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SALT-BATH FURNACE.

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The present invention refers to a known type of salt bath hardening furnaces in which the heat is supplied by alternating electric current passing through the salt. The object of the invention is to ensure substantial freedom from decarburization at the surface of the heated steel articles. The furnace consists of a receptacle for the salt, or crucible, made of refractory non-conducting material. On the inside of the walls of the crucible are provided two or more electrodes, usually made of iron or soft steel, which are connected with the source of current and serve to transmit the current to the salt. By regulating the current the molten salt is kept at the desired temperature. The objects to be hardened are heated by immersion in the salt.

On heating steel articles in salt, decarburization of the steel surface is liable to occur, particularly when high temperatures are employed as in hardening high-speed steel. Since for many classes of tools decarburization is not permissible, salt bath furnaces have not come into general use for the hardening of high-speed steel, although it is realized that they present obvious advantages for such purpose, for instance: uniformity of temperature, rapid heating and freedom from surface scale.

During an investigation that led to the present invention various refractory materials were tried for the lining, in each case the depth of decarburization of immersed high-speed steel objects being determined by microscopical investigation. The salt employed was barium chloride. With basic or neutral lining the amount of decarburization, in the comparatively short time required for sufficient heating of the object, was found to be considerable. No only is this decarburization objectionable on account of the softness imparted to the surface layer of the hardened tool but it is often accompanied by hardening cracks, probably resulting from stresses due to differential composition of surface portion and interior. When silica was used for the lining, however, no decarburization occured or only a negligible one. Also it was found that hardening cracks became very rare. Silica is, of course, a well-known refractory, generally used for certain applications. The reason why it has not been used for salt bath furnaces probably is, that it is liable to spalling and cracking, when rapidly heated, as is generally the case with electric salt baths. When proper care is taken in heating this is not a serious objection, however, and in any case the advantages associated with the use of silica for this purpose far outweigh that drawback.

The mechanism of the decarburization from heating in the salt and the action of silica in preventing such decarburization may be explained as follows. The molten salt dissolves an appreciable quantity of FeO formed by reaction between the hot iron electrodes and the oxygen of the air, also from scale introduced with the preheated steel objects. The dissolved FeO is the active reagent in decarburizing the steel. When silica is used for lining any FeO present in solution immediately reacts with the silica to form silicate. This, being practically insoluble in the salt, settles at the bottom from where it may be removed. The fact that the silica is in excess ensures that no appreciable amount of free iron oxide can be present in the salt.

It is obvious that any acid refractory capable of neutralizing iron oxide at the temperature in question by forming a salt will serve the purpose, provided it can be made into a lining. If desired, silica, or another acid, non-volatile oxide, may also be introduced into the salt, for the purpose mentioned, in any other form than as lining, for instance as sand. In that case it is not necessary that the lining consists of silica.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. Method of keeping a fused salt bath for hardening of steel in a non-decarburizing condition, which consists in the introduction of an acid, non-volatile oxide, preferably silica, in contact with the salt.

2. Method of keeping a fused salt bath for hardening of steel, in a non-decarburizing condition, which consists in the use of an acid refractory oxide, preferably silica, as wall material or lining for the crucible containing the salt.

In witness whereof, I have hereunto signed my name.

AXEL GUSTAF EMANUEL HULTGREN.