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(71) Applicant (for all designated States except AU, CN, ID, IN, JP, KP, KR, LA, LK, MY, NZ, PG, PH, SG, US, VN): **FCI** [FR/FR]; 145/147, rue Yves Le Coz, F-78000 Versailles (FR).

(71) Applicant (for AU, CN, ID, IN, JP, KP, KR, LA, LK, MY, NZ, PG, PH, SG, VN only): **FCI CONNECTORS SINGAPORE PTE LTD** [SG/SG]; 159 Kampong Ampat, #04-01/04 KA Place, Singapore 36832 (SG).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **FUNAMIZU, Daisuke** [JP/JP]; 1-21-5 Ishikawa, Fujisawa City, Kanagawa (JP). **WADA, Kazumi** [JP/JP]; 5055-13 Ohba, Fujisawa, Kanagawa (JP). **NISHIJIMA, Hideki** [JP/JP]; 3-32-25 Ozanji Higashi, Asou-ku, Kawasaki City, Kanagawa (JP).

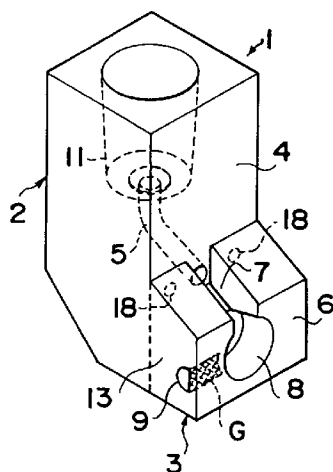
(74) Agent: **REGI, François-Xavier**; FCI-IP Department, 145-147, rue Yves Le Coz, F-78035 Versailles Cedex (FR).

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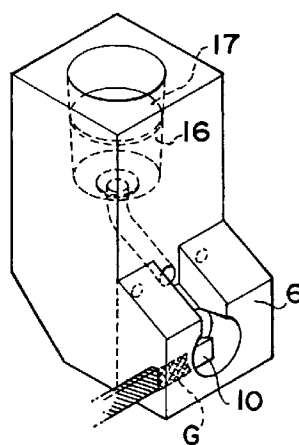
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(54) Title: THERMITE WELDING TOOL, CRUCIBLE AND THERMITE WELDING METHODS

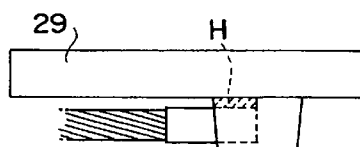
(a)



(b)



(c)



(57) Abstract: The present application relates to a thermite welding method comprising a step of inserting a welding lug into a through hole (9) of a thermite tool or crucible (2) and positioning at least a portion (10) of the welding lug inside a hollow portion (8) with a predetermined spacing from the base metal surface; a step of sealing the aperture portion of the hollow portion (8) by the surface of the base metal; a step of pouring melted thermite into the hollow portion (8) to form a welded portion; and a step of destroying at least the portion (6) between the welding lug and the surface of the base metal in the crucible (13) or the welding tool (1). The invention also provides a welding tool (1) and a crucible (2) for performing this method. The invention achieves an increase in the welding area between the surface of the base metal and the welding lug in thermite welding.



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THERMITE WELDING TOOL, CRUCIBLE AND THERMITE WELDING METHODS

5 TECHNICAL FIELD

The present invention relates to a novel welding method of performing thermite welding between a base metal and a welding lug connected to a conductor cable, and a welding tool and crucible for performing this method. The present invention more specifically relates to a welding method, welding tool and crucible for improving the welding strength by retaining an adequate welding area between the base metal and the welding lugs.

BACKGROUND ART

Thermite welding is performed by igniting and burning a mixed powder of aluminum and copper oxide (or iron oxide) near the surface of a base metal, and melting the copper (or iron) and a portion of the base metal with the heat generated by the chemical reaction to fuse them together. Thermite welding is often used in the field of railroads to electrically connect two rails using bonding cables, or to connect pipes buried underground. Fig. 5 shows an example of thermite welding on railway rails.

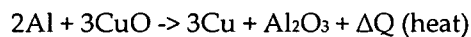
Special equipment is needed to perform thermite welding, and this special equipment shall be referred to hereafter as a crucible. The portion of the crucible that actually fuses together the base metal and the welding lugs connected to the conductor cable shall be referred to as the welding tool.

Hereafter, the structure of a conventional crucible shall be described with reference to Fig. 6(a). The crucible 61 consists of a combustion chamber 65 containing a thermite material 62 and an ignition material 63, where the ignition material is ignited to cause combustion, a channel 67 for allowing the melted thermite material 62 to flow out after combustion, an insertion portion 69 for inserting a welding lug connected to a conductor cable, and a recess portion 68 into which the melted thermite material 62 is caused to flow from the channel 67 to fuse together the base metal and the welding lug. The recess portion 68 opens onto a surface 70.

Before combustion, the bottom of the combustion chamber is covered by a steel disk 64, under which the channel 67 extends.

In preparing to perform thermite welding, as shown in Fig. 6(b), the thermite material 62 is loaded and covered by the ignition material 63. Next, a welding lug 71 connected to a conductor cable is provided in the insertion portion 69 such that at least the tip is positioned inside the recess portion 68. Additionally, the surface of the base metal (not shown) is brought into contact with the surface 70 and the surface of the welding lug 71, and the recess portion 68 is sealed. The surface of the welding lug 71 is flush with the surface 70.

Then, in order to perform thermite welding, the ignition material 63 is ignited so as to induce the below-indicated combustion reaction in the thermite material 62 (for the example of copper thermite welding). The heat generated by the reaction causes the metal components in the thermite material 62 to melt.



At this time, the steel disk 64 also melts, thus enabling the molten metal to pass through the channel 67 to flow downward. Molten metal flows from the channel 67 toward the recess portion 68. In this way, the heat of the molten metal causes a portion of the welding lug and base metal to melt inside the recess portion 68, and after cooling, a welded portion (see Reference Number 72 of Fig. 6(c)) is formed on the surface of the base metal with a portion of the welding lug contained inside, thus fusing the base metal and the welding lug 71 by means of the welded portion 72. Fig. 6(c) shows a side view of the state of the base metal surface, welded portion and welding lug after thermite welding. While the actual process of thermite welding is more complicated, involving polishing of the base metal, preheating, removal of the crucible after thermite welding, removal of slag and shape adjustment, these processes are already known to those skilled in the art, so they will not be described in detail here.

A conventional thermite welding method is described, for example, in JP 2000-301254A.

In the conventional thermite welding method described above, as shown in Fig. 6(c), the portion to which the molten metal fuses, on the welding lug, corresponds to the surface portion of the welding lug positioned in the recess portion 68, or roughly the area Z indicated by the dashed line, and on the surface of the base metal 73, corresponds to the aperture of the recess portion 68 on the surface 70 of the crucible 61, or roughly the area V other than the welding lug. Since the welding area between the base metal and

the welding lug is the sum of the areas V and Z, it is determined even before thermite welding by the position of the welding lug 71 in the recess portion 68. Therefore, unless the portion of the welding lug 71 positioned inside the recess portion 68 is large, the welding area on the surface of the base metal 73 will be small, and if the portion of the welding lug positioned inside the recess portion 68 is too small, the welding area of the welding lug will be small. In any case, the area of contact W between the welding lug and the base metal surface will not be welded, leaving some concerns as to the strength of the weld.

DISCLOSURE OF THE INVENTION

In order to resolve the above-described problem, the present invention has the purpose of offering a thermite welding method and a crucible or welding tool capable of performing a thermite welding method, wherein the surface of the base metal and the welding lug are spaced apart by a predetermined distance inside the aperture of the recess portion 68 when positioning a welding lug before thermite welding, so that molten metal is allowed to flow into said space during thermite welding to increase the welding area between the base metal and the welding lug, thereby reducing the non-welded area W.

(1) In order to achieve the above purpose, the thermite welding tool of the present invention is characterized by forming a crucible for thermite welding of a base metal and a welding lug connected to a conductor cable, the welding tool comprising a hollow portion for receiving melted thermite; the hollow portion comprising an aperture portion provided on the surface contacting the base metal, an inlet portion for pouring melted thermite into the hollow portion and a through hole opening on a portion spaced from the surface of the contacting base metal by a predetermined distance and on the hollow portion.

(2) Additionally, the crucible of the present invention is characterized by comprising a welding tool as recited in (1), a flow channel extending from the inlet portion for inflow of thermite and a combustion chamber for burning the thermite, provided with a communication port communicating with the flow channel.

(3) Furthermore, the welding tool or crucible of the present invention should preferably be such that at least a portion between the through hole and the surface of the

base metal or the entirety is produced by a ceramic or by a CO₂ molding method.

(4) Furthermore, the thermite welding method of the present invention is a method for performing thermite welding using a welding tool or a crucible as recited in (1) to (3), characterized by comprising a step of inserting the welding lug into the through hole and positioning at least a portion of the welding lug inside the hollow portion; a step of sealing the aperture portion of the hollow portion by the surface of the base metal; a step of pouring melted thermite into the hollow portion to form a welded portion; and a step of destroying at least the portion between the welding lug and the surface of the base metal in the crucible or the welding tool.

(5) Furthermore, the thermite welding method of the present invention may be a method of thermite welding using a welding tool for thermite welding of a base metal and a welding lug connected to a conductor cable, the welding tool comprising a hollow portion for receiving melted thermite; the hollow portion comprising an aperture portion provided on the surface contacting the surface of the base metal; an inlet portion for pouring melted thermite into the hollow portion; and a recess portion communicating with the hollow portion and having an aperture portion on a surface of contact with the base metal; the method comprising a step of positioning the welding lug inside the recess portion so that at least a portion of the welding lug is positioned inside the hollow portion; a step of positioning a piece between the welding lug and the surface of the base metal inside the recess portion; a step of bringing into contact, the surface of the hollow portion on which the aperture portion is formed and the surface of the recess portion on which the aperture portion is formed, with the surface of the base metal; and a step of pouring melted thermite into the hollow portion and forming a welded portion.

(6) Furthermore, the thermite welding method of the present invention may be a method of thermite welding using a crucible for thermite welding of a base metal and a welding lug connected to a conductor cable, the crucible comprising a combustion chamber for burning the thermite; a flow channel communicating with the combustion chamber for flow of thermite melted by the burning; a hollow portion for forming a welded portion welding the welding lug and the base metal, communicating with the flow channel and having an aperture portion opening to the base metal; and a recess portion communicating with the hollow portion and having an aperture portion on a surface of contact with the base metal, the method comprising a step of positioning the

welding lug inside the recess portion so that at least a portion of the welding lug is positioned inside the hollow portion; a step of positioning a piece between the welding lug and the surface of the base metal inside the recess portion; a step of bringing into contact, the surface of said hollow portion on which the aperture portion is formed and the surface of said recess portion on which the aperture portion is formed, with the surface of the base metal; and a step of pouring melted thermite into the hollow portion and forming a welded portion.

(7) Furthermore, the thermite welding method of the present invention may be a method of thermite welding using a welding tool for thermite welding of a base metal and a welding lug connected to a conductor cable, the welding tool comprising a hollow portion for receiving melted thermite; the hollow portion comprising an aperture portion provided on the surface contacting the surface of the base metal; an inlet portion for pouring melted thermite into the hollow portion; and a recess portion communicating with the hollow portion and having an aperture portion on a surface of contact with the base metal; the method comprising a step of positioning the welding lug inside the recess portion so that at least a portion of the welding lug is positioned inside the hollow portion, the welding lug positioned inside the hollow portion having a width greater than the width of the portion of contact with the surface of the base metal on a cross section parallel to the surface of the base metal; a step of bringing into contact, the surface of the hollow portion on which the aperture portion is formed and the surface of the recess portion on which the aperture portion is formed, with the surface of the base metal; a step of pouring melted thermite into the hollow portion and forming a welded portion; and a step of destroying at least the portion between the welding lug and the surface of the base metal.

(8) Furthermore, the thermite welding method of the present invention may be a method of thermite welding using a crucible for thermite welding of a base metal and a welding lug connected to a conductor cable, the crucible comprising a combustion chamber for burning the thermite; a flow channel communicating with the combustion chamber for flow of thermite melted by the burning; a hollow portion for forming a welded portion welding the welding lug and the base metal, communicating with the flow channel and having an aperture portion opening to the base metal; and a recess portion communicating with the hollow portion and having an aperture portion on a

surface of contact with the base metal; the method comprising a step of positioning the welding lug inside the recess portion so that at least a portion of the welding lug is positioned inside the hollow portion, the welding lug positioned inside the hollow portion being wider than the portion of contact with the surface of the base metal on a cross section parallel to the surface of the base metal; a step of bringing into contact, the surface of the hollow portion on which the aperture portion is formed and the surface of the recess portion on which the aperture portion is formed, with the surface of the base metal; a step of pouring melted thermite into the hollow portion and forming a welded portion; and a step of destroying at least the portion between the welding lug and the surface of the base metal.

(1) Since the welding tool of the present invention comprises a through hole opening on a portion spaced from the surface of the contacting base metal by a predetermined distance and on the hollow portion, when performing thermite welding, molten metal flows into the space between the surface of the base metal and the welding lug inside the aperture portion provided on the surface contacting the surface of the base metal, thereby increasing the welding area between the base metal and the welding lug and improving the welding strength.

Additionally, the welding tool of the present invention can be made detachable from the crucible body, thus raising the portability.

(2) Since the crucible of the present invention comprises, in addition to the above welding tool, a flow channel extending from the inlet portion for inflow of thermite; and a combustion chamber for burning the thermite, provided with a communication port communicating with the flow channel, it forms a crucible integrating a welding tool and a molten metal forming portion, so that the effects of thermite welding according to (1) can be achieved simply by igniting an ignition material.

(3) Since the welding tool or crucible of the present invention is such that at least a portion between the through hole and the surface of the base metal is produced by a ceramic or by a CO₂ molding method, the portion can be easily destroyed after thermite welding to remove the welding tool or crucible from the thermite welded portion.

(4) Since the thermite welding method of the present invention uses the above thermite welding tool or crucible and comprises a step of destroying at least the portion between the welding lug and the surface of the base metal, the portion making the

welding tool or crucible impossible to remove after welding can be destroyed, so that molten metal flows into the space between the surface of the base metal and the welding lug inside the aperture portion provided on the surface contacting the surface of the base metal after thermite welding, thereby increasing the welding area between the base metal and the welding lug and enabling thermite welding with improved welding strength to be achieved.

(5) The thermite welding method according to another embodiment of the present invention comprises a step of positioning the welding lug inside the recess portion so that at least a portion of the welding lug is positioned inside the hollow portion; a step of positioning a piece between the welding lug and the surface of the base metal inside the recess portion; a step of bringing into contact, the surface of the hollow portion on which the aperture portion is formed and the surface of the recess portion on which the aperture portion is formed, with the surface of the base metal; and a step of pouring melted thermite into the hollow portion and forming a welded portion.

As a result, a space is formed between the welding lug and the surface of the base metal equivalent to the thickness of the piece inside the aperture portion of the hollow portion provided on the surface contacting the surface of the base metal, as a result of which molten metal flows into the space when thermite welding is performed so as to weld the welding lug to the surface of the base metal, thereby increasing the welding area with the surface of the base metal over the entire area of the aperture portion of the hollow portion (the bottom surface of the welded portion formed on the base metal surface).

(6) The thermite welding method according to another embodiment of the present invention can achieve the effects described in (5) by integrating a molten metal forming portion in addition to the welding tool.

(7) The thermite welding method according to another embodiment of the present invention is such that the welding lug positioned inside the hollow portion has a width greater than the width of the portion of contact with the surface of the base metal in a cross section parallel to the surface of the base metal, so for example, if the vertical cross section of the welding tool or crucible in the direction of insertion of the welding lug is triangular, and the edge of the vertex of the triangle and the surface of the base metal are brought into contact in order to stably position the welding lug on the surface of the base

metal before thermite welding, then the area of contact can be made smaller than in conventional welding lugs, while increasing the welding area on the surface of the base metal in the aperture portion of the hollow portion.

BRIEF DESCRIPTION OF THE DRAWINGS

5 [Fig. 1] (a) is a perspective view of a welding tool and crucible according to Example 1 of the present invention. (b) is a perspective view of a welding lug connected to a conductor cable inserted into an insertion hole in a preparatory stage prior to thermite welding. (c) is a side view of a weld between a base metal and a welding lug by means of a welded portion after thermite welding.

10 [Fig. 2] (a) is a perspective view of a welding tool and crucible according to Example 2 of the present invention. (b) is a perspective view of the positioning of a welding lug connected to a conductor cable using a small piece in a preparatory stage prior to thermite welding. (c) is a side view of a weld between a base metal and a welding lug by means of a welded portion after thermite welding.

15 [Fig. 3] (a) is a diagram showing a welded portion immediately after being formed with an area of contact between the surface of the base metal (not shown) and the welding lug by pouring thermite material using a cylindrical lug. (b) is a diagram showing the welding lug and the welding tool separated by destruction of a portion of the welding tool. (c) is a diagram showing a welded portion covering the cylindrical lug on the
20 surface of the base metal.

[Fig. 4] (a) is a cross section viewed from X-X in Fig. 3(c). (b) is a cross section viewed from the longitudinal direction of a triangular cylindrical welding lug in the welded portion after thermite welding by another embodiment.

[Fig. 5] A diagram showing thermite welding on a base metal of a railway rail.

25 [Fig. 6] (a) is a perspective view of a conventional crucible for thermite welding. (b) is a perspective view of the positioning of a welding lug connected to a conductor cable in a preparatory stage prior to thermite welding. (c) is a side view showing the state after thermite welding.

30 BEST MODES FOR CARRYING OUT THE INVENTION

Preferred embodiments of the present invention shall now be explained with reference to the drawings. In Figs. 1-4, the same reference numbers shall be used to

refer to the same parts, and their explanations shall be skipped where appropriate.

First Embodiment

Figs. 1(a)-(c) show a first embodiment of the present invention. Fig. 1(a) shows a perspective view of a crucible 1 according to a first embodiment of the present invention. Fig. 1(b) is a perspective view of a crucible positioning a welding lug connected to a conductor cable at a predetermined position for performing thermite welding. Fig. 1(c) shows a side view of a weld between a base metal and a welding lug after thermite welding using a crucible.

Explaining the crucible 1 of the present invention with reference to Fig. 1(a), the crucible 1 comprises a crucible body 2 containing a generating portion for forming a molten metal for thermite welding as shown in Fig. 6, and a welding tool 3 for performing detachable thermite welding on the surface 4 of the crucible body 2. The attachment and detachment of the crucible body 2 and the thermite welding tool 3 can, for example, be performed by forming joint portions 18 by engaging a bump on the welding tool 3 with a hole portion in the surface 4 of the crucible body 2.

The crucible body 2 comprises a combustion chamber 11 for receiving, and burning and melting a thermite material, and a channel 5 opening onto the inner surface of the bottom portion of the combustion chamber 11 and the surface 4, for allowing passage of melted thermite material.

The welding tool 3 has a channel 7, a recess portion 8 having a truncated conical shape and a through hole 9 which opens on the surface 13 and the inner surface of the recess portion 8. When the welding tool 3 is mounted on the crucible body 2 to perform thermite welding, a melted thermite material is allowed to flow from an aperture in the surface 4 of the crucible body 2 into the channel 7.

While the channel 7 is open from the aperture on the surface 4 of the crucible body along the recess portion 8, it may be a through hole that is not open.

The recess portion 8 forms a hollow portion communicating between the channel 7 and the through hole 9, and has an aperture in the surface 6 contacting the surface of the base metal (not shown) during thermite welding. The through hole 9 has an internal shape that is roughly complementary to the profile of the welding lug to be thermite welded. The portion of region G between the surface of the base metal and the through hole 9 provided in the preparatory stage before thermite welding is formed by

of a material that is easily destroyed by an external force such as a ceramic or by a CO₂ molding method.

Next, explaining the preparatory stage prior to thermite welding with reference to Fig. 1(b), as shown in Fig. 6, a disk 14 covering the channel is placed in the bottom of the combustion chamber 11, and this is covered by a thermite material 16 and an ignition material 17. Furthermore, the welding lug 10 connected to the conductor cable is inserted to a predetermined position in the through hole 9 having a shape complementary to the outer surface of the welding lug 10 so that the tip protrudes into the interior of the recess portion 8. At that time, the welding lug 10 of the recess portion 8 is spaced from the surface 6 by a predetermined distance.

Finally, the surface of the base metal is brought into contact with the surface 6, and the recess portion 8 is sealed. Then, the ignition material 17 is ignited to perform thermite welding. After molten metal flows into the recess portion 8, it is cooled to fuse the base metal (not shown) and the welding lug 10 via a welded portion formed with the same shape as the interior of the recess portion 8. While the existence of the portion G between the through hole 9 of the welding tool 3 and the surface of the base metal prevents the crucible 1 or welding tool 3 from being removed, the portion G can be destroyed by pulling the welding tool 3 apart from the base metal or striking the welding tool 3 using a hammer or the like after thermite welding. As a result, the welding tool 3 can be removed from the thermite welding portion to results in a weld between the base metal 29 and the welding lug 10 due to a welded portion as shown in Fig. 1(c). Additionally, since the welding tool 3 is detachable from the crucible body 2, by producing the entirety with a ceramic or by CO₂ molding, for example, it can be produced at low cost and easily destroyed, as well as being capable of being used economically and replaceably. Of course, the thermite welding method of the present invention is also achievable by making the welding tool integral with the crucible body, and by including a step of destroying the entire crucible, and this is also included within the scope of the invention.

With reference to Fig. 1(c), after welding using the welding tool 3 or crucible 1 for thermite welding and the thermite welding method according to the present invention, the weld metal has flowed into the region H forming a space of a predetermined distance between the welding lug 10 and the base metal 29, as a result of

which the thermite welding method of the present invention increases the welding area as compared with conventional thermite welding methods.

Second Embodiment

Figs. 2(a)-(c) show a second embodiment of the present invention. Figs. 2(a) shows a crucible 1 according to the second embodiment of the present invention. Explaining the crucible 1 of the second embodiment with reference to Fig. 2(a), the crucible differs from that of the first embodiment in that the recess portion 19 for positioning the welding lug opens onto the surface of contact with the base metal, and the portion G of the first embodiment exists independently as a small piece 15.

Next, explaining the preparatory stage prior to thermite welding according to the second embodiment with reference to Fig. 2(b), as in the first embodiment, a disk 14 is placed so as to cover the channel at the bottom of the combustion chamber 11, and this is covered by a thermite material 16 and an ignition material 17. Next, when positioning the welding lug 10, a portion of the welding lug 10 having a dome-shaped external profile is brought into close contact with the complementary inner surface of the recess portion 19, and the tip of the welding lug 10 is positioned so as to protrude into the interior of the recess portion 8. At this time, the welding terminal 10 inside the recess portion 8 is spaced by a predetermined distance from the surface 6. Next, the small piece 15 is positioned between the welding lug 10 and the surface of the base metal so as to be flush with the surface 6.

Finally, the surface of the base metal is brought into contact with the surface 6 and the recess portion 8 is sealed, after which the ignition material 17 is ignited to perform thermite welding. After the molten metal has flowed into the recess portion 8, it is cooled so as to fuse together the base metal (not shown) and the welding lug 10 by a welded portion formed with the same shape as the internal shape of the recess portion 8. Next, the welding tool 3 or crucible 1 is pulled in a direction away from the base metal to remove it from the thermite welding portion, thus resulting in a weld between the base metal 29 and the welding lug 10 by means of a welded portion as shown in Fig. 2(c).

Next, with reference to Fig 2(c), after welding using the thermite welding tool 3 or crucible 1, and thermite welding method according to the second embodiment of the present invention, molten metal has flowed into the portion H spaced with a predetermined distance between the welding lug 10 and the base metal 29 at the welded

portion, so the thermite welding method of the present invention results in an increase in the welding area as compared with conventional thermite welding methods. The small piece 15 may be left as is, removed, or destroyed if produced of a material such as a ceramic that is easily destroyed.

Example 3

Fig. 3 shows a third embodiment having a different profile of the welding lug with a conductor cable inserted inside. Fig. 3(a) shows a diagram immediately after the thermite material has flowed in, so as to form a welded portion having an area of contact between the welding lug and the surface of the base metal 29 which is not shown, and Fig. 3(b) shows how a portion of the welding tool is destroyed to separate the welding lug and the welding tool. Fig. 3(c) shows a welded portion formed on the surface of the base metal 29.

Fig. 4(a) shows a cross section viewed from X-X in the longitudinal direction of the welding lug (direction of insertion of the welding lug) in Fig. 3(c).

While the embodiments shown in Figs. 1 and 2 are such that the cross section viewed from the longitudinal direction of the welding lug (direction of insertion of the welding lug) has a semicircular cylindrical shape and a space is formed between the surface of the base metal and the welding lug at a welded portion on the surface of the base metal, the embodiment of Fig. 4(a) is such that the cross section viewed from X-X of the welding lug in Fig. 3(c) is a circular cylinder.

Additionally, Fig. 4(b) shows an embodiment wherein the horizontal cross section of the welding lug has a triangular cylindrical shape. In each cross section, the surface of the base metal and the welding lug have an area of contact along the entire longitudinal length of the welding lug.

In Figs. 4(a) and 4(b), the contacting width between the welding lug and the surface of the base metal is indicated by l . Since the molten metal flows into the boundary in the area of contact between the welding lug and the surface of the base metal at the time of thermite welding, the welding area clearly increases as compared with the case where the entire rectangular cross section of a conventional semicircular cylindrical portion forms an area of contact W (see Fig. 6(c)) with the surface of the base metal.

Therefore, with the thermite welding method of the present invention, the

welding tool 3 can be easily removed after thermite welding by destroying the portion between the welding lug 10 and the surface of the base metal 29 at least in the welding tool 3 (see Fig. 3(b)), so that the welding lug 10 provided in the recess portion 8 can be made to have an arbitrary cross section, for example, a cylinder or an angled cylinder, wider than the width of the area of contact I with the surface of the base metal 29 in the cross section parallel to the surface of the base metal 29. By providing the welding lug 10 with such a profile, the non-welded area (contact area) I in Fig. 4(a) is reduced as compared with the non-welded area W of the conventional welding lug shown in Fig. 6, and the welded area is increased, consequently raising the strength of the weld.

CLAIMS

1. A welding tool forming a crucible for thermite welding of a base metal and a welding lug connected to a conductor cable, said welding tool comprising a hollow portion for receiving melted thermite;

said hollow portion comprising:

an aperture portion provided on the surface contacting the surface of the base metal;

an inlet portion for pouring melted thermite into the hollow portion; and

a through hole opening on a portion spaced from the surface of said contacting base metal by a predetermined distance and on said hollow portion.

2. A welding tool as recited in claim 1, characterized in that at least a portion between the through hole and the surface of the base metal is produced by a ceramic or by a CO₂ molding method.

3. A crucible comprising:

a welding tool as recited in claim 1 or 2;

a flow channel extending from said inlet portion for inflow of thermite; and

a combustion chamber for burning the thermite, provided with a communication port communicating with said flow channel.

4. A crucible as recited in claim 3, characterized by being produced by a ceramic or by a CO₂ molding method.

5. A thermite welding method for performing thermite welding using a welding tool as recited in claim 1 or 2, or a crucible as recited in claim 3 or 4, characterized by comprising:

a step of inserting said welding lug into said through hole and positioning at least a portion of the welding lug inside the hollow portion;

a step of sealing the aperture portion of said hollow portion by the surface of said base metal;

a step of pouring melted thermite into the hollow portion to form a welded portion; and

a step of destroying at least the portion between the welding lug and the surface of the base metal in said crucible or said welding tool.

5 6. A method of thermite welding using a welding tool for thermite welding of a base metal and a welding lug connected to a conductor cable, said welding tool comprising a hollow portion for receiving melted thermite;

said hollow portion comprising:

an aperture portion provided on the surface contacting the surface of the base metal;

10 an inlet portion for pouring melted thermite into the hollow portion; and

a recess portion communicating with said hollow portion and having an aperture portion on a surface of contact with said base metal;

the method comprising:

15 a step of positioning the welding lug inside the recess portion so that at least a portion of the welding lug is positioned inside the hollow portion;

a step of positioning a piece between the welding lug and the surface of the base metal inside said recess portion;

20 a step of bringing into contact, the surface of said hollow portion on which the aperture portion is formed and the surface of said recess portion on which the aperture portion is formed, with the surface of the base metal; and

a step of pouring melted thermite into the hollow portion and forming a welded portion.

25 7. A method of thermite welding using a crucible for thermite welding of a base metal and a welding lug connected to a conductor cable, said crucible comprising:

a combustion chamber for burning the thermite;

a flow channel communicating with said combustion chamber for flow of thermite melted by the burning;

30 a hollow portion for forming a welded portion welding said welding lug and the base metal, communicating with said flow channel and having an aperture portion opening to the base metal; and

a recess portion communicating with said hollow portion and having an aperture portion on a surface of contact with said base metal;

the method comprising:

a step of positioning the welding lug inside the recess portion so that at least a portion of the welding lug is positioned inside the hollow portion;

a step of positioning a piece between the welding lug and the surface of the base metal inside said recess portion;

5 a step of bringing into contact, the surface of said hollow portion on which the aperture portion is formed and the surface of said recess portion on which the aperture portion is formed, with the surface of the base metal; and

a step of pouring melted thermite into the hollow portion and forming a welded portion.

10

8. A method of thermite welding using a welding tool for thermite welding of a base metal and a welding lug connected to a conductor cable, said welding tool comprising a hollow portion for receiving melted thermite;

said hollow portion comprising:

15 an aperture portion provided on the surface contacting the surface of the base metal;

an inlet portion for pouring melted thermite into the hollow portion; and

a recess portion communicating with said hollow portion and having an aperture portion on a surface of contact with said base metal;

20 the method comprising:

a step of positioning the welding lug inside said recess portion so that at least a portion of the welding lug is positioned inside the hollow portion, the welding lug positioned inside said hollow portion having a width greater than the width of the portion of contact with the surface of the base metal on a cross section parallel to said surface of said base metal;

25

a step of bringing into contact, the surface of said hollow portion on which the aperture portion is formed and the surface of said recess portion on which the aperture portion is formed, with the surface of the base metal;

a step of pouring melted thermite into the hollow portion and forming a welded portion; and

30

a step of destroying at least the portion between the welding lug and the surface of the base metal.

9. A method of thermite welding using a crucible for thermite welding of a base

metal and a welding lug connected to a conductor cable, said crucible comprising:

a combustion chamber for burning the thermite;

a flow channel communicating with said combustion chamber for flow of thermite melted by the burning;

5 a hollow portion for forming a welded portion welding said welding lug and the base metal, communicating with said flow channel and having an aperture portion opening to the base metal; and

a recess portion communicating with said hollow portion and having an aperture portion on a surface of contact with said base metal;

10 the method comprising:

a step of positioning the welding lug inside said recess portion so that at least a portion of the welding lug is positioned inside the hollow portion, the welding lug positioned inside said hollow portion having a width greater than the width of the portion of contact with the surface of the base metal on a cross section parallel to said surface of said base metal;

15 a step of bringing into contact, the surface of said hollow portion on which the aperture portion is formed and the surface of said recess portion on which the aperture portion is formed, with the surface of the base metal;

20 a step of pouring melted thermite into the hollow portion and forming a welded portion; and

a step of destroying at least the portion between the welding lug and the surface of the base metal.

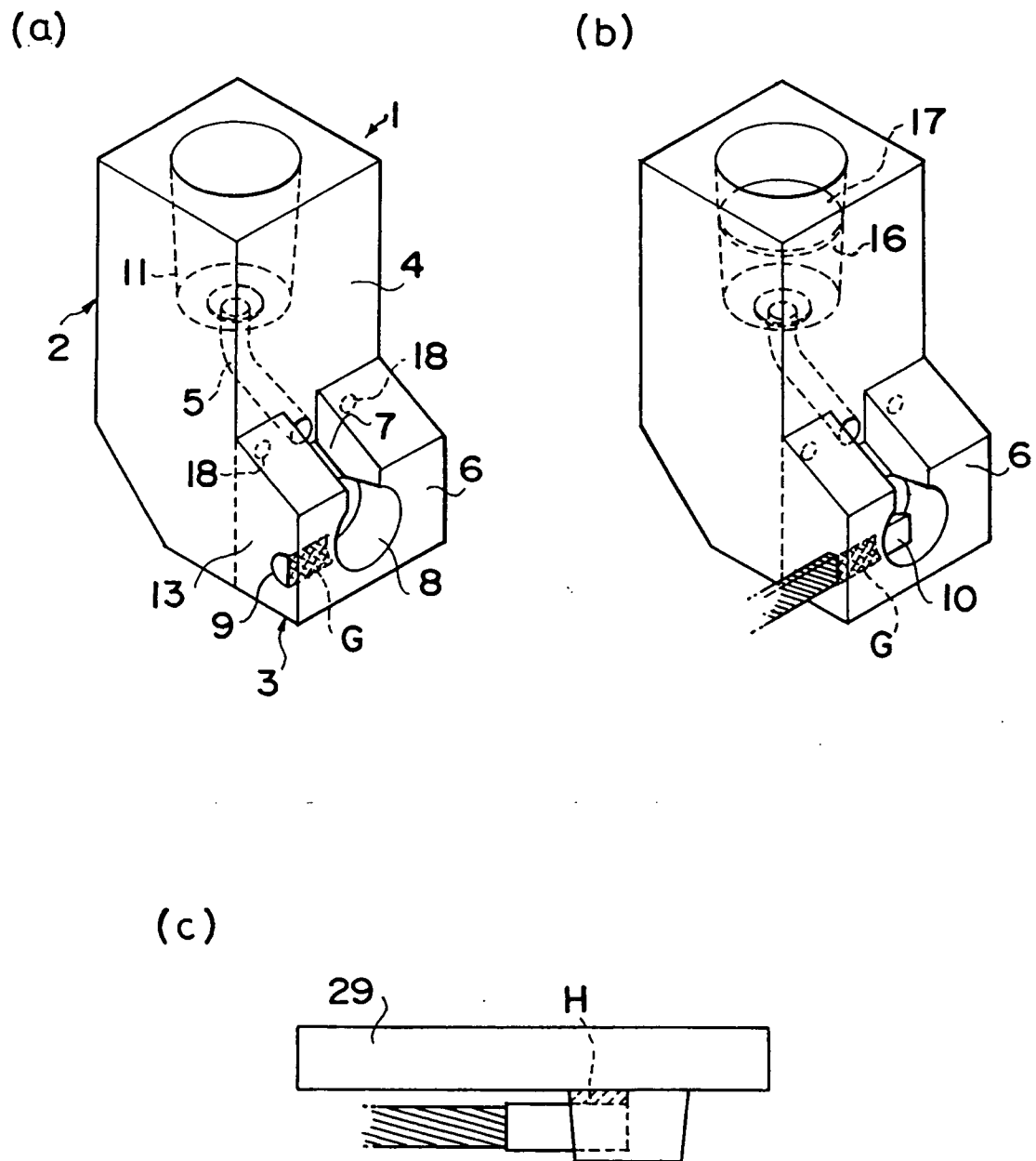


FIG. 1

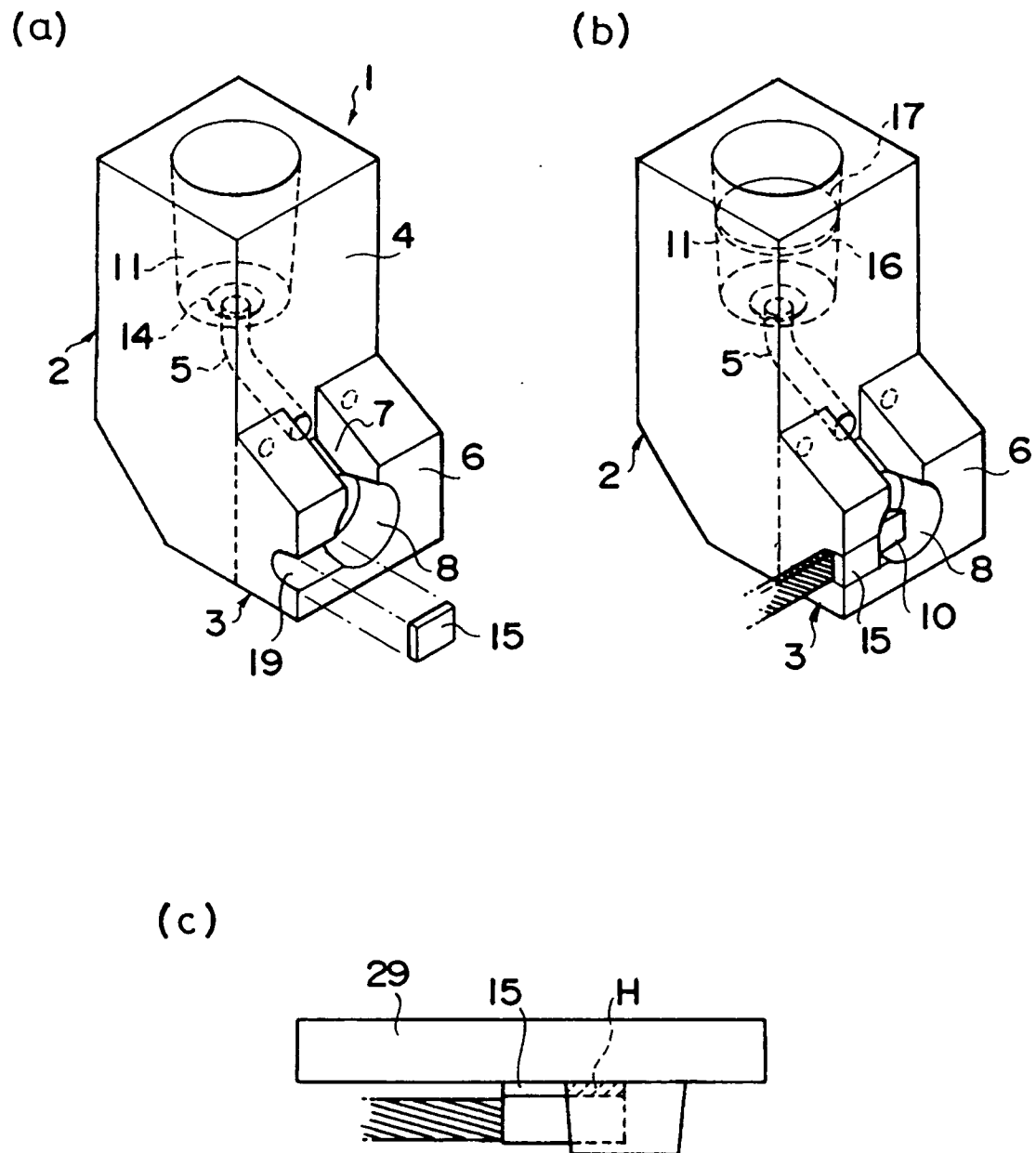
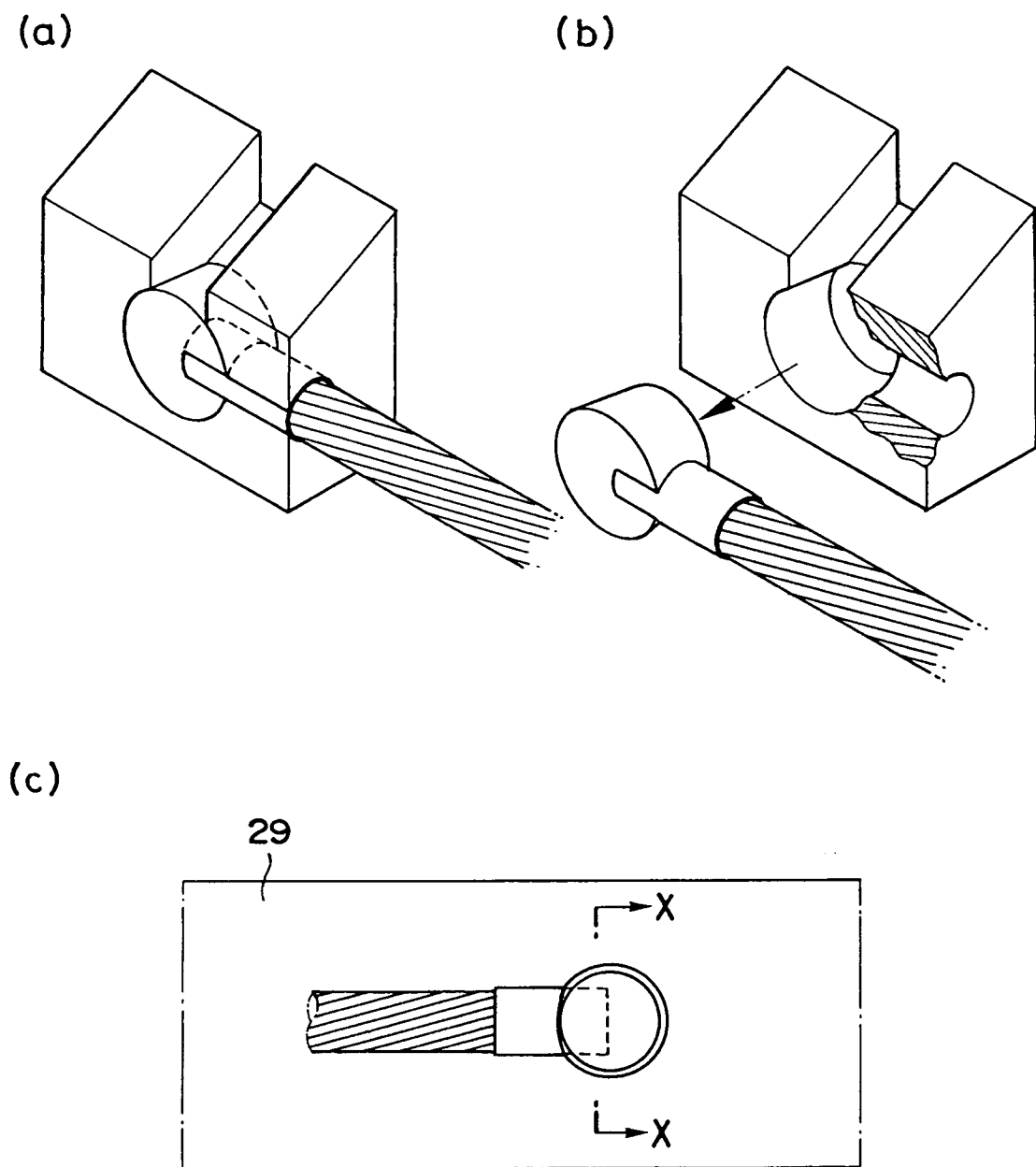
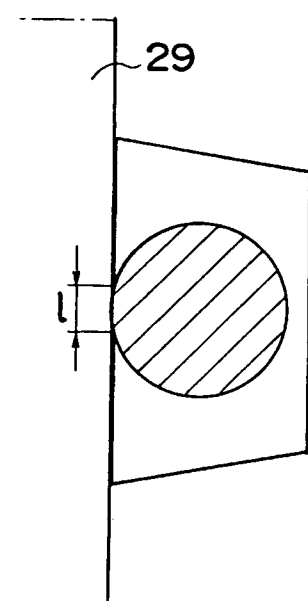


FIG. 2



(a)



(b)

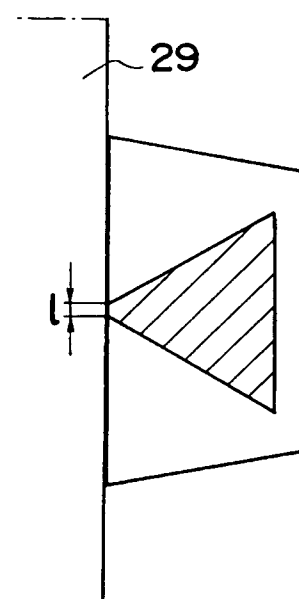


FIG. 4

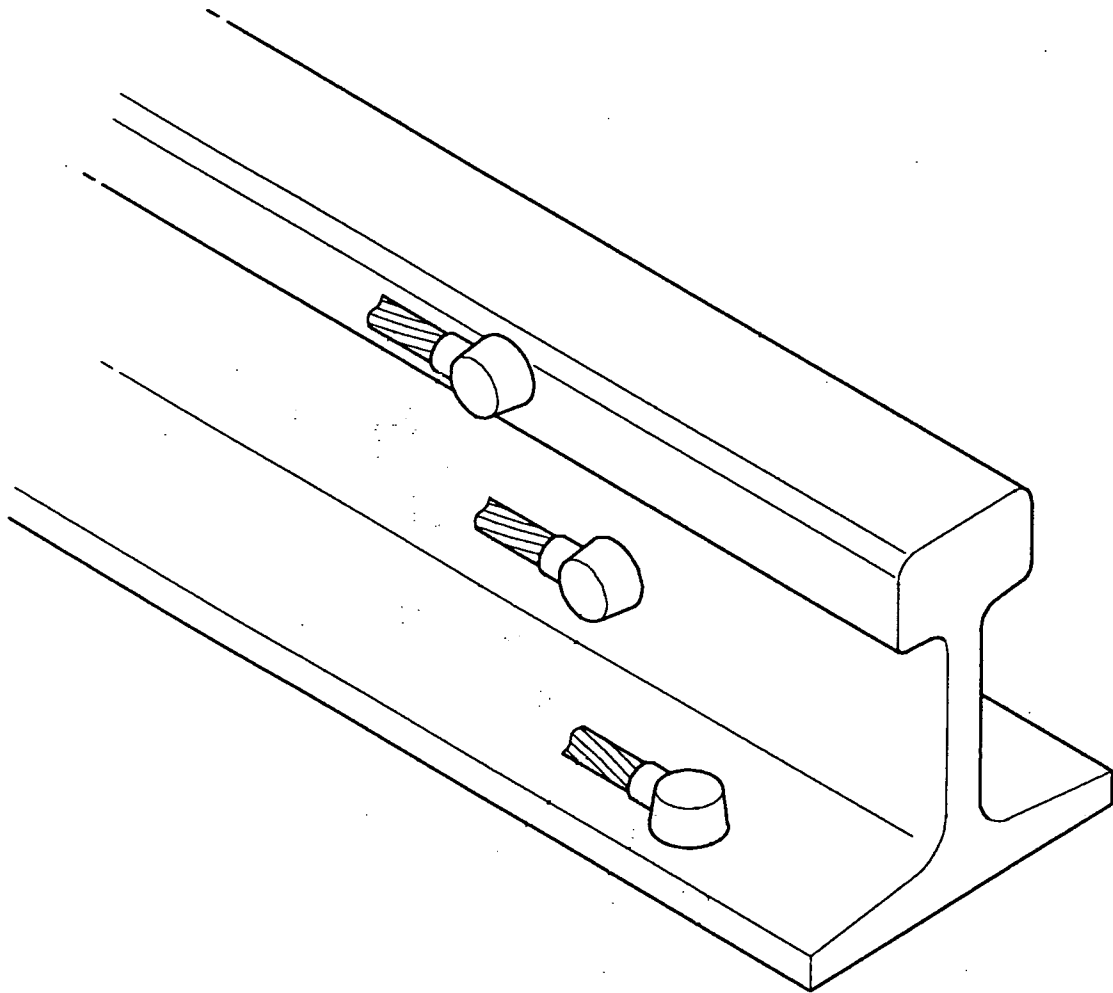


FIG. 5

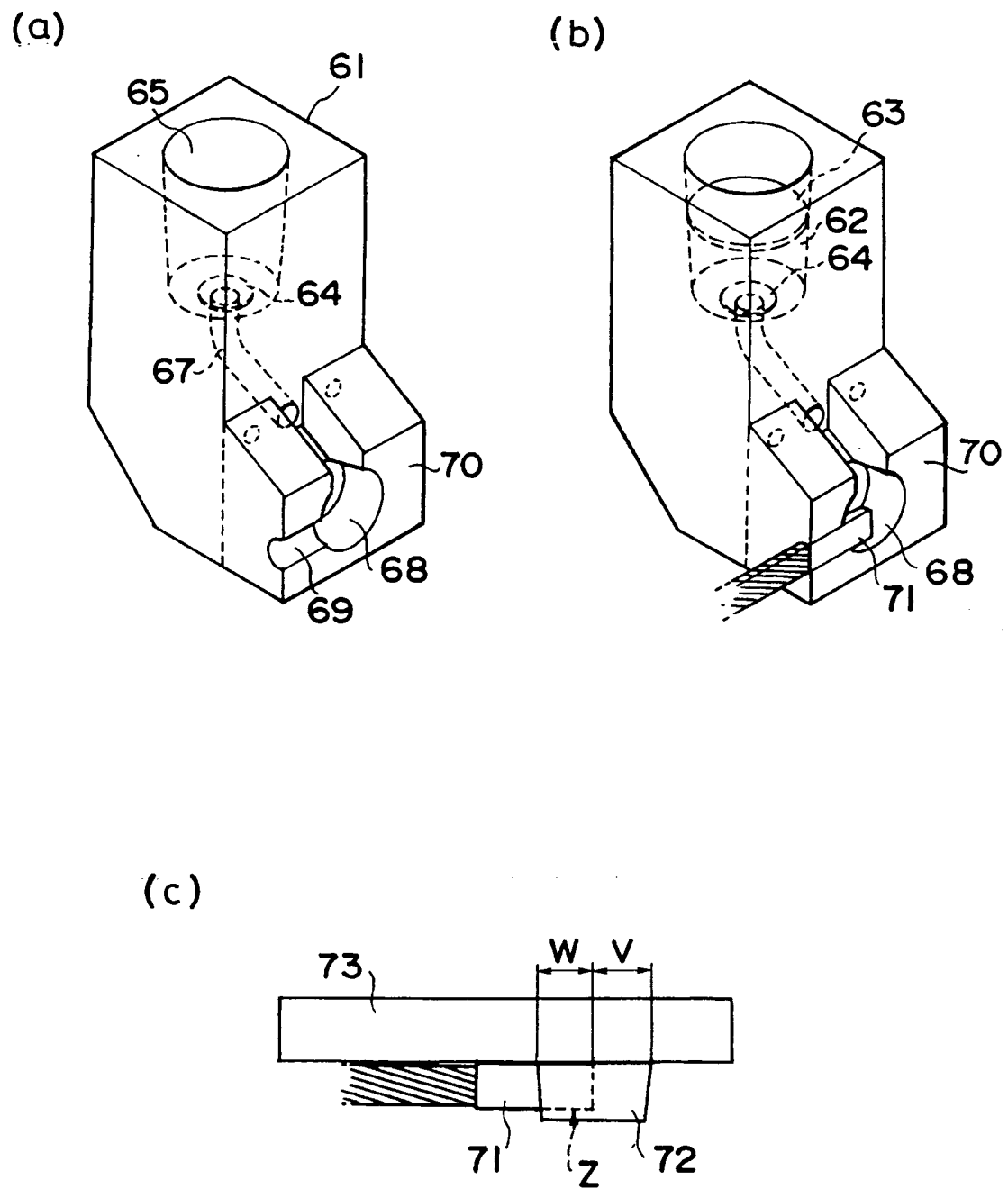


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2007/006776

A. CLASSIFICATION OF SUBJECT MATTER

INV. B23K23/00 B60M5/02 E01B31/00 H01R4/64 H01R43/02

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)

B23K B60M E01B H01R B22D

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 practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 007 055 A (ELEKTRO-THERMIT GMBH) 23 January 1980 (1980-01-23)	1, 3
Y	page 6, lines 14-28; figures -----	2, 4, 5
Y	GB 920 919 A (ERICO PROD INC) 13 March 1963 (1963-03-13)	2, 4, 5
	page 3, lines 10-25; figures -----	
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X	US 5 292 057 A (J.A. LOMASTRO) 8 March 1994 (1994-03-08)	1, 3
A	column 2, line 22 - column 3, line 7; figures 1-3 -----	5-9
	-/--	



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

13 November 2007

Date of mailing of the international search report

27/11/2007

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Jeggy, Thierry

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2007/006776

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	column 2, lines 7-35; figures 1-3 -----	5-9
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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