UNITED STATES PATENT OFFICE.

JAMES CHURCHWARD, OF NEW YORK, N. Y.

STEEL ALLOY AND ITS MANUFACTURE.

No. 846,979. Specification of Letters Patent. Patented March 12, 1907.

Application filed December 14, 1906. Serial No. 347,821.

To all whom it may concern:

Be it known that I, JAMES CHURCHWARD, a subject of the King of Great Britain, residing in the borough of Manhattan, in the city, county, and State of New York, have invented certain new and useful Improvements in Steel Alloys and Their Manufacture, of which the following is a specification.

This invention relates to the production of nickel-steel alloys; and it has for its object the production of a steel alloy containing titanium, which owing to the high melting-point of titanium and its relatively high retardation-point is especially valuable for constructing gun-forgings and other steel parts so employed as to require them to resist high temperatures and great strains.

The following-named alloying metals are combined with the steel in the varying proportions here given:

Steel, containing from .10 per cent. to .60 per cent. of carbon	98.25 to 84.3 parts
Nickel	1.00 to 5.0 parts
Manganese	.25 to .7 parts
Titanium	.50 to 10.0 parts
	100.00 100.0

Following is a good working proportion:

Steel, containing from .10 per cent. to .60 per cent. of carbon	95.00 parts
Nickel	3.00 parts
Manganese	.50 parts
Titanium	1.50 parts
	100.00

Titanium has a much higher melting-point than any of the other elements named in the list above, its melting-point being about 3,000° centigrade, and under ordinary conditions if molten titanium were mixed with the molten steel direct or the alloy of nickel and steel the great difference between the melting-points would cause the titanium to chill and segregate; but with a small percentage of manganese added this difficulty is overcome if the procedure be the proper one. With the proper employment of manganese the titanium will be completely assimilated, so that a conglomerate molecule is formed in which no microscopic segregation of titanium is visible. In this formation of nickel-titanium steel the employment of manganese is absolutely essential to prevent the chilling of the molten titanium when the steel comes in contact with it. The action of the manganese is both chemical and physical in its characteristics, for on the titanium coming in contact with it a new and independent action which may be characterized as artificial boiling is set up in the molten mass, and this prevents the chilling and segregating of the titanium in the same manner that open water is prevented from freezing in very cold weather by agitation or stirring. During the action caused by the presence of manganese, which forms an interchange between the molecules of iron and those of titanium, the chilling action of the less refractory metals on the more refractory metal is eliminated for the time, and then before it can begin the chilling action the titanium will have been absorbed and assimilated by the molecules of the iron.

Without the intermediation in the alloy of the metal manganese the titanium would not become a part of the mass molecules, but would form minute segregated particles between the molecules, thereby adding nothing valuable to the characteristics or physical properties of the alloy.

The procedure for making the alloy is as follows: The titanium is melted in a crucible at a temperature, say, of about 3,000° centigrade, and the steel and nickel are melted in another crucible and heated up to a point just below the point of volatilization of that metal having the lowest volatilizing-point. The manganese is now added to the molten titanium, and while it is being melted and incorporated with the latter, the molten nickel-steel alloy from the other crucible is gradually added by pouring it in, and the alloy formed may be poured or cast directly into the mold.

The nickel is employed to impart toughness to the alloy.

Obviously the titanium may be melted at the same time the nickel and steel are being melted, and the only object in pouring the nickel-steel into the crucible containing the titanium instead of the reverse is that the titanium has the lower specific gravity.

The producing of alloys by pouring molten metals from one crucible to another is not new and is not herein claimed.

Having thus described my invention, I claim—

1. An alloy consisting of steel, nickel,

manganese and titanium, in substantially the proportions specified.

2. The herein-described mode of producing a steel alloy containing titanium, which consists in first melting titanium, then melting together steel and nickel, then mixing manganese with the molten titanium, and then adding to the molten titanium and manganese the molten alloy of nickel and steel the latter being at as high a temperature as the metals may be raised to avoid volatilization.

In witness whereof I have hereunto signed my name, this 13th day of December, 1906, in the presence of two subscribing witnesses.

JAMES CHURCHWARD.

Witnesses:
H. G. HOSE,
WILLIAM J. FIRTH.