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Baguet

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[54] **PROCESS AND TANK FOR THE PATENTING OF METAL WIRES**

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[52] **U.S. Cl.** ..... **266/3 R,** 266/4 A, 148/15

[51] **Int. Cl.** **C21d 9/64**

[58] **Field of Search** ..... 266/3 R, 4 R, 4 A; 148/15, 148/20

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[57] **ABSTRACT**

A wire is cooled while in motion by immersing the wire in a pre-cooled molten lead which flows in the same direction in a lead bath as the moving wire. The wire is maintained at a substantially uniform temperature by complete immersion and is reheated, in normal operation, by calories given off by the core of the wire to its surface portions. The wire, which has attained a substantially uniform temperature over its entire core section, is then subjected to structural transformation in another zone of the lead bath at substantially uniform temperature.

6 Claims, 5 Drawing Figures

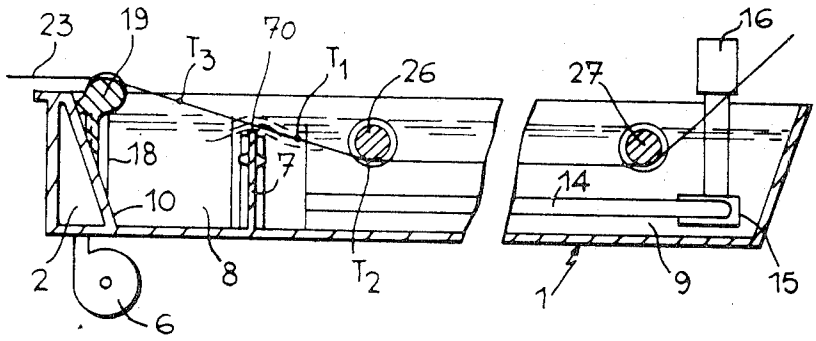
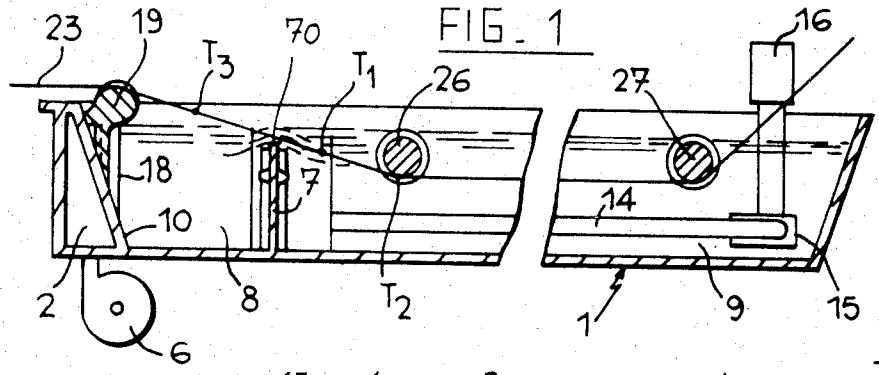


FIG. 1



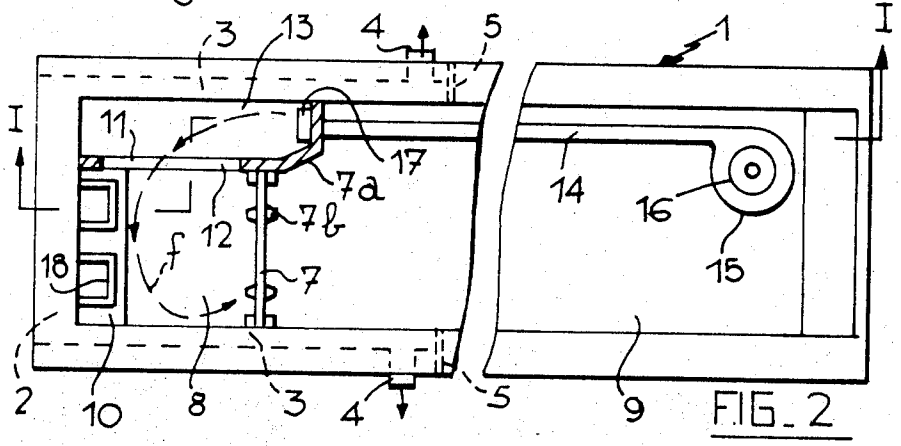
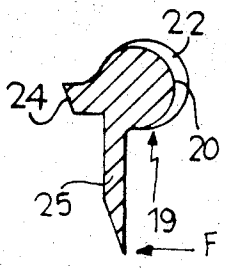


FIG. 2

FIG. 3



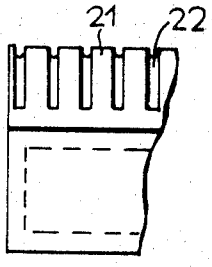
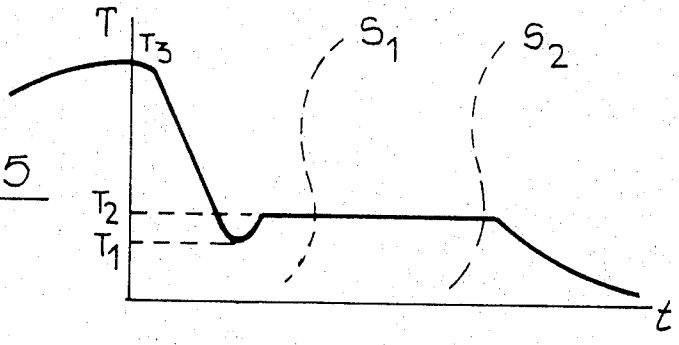


FIG. 4

FIG. 5



PROCESS AND TANK FOR THE PATENTING OF METAL WIRES

DESCRIPTION OF THE PRIOR ART

It is known that patenting consists of cooling in a lead bath a wire which has been previously brought to a high temperature. During this operation, the austenite constituting the metal decomposes and gives rise to a precipitation of pearlite. In order that the metal exhibit the mechanical properties favourable to its subsequent working (breaking, elongation, contraction of cross-section, torsion and bending), it is desirable that the wire be finally cooled in a manner as uniform as possible over the entire extent of its cross-section so that all the portions of the section of the wire reach the stage of structural transformation at the same time. The formation of grains of pearlite having different sizes and the formation of heterogeneous structure which in German is termed "Gemischstruktur" would thus be avoided.

It has been attempted to obtain these results by using a patenting tank whose head (in which the wires penetrate into the lead bath) is surrounded by a casing through which passes a current of cooling air. This casing protects the inlet of the tank in the vicinity of the furnace and its cooling effect is exerted at a greater or lesser distance on the sides of the tank, accordingly as air is permitted to escape from this casing at a greater or lesser distance from the head edge of the tank. However, these arrangements which have the main purpose of cooling the tank in the part in which the hot wires impart heat to it have not made it possible to obtain the desired uniformity in the structure of the wires, mainly in the case of wires having large diameters.

There has also been proposed a process called "Double Cascade Quench" in which the wire is caused to pass through two salt baths at different temperatures, the purpose of the first bath being to cool the wire rapidly, while in the second bath the wire is gradually reheated, the latter stage of which has the purpose of enabling the structural transformation of the metal to take place at approximately uniform temperature (about 500°C). This known process is very complicated and its use is difficult to control when the wires have different diameters. Moreover, the use of salts (nitrates and nitrites) causes the wires to rust and offers very high risks of explosion and fire.

The process according to this invention, like the conventional process, uses a lead bath which avoids any corrosion but in contrast to the arrangements of this conventional process, and in order to obviate its inherent inadequacies it provides a sequence of operations conceived with the purpose of making uniform the temperature of the cross-section of the wire before the structural transformation commences, which is the essential object of patenting.

DETAILED DESCRIPTION OF THE INVENTION

In accordance with the invention the wire is cooled while in motion by immersing it in a stream of molten lead which has been previously cooled and which surrounds it all over and of which the direction of outflow coincides with the direction of progress of the wire. The wire is maintained at a substantially uniform temperature by complete immersion of the wire in a lead bath receiving the aforesaid stream and reheated, in normal operation, by the calories given off by the wire,

during sufficient time for the core of the wire, which is hottest, to give off its heat to its surface portion. Then the wire, which has reached a substantially uniform temperature over its entire cross-section, is subjected to the structural transformation stage in another zone of same lead bath at substantially uniform temperature.

The patenting tank utilised to carry out this process is characterised essentially in that it comprises, at the side from which the hot wire arrives, a head portion separated from the rest of the tank by a partition, preferably heat-insulated, a lead pump located in the tank at the side where the patented wires leave it, and a pump delivery pipe discharging into the head portion of the tank. The stream of lead, whose direction of outflow coincides with the direction of progress of the wire penetrating into the tank, is obtained by discharging the relatively cold lead contained in the head portion of the tank over the upper ridge of the partition separating the head portion from the rest of the tank.

The invention will be described in the following by way of an example of embodiment with the aid of the attached drawings, in which:

FIG. **1** is a longitudinal section of the patenting tank in accordance with the invention:

FIG. **2** is a plan view from above of said tank, from which there have been removed the wire lead-in guides and the guide members which hold the wires in the patenting tank;

FIG. **3** is a cross-section of a wire guide;

FIG. **4** is a partial view in elevation of a wire guide, viewed in the direction of the arrow F in FIG. **3**, and

FIG. **5** is a graph of the variations in the temperature of the wire as a function of time, for the purpose of explaining the phenomena.

FIGS. **1** and **2** represent a patenting tank generally designated by **1**, in which there is found the known arrangement for cooling the tank head (left-hand part of drawings); the tank is surrounded at the inlet by a cooling casing comprising a transverse chamber **2** connected to two lateral chambers **3** which extend externally along the tank up to partitions **5**. A fan **6** forces air into the chamber **2**, from where the air passes into the lateral chambers **3** to finally escape from the latter through adjustable apertures **4**. The essentially novel arrangements of the tank comprise a vertical partition **7** which is heat-insulated (extended in the described embodiment by a wall **7***a*). The partition **7** divides the tank into two portions **8** and **9**, the first, called the head portion, being bounded at the front by a inclined surface **10** forming a wall of the chamber **2**, and on one side by a partition **11** provided with a window **12** which puts the portion **8** of the tank into communication with a receiving chamber **13**. In this chamber **13** there discharges a lead delivery tube **14** connected to a pump **15** immersed in the tank **1** and drawing off the lead near the terminal end of the tank where the bath is comparatively cold. The pump is driven by a motor **16**. The pump is situated at such a level that the drawing off of the lead is effected sufficiently far away from the bottom of the tank to avoid agitating the lead bath and sucking up the sludge which settles at the bottom thereof. The outlet of the tube **14** into the chamber **13** takes place near a deflector **17** arranged so as to impart to the lead an outflow movement substantially following the path of the arrows *f*, and which has the effect of circulating the lead, delivered by the pump, along the cooled walls of the head portion of the tank.

The partition **7** is formed by a panel provided with lifting lugs such as *7b* sliding between pairs of flanges, one of which is fixed to the partition **11**, the other to the lateral opposite wall of the tank. It is thus possible to interchange the panels **7** and adjust the height of their ridge **70** in relation to the bottom of the tank, according to the required conditions.

The wall **10** of the chamber **2** carries supports **18** behind which a wire guide **19** is positioned, said guide being visible in greater detail in FIGS. **3** and **4.** The wire guide **19** comprises a body **20** having on its upper surface teeth **21** between which there are situated grooves **22.** The wire **23** passes along the bottom of these grooves. The body **20** of the wire guide is extended by a support butt **24** and by a stem **25,** the two latter elements being bevelled-off so as to apply against the wall **10.** The stem **25** of the wire guide is immersed into the mass of liquid lead contained in the tank **8** and thus imparts to the bottom of the grooves **22** a temperature near that of the lead contained in the tank portion **8.**

The wire guiding system is completed by guides **26** and **27** submerged in the mass of lead contained in the portion **9** of the tank **1.** The relative position of the members **19, 7** and **26** is such that the wire **23** clears the partition **7** just above its ridge **70** and plunges into the stream of lead passing from the portion **8** into the portion **9** of the tank over the ridge **70.**

During operation, while the wire passes through the tank from left to right, the pump **15** discharges the relatively cool lead, taken from the outlet end of the tank, into the chamber **13** from where the cold lead passes into the first portion, called the head portion **8** of the tank. The lead level rises in this portion until a flow of molten lead is caused above the ridge **70** of the partition **7.** It is into the stream of cold lead, which passes above this overflow element, that the wire **23** passes in the same direction before plunging into the bath contained in the portion **9** of the tank.

The cooling method for the wire is explained as follows: the wire heated in a furnace (not shown, situated to the left in FIG. **1** of the tank **1**) firstly passes between the teeth of the wire guide **19.** The mass of wire is altogether at a temperature T_3 of about 950°C for example, substantially corresponding to the maximum temperature attained by the wire on emerging from the furnace. The wire then arrives in the stream of lead which flows from the portion **8** to the portion **9** of the tank. The lead accompanies the wire and cools it until imparting to it a surface temperature T_1 lower than the temperature T_2 (near to 500°C for example) considered favourable for patenting. The passage of the wire from temperature T_1 to temperature T_2 corresponds to a reheating of the wire which takes place between the ridge **70** and the guide member **26.** During this time the heat of the core of the wire disperses towards its periphery, thus tending to make uniform the temperature of the section of the wire. It is essential that this regularization takes place before the initiation (this takes place within the space substantially starting from the guide member **26**) of the structural transformation which occurs in the bath between the guide members **26** and **27** at a constant temperature, starting at the curve S_1 and comes to an end at the curve S_2. As has been stated, structural irregularities in the wire, which are harmful to its properties are thereby avoided.

Of course, the described embodiment can undergo modifications without departing from the scope of the invention. In particular, it is possible to provide all types of devices, for example coils contained in the portion **8** of the tank for modifying the temperature of the lead bath at the desired points. The details of the arrangements of this type will vary for example according to whether one or two delivery tubes for the lead are provided, etc.

What I claim is:

1. A wire patenting tank comprising:

a tank containing a lead bath;

said tank having a head portion positioned at a location in the tank at which a hot wire enters the tank;

a partition means for separating said head portion from a second portion of the tank;

a lead pump positioned in the second portion of said tank near a side thereof from which a patented wire leaves the tank; and,

means for conveying a lead effluent of said pump into the head portion of said tank.

2. The tank of claim **1** including a cooling coil immersed in the lead bath in the head portion of said tank.

3. The tank of claim **1** wherein said head portion includes a casing, means for supplying said casing with cooling air, said casing surrounding said portion of the tank at an end face thereof and at first and second lateral faces, and said lead conveying means discharges near a deflector which directs a discharge stream of lead delivered by the pump against the cooled walls of the head portion of the tank.

4. The tank of claim **1** wherein said partition means is terminated at an upper portion thereof by an overflow ridge and the tank includes means for causing the hot wire entering above this ridge to pass adjacent to the ridge.

5. The tank of claim **1** wherein the tank includes a wire guide positioned at a side of the tank at which the hot wire enters the tank, said guide formed by a metal body having a comb shape, said wire passing along the bottom of the grooves of said comb shaped body, a stem comprising heat well immersed in the head portion of the tank below a plane of a free surface of the relatively cool lead which occupies said portion of the tank.

6. The tank as claimed in claim **1** wherein said partition means includes a heat insulating body.

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