PUBLISHED
MAY 4, 1943.
BY A. P. C.

W. REINECKEN
ARMOUR-PIERCING PROJECTILES
Filed Sept. 15, 1939

Serial No.
295,135

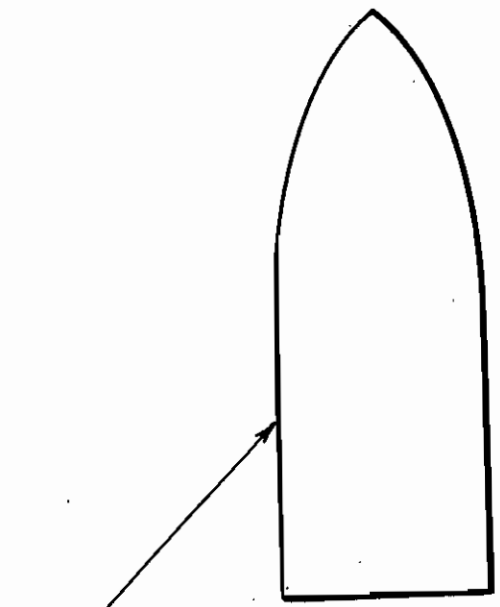

Fig.1.

Chrome Steel

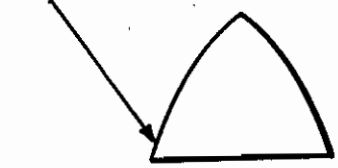

Fig.2.

Inventor:
Walter Reinecken

By Young, Emery & Thorpe
Attorneys

Published May 4, 1943

Serial No. 295,135

ALIEN PROPERTY CUSTODIAN

ARMOUR-PIERCING PROJECTILES

Walter Reinecken, Dusseldorf-Gerresheim, Germany; vested in the Alien Property Custodian

Application filed September 15, 1939

Projectiles for piercing or tearing armour plates, whether they be armour-piercing projectiles, semi-armour-piercing projectiles, or high-explosive armour-piercing projectiles, have hitherto generally been made of steel alloys of which the constituents determining the properties of the alloy are carbon, chromium and nickel. A carbon content up to 1.75 per cent., preferably 1.1 per cent., and a chromium content up to 2.5 per cent. were regarded as required to produce hardness. It was believed to be necessary to add nickel in the same amount as the chromium or even in greater amount in order to lessen the brittleness exhibited by steels hardened by the aforesaid quantities of carbon and chromium.

It has also been proposed to produce a projectile having a hard skin and a soft core by subjecting to a special heat treatment an alloy containing 3.5 per cent. of chromium and 6 per cent. of carbon. For armour plates the alloy could contain a smaller quantity of carbon, the parts of the plates which required the greatest hardness, especially the surface, being subsequently carbonised by cementation.

This method would be impracticable for the production of projectiles, especially small projectiles having a calibre of the order of magnitude of 4 cm.

The present invention consists in armour-piercing projectiles made of a steel alloy the composition of which with respect to the main constituents named above differs substantially in two respects from the known alloys, but which shows a surprising improvement with respect to the performance and the piercing force of the projectile. The projectiles of the invention are made of a chrome steel free from nickel and containing 2 to 3.5 per cent. of carbon, 2.5–5 per cent. of chromium and up to 1 per cent. of manganese and silicon. This steel is especially advantageous for the production of high-grade armour-piercing projectiles of the smaller calibres; it affords a good hardness reaching to the core, shows during hardening remarkably little tendency to form cracks and has an outstanding piercing force owing to the great hardness which it can attain, which is of the order of about 630 Brinell units.

It is to be understood that the expression "free from nickel" includes the case in which the alloy contains traces of nickel which cannot be removed by ordinary industrial processes. The quantity of carbon preferably does not exceed 2.5 per cent. In certain cases the chrome steel may contain one or more of the metals molybdenum, vanadium, titanium, tantalum or beryllium, depending on the properties required of the alloy, the quantity of such metal or metals not exceeding 1 per cent. The contents of manganese and that of silicon are not of decisive importance provided they are kept within moderate limits, preferably, for example, about 0.4 per cent. or less.

When 2 cm. armour-piercing grenades made of a steel containing:

	Per cent
Carbon, about	2
Chromium, about	3.5
Silicon, about	0.35
Manganese, about	0.40

were shot at an angle of incidence of 90° and ranges of 200 and 600 metres at armour-plate of the latest kind having a thickness of 30 mm. and a material strength of 170 kgm², the plates were pierecd, while hardened projectiles of the kind hitherto known, even with a relatively high chromium content, for instance 12 per cent., were shattered by the plates without piercing them.

As is known in the manufacture of projectiles, only the head of the projectile which is subject to the greatest stress on impact with the target need be made of the nickel-free alloy according to the invention, the head being welded on the body and base of the projectile, which may be made of carbon steel or an alloy steel. We have found that the steel alloy according to the invention can readily be welded on to other steels which, in spite of a lack, or only a small quantity, of high-grade alloying metals are adequate for the less stressed part of the projectile. In this manner there are obtained projectiles with a tenacity of the whole projectile and a hardness of the head which are as effective in piercing armour-plate targets as projectiles made throughout of the alloy according to the invention.

WALTER REINECKEN.