

UNITED STATES PATENT OFFICE.

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MANUFACTURE OF ARMOR-PLATES.

1,051,799.

Specification of Letters Patent.

Patented Jan. 28, 1913.

No Drawing. Original application filed March 11, 1911, Serial No. 613,787. Divided and this application filed March 9, 1912. Serial No. 682,734.

To all whom it may concern:

Be it known that I, JOHN LAWRENCE BENTHALL, a subject of the King of Great Britain, residing at Highfield Hall, Chesterfield, in the county of Derby, England, have invented certain new and useful improvements in the Manufacture of Armor-Plates, of which the following is a specification.

10 This invention relates to the manufacture of armor plates that are composed of nickel steel alloyed with one or more of the metals chromium, vanadium, tantalum, molybdenum, etc., and that are subjected during their manufacture to various heat treatments.

15 The present invention has reference to steel plates of the above stated kind containing percentages of carbon hereinafter stated and the chief object is to improve the structure of the face and back portions of the plate so that its resisting power in attack will be strengthened, thus rendering the plate particularly suitable for resisting penetration by capped projectiles.

20 According to this invention the plate, after having been rolled and annealed in the usual manner, is subjected to cementation on the side that eventually forms the face; then after treatment by known methods adopted in the manufacture of armor plates such for example as successive oil, air, and water coolings (after heating in each case to a suitable temperature as hereinafter set forth) and after machining, the whole plate is heated uniformly in a furnace to the temperature required to give the best tensile strength at the back of the plate, and, when thoroughly heated, the plate is quickly transferred to a second furnace, the temperature of which is such that, by rapid heating, the face is quickly brought to a temperature that will give glass hardness to the cemented portion when quenched in water, the back portion of the plate remaining at such a temperature that when quenched at the same time as the face it retains its high tensile strength and is also fibrous and ductile.

30 In order that the invention may be clearly understood and readily carried into effect, I will now describe the same more fully with reference to one specific mode of procedure.

A plate containing from about 0.40 to 0.60

per cent. of carbon, 0.30 to 0.40 per cent. of manganese, 4.8 to 6.0 per cent. of nickel, and 1.8 to 2.25 per cent. of chromium, after being subjected to cementation on its face for the requisite time, which varies with the thickness of the plate, amounting to from about twelve days for a six-inch plate to about sixteen days for a twelve inch plate, is heated to from 1450° F., to 1550° F., and bent to shape while hot. It is then heated to from 1450° F., to 1550° F., and oil hardened in the ordinary way. The plate is then heated to from 1150° F., to 1250° F., and cooled in oil or in air on supports. It is then heated to from 1100° F., to 1250° F., and sprinkled, then heated again at from 1050° F., to 1150° F., and sprinkled a second time. The plate is then machined and drilled where necessary prior to the final hardening.

To perform the final hardening the whole plate is placed in a furnace and heated uniformly to a temperature of from 1100° F., to 1250° F., and while still hot is placed on supports on a base plate, the sides being bricked around to prevent the edges of the plate being overheated, but a space being left between the back of the armor plate and the top of the base plate. It is then transferred on the base plate to a second furnace the temperature of which is from 1850° F., to 2050° F., according to the thickness of the plate. The face having attained the desired temperature, the plate is removed from the furnace and quenched on the face and back in the usual way. The quenching of the cemented face at the high temperature referred to produces the extreme glass hardness that is desired, and the quenching of the back of the plate at the temperature it attained in the first furnace and retained during the heating of the face in the second furnace produces the requisite toughness and high tensile strength at the back.

This application is a division of my co-pending application, Serial No. 613,787, filed March 11, 1911.

What I claim and desire to secure by Letters Patent of the United States is:—

1. In the manufacture of armor plates, subjecting the steel plates to cementation on the side that eventually forms the face, and to preliminary heatings and coolings, and then subjecting the plate to a final hardening

treatment consisting in heating the whole plate uniformly to a comparatively low temperature, then while the plate is still hot quickly exposing the face only of the plate to a temperature of from 1850° F. to 2050° F., and finally quenching the face and back of the plate.

2. In the manufacture of armor plates, rolling and annealing the plate, subjecting it to cementation on the side that eventually forms the face, heating the plate to a temperature suitable for oil hardening, cooling it with oil, heating it to a temperature suitable for air hardening, cooling it in air, heating it to a temperature suitable for water hardening, cooling it with water, then machining the plate, and then subjecting the plate to a final hardening treatment consisting in heating the whole plate uniformly to a comparatively low temperature, then while the plate is still hot quickly exposing the face only of the plate to a temperature of from 1850° F. to 2050° F., and finally quenching the face and back of the plate.

3. In the manufacture of armor plates, subjecting the steel plate to cementation on the side that eventually forms the face, and to preliminary heatings and coolings, and then subjecting the plate to a final hardening treatment consisting in heating the whole

plate uniformly to a temperature of from 1100° F., to 1250° F., then while the plate is still hot quickly exposing the face only of the plate to a temperature of from 1850° F., to 2050° F., and finally quenching the face and back of the plate simultaneously.

4. In the manufacture of armor plates, rolling and annealing the plate, subjecting it to cementation on the side that eventually forms the face, heating the plate to a temperature suitable for oil hardening, cooling it with oil, heating it to a temperature suitable for air hardening, cooling it in air, heating it to a temperature suitable for water hardening, cooling it with water, then machining the plate, and then subjecting the plate to a final hardening treatment consisting in heating the whole plate uniformly to a temperature of from 1100° F., to 1250° F., then while the plate is still hot quickly exposing the face only of the plate to a temperature of from 1850° to 2050° F., and finally quenching the face and back of the plate simultaneously.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN LAWRENCE BENTHAL.

Witnesses:

C. A. SEARLE,

JNO. R. CASWELL.