UNITED STATES PATENT OFFICE.

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HEAT TREATMENT OF METALS.

1,399,044. Specification of Letters Patent. Patented Dec. 6, 1921.

No Drawing. Application filed November 26, 1920. Serial No. 426,620.

To all whom it may concern:

Be it known that I, ARTHUR E. BELLIS, a citizen of the United States, and resident of the city of Springfield, county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in the Heat Treatment of Metals, of which the following is a specification.

This invention relates to the heat treatment of metals and generically considered, contemplates the provision of a method of treating the metal in forging, hot stamping or hot rolling which will result in a material reduction in labor and expense, and will enable the treated piece to be more easily machined.

It is the present practice in the art when metal pieces are to be hot stamped or rolled or shaped at forging temperatures, to first heat the piece in an oven type of furnace, and when heated to the requisite temperature to then insert the metal piece in the hammer, press or between the rolls so that the piece will be properly formed or shaped while hot. Metal pieces treated by this method usually becomes oxidized, a surface scale forming thereon due to contact of the piece with free oxygen while it is being heated in the furnace and also by coming into contact with atmospheric oxygen during transference while in the highly heated state from the furnace to the press, forge-hammer or rolls. This oxid scale is in many cases very objectionable and must be removed since its hard flinty structure causes great physical distress in tools used in machining the parts. In cases where the piece is to be ground, the initial removal of this hard flinty surface, coating or scale, by means of the grinding wheels causes additional labor and expense. Further, with the method now in common use metal pieces of thin cross sectional area when they are transferred from the oven to the shaping machine, or while under the forge-hammer, stamping press or in the rolls, may be unevenly cooled by contact with air currents. This variation in the rate of cooling different parts of the metal results in a non-uniform molecular structure of the piece.

Therefore, I propose a new method of treating or shaping metals in the hot state, whereby the several serious disadvantages above enumerated may be entirely overcome. To this end, I employ in lieu of the usual oven type of furnace for heating the metal piece to the requisite temperature, a highly heated bath of metal salts. Preferably, I use a bath wherein the several salts are of eutectic proportions such for instance as the bath disclosed in my pending application for patent, Serial No. 412,588 filed September 24, 1920. A characteristic bath may consist of a mixture of 39% of NaCl (sodium chlorid and 61% Na_2CO_3 (sodium carbonate).

In practice, the piece to be treated is permitted to remain submerged in the salt bath until it becomes heated throughout its structure to the temperature of the bath. It is then removed from the bath and transferred to the forge-hammer the stamping press or the shaping rolls. When the piece is removed from the salt bath it is covered with a thin film of the bath material, so that the metal surfaces are completely protected against atmospheric oxidization and remain more uniformly heated. Accordingly it has been found that the metal piece remains at a more uniform temperature throughout its structure than has been the case in the use of the prior arts methods. It consequently follows that after the pressing, forging or rolling of the piece is completed the physical structure of this finished piece will also be uniform and all surfaces of the piece are comparatively free from scale due to oxidization.

In some instances, metal pieces are forged, stamped or rolled, then hardened and tempered without being machined before hardening. In this case, the piece is first heated in the salt bath and then forged, pressed or rolled as above described. The piece is then permitted to cool to predetermined temperature and its surfaces are washed, after which it is immersed in another salt bath having the property of hardening the metal. The piece is then removed from the hardening bath and quenched in oil or water. After removal from the quenching bath the piece the temperature of which is still greater than atmospheric, is again washed and then immersed in another salt bath, having the property of drawing and tempering the metal. After removal from the latter bath, the piece is given a final washing. This method has been found to result in a finished piece having an extremely clean surface and a uniform physical structure.

From the foregoing description it is believed that my improved method of heat treating metals and the distinct advantages incident thereto will be readily understood and appreciated. Since the hardening and tempering salt baths above referred to involve merely the use of well known salt components which will have the necessary action upon the metal structure and the heating of the bath solutions to certain predetermined temperatures further specific disclosure of these baths is not deemed necessary. They may also be of a eutectic nature as referred to in my prior application. It will be understood that the essential distinguishing characteristic of the present invention resides in the heating of the piece to be treated in a bath of fused salts instead of in the usual oven type of furnace.

In so far as I am aware, the treatment of metals in the hot state has never before been carried out with the use of a liquid medium for the purpose of heating the metal to the requisite temperature for the proper mechanical operations thereon. It is to be accordingly understood that I do not consider myself limited in the actual practice of the present invention to the specific mechanical operations above referred to as the metal might be shaped by various other means and with the use of other processes either before or after its treatment in the salt baths.

What I claim is:

1. In the art of heat treating metals to be forged, stamped, rolled or otherwise mechanically operated upon while in the hot state, first heating the metal piece to the requisite temperature by immersion in a bath of metal salt components in the form of a single liquid, then withdrawing the metal piece from the bath with a film of the bath material thereon and subjecting the piece without removing the bath film therefrom to the mechanical shaping operation.

2. In the art of heat treating metals to be forged, stamped, rolled or otherwise mechanically operated upon while in the hot state, that step which consists in immersing the metal in a liquid heat transferring medium and permitting the same to remain therein until heated to the requisite temperature, such liquid medium being characterized by the formation of a protective coating upon the metal piece when the latter is withdrawn from said liquid medium to be transferred to the mechanical shaping means.

3. In the art of forging, stamping, rolling or otherwise mechanically treating metals, the method which consists in immersing the metal piece to be treated in a high temperature salt bath solution and permitting the piece to remain therein until heated to the requisite temperature, then removing the piece from the fused salt bath with a film of the fused salt on the surface thereof, such film of salt solution protecting the metal surfaces against oxidization, and finally subjecting the salt covered surfaces of the metal piece to mechanical treatment.

In testimony that I claim the foregoing as my invention, I have signed my name hereunder.

ARTHUR E. BELLIS.