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HEAT TREATMENT OF COLD SHAPED MANGANESE STEEL ARTICLES

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Iron or steel alloys, containing from ten to fifteen per cent of manganese and effective amounts of nickel or nickel and chrome, such as disclosed in Letters Patent No. 1,732,202, are distinguished from ordinary manganese steel in that they do not require water or other usual form of toughening, but may be toughened by cooling in the air. Hence, they readily lend themselves to rolling, pressing, drawing and other forms of cold working or shaping and can be and are employed in the manufacture of articles for which ordinary manganese steel has failed, either in the making of the article or in the service thereof.

A particularly desirable application of such special iron or steel alloys is in the production of cold shaped articles from rods or wires as, for example, woven screens, or of cold shaped articles from sheets or plates as, for example, military helmets, chutes, grids, etc.

In the die forming, drawing, pressing or other method of cold shaping, the metal acquires, as a natural concomitant of cold working, added hardness or stiffness which, under different circumstances or conditions, may prove beneficial or detrimental. For example, the hardness imparted by cold drawing of the sheet to helmet form might attain to a degree of brittleness such that when fired upon under regulation conditions of distance and caliber of weapon, the helmet would be punctured or badly cracked.

The object of my invention is to improve the manufacture of articles formed by cold working from special iron or steel alloys of the character indicated, by controlling the effect of cold working so that the finished articles will be usefully stiff and hard without being either too brittle or too soft; and the nature of the invention consists in the method hereinafter stated of heat treating steel containing, for example, less than one per cent of carbon, an effective amount up to five per cent nickel, less than decimal fifty per cent silicon and ten to fifteen per cent of manganese; or a steel containing decimal thirty to decimal eighty-five per cent of carbon, an effective amount up to five per cent nickel, less than decimal fifty per cent silicon, an effective amount up to eight per cent chrome, and ten to fifteen per cent manganese.

In the practice of the invention, it is sometimes desirable or expedient, depending upon circumstances or conditions, to subject the rolled sheet or otherwise formed blank to a preliminary annealing before proceeding further with the cold shaping or partial shaping of the article. For example, the blank is heated to a temperature within the range of about 1400° to about 1800° F., cooled in air or water and then subjected to cold shaping by drawing or otherwise. After finish forming or partial forming, depending upon its nature, the article is heated to an adequate temperature, say about 1300° F., held for an effective period, and then cooled in the air. Any further shaping that may be required is thereupon proceeded with by cold working operations upon the completion of which the article is heated to about 1200° F., held for an effective period and then air cooled. If a number of cold passes or operations are requisite to the finish forming of the article, it is sometimes expedient or beneficial to interrupt the continuity of the cold working by heat treating the partially formed article at successively decreasing temperatures between say about 1800° F. and 1400° F.

The described heat treatment has the effect of obviating undesirable inequalities of hardness and, without wholly destroying the influence of cold working, of eliminating superhardness so that the finished article possesses desirable stiffness and hardness without being either too brittle or too soft.

Having described my invention, I claim:

1. In the production of articles by cold working iron or steel alloys containing ten to fifteen per cent manganese and up to five per cent nickel, and in order to correct conditions resulting from superhardening of the article under the influence of cold working, the improvement which consists in heating the article, following severe cold shaping, to a temperature of about 1200° F., holding the heat for an effective period, and thereafter cooling the article in the air.

2. In the production of articles by cold working iron or steel alloys containing ten to fifteen per cent manganese and up to five per cent nickel and where a number of cold passes or operations are required to complete the article, the improvement which consists in interrupting the continuity of the cold working by heat treating the article, following severe cold shaping, at successively declining temperatures of from about 1800° F. to about 1400° F.

3. In the production of articles by cold working iron or steel alloys containing ten to fifteen per cent manganese and up to five per cent nickel, the improvement which consists in subjecting the blank to a preliminary heating at a temperature about 1400° to 1800° F. and then cooling it, cold shaping the article under conditions to avoid superhardening, heating the finished article to a temperature of about 1300° F., and then cooling it in the air.

In testimony whereof I affix my signature.

JOHN HOWE HALL.