature of the rivets being continuously reduced at each step.

7. The method of treating age-hardening aluminum alloy rivets, the hardening of which may be arrested by refrigeration, which comprises heating the rivets, quenching said rivets in water at about 32° F., rinsing said rivets in a bath of a liquid having a boiling point below 90° C. and miscible with water, said bath being kept at 5° to 15° F., and storing said rivets in refrigerated storage cabinets at about —20° F. until used.

8. The method of treating age-hardening aluminum alloy parts in bulk, the hardening of which may be arrested by refrigeration, which comprises heating the parts, quenching said parts in water at about 32° F., rinsing said parts in a bath of a liquid having a boiling point below 90° C. and miscible with water, said bath being maintained at 5° to 15° F. and storing said rivets in refrigerated storage cabinets at about —20° F. until used.

9. The method of treating age-hardening aluminum alloy parts, the hardening of which may be arrested by refrigeration, which comprises heating said parts, quenching said parts in water at about 32° F., rinsing said parts in a bath of a liquid having a boiling point below 90° C. and miscible with water, said bath being maintained at a lower temperature than the water and storing said parts in refrigerated storage cabinets, the temperature of said parts being positively reduced at each step.

10. The method of treating age-hardening aluminum alloy rivets, the hardening of which may be arrested by refrigeration, which comprises subjecting the rivets to a solution heat treatment, quenching said rivets in water maintained at not more than about room temperature, rinsing said rivets in alcohol the temperature of which is less than the freezing point of water, and then storing the rivets in refrigeration cabinets maintained at a temperature below —20° F.

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