

# UNITED STATES PATENT OFFICE.

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## MANUFACTURE OF ARMOR-PLATE.

SPECIFICATION forming part of Letters Patent No. 696,941, dated April 8, 1902.

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*To all whom it may concern:*

Be it known that I, GEORGES CHARPY, a citizen of the Republic of France, residing in Montlucon, Allier, France, have invented certain new and useful Improvements in the Manufacture of Armor-Plates, of which the following is a specification.

This invention has for its object the manufacture of cemented armor-plates of as little thickness as may be desired and satisfying the two conditions most desirable in a plate of this nature—that is to say, first, that on one face there shall be a layer of great hardness, capable of breaking the point of the projectile; second, that throughout the thickness of the mass other than the hardened face there shall be a texture offering a considerable increase of resistance to perforation and an absence of fragility and fissility—that is to say, any tendency to crack under the influence of the blow of the projectile.

My process enables me to obtain a result superior to that commonly obtained by the process which consists in uniformly hardening a plate or one of its faces on which the content of carbon has been increased by cementation. In fact, I obtain by a single hardening and without annealing the texture which is characterized by absence of fissility in all that part which is not cemented. In seeking this result, which is of capital importance from the point of view of the resistance of the armor-plate to perforation, processes have been carried out comprising several successive operations of hardening, one of which is at least always difficult to realize and involves conditions which are different for the cemented parts and those not cemented, whether from the point of view of the temperature of heating or from the point of view of the speed of cooling. In contrast to these processes mine presents the advantage that an analogous result is obtained by a single hardening at a uniform temperature—an operation easily to be realized. Moreover, my process enables cemented armor-plates of a thickness as reduced as may be desired to be treated, since it is no longer necessary that different conditions obtain on the two faces.

According to my invention I manufacture armor-plates from a metal whose composition is determined by the conditions that the metal must acquire by a single hardening, without subsequent annealing, a texture such as an armor-plate must have if it is not to be fissile and that the hardening at the same temperature must give to the metal after cementation a porcelain-like texture and great hardness. The metal I use and which realizes these conditions is an extra-soft steel—that is to say, one containing not appreciably more than 0.15 per cent. of carbon, to which has been added a proportion of nickel amounting to five or six per cent. To this metal is generally added a proportion of chromium slightly higher than 0.5 per cent., which without modifying the peculiar property of my metal improves the results obtained, especially in respect of hardness of the part cemented. When the armor-plates have been made of the desired dimensions from ingots of this metal obtained by any known metallurgical process, they are cemented on the face to be hardened by any usual method and are then hardened, the plate being uniformly heated at a temperature of about 750° to 800° centigrade and quenched, which imparts to the different parts the texture desired in the manufacture of armor-plates.

I claim—

1. As a new article of manufacture, an armor-plate of steel containing about five per cent. of nickel and from 0.1 to 0.15 per cent. of carbon, cemented on one face only, and hardened at a temperature of about 750° to 800° centigrade without subsequent annealing, whereby after hardening the cemented face has a porcelain-like texture and hardness, and the remainder of the mass has a non-fissile texture.

2. As a new article of manufacture, an armor-plate of steel containing about five per cent. of nickel, from 0.1 to 0.15 per cent. of carbon, and about 0.5 per cent. of chromium, cemented on one face only, and hardened at a temperature of about 750° to 800° centigrade without subsequent annealing, whereby after hardening the cemented face has a

porcelain-like texture and hardness, and the remainder of the mass has a non-fissile texture.

3. The process of manufacturing armor-  
5 plates which consists in treating a plate of  
steel containing about five per cent. of nickel  
and from 0.1 to 0.15 per cent. of carbon, to  
cementation on one face only, and then har-  
dening at a temperature of about 750° to 800°  
10 centigrade without subsequent annealing,

whereby the cemented face is given a porce-  
lain-like texture and hardness and the re-  
mainder of the mass has a non-fissile texture.

In witness whereof I have hereunto signed  
my name in the presence of two subscribing 15  
witnesses.

GEORGES CHARPY.

Witnesses:

JULES ARMENGAUD, Jeune,  
EDWARD P. MACLEAN.