

UNITED STATES PATENT OFFICE.

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ALLOY.

1,251,341.

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No Drawing.

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To all whom it may concern:

Be it known that I, JAMES CHURCHWARD, a citizen of the United States, residing in Lakeville, county of Litchfield, and State of Connecticut, have invented an Improvement in Alloys, of which the following is a specification.

This invention relates to alloys and more particularly to what may be termed steel alloys, that is, alloys in which iron is a preponderating constituent element. One of the objects thereof is to provide an alloy of the above type in which certain desirable physical qualities, such as hardness and toughness are present in a high degree. Another object is to provide an alloy of the above nature which shall have a close homogeneous structure. Another object is to provide an alloy of the above nature which shall be of moderate cost. Another object is to provide an efficient and practical art for forming an alloy of the above nature. Other objects will be in part obvious and in part pointed out hereinafter.

An alloy which embodies certain features of my invention may be formed by melting together in the furnace or crucible, steel or iron with a suitable proportion of manganese, together with chromium, nickel and molybdenum. The charge should be heated to a high temperature and the metal should be teemed at a temperature of about 2650° to 2750° Fahrenheit.

A suitable portion of titanium should be finely crushed and either put into a charge in the furnace just before tapping or into a trough while the metal is running from the furnace to the ladle. It may even be added in the ladle. The addition of this titanium is believed to act to a considerable extent as a cleanser tending to collect oxygen and nitrogen and carry these gases into the slag. This action results in a closer grain and firmer adhesion of the crystals in the cooled metal.

The portions of the above ingredients should preferably be substantially as follows:

50	Nickel	-----	From about 1	to 5	%
	Molybdenum	---	From about .25	to 5	%
	Chromium	----	From about .25	to 2.50	%
	Titanium	-----	From about .25	to .50	%
	Manganese	-----	From about .15	to .50	%

To develop certain qualities I have found that better results may be obtained by limit-

ing the maximum of certain ingredients to the following proportions:

Nickel	-----	3	%	
Molybdenum	-----	3	%	60
Chromium	-----	1.50	%	

The titanium, due to its action above described, may be to a large extent reduced in the resultant metal and may even appear merely as a trace after it has performed the above functions, but the remaining elements are not believed to suffer any great loss, thus bringing the resultant alloy within the terms of the following claims.

It has been found that for many classes of work this steel is best formed by having used about twice as much molybdenum as chromium.

An alloy of this nature is valuable for either armor plate or commercial use.

It is to be understood that although the above described art is preferable, nevertheless the resultant alloy may perhaps be formed by other methods. It is also to be understood that in this alloy, the chief constituent is iron with the incidental elements usually combined therewith to form what is known as steel.

I claim as my invention:

1. A steel alloy containing nickel, chromium, molybdenum, titanium and manganese.

2. A steel alloy containing constituents in about the following proportions:

Nickel	-----	From about 1	to 5	%
Molybdenum	---	From about .25	to 5	%
Chromium	----	From about .25	to 2.50	%
Titanium	-----	From about .25	to .50	%
Manganese	-----	From about .15	to .50	%

3. A steel alloy containing constituents in about the following proportions:

Nickel	-----	From about 1	to 3	%
Molybdenum	--	From about .25	to 3	%
Chromium	----	From about .25	to 1.50	%
Titanium	-----	From a trace	to about .50	%
Manganese	----	From about .15	to .50	%

4. A steel alloy containing titanium and other constituents in about the following proportions:

Nickel	-----	From about 1	to 5	%
Molybdenum	---	From about .25	to 5	%
Chromium	----	From about .25	to 2.50	%
Manganese	-----	From about .15	to .50	%

5. A steel alloy containing nickel, chro-

mium, molybdenum, titanium and manganese, and molybdenum being present in about twice the quantity as the chromium and the amount of titanium in the finished alloy being relatively small.

5 6. The art of forming a steel alloy which comprises melting together iron, nickel, chromium, molybdenum and manganese and adding titanium thereto at a stage not earlier than shortly before tapping.

10 7. The art of forming a steel alloy which comprises melting together nickel, chromium, molybdenum and manganese and adding to the molten metal at a late stage titanium in finely crushed form.

15 8. The art of forming a steel alloy which comprises utilizing the constituents as set forth in claim 2 in about the proportions therein set forth, the nickel, molybdenum,

chromium and manganese being melted together and the titanium added to the molten mass.

9. The art set forth in claim 8, the titanium being added in finely crushed form not earlier than shortly before the tapping of the charge.

10. A steel alloy containing titanium and an element of the nature of molybdenum and other constituents in about the following proportions:

Nickel -----	From about 1	to 5	%
Chromium -----	From about .25	to .50	%
Manganese -----	From about .15	to .50	%

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In testimony whereof, I have signed my name to this specification this 2nd day of August 1917.

JAMES CHURCHWARD.

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