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METHOD OF QUENCHING STEEL AND OTHER ALLOYS

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This invention relates to a composition of matter suitable to be used as a quenching medium for metals.

This invention further relates to a composition of matter characterized by its ability, when used as a quenching medium for the heat treatment of metals, to give cooling rates capable of variation, within limits, according to the results desired.

This invention still further relates to an aqueous, viscous bath, suitable to be used as a quenching medium for metals, the bath having surface tension and viscosity which may be controlled.

The usual practice employed in the quenching of metals is to heat the metal to desired temperatures for a sufficient time interval to obtain conversion of the metal and then to cool it to a suitable temperature at a suitable rate.

The cooling of the metal is usually accomplished by means of quenches. A wide variety of quenching materials is encountered in commercial practice, but those which find most general use are: water, both as a bath and as a spray; salt brines; oils; oil-water emulsions; acid baths; alkaline baths; and air.

In the choice of a quenching medium, there are many requirements which must be met, depending on the type of metal being quenched, its size and shape, and the hardness desired. The first requirement, however, of any quenching medium is that it provide the necessary cooling rate to effect the result desired. The further adaptability of a quenching medium is dependent on several other factors, namely: cost, availability, ease of handling, safety from fire hazard, effect on scale adherence, fumes and odors, as well as ability to maintain its cooling characteristics upon continued use and throughout the temperatures encountered.

I have ascertained that a quenching bath comprising an aqueous solution containing an alkali pectate or a pectated pulp and, preferably, a surface tension depressant tends to produce a quench which is slower than water.

Accordingly, this invention is based on the discovery that it is possible to produce a quenching medium having a cooling rate capable of variation according to the needs of the metal being quenched. My quenching medium seems to give comparatively rapid cooling in the upper temperature ranges and thereby producing great hardness yet gives a slower quench at the lower temperatures and thereby eliminating undue stress and cracking.

An object of this invention, therefore, is to disclose methods and means for producing a quenching medium suitable for use in the heat treatment of metals in which the cooling rate is capable of being varied in accordance with the results desired.

Another object of this invention is to disclose methods and means for producing a quenching medium free from the hazards of fire.

A further object of this invention is to disclose methods and means for producing a quenching medium which is relatively inexpensive and readily available.

A still further object of this invention is to provide a quenching medium which is especially suited to the quenching of alloy steels in general and is even capable of being used successfully with chromium-vanadium steels which are known to be subject to unusual difficulties in quenching.

Another object of this invention is to provide a quenching medium characterized by its ability to de-scale the specimens quenched therein and leave them comparatively clean and free from scale.

A further object of this invention is to disclose methods and means of producing a quenching medium which is characterized by the fact that its cooling rate is variable almost at will, since cooling rates may be obtained ranging from that of water to rates slower than oil by varying the proportions of the various constituents of the quench.

Other objects, uses, and adaptations of this invention will be apparent from an illustration of the invention hereinafter described.

Various plant materials have been suggested for use in quenches, but commercial results have been unsatisfactory. In particular, pectin has been suggested as a suitable substance to be used as a quenching material. The relatively high cost of this material coupled with the fact that the viscosity of its sols is subject to considerable variation, depending upon the temperature, and the further disadvantage that this substance is subject to considerable loss of viscosity under the usual conditions of use, tends to limit its general use.

The materials used in accordance with the present invention are the soluble pectates in general, such as alkali pectates, as well as pectates of ammonium and the like. In particular, I find especially suited those "fibrous" alkali and ammonium pectates disclosed in my U. S. Patent 2,132,065, and/or the crude pectated pulp from which these alkali pectates may be purified.

Pectated pulp as referred to in this specification includes the crude alkaline source material,

for example, citrus peel or the more or less purified pectated material. By the term alkali pectates I mean in general the alkali and ammonium and similar compounds, including those prepared as in accordance with my U. S. Patent 2,132,065. These latter are referred to in the application as "fibrous pectates" due to a distinctive fibrous appearance.

It has been found possible to obtain varying results according to the concentrations of the pectates used so that the hardness, for instance, can be varied by varying the percentage of the pectate used.

For the hardening of an alloy steel of the chromium-vanadium type (S. A. E. 6150), I have found the following bath to be satisfactory. The bath may be prepared by dispersing in any suitable way the material to be used. For example, about 2 kg. of pectated pulp of the fibrous-appearing type mentioned may be dispersed in about 100 liters of water to which has been added about 100 g. of Na_2HPO_4 and 50 g. of NaOH. This mixture is thoroughly agitated and then passed through a screen of about 60 mesh to aid in the dispersion and to remove any undispersed material. To this mixture is added about 1.5 kg. of a good cocoanut oil soap, calculated as anhydrous soap. When this mixture is to be used as a quenching medium, it is further diluted with water in the proportion of about 1 part of the mixture plus 1⅔ parts of water. The resulting viscous sol will contain about 0.75% pectated pulp and about 0.6% soap.

The purpose of the alkali is to act as a dispersing agent for the pectate, whereas the soap acts as a modifying agent. Other alkalies than those mentioned above may be used if they effect the desired results. Also, other modifying agents, as, for example, crude sugar, may be employed.

The amount and kind of the modifier will vary depending on the water used for making the dispersions, as well as on the surface tensions desired. For the hardening of steels and alloys, viscous sols of pectated pulp varying in composition from 0.1% to about 1.5% pectated pulp have been found suitable, the percentage variation being dependent on the results sought.

It is to be understood that the results obtainable are dependent upon a satisfactory grouping of the many factors which affect the quench. For example, the conditions of the bath, as to temperature and agitation, are variables which affect the quench. Other factors which also affect the quenching are composition of the steel or alloy to be quenched, temperature to which steel or alloy is heated. The viscosity of the bath also affects speed of cooling and therefore the hardness of the material being quenched.

It is evident, therefore, that the characteristics desired for a particular steel or alloy under particular conditions must be exactly determined by empirical means.

I am aware that many modifications will occur to those skilled in the art, and it is not intended that the invention shall be limited other than as set forth in the appended claims.

Having now fully described my invention in such full and concise terms as to enable others skilled in the art to make, compound and use the same, I claim as my invention and desire to secure Letters Patent on the following:

I claim:

1. A process which comprises quenching heated metals or metal alloys in an aqueous medium comprising an alkali or ammonium pectate and a suitable surface-tension depressant.

2. A steel quenching medium comprising an aqueous dispersion of a soluble pectate in an amount of from 0.1% to 1.5% of the medium and a suitable soap in an amount of about 0.6% of the medium.

3. A process for quenching heat-treatable alloys which comprises the steps of heating the alloy to a desired temperature and subsequently treating the alloy with a medium comprising an aqueous dispersion of an alkali or ammonium pectate and a surface-tension depressant.

4. A process for quenching and descaling alloys comprising the steps of heating the alloy to be quenched to the desired temperature and subsequently treating the alloy with a medium comprising an aqueous dispersion of a soluble pectate to which has been added a surface-tension depressant.

5. A process for quenching and descaling alloys comprising the steps of heating the alloy to the desired temperature and subsequently treating the alloy with a medium comprising an aqueous dispersion of a soluble pectate.

6. In a composition of matter the admixture of an aqueous dispersion of a soluble pectate and soap which perfects the admixture for use as a quenching medium.

7. In a composition of matter the admixture of an aqueous dispersion of a soluble "fibrous" pectate and soap which perfects the admixture for use as a quenching medium.

8. In a composition of matter the admixture of a 0.1% to 1.5% aqueous dispersion of a soluble pectate and a suitable quantity of soap which perfects the admixture for use as a quenching medium.

9. In a composition of matter the admixture of an aqueous dispersion of a soluble pectate and a surface-tension depressant which perfects the admixture for use as a quenching medium.

10. A process which comprises quenching alloys with a medium comprising an aqueous dispersion of a soluble pectate.

11. A process which comprises quenching alloys with a medium comprising an aqueous dispersion of an alkali or ammonium pectate.

12. A process which comprises quenching alloys with a medium comprising an aqueous dispersion of a soluble "fibrous" pectate.

13. A process which comprises quenching alloys with a medium comprising an aqueous dispersion of a soluble "fibrous" pectate and a suitable surface-tension depressant.

14. A process which comprises quenching alloys with a medium comprising an aqueous dispersion of a soluble "fibrous" pectate and a suitable soap.

15. A process which comprises quenching alloys with a medium comprising an aqueous dispersion of a "fibrous" alkali or ammonium pectate.

16. A process for quenching and descaling alloys comprising the steps of heating the alloy to the desired temperature and subsequently treating the alloy with a medium comprising an aqueous dispersion of a soluble "fibrous" pectate.

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