

PATENT SPECIFICATION (11)

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(54) METHOD OF AUTOMATIC WELDING

(71) We, KAWASAKI JUKOGYO KABUSHIKI KAISHA, a Japanese Company, of No. 14, Higashi-Kawasaki-Cho 2-Chome, Ikuta-Ku, Kobe-Shi, Hyogo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of automatic welding and more especially to a method of preventing crack formation at an end zone of a weld line between plates subjected to an automatic welding process from one side of the plates.

Recently, an automatic welding process for welding plates from one side thereof has been widely applied to the joining of plates for forming ship hulls or the like and has contributed greatly to the automation in welding, but such a welding process has the defect that a crack tends to be caused at the end zone of the weld bead and the repairing of such a crack is costly and extremely troublesome. The prevention of the formation of such end cracks is thus an urgent problem required to be solved.

There are two methods in general use for preventing end cracks. One method involves the preliminary welding of a seam having a length of five hundred to one thousand millimetres at the end zone of the weld line, and is known conventionally as the "sealing bead method". This is illustrated in Fig. 3 (see below). The second method involves stopping the welding at the centre zone of the weld line, forming a new groove at the end of the initially formed weld seam, and welding from the opposite end of the plate in the reverse direction towards the new groove. This process is known conventionally as the "crater encountering method" and is illustrated in Fig. 5 (see below). These methods, however, require either the upsetting of the welded plates and repairing of the localized defect where the preliminary weld has failed to form a penetration bead on the rear face, or the stopping of the welding in one direction and the commencement of welding from the opposite direction. The

automatic welding process from one side of the plates is of advantage if there is no requirement for upsetting of the steel plates and if welding can be carried out in a continuous operation to simplify the welding process. However, the necessity for additional welding work to repair the bead and the interruption of the welding operation, greatly reduces the advantages of this automatic welding process.

An investigation of end cracks which are the cause of the above mentioned disadvantages, taking into consideration the time of crack initiation and the condition of the fracture, shows that the end cracks are a type of hot crack caused at an extremely high temperature range. The cause of such end cracks is considered to be the fact that the welding zone cannot withstand the slightest deformation at the time immediately before solidification of the weld, and that at this time the parts of the plates at the end of the welded seam are subject to distortion as a result of the heat of the welding process.

The present invention provides a method of automatically welding together, from one side, abutting plates along a weld seam defined by the abutting edges of the plates, wherein said plates are progressively welded along said seam, starting at one end and terminating at the other end, and the said plates are forcibly urged together adjacent the said other end by external forces applied to the plates adjacent the said other end so that cracking of the welded seam is prevented.

The invention is illustrated by way of example in the accompanying drawings; in which

Fig. 1 is a top plan, schematic view of one type of apparatus for use in the method of the present invention,

Fig. 2 is a top plan, schematic view of another embodiment of such apparatus,

Fig. 3a is a top plan view illustrating a known automatic welding process employing an end crack prevention step,

Fig. 3b is an end view corresponding to Fig. 3a, and

Fig. 4 is a top plan view illustrating diagrammatically another known method of

preventing end crack formation in an automatic welding process.

As shown in Fig. 1, a U-shaped member 2 is positioned such that legs of the U-shaped member terminate adjacent the side edges of steel plates 1 which are to be welded together at their abutting edges. A pair of fixing members 3 are fixed to the side edges of the plates on each side of the weld line, and a pair of mechanical or hydraulic rams 4 such as hydraulic cylinders, are inserted between the legs of the U-shaped member 2 and are preferably carried by the fixing members 3. When the means 4 are actuated they produce a thrust tending to force the end zones of the plates together to prevent deformation and crack formation, especially in the end zone of the weld line, as a result of welding along the line of abutment between the plates 1.

Referring to Fig. 2, a pair of thrust applying members 5 are positioned along the outside lateral edges of similar plates 1 which again have their internal edges in abutment adjacent the plate end zone and again a pair of mechanical or hydraulic pressure applying means 4¹, such as hydraulic cylinders, are fixed to machine frames 6 and direct a thrust force at the end zones of plates 1 toward each other to prevent the deformation and crack formation near the end of the weld line.

As particularly mentioned above, since the steel plates to be welded together are forcibly fixed in position in the end zone by an external load or an external pressure to prevent the slightest deformation during welding, which would result in crack formation, the disadvantages of the conventional one side automatic welding processes are reduced. Therefore, the productivity of the one side welding method in accordance with the present invention is greatly increased and

the quality of the weld which is produced is improved.

WHAT WE CLAIM IS:—

1. A method of automatically welding together, from one side, abutting plates along a weld seam defined by the abutting edges of the plates, wherein said plates are progressively welded along said seam, starting at one end and terminating at the other end, and the said plates are forcibly urged together adjacent the said other end by external forces applied to the plates adjacent the said other end so that cracking of the welded seam is prevented.

2. A method as claimed in Claim 1, wherein the external forces are applied to means fixed to and extending beyond the free ends of the plates at said other end of the seam, the said forces being directed towards one another in directions transverse to the axis of the said seam in order to compress the abutting edges of said plates together.

3. A method as claimed in Claim 1, wherein the external forces are applied to opposite free lateral edges of said plates remote from said abutting edges, the said forces being directed towards one another in directions transverse to the axis of the said seam in order to compress the abutting edges of said plates together.

4. A method as claimed in Claim 1, substantially as described herein with reference to Figs. 1 or 2 of the accompanying drawings.

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preventing end crack formation in an automatic welding process.

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Referring to Fig. 2, a pair of thrust applying members 5 are positioned along the outside lateral edges of similar plates 1 which again have their internal edges in abutment adjacent the plate end zone and again a pair of mechanical or hydraulic pressure applying means 4', such as hydraulic cylinders, are fixed to machine frames 6 and direct a thrust force at the end zones of plates 1 toward each other to prevent the deformation and crack formation near the end of the weld line.

As particularly mentioned above, since the steel plates to be welded together are forcibly fixed in position in the end zone by an external load or an external pressure to prevent the slightest deformation during welding, which would result in crack formation, the disadvantages of the conventional one side automatic welding processes are reduced. Therefore, the productivity of the one side welding method in accordance with the present invention is greatly increased and

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