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(54) Title: APPARATUS OF LASER STITCH WELDING FOR LARGE SCALE SHEETS

(57) Abstract: An apparatus of laser stitch welding for large scale sheets includes that: a slipway (2) moves in Y direction; a laser head (1) is mounted on the slipway (2); a total clamping mechanism is placed over a workbench being parallel so Y direction and perpendicular to the slipway (2), which can be moved up and down; a direct clamping mechanism is mounted on the slipway (2) which is moved together with the laser head (1); a work area is enclosed by the total clamping mechanism and the direct clamping mechanism. The apparatus can control the flatness and the gap between two blanks to be welded and obtain a good welding quality.

Fig. 1
Description

APPARATUS OF LASER STITCH WELDING FOR LARGE SCALE SHEETS

Technical Field

This invention relates to a mechanical clamping device, particularly to an apparatus of the laser stitch welding for large scale sheets, which can control the flatness and the gap between the two blanks to be welded.

Background Art

This stitch laser welding system proposed to combine two large-scale stainless steel blanks overlapped together. Large-scale stainless steel blanks laser welding has the following technical difficulties: In the stitch laser welding of stainless steel blanks being the welding seam may develop irregularities and faults due to the fact that the sheets at the weld point arch in places and therefore they do not be placed flat one against the other. Such faults occur more particularly in the laser welding of large scale sheets (for example, from 6000mm to 12000mm in lengths), due to arching, the two blanks may not be welded together. It is difficult to control their deformations and gaps caused by the deformations under the required value (15% of the sheet thickness), and to clamp them firmly overlapped at least at the weld point by means of the common clamping device.

Disclosure of Invention

Technical Problem

Problems are of irregularities and faults result from gap between the two blanks to be welded

Technical Solution

In order to solving problems of irregularities and faults result from gap between the two blanks to be welded, it is therefore an object of the invention to provide a total-direct clamping mechanism for the continuous stitch welding of sheets overlapped, which can control the flatness and the gap between the two blanks to be welded and control self-deformation of the two blanks.

In order to realize the purposes above-mentioned, the technical program of this invention is as follows:

Includes:

- a slipway, moving in Y direction;
- a laser head, mounted on the slipway by means of a bed fixing pedestal;
- a total clamping mechanism, placed over a workbench being parallel to Y direction and perpendicular to the slipway, which can be moved up and down;
[10] a direct clamping mechanism, mounted on the slipway by means of the bed fixing pedestal located in X direction being moved together with the laser head in Y direction forming a gantry.

[11] a work area is enclosed by the total clamping mechanism monitoring the entire blanks assembly and the direct clamping mechanism monitoring weld joints at a close distance from the weld point to meet the metal fit-up requirement.

[12] The said total clamping mechanism is made up of a front pressing beams, a rear pressing beams and a pressing wheel; the front and rear pressing beams, respectively placing two sides of the slipway, connects to driven air cylinders for driving up and down; at least two pressing wheels are respectively mounted on the front and rear pressing beam.

[13] The said direct clamping mechanism is made up of the laser head, a left pressing roller and a right pressing roller; the left and right pressing rollers connecting to driven air cylinders are disposed on the two sides of the laser head by means of the bed fixing pedestal; the laser head is mounted on the slipway moving together with the left pressing roller and the right pressing roller.

[14] The said left and right pressing rollers disposed on the two sides of the laser head are mounted on the bed fixing pedestal by a movable mechanism. The driven air cylinders have a pressure valve. The said laser head which can be moved in X, Y and Z directions is mounted on the slipway by movable mechanism in X, Y directions

**Advantageous Effects**

[15] 1. It has a good welding quality. The pressing rollers and pressing wheels provided by the present invention can move down to the welding blanks; the total clamping mechanism monitors the entire blanks assembly and the direct clamping mechanism which clamps at a close distance from the weld point monitors the weld joints to have a good welding quality.

[16] 2. It is a device for blanks with different thickness. Each air cylinder having a pressure valve can adjust the clamping force for the pressing rollers and pressing wheels to the blanks with different thickness to meet the welding requirements of flatness of sheets and minimum gas in between.

[17] 3. This apparatus with simple structure and convenient operation characters can work in a stable and reliable status.

**Description of Drawings**

[18] FIG. 1 is a structural diagram of the invention

[19] FIG. 2 is the top view of the clamping device

[20] Here, 1 is the laser head, 2 is the slipway in Y direction, 3 is the first press roller, 4 is the right air cylinder, 5 is the bed fixing pedestal, 6 is the left press roller, 7 is the
second air cylinder, 8 is the third press beam, 9 is the front air cylinder, 10 is the forth press beam, 11 is the rear air cylinder, 12 and 13 are the steel blanks and 14 is the pressing wheels.

Mode for Invention

[21] The invention will be further described in detail with reference to drawings attached.

[22] According to Fig. 1 and Fig. 2, this invention includes:

[23] the slipway 2, moving in Y direction;

[24] the laser head 1, mounted on the slipway 2 by means of the bed fixing pedestal 5;

[25] the total clamping mechanism, placed over the workbench being parallel to Y directions and perpendicular to the slipway 2, which can be moved up and down;

[26] the direct clamping mechanism, mounted on the slipway 1 by means of the bed fixing pedestal 5 located in X direction being moved together with the laser head 1 in Y direction (length of sheets ) forming a gantry.

[27] The work area is enclosed by the total clamping mechanism monitoring the entire blanks assembly and the direct clamping mechanism monitoring weld joints at a close distance from the weld point to meet the metal fit-up requirement.

[28] Wherein, the total clamping mechanism is made up of the front pressing beams 8, rear pressing beams 10 and the pressing wheels 14; The front and rear pressing beams 8 and 10 respectively placing two sides of the slipway 2, are connected to the third air cylinder 9 and the forth cylinder 11 respectively which can drive the pressing beam up and down; there are at least two pressing wheels 14 (the present invention has 6 × 2 wheels) on the front pressing beams 8 and rear pressing beams 10 respectively; Each of the third air cylinder 9 and the forth cylinder 11 has a pressure valve (the present invention use high-speed valve) which is used to adjust the clamping force of the pressing wheels 14 to control the flatness of the blanks.

[29] The direct clamping mechanism is made up of the laser head 1, the left pressing roller 6 and the right pressing roller 3; the left and right pressing rollers 6, 3 connecting to the second air cylinder 7 and the first air cylinder 4 are disposed on the two sides of the laser head 1 by means of the bed fixing pedestal 5; the laser head 1, the left pressing roller 6 and the right pressing roller 3 are mounted on the slipway 2; Each of the second air cylinder 7 and the first air cylinder 4 has a pressure valve (the present invention use high-speed valve) which is used to adjust the clamping force of the pressing rollers 3, 6 to control the flatness of the blanks.

[30] The laser head 1 is mounted on the slipway 2 by movable mechanism in X, Y directions which can be moved in X, Y and Z directions; the laser head 1 moves in Y directions together with the left and right pressing roller 6, 3 driven by slipway 2; the laser head 1 laid between the left and right pressing roller 6, 3 moves in X, Y and Z directions as reciprocating motion; during the welding process, the total clamping...
mechanism monitors the deformations of the blanks in the entire working area and moves together with the laser head 1 in Y direction clamps at a close distance from the weld point, which guarantees the welding quality.

[31] Working principle of the invention:

[32] The blanks (or sheets) 12, 13 are overlapped on the workbench. Before stitch welding, the third air cylinder 9 drives the front pressing beam 8 down until the pressing wheels 14 on the beam presses the blanks 12, 13, and the forth air cylinder 11 drives the front pressing beam 10 down until the pressing wheels 14 on the beam presses the blanks 12, 13 before welding; the second air cylinder 7 drives the left pressing roller 6 down to the blanks 12, 13 and the first air cylinder 4 drives the right pressing roller 3 down to the blanks 12, 13; The work area is enclosed by the left and right pressing roller 6, 3, and the pressing wheels 14 on the pressing beam. When stitch welding, the laser head moves in X, Y and Z directions shown in Fig. 1 and Fig. 2; when finishing the welding in the working area, the next area is driven into the welding area in X direction, during this process, the pressing wheels 14 keep clamping to make the blanks smooth, the total clamping mechanism monitors the deformations of the blanks in the entire working area, and the direct clamping mechanism guarantees the gap and flatness near the weld point, which leads to a good welding quality.
Claims

[1] A apparatus of laser stitch welding for large scale sheets, characterized in that: a slipway (2), moving in Y direction; a laser head (1), mounted on the slipway (2) by means of a bed fixing pedestal (5); a total clamping mechanism, placed over a workbench being parallel to Y direction and perpendicular to the slipway (2), which can be moved up and down; a direct clamping mechanism, mounted on the slipway(1) by means of the bed fixing pedestal (5) located in X directions being moved together with the laser head (1) in Y direction forming a gantry; a work area is enclosed by the total clamping mechanism monitoring the entire blanks assembly and the direct clamping mechanism monitoring weld joints at a close distance from the weld point to meet the metal fit-up requirement.

[2] The apparatus of laser stitch welding for large scale sheets according to the claim 1, characterized in that the said total clamping mechanism is made up of a front pressing beams (8), a rear pressing beams (10) and a pressing wheel (14); the front and rear pressing beams (8, 10), respectively placing two sides of the slipway (2), connects driven air cylinders for driving up and down; at least two pressing wheels (14) are respectively mounted on the front and rear pressing beam (8, 10).

[3] The apparatus of laser stitch welding for large scale sheets according to the claim 1, characterized in that the said direct clamping mechanism is made up of the laser head (1), a left pressing roller (6) and a right pressing roller (3); the left and right pressing rollers (6, 3) connecting to driven air cylinders are disposed on the two sides of the laser head (1) by means of the bed fixing pedestal (5); the laser head (1) is mounted on the slipway (2) moving together with the left pressing roller (6) and the right pressing roller (3).

[4] The apparatus of laser stitch welding for large scale sheets according to the claim 3, characterized in that the said left and right pressing rollers (6, 3) disposed on the two sides of the laser head (1) is mounted on the bed fixing pedestal (5) by a movable mechanism.

[5] The apparatus of laser stitch welding for large scale sheets according to the claim 2 and 3, characterized in that the driven air cylinders have a pressure valve.

[6] The apparatus of laser stitch welding for large scale sheets according to the claim 1, characterized in that the said laser head (1) is mounted on the slipway (2) by movable mechanism in X, Y directions which can be moved in X, Y and Z
directions.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B23K 37/04, 37/02, 37/053, 37/00, 26/02, 26/08, 26/10, 26/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WP; EPDOC; PAI; CNPAT; CNKI: weld+, solder+, laser, stitch+, sheet, plate, planar, board, slab, flat, gap, clamp, composite, layer, overlap, hold, seam, clearance, space, fix+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Date of the actual completion of the international search
08 Oct. 2008 (08.10.2008)

Date of mailing of the international search report

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100088
Facsimile No. 86-10-62019451

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HOU, Yanpin
Telephone No. (86-10)62084500

Form PCT/ISA/210 (second sheet) (April 2007)
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**INTERNATIONAL SEARCH REPORT**

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