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HEAT TREATMENT AND QUENCHING OF ALLOYED STEELS.

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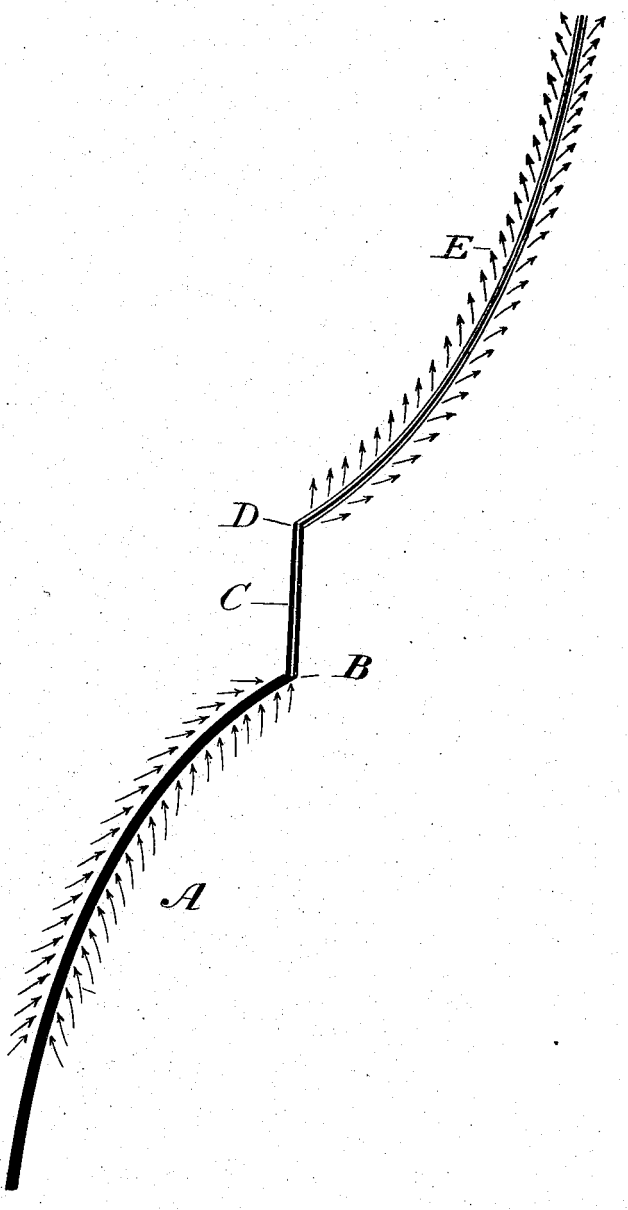
899,713.

Patented Sept. 29, 1908.



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UNITED STATES PATENT OFFICE.

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HEAT TREATMENT AND QUENCHING OF ALLOYED STEELS.

No. 899,713. Specification of Letters Patent. Patented Sept. 29, 1908.

Application filed September 18, 1907. Serial No. 393,489.

To all whom it may concern:

Be it known that I, JAMES CHURCHWARD, a subject of the King of Great Britain, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Heat Treatments and Quenching of Alloyed Steels, of which the following is a specification.

This invention relates to certain improvements in heat-treating and quenching alloyed steels, and has for its object to provide an improved process for use in the production of alloyed steels whereby the resultant product is rendered of extraordinary toughness and hardness.

Each successive heat or heat-wave is carried to a point a little below either the segregating or retardation points of the corresponding alloying metal, the mass being cooled or quenched after each successive heat or heat-wave.

For affording a better understanding to those versed in the art, I have shown in the accompanying drawing a diagram illustrating the different phases of the metal under a rising temperature.

In this drawing A is a period of restoration where the alloying metal reënters the mass particle.

B is the retardation point. At this point the alloying metal has been completely restored and enters in a period of rest or retarded activity.

C is the period of rest or inactivity of the alloy.

D is the segregating point. Here a reverse-chemical action takes place and the mass particle again sweats or throws out from itself the alloying metal.

E is the period of segregations, which commences at the segregating point and continues on to the melting point.

If the temperature is carried to within 100° F. of the retardation point of the alloying metal and the mass of metal allowed to soak for a while at this temperature, the restoration will be accomplished but not in so perfect a manner as if the temperature were carried to a point nearer the retardation point. It is very dangerous to attempt to carry a restoration temperature beyond the retardation point and into the zone of rest or inactivity. This period of time is so short, that it is more than likely that such treatment would be extended beyond the segregating point and then the restoration would only be partial.

All quenchings given above the retardation point of manganese should be with a view of toughening only, and oils are the best substances for this use. The metal is not brought into a proper or fit state for hardening until the temperature is stopped at the retardation point of the manganese contained in the steels. This point is generally known as the recalescent point. There are two actions occurring within the body of the metal at this point, namely:—a thermo-chemical action which forces a physical action, whereby the manganese is caused to release its bond or grip on the mass particle, the mass particle thereupon assuming a new shape or form, and the carbon contained in the particle working its way out to the surfaces of the particle, leaving little or no carbon in the center thereof. This brings the hardening element—carbon—to the surface, a position where it can receive the chill and shock from the bath, causing the particle to collapse, shrink in size and harden, and, as the mass is an aggregation of particles this hardening is conveyed to the whole mass. Further hardening can be done by a plurality of quenchings, if they follow down from the retardation point of manganese. The carbon will not be re-arranged in the particle by any subsequent temperature provided, such subsequent temperature or temperatures being all below the retardation point of the manganese, but if a subsequent temperature is carried beyond the retardation point of the manganese the particle will again re-form and go back into its old shape, carrying the carbon in with it.

By quenching in any ordinary or suitable manner two operations are conducted under one heat, namely the restoration of the alloying metal and the toughening and hardening of the mass itself by the quenching. This very materially reduces the cost of production, and is of great value to manufacturers of alloyed steels. The degree of hardness of the product can also be governed. If allowed to atmospherically cool it will be hard, but not nearly so hard as when quenched and yet harder than when cooled more slowly.

This invention is a modification of that described and claimed in my Letters Patent

No. 855,756, dated June 4th, 1907. For more detailed statement of steps and temperatures employed see this patent.

Having thus described my invention I claim:—

1. The herein described method of heat-treating and hardening alloyed steels, which consists in subjecting the mass of metal to a series of heats or heat waves of successively decreasing maximum temperature, designed to affect the alloying metals in order of their respective segregating points, the first heat or heat-wave being carried to a temperature a little below the segregating point of the alloying metal having the highest segregating point, and each successive heat or heat-wave to a temperature a little below the segregating point of the corresponding alloying metal and quenching the mass after each successive heat or heat-wave.

2. The herein described method of heat-treating and hardening alloyed steels, which consists in subjecting the mass of metal to a series of heats or heat-waves of successively decreasing maximum temperature, designed to affect the alloying metals in order of their respective retardation points, the first heat or heat-wave being carried to a temperature a little below the retardation point of the alloying metal having the highest retardation point, and each successive heat or heat-wave to a temperature a little below the retardation point of the corresponding alloying metal and quenching the mass after each successive heat or heat-wave.

3. The herein described method of heat-treating and hardening alloyed steels, which consists in subjecting the mass of metal to a series of heats or heat-waves of successively decreasing maximum temperature, designed to affect the alloying metals in order of their respective retardation points, the first heat or heat-wave being carried to a temperature within 100° F. of the retardation point of the alloying metal having the highest retardation point, and each successive heat or heat-wave to a temperature within 100° F. of the retardation point of the corresponding alloying metal, and quenching the mass after each successive heat or heat-wave.

In witness whereof I have hereunto signed my name this 17th day of September 1907, in the presence of two subscribing witnesses.

JAMES CHURCHWARD.

Witnesses:
J. D. CAPLINGER,
F. W. WIMAN.