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AUSTENITIC ADDITION MATERIAL FOR
FUSION WELDING

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This invention relates to austenitic addition material for fusion welding of non-austenitic base material which may be either unalloyed common steel or highly alloyed steel with high or low tensile strength.

The invention consists essentially in the selection, as addition material for fusion welding, of austenitic manganese-nickel steels, within certain well defined limits, with or without additions of chromium, molybdenum, copper, vanadium, titanium, tantalum and zirconium.

Austenitic chromium-nickel steels, containing about 20% chromium and about 20%, or more, nickel, have heretofore been used for this purpose. This invention attains the same result by using steels of far lower alloy content.

To attain this end, a small and limited field in which the required characteristics, i. e., a tensile strength of 85,340 lbs./sq. in. or more, could be realized, had to be carefully selected from amongst the many possible austenitic steels by diligent research. An appropriate selection had to be made from amongst the alloying elements nickel, manganese and chromium, to obtain a dendritic crystalline structure and ductility coefficients which do not cause stresses. The choice of a correct carbon content is of capital importance; carbon contents between 0.05–0.20% have been found to be the most appropriate. In addition, the silicon content definitely influences the crystalline structure. It has been observed that with increasing silicon content there is a strong tendency towards forming dendritic crystalline structures. A high silicon content may also be maintained in certain cases for other reasons.

The following examples of austenitic alloys were found by experiment to meet the above-described conditions in the welding of non-austenitic steels:

C	Si	Mn	Ni	Cr	Mo
Percent	Percent	Percent	Percent	Percent	Percent
0.10	0.08	12.50	5.50	3.80	1.20
0.10	0.07	16.50	6.00	3.80	1.10
0.09	0.09	17.00	11.00	4.00	1.20
0.10	0.09	12.00	11.00	3.80	1.15

In accordance with the principles disclosed above, the invention comprises filler material for welding steel, and particularly for uniting contiguous members of nonaustenitic steel, which filler material is an austenitic nickel-manganese steel containing, aside from the iron, 0.01% to 0.5% carbon, 3% to 25% manganese, 20% to 3% nickel, and 0.01% to 3% silicon. Narrower ranges for these ingredients are 0.05% to 0.2% carbon, 8% to 15% manganese, 8% to 4%

nickel, and 0.01% to 0.2% silicon. Chromium may be present in an amount up to 6%; and molybdenum may be added in an amount up to 15%, preferably between 1% and 3%. The molybdenum content may be entirely or partly replaced by copper, the copper content not exceeding 5% and being preferably between 2% and 3%. The molybdenum content may also be entirely or partly replaced by vanadium, the vanadium content not exceeding 3% and being preferably between 0.4% to 1%, or by up to 3% (preferably 0.5% to 1.5%) of one or more of the elements titanium, tantalum, and zirconium.

I claim:

1. A welded joint comprising at least two contiguous non-austenitic steel members united by weld filler material, said filler material being composed of fully austenitic nickel-manganese steel containing 0.01% to 0.2% carbon, 3% to 25% manganese, 20% to 3% nickel, 0.01% to 3% silicon, and the remainder principally iron.

2. A welded joint comprising at least two contiguous non-austenitic steel members united by weld filler material, said filler material being composed of fully austenitic nickel-manganese steel containing 0.05% to 0.2% carbon, 8% to 15% manganese, 8% to 4% nickel, 0.2% to 3% silicon, and the remainder principally iron.

3. A welded joint comprising at least two contiguous non-austenitic steel members united by weld filler material, said filler material being composed of fully austenitic nickel-manganese steel containing 0.05% to 0.2% carbon, 8% to 15% manganese, 8% to 4% nickel, 0.2% to 3% silicon, chromium in an amount not exceeding 6%, and the remainder iron.

4. A welded joint comprising at least two contiguous non-austenitic steel members united by weld filler material, said filler material being composed of fully austenitic nickel-manganese steel containing 0.05% to 0.2% carbon, 8% to 15% manganese, 8% to 4% nickel, 0.2% to 3% silicon, substantial amounts not exceeding 3% of at least one metal of the group consisting of molybdenum, vanadium, titanium, tantalum, zirconium, and the remainder iron.

5. A welded joint comprising at least two contiguous non-austenitic steel members united by weld filler material, said filler material being composed of fully austenitic nickel-manganese steel containing 0.05% to 0.2% carbon, 8% to 15% manganese, 8% to 4% nickel, 0.2% to 3% silicon, chromium in an amount not exceeding 6%, and 0.5% to 1.5% of at least one metal of the group consisting of molybdenum, vanadium, titanium, tantalum, zirconium, and the remainder substantially all iron.

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