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Nilsson

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[54] **SOLUTION HEAT TREATMENT OF HARDENABLE ALUMINIUM ALLOYS**

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[52] **U.S. Cl.** ..... **148/11.5 A,** 148/12.7

[51] **Int. Cl.** **C22f 1/04**

[58] **Field of Search** ..... 148/11.5 A, 12.7, 148/159

[56] **References Cited**

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Primary Examiner—W. W. Stallard

Attorney—Jennings Bailey, Jr.

[57] **ABSTRACT**

A billet, formed of a hardenable aluminium alloy containing substantial amounts of undissolved constituents other than aluminium and which has not been solution-heat treated, is hydrostatically extruded through a die at such a rate that, considering the reduction in cross-section and the rate of extrusion, the extruded product attains a temperature greater than the dissolving temperature of the constituents. The temperature of the extruded product is kept at substantially the dissolving temperature for a time sufficient to product dissolution and is thereafter rapidly cooled.

3 Claims, 2 Drawing Figures

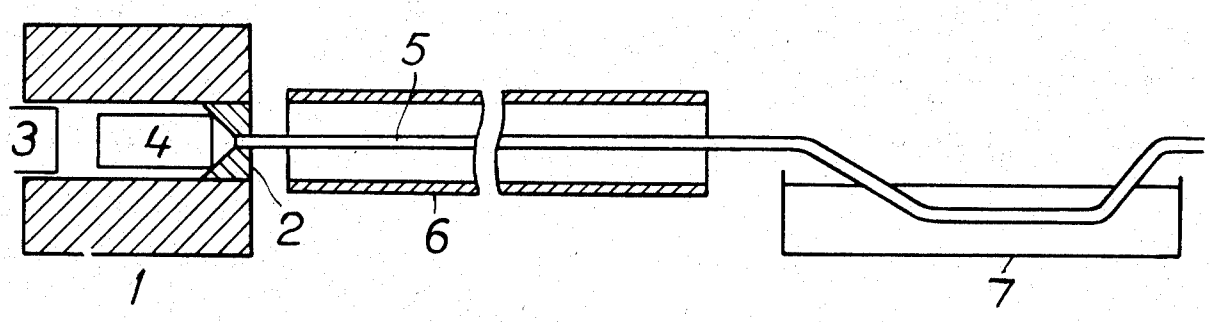


Fig. 1

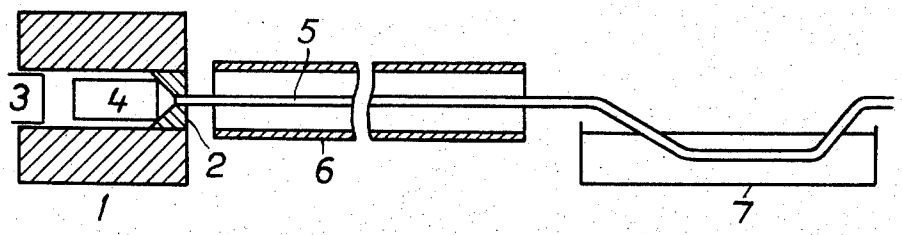
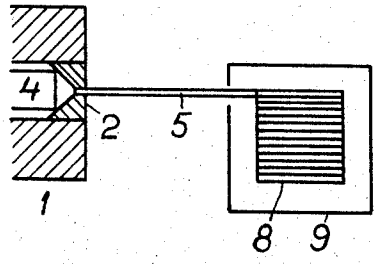


Fig. 2



SOLUTION HEAT TREATMENT OF HARDENABLE ALUMINIUM ALLOYS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method of hydrostatically extruding hardenable aluminium alloys and thus simultaneously starting and partially performing the heat treatment of the alloys which is necessary to achieve homogenization and hardening of the finished billets.

2. The Prior Art

The treatment under consideration is often called solution heat treatment and is performed because the cast raw billets of aluminium alloys are often rather coarse grained and inhomogenous. By means of heating to a certain temperature "the dissolving temperature," which is specific for the alloy being used, for a certain length of time adjacent grains will dissolve into each other so that the metals of the alloy, for example copper or zinc will be completely homogenously dissolved in the aluminium phase. When this solution is complete, the material must be quickly cooled, preferably in water, after which it must usually be subjected to an ageing process at normal temperature or possibly while being heated to some hundred degrees centigrade.

SUMMARY OF THE INVENTION

The heating for the solution heat treatment has hitherto been performed in some form of furnace. The idea according to the present invention is to avoid this step in the process and instead to use the heat procuced when the material is hydrostatically extruded. Besides avoiding one stage in the process, the invention has the advantage that the untreated, cast billet is both softer and more pliable than one which has been treated, and thus is easier to extrude. According to the invention, the cross-section of the raw billets is adjusted to the final cross section so that the cross-sectional reduction will be such that the extruded product reaches a temperature which exceeds the dissolving temperature mentioned above. The extrusion must thus be performed so quickly that the cooling from the press die does not cool the extruded product below said temperature. However, in conventional extrusion presses the extrusion rate is always so high that the heat losses during the actual extrusion process are less than 10 percent. After extrusion, the temperature must be maintained for a certain length of time, which may also be considered to be specific for the alloy concerned. This may be done in several ways and after that the cooling must be performed quickly in order to fix the structure acquired.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be further described with reference to the accompanying drawings, where

FIGS. 1 and 2 illustrate the invention purely symbolically.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows a high pressure cylinder 1 having a die

2 at one end and a piston 3 which is pressed into the other end. The billet 4 is located in the cylinder and is completely surrounded by a pressure medium which, due to the action of the piston 3, forces the billet out through the die. Due to the cross-sectional reduction, the billet is heated and if the initial cross-section is sufficiently large in relation to the extruded cross-section, the product 5 will be heated to a temperature above the dissolving temperature. In order to reach the correct temperature, the billet may possibly be pre-heated to 100°–300°C.

In order to maintain the temperature achieved for sufficiently long, usually some tenths or tens of seconds, in certain cases even longer, the extruded product may be allowed to pass through an insulated, possibly heated tube 6 before it is immersed for cooling, for example in a water bath 7.

It appears that the length of the tube 6 is determined as the product of the delivery rate of the extruded product and the time required for the dissolution process in the material. When products having a small cross-section are being extruded, said delivery rate is often rather great, about 10 m/sec. or more, which with a treating time of 10 s means that the tube 6 must be 100 m or longer, which is inconvenient.

In such cases, however, the product is usually a wire or the like and it is therefore natural to wind the material on to a coil 8, as can be seen in FIG. 2. This coil may then be surrounded by an insulating housing 9 and kept there at the dissolving temperature or above until it is time to cool the material. It should be pointed out here that the storage time may very well exceed that prescribed since, as long as the temperature is sufficiently high, the dissolving process will move towards a stable and desired state, i.e., completely homogenous dissolution of the alloying components in the basic phase.

As mentioned previously, artificial ageing of the material is usually necessary after the cooling process in order to achieve the desired structure. However, this process is outside the scope of the present invention and may be carried out conventionally.

I claim:

1. Method of hydrostatic extrusion of a hardenable aluminium alloy, which comprises hydrostatically extruding a billet of an aluminium alloy containing substantial amounts of undissolved constituents other than aluminium at such a rate that the extruded product attains a temperature greater than the dissolving temperature of such constituents, maintaining the temperature of the extruded product at substantially such dissolving temperature for a time at least sufficient to product dissolving of said constituents, and thereafter rapidly cooling the extruded product.

2. Method as claimed in claim 1, which comprises heating the billet before extrusion to a temperature of 100° to 300°C.

3. Method as claimed in claim 1, which comprises storing the extruded product in substantial batches while maintaining the dissolving temperature and cooling the batches.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,762,962 Dated October 2, 1973

Inventor(s) Jan Nilsson

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading, insert:

Claims priority, Application Sweden
March 18, 1971, 3485/71.

Signed and sealed this 25th day of December 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

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