

UNITED STATES PATENT OFFICE.

JOSEPH W. RICHARDS, OF BETHLEHEM, AND ALFRED E. HUNT, OF PITTSBURG,
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ALLOY.

SPECIFICATION forming part of Letters Patent No. 501,233, dated July 11, 1893.

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To all whom it may concern:

Be it known that we, JOSEPH W. RICHARDS, a subject of the Queen of Great Britain, residing at Bethlehem, in the county of Northampton, and ALFRED E. HUNT, a citizen of the United States, residing at Pittsburg, in the county of Allegheny, State of Pennsylvania, have invented or discovered certain new and useful Improvements in Alloys, of which improvements the following is a specification.

As is well known, it is necessary to add manganese in the form of ferro-manganese to steel in order to render the same soft and malleable, the manganese effecting a removal of the oxygen and neutralizing the effect of sulphur and rendering the steel free from red shortness. As, however, ferro-manganese contains a high percentage, *i. e.*, five to six per cent. of combined carbon, its employment in the manufacture of steels containing less than five to eight hundredths of one per cent. (.05 to .08%) of carbon has been extremely difficult, if not impossible.

The present invention has for its object an alloy for use in the manufacture of soft steels, the alloy containing, among other ingredients, a low percentage of carbon and about thirty per cent. or more of manganese.

In the practice of our invention the alloy of iron and manganese commercially known as ferro-manganese and containing about thirty per cent. (30%) or more of manganese is melted in a reverberatory furnace whose bottom or lining is incapable of supplying carbon to the molten alloy. When this alloy has been heated preferably to a temperature much higher than its melting point, metallic aluminum or some alloy thereof one of whose chief ingredients is aluminum, is added to and stirred well into the bath on the hearth of the furnace. The addition of the aluminum to the molten ferro-manganese causes the carbon combined therewith to separate out in a graphitoidal state as kish which will float upon the surface of the alloy. The heat of the furnace is now allowed to decrease and as the alloy cools any scum, *i. e.*, kish, arising to its surface is continually skimmed aside and removed. When the bath is cooled to a point approximately that of solidification, the skimming may be stopped and all the kish

having been removed the alloy is run out and cast into suitable shapes for subsequent use. If the bath has become too cool for casting the heat may be increased and the alloy made sufficiently molten to permit of its being tapped from the furnace.

In lieu of the above described process of making the aluminum ferro-manganese alloy, aluminum may be added to the blast furnace or cupola during the process of manufacturing or melting ferro-manganese, or it may be added to the ferro-manganese after it has been tapped from the furnace into a ladle, care being always taken that any scum or foreign matter rising to the surface of the molten metal shall be removed.

A comparatively small percentage (*i. e.*, one per cent. more or less) of aluminum will be sufficient to effect an elimination of carbon from the ferro-manganese, but as the aluminum has a beneficial effect upon the iron or steel with which the triple alloy is to be subsequently mixed, the aluminum may be added in such quantities that the resulting triple alloy will contain up to fifty or seventy-five per cent. of aluminum.

By the addition of the aluminum to the ferro-manganese the carbon therein is reduced to a very low percentage, if not entirely removed, thereby rendering it possible to employ the resulting alloy in the manufacture of what are technically known as dead soft steels. By the addition of triple alloy of iron, manganese and aluminum to steels, such alloy being added to the steel in the same manner as ferro-manganese has heretofore been employed, we obtain not only the useful effect of the ferro-manganese in removing red shortness from the steel and neutralizing the sulphur, and an improvement in the quality of the steel by the addition of the aluminum, but an additional and distinct beneficial effect is also produced by the compound or alloy of the three metals.

We are aware that ferro-manganese and ferro-aluminum have been added simultaneously but as two distinct compounds, to a bath of iron. But as the ferro-manganese contains a high percentage of carbon, the addition of sufficient ferro-manganese to a bath of metal to effect the elimination of the oxy-

gen will also introduce so much carbon that the percentage thereof will be higher than is permissible in what is known as soft steels. Nor will the aluminum added at the same time with the ferro-manganese but separately therefrom effect any appreciable elimination of carbon from the bath.

We are also aware that aluminum has been added to spiegeleisen as a laboratory experiment to determine the effect of aluminum on the spiegeleisen. But the employment of aluminum and spiegeleisen in the manufacture of soft steels is undesirable for the reason that the spiegeleisen is comparatively rich in carbon and poor in manganese, and in order to effect a sufficient elimination of the carbon from the spiegeleisen so large a percentage of aluminum has to be added thereto that it operates injuriously to the bath.

We claim herein as our invention—

1. An alloy for use in the manufacture of steel consisting of aluminum, iron and manganese, the same containing about thirty per cent. or more of manganese, substantially as set forth.

2. An alloy for use in the manufacture of steel, consisting of aluminum, iron and thirty per cent. or more of manganese and containing a low percentage of carbon, substantially as set forth.

In testimony whereof we have hereunto set our hands.

JOSEPH W. RICHARDS.

ALFRED E. HUNT.

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