Nov. 10, 1936. A. R. WELCH 2,060,765

WELDED JOINT AND METHOD OF MAKING THE SAME

Filed Aug. 28, 1935

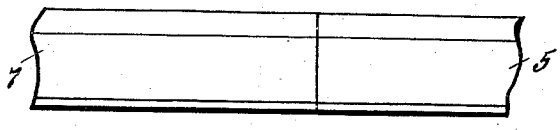


Fig. 1



Fig. 2

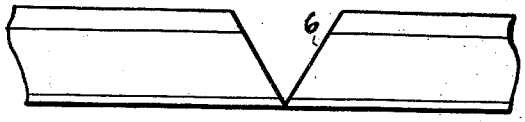


Fig. 3

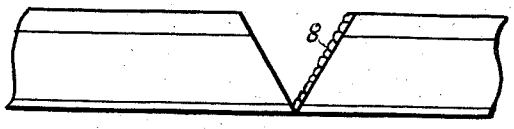


Fig. 4

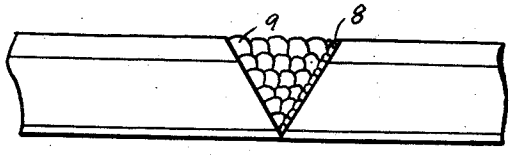


Fig. 5

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WELDED JOINT AND METHOD OF MAKING THE SAME

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Application August 28, 1935, Serial No. 38,279

10 Claims. (Cl. 113—112)

The object of the invention is to unite austenitic ferrous metals high in manganese, such as iron or steel alloys containing ten to fifteen per cent manganese and which have been heat-treated in the regular way, and non-austenitic ferrous metals, such as relatively low and high carbon steels and low alloy steels in the category of nickel, nickel chrome, chrome vanadium, intermediate manganese, etc., and to effect a homogeneous joinder of the austenitic ferrous metal and the non-austenitic ferrous metal by fusion welds of high tensile strength and marked ductility.

The joinder of dissimilar metals other than those just mentioned has heretofore had considerable attention and has, in fact, offered no serious obstacle. However, in the case of austenitic manganese steel and non-austenitic ferrous metals it has not been possible, prior to my invention, to effect satisfactory welds, meaning by that fusion welds of high tensile strength and marked ductility, because it has not been possible to establish and conserve conditions tending to homogeneous union of the metals. The difficulty is due to the peculiar characteristics of austenitic manganese steel, that is to say, the paradoxical property of tough hardness, which property is conferred upon the metal, as is well known, by proper heat-treatment. The metal will be deprived of that property if subsequently subjected to high heat as in welding.

The invention covers a wide field of applications and is especially meritorious in its application to trackwork as, for example, in the installation and repair of railroad frogs, crossings, switches, mates, etc.

One former method of attacking the problem was to cast the manganese parts with spaced-apart inserts of mild steel that were availed of as tying members in the subsequent welding by any of the many methods of joining like or similar metals. Aside from the added trouble and expense of the composite casting, such method generally was unsatisfactory because of the hazard of faulty and insecure bonding and support of the parts.

Another conventional practice involved the welding of austenitic manganese steel directly to the carbon steel or other non-austenitic ferrous metal and using, for that purpose, welding rods of the well-known 18-chrome-8-nickel composition of low carbon content. Welds of that type are deceptive in that they look fair but in reality are unreliable because they lack the ductility and tensile strength required.

After extended study and experimentation, I have discovered that I can obviate the difficulties aforementioned and can join austenitic manganese steel and rail steel or other non-austenitic ferrous metal with sound and homogeneous welds by following the practice hereinafter described and finally claimed.

The invention will be described in connection with the accompanying drawing, forming a part hereof, illustrating the joinder of a manganese steel rail to a carbon or other low alloy steel rail, wherein

Figures 1 and 2 are side elevational and sectional views of austenitic manganese steel and carbon or low alloy steel rails integrated according to the invention.

Fig. 3 illustrates the first step of beveling the proximate ends of the rails.

Fig. 4 illustrates the next step of applying a priming weld to the beveled end of the carbon or other low alloy steel rail.

Fig. 5 illustrates the joinder of the primer weld with the manganese steel rail.

According to the invention, the carbon or non-austenitic ferrous metal rail **5** is first treated by covering its beveled end **6**, that ultimately is to be united to the austenitic manganese steel rail **7**, with a priming weld **8** constituted of metal that is compatible with the underlying carbon steel or other non-austenitic ferrous metal, in the sense that it will effect a sound fusion weld therewith, and likewise compatible with the major joining metal, namely, an air toughening metal that in turn is compatible with the austenitic manganese steel in the sense that it insures homogeneous union thereof without impairing the tough hardness of the manganese steel. For example, the carbon steel or other non-austenitic ferrous metal has deposited thereon a layer or layers of weld deposit metal of substantially the following analysis:—

	Per cent
Carbon	.05 to 1.00
Silicon	.10 to 2.50
Manganese	.20 to 4.00
Nickel	.50 to 10.00

Excellent results have been obtained with a priming weld of the following composition:—

Carbon	.18
Silicon	.24
Manganese	.40
Nickel	4.95

and, at this time, that is my preference. I would add, however, that within the limits of the wide

range the nickel may be replaced by copper in amounts up to fifty per cent of the nickel present.

When the #1 or priming deposit metal is of a depth or thickness sufficient to eliminate the hazard of exposure of the underlying metal, it is cleaned and otherwise prepared for the fusion weld deposit of the air toughening metal that is to effect the joinder of the manganese steel element.

The weld deposit metal 9 of air toughening properties may comprise an alloy steel essentially embodying ten to fifteen per cent manganese, an effective amount up to five per cent nickel, an effective amount of silicon, and with carbon relatively low.

In depositing the #1 or priming weld metal, the non-austenitic ferrous metal preferably forms the positive pole and the electrode the negative pole. However, such preference obtains in the use of uncoated or lightly coated wire, and when heavy coatings are employed it is sometimes desirable to make the electrode the positive pole. In the subsequent deposit of #2 or air toughening metal 9, the polarity is reversed.

It will be obvious to those skilled in the art that by the described method a strong and reliable weld is secured between an austenitic manganese steel article and a carbon steel or other non-austenitic ferrous metal article, by depositing a nickel steel coating over the latter and then filling the space between the deposited coating and the manganese steel article with air toughening metal.

This application is a continuation in part of my application filed March 15th, 1933, Serial No. 660,977.

Having described the invention, what is claimed as new, is:—

1. Method of fusion welding austenitic manganese steel and non-austenitic ferrous metal without destroying the tough hardness of the manganese steel, which consists in preparing a welding space between the parts to be joined, priming the non-austenitic metal of the welding space by coating it with nickel steel, and homogeneously joining the parts by applying between the nickel steel and the manganese steel weld deposit metal comprising manganese steel susceptible to air toughening.

2. Method of fusion welding austenitic manganese steel and non-austenitic ferrous metal without destroying the tough hardness of the manganese steel, which consists in preparing a welding space between the parts to be joined, priming that part of the non-austenitic metal to be welded by coating it by weld deposit of nickel copper steel, and fusion welding the parts with weld deposit metal comprising manganese steel susceptible to air toughening.

3. Method of fusion welding an austenitic manganese steel body to a non-austenitic ferrous metal body without impairing the tough hardness of the manganese steel body, which consists in placing the parts in welding relation, coating the juxtaposed face of the non-austenitic ferrous metal body with nickel steel, fusion welding the parts with manganese steel having air toughening properties, and air quenching the weld.

4. Method of fusion welding an austenitic manganese steel body to a carbon steel body without impairing the tough hardness of the manganese steel body, which consists in placing the parts in welding relation, coating the juxtaposed face of the carbon steel body with nickel steel, fusion welding the parts with manganese steel having air toughening properties, and air quenching the weld.

5. Method of fusion welding austenitic manganese steel and carbon steel without destroying the tough hardness of the manganese steel, which consists in preparing a welding space between the parts to be joined and facing the carbon steel of the weld space with weld deposited nickel steel, and homogeneously joining the parts by fusion deposit, between the faced metal and the manganese steel, of manganese steel having air toughening characteristics.

6. Austenitic manganese steel and non-austenitic ferrous metal in fusion weld relation, the non-austenitic ferrous metal in the weld area having a facing of nickel steel, the remainder of the weld deposit metal comprising manganese steel having air toughening properties whereby no after heat treatment is required such as would impair the inherent tough hardness of the austenitic manganese steel.

7. Austenitic manganese steel and carbon steel in fusion weld relation, the carbon steel in the weld area having a weld deposit facing of nickel steel, the remainder of the weld deposit metal comprising manganese steel having air toughening properties whereby no after heat treatment is required such as would impair the inherent tough hardness of the austenitic manganese steel.

8. An austenitic manganese steel rail and a low alloy metal rail in homogeneous fusion weld relation, the low alloy rail in the weld area having a weld deposit facing of nickel steel, the remainder of the weld deposit metal comprising manganese steel having air toughening properties whereby no after heat treatment is required such as will impair the inherent tough hardness of the austenitic manganese steel.

9. Austenitic manganese steel and non-austenitic ferrous metal in fusion weld relation, the non-austenitic ferrous metal in the weld area having a facing of nickel copper steel, the remainder of the weld deposit metal comprising manganese steel having air toughening properties.

10. Method of fusion welding austenitic manganese steel and non-austenitic ferrous metal without destroying the tough hardness of the manganese steel, which consists in preparing a welding space between the parts to be joined, applying to the non-austenitic metal in the welding space a predominantly nickel alloy steel coating of a depth or thickness sufficient to eliminate the hazard of exposure of the underlying metal, and filling the balance of the welding space with weld metal comprising manganese steel susceptible to air toughening for the purpose and with the result of effecting a homogeneous union of the parts.

ARTHUR R. WELCH.