The invention relates to a bath of molten salts for cementing iron, steel and the like more particularly to melt baths which comprise barium chloride as chief constituent and alkali metal cyanide as effective ingredient the amount of barium chloride present being preferably at least four times as great as that of the alkali metal cyanide, and which contain, in addition such salts as alkali metal chlorides or the like, which have the effect of making the melt more fluid.

We have found that the activity of such baths may be enhanced and their efficacy maintained for a long period by the presence, on the one hand, of strontium salts and, on the other alkali metal compounds such as barium oxide, barium hydroxide, barium carbonate and the like.

The strontium salts, of which chiefly the chloride comes into consideration, act by favourizing the decomposition of the cyanide present in the bath, whereby the cementation i. e. migration of carbon and nitrogen or both are facilitated, whilst on the other hand the alkali metal compounds decrease the premature decomposition of the cyanide present and, above all, prevent the precipitation of free carbon in the bath. By properly choosing the proportion of the amounts of both these groups of compounds to be added, either to each other or to the total quantity of the melt to which they are added, and which may be ascertained easily beforehand by trial, one is capable of regulating the whole cementation and carburizing process in the way it is desired under the given circumstances and for the desired purpose, and further, adapt to the material to be treated in the bath.

A further advantage of the melt baths composed according to our invention consists in their long life, which allows them to be utilized for a very long time, for instance, for several weeks and even months by simply replacing those parts of the melt which have been used up or decomposed, i. e. the cyanides.

In many cases it might be useful to replace a part of the alkaline barium compounds in the melt bath by alkali compounds of strontium such as strontium oxide, strontium carbonate or the like. This means it is possible to attain a certain degree of precipitation of carbon within the melt, which might be desirable in certain cases in order to favorize the migration of the carbon in preference to that of the nitrogen.

The temperatures to be utilized for the carburizing process according to our invention may vary to a large extent, for instance between 820° up to 950° C.

Example 1. — A melt of the following composition is used for carburizing iron articles containing 0.15% of carbon:

- 60 parts barium chloride
- 12 parts sodium cyanide
- 8 parts potassium chloride
- 1 part sodium chloride
- 15 parts strontium chloride
- 3 parts barium carbonate.

After immersion for two hours at 930° C., the carburizing depth attained is about 1 mm. After four hours about 1.4 to 1.6 mm. and after six hours altogether about 1.8 to 2.0 mm. The hardness after quenching in cold water is about 60 to 65° Rockwell.

Example 2. — Another bath according to our invention consists of the following ingredients:

- 50 parts barium chloride
- 8 parts sodium cyanide
- 15 parts potassium chloride
- 3 parts strontium chloride
- 14 parts barium carbonate
- 1 part strontium oxide.

An iron bolt with 0.15% carbon is immersed at 920° C. for two hours, the carburizing depth is about 1 mm. After four hours the carburizing depth is about 1.6 mm. and after six hours about 2 mm. The hardness after quenching is 60 to 65° Rockwell.

Example 3. — Excellent results were obtained with a melt of the following composition:

- 62.5 parts barium chloride
- 9 parts sodium cyanide
- 5.5 parts potassium chloride
- 1 part strontium carbonate
- 11.5 parts barium carbonate.

For filling up a bath of this composition which is made necessary by the withdrawal of cemented articles, a mixture of the following composition may be used:

- 71 parts barium chloride
- 10 parts sodium cyanide
- 6.4 parts potassium chloride
- 10 parts strontium chloride
- 2.7 parts barium carbonate.

The constituents of this mixture may be added ready mixed or they may be added separately, as is most convenient. We prefer to prepare
a mixture and add it as such. If the efficiency of the melt deteriorates by prolonged use or the decomposition respectively of the cyanide, it can easily be made up by the addition of alkali metal cyanides, in particular sodium cyanide, according to the constancy of the bath desired.

By the addition of the said mixture in order to fill up and replace any losses of the bath and on the other hand alkali metal cyanide, we were able to maintain a melt for several months and get good carburizing effects after even this length of time.

What we claim is:

1. Fused salt bath for cementing iron articles which comprises, in addition to barium chloride and alkali metal cyanide, strontium halide and alkaline compound of barium selected from the group comprising barium oxide, barium hydroxide, and barium carbonate.

2. Fused salt bath for cementing iron articles which comprises, in addition to barium chloride and sodium cyanide, strontium halide and alkaline compound of barium selected from the group comprising barium oxide, barium hydroxide, and barium carbonate.

3. Fused salt bath for cementing iron articles which comprises, in addition to barium chloride and alkali metal cyanide in the proportion of at least four parts by weight of barium chloride to each one part by weight of alkali metal cyanide, strontium halide and alkaline compounds of barium selected from the group comprising barium oxide, barium hydroxide, and barium carbonate.

4. Fused salt bath for cementing iron articles which comprises, in addition to barium chloride and alkali metal cyanide, strontium chloride and an alkaline compound of barium selected from the group comprising barium oxide, barium hydroxide, and barium carbonate.

5. Fused salt bath for cementing iron articles which comprises, in addition to barium chloride and alkali metal cyanide, strontium chloride and barium oxide.

6. Fused salt bath for cementing iron articles which comprises, in addition to at least four times the amount of barium chloride to the amount of sodium cyanide present, strontium chloride and barium carbonate.

7. Fused salt bath for carburizing iron and steel articles which comprises in addition to barium chloride and alkali metal cyanides, alkali metal chlorides for making the melt more fluid, strontium halides and alkaline barium compounds selected from the group comprising barium oxide, barium hydroxide, and barium carbonate.

8. Fused salt bath for carburizing iron and steel articles which comprises in addition to barium chloride and alkali metal cyanides, alkali metal chlorides for making the melt more fluid, strontium halides and alkaline barium compounds selected from the group comprising barium oxide, barium hydroxide, and barium carbonate part of which are replaced by alkaline strontium compounds selected from the group comprising strontium oxide and strontium carbonate.

9. Fused salt bath for carburizing iron and steel articles which comprises in addition to barium chloride and alkali metal cyanides, alkali metal chlorides for making the melt more fluid, strontium halides and alkaline strontium compounds selected from the group comprising strontium oxide and strontium carbonate.

10. Fused salt bath for carburizing iron articles which contains 50 to 65 parts by weight of barium chloride, 8 to 15 parts by weight of sodium cyanide, 6 to 15 parts by weight of strontium chloride, 3 to 15 parts by weight of barium carbonate, 5 to 10 parts by weight of potassium chloride.

11. Fused salt bath for carburizing iron articles containing 65 parts by weight of barium chloride, 9 parts by weight of sodium cyanide, 6 parts by weight of potassium chloride, 9 parts by weight of strontium chloride, 11 parts by weight of barium carbonate.

12. The method of operating a carburizing bath which includes barium chloride in amount at least several times that of the alkali metal cyanide present which comprises regulating the activity thereof by adding thereto, as required, by the leached activity thereof, an alkaline compound selected from the group comprising barium oxide, barium hydroxide, barium carbonate, strontium oxide, and strontium carbonate.

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