

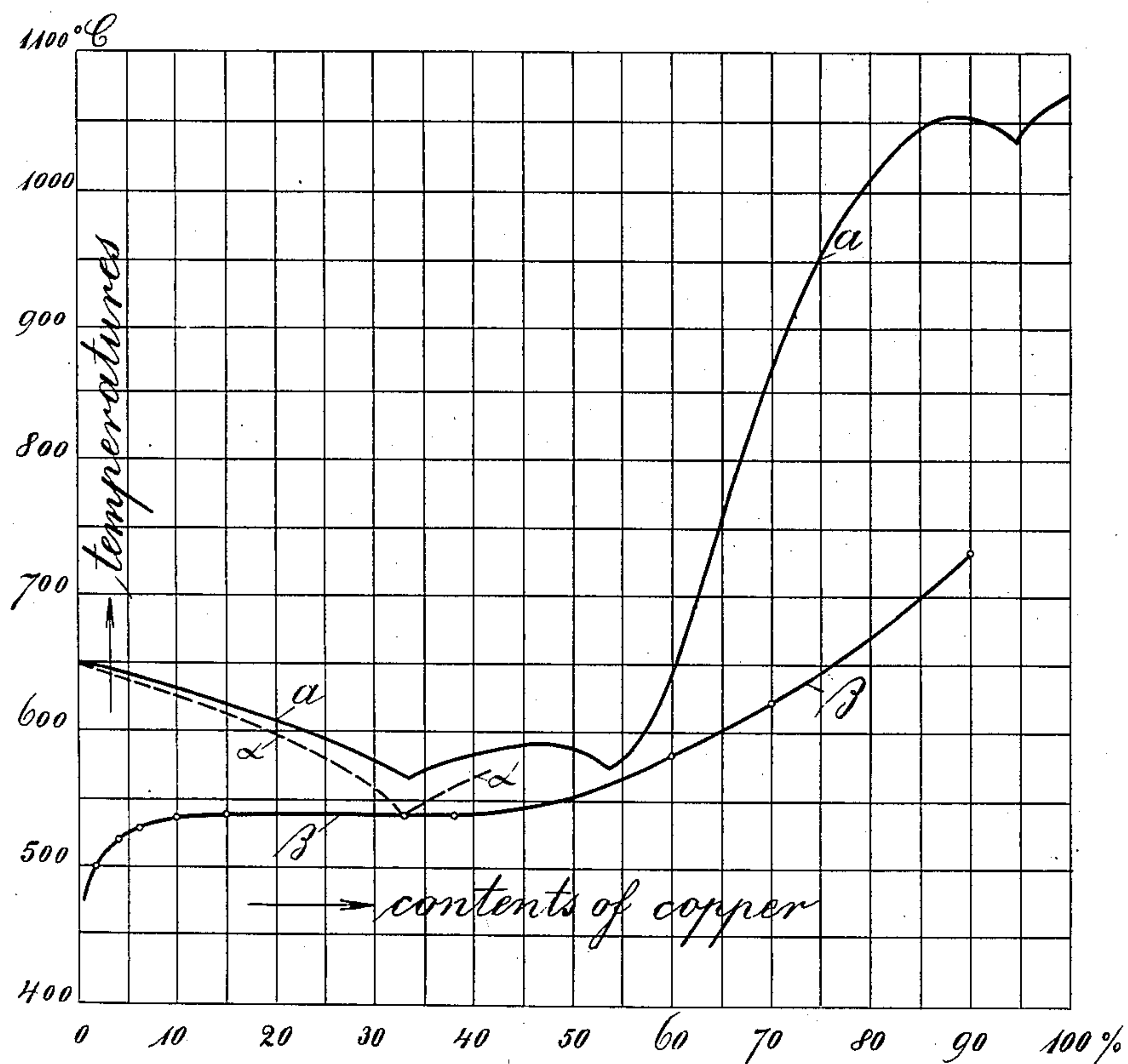
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PATENTED OCT. 15, 1907.

F. G. A. WILM.

PROCESS FOR IMPROVING ALUMINIUM ALLOYS BY HEATING AND CHILLING.

APPLICATION FILED OCT. 17, 1906.



WITNESSES:

John A. Percival  
Miller

INVENTOR

Ferdinand Gustav Alfred Wilm

BY Richards & Co

ATTORNEYS

# UNITED STATES PATENT OFFICE.

FERDINAND GUSTAV ALFRED WILM, OF DREWITZ, GERMANY.

## PROCESS FOR IMPROVING ALUMINIUM ALLOYS BY HEATING AND CHILLING.

No. 868,383.

Specification of Letters Patent.

Patented Oct. 15, 1907.

Application filed October 17, 1905. Serial No. 283,187.

*To all whom it may concern:*

Be it known that I, FERDINAND GUSTAV ALFRED WILM, hütteningsuieur, a subject of the King of Prussia, German Emperor, residing at Drewitz, Kreis Teltow, have invented a new and useful Process for Improving Aluminium Alloys by Heating and Chilling, of which the following is a specification.

It is generally known that certain metals are completely altered in their technological qualities by rapidly cooling the same when they are heated to a certain degree of temperature and that comprehensive use is made of this fact in the arts, as for instance in steel-hardening.

With regard to the application of chilling in the art of casting and the manufacture of aluminium-alloys no success of any practical importance has resulted up to this day. Now the applicant has succeeded in developing the rapid-cooling process to a degree of perfection allowing of its general application to the manufacture of aluminium-alloys, so that the strength and the ductility are considerably increased in such alloys by rapidly cooling (or chilling) the same from a certain characteristic and physically well defined temperature to a lower degree of temperature.

All particular circumstances and characteristic features of the present refining method may be explained in considering alloys of aluminium with copper. As a matter of course it may only be mentioned that the refining process embodying the present invention is logically applicable also to other aluminium-alloys.

From numerous experimental trials and observations it has been found that all alloys of aluminium and copper have a certain critical point of temperature, which is called the recalescence point and becomes apparent by sudden emanation of heat whenever an alloy of the respective kind is cooled down from a higher temperature to a considerably lower one; and as to methods for determining such critical temperature-points (which have been observed for the first time in treating iron), their explanation being beyond the scope of the present invention may be supposed as known matter. It may be suggested only to the reader that a synoptic treatise on methods of determining recalescence-points is that of Guillet bearing the title: "Les alliages métalliques."

In the diagram annexed to this specification the situation of the recalescence point is indicated, for any percentage of copper in the aluminium-alloy  $\alpha\alpha$  show-

ing the curve of the melting points,  $\alpha\alpha$  the curve of the solidification points and  $\beta\beta$  the curve of the recalescence points.

According to the present invention the refining process is performed by heating during a certain lapse of time the aluminium-alloy at a temperature, which is situated in the temperature interval between its solidification-point and a temperature being 30° centigrade below the recalescence point, and by rapidly cooling (or chilling) the ingot or object brought to this temperature. It is admissible to go below the recalescence point by some degrees (in practice 30 degrees have been found admissible) as a conversion successively takes place. It is not necessary that the temperature, from which the metal is chilled, coincides with the temperature to which the metal is first heated. It is only necessary that the temperature from which the alloy is chilled, is never situated at a lower point than 30° centigrade below the recalescence temperature. Considering for instance an aluminium-alloy containing 4% of copper, its refining temperature is situated between 525—30—495 centigrade and its solidification point of 640 centigrade.

The cooling or chilling operation may be effected by using water of normal temperature.

In case of chill-castings of an aluminium-alloy containing 4% of copper made with application of the present refining method the tensile strength has been increased from 15.5 to 22.9 kg sq m m and the elongation approximately from 5% to 7%. Almost the same increase of the tensile strength has been stated in the examination of sand-castings which have been made with the same aluminium-copper-alloy. When examining the same aluminium-alloy with 4% of copper, after it had been rolled and refined until increasing its tensile strength to 27.9 kg sq m m, its elongation has been augmented from about 2.6% to 17.3%. Comparing these results to that obtained by annealing the same rolled material to 220° centigrade, following to that effect the usual process, it has been observed that the tensile strength was reduced by 3.4 kg sq m m, when an increase of 2.6% to only 7.8% had been obtained in elongation.

In treating by the refining process an alloy to which by mechanically working the same the highest attainable degree of strength had been imparted, a very considerable increase of the ductility (elongation) was obtained, which was not accompanied by an observable



diminution of the tensile strength, whereas the usual process of annealing causes a very considerable diminution of the tensile strength.

By the following table I suggest a record of the recalcence points as they have been determined for a series of different aluminium-copper-alloys

	Percentage of copper:	Recalescence temperature: 485° centigrade.			
		1.	2.	3.	4.
10	"	501	"	"	"
	"	512	"	"	"
	"	524	"	"	"
	"	530	"	"	"
	"	535	"	"	"
15	"	538	"	"	"
	"	540	"	"	"

It is obvious that the present refining-process is available both for finished castings or work-pieces or the like and for ingots and blocks of metal-alloys, the latter being subjected after the refining operation to working by rolling or hammer-mills etc. In particular it will be

found advantageous to effect the caloric refining process on plates, wires etc., before subjecting the same to rolling or drawing-operations, or to interpose the new process between the several steps of said working.

Though in the foregoing the new refining method has been exemplified only on an alloy of aluminium with copper, it is obvious that it is likewise available for the other aluminium-alloys.

What I claim and desire to secure by Letters Patent is:

The herein described method of refining aluminium alloys which consists in heating said alloy to a point immediately under its fusing temperature, and then chilling such alloy at a temperature lying between the fusing temperature of that alloy and a temperature lying not over 30° below the point of recalescence of that alloy substantially as described.

In testimony whereof have signed name to this specification in the presence of two subscribing witnesses.

FERDINAND GUSTAV ALFRED WILM.

Witnesses:

WOLDEMAR HAUPT,  
HENRY HASPER.