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(54) Tool for use with molten metal, assembly and method for attachment thereof

(57) The present invention relates to a tool for use with molten metal, to an assembly of such a tool with a handle and to a method for the attachment of such a tool to a handle.
the invention provides a tool for use with molten metal comprising a bowl portion (1) made from a refractory material and defining an inner region (2) and an outer region (3) and means for connecting the bowl portion to a handle. According to the invention, the connecting means are located in the outer region (3). Therefore, contrarily to the conventional assemblies (figures 1 and 2), which have connecting means (8,9) located in the inner region (2) of the bowl portion, there is no bore (11) ending into the inner region of the bowl portion. The problems relating to cement patching for the threaded bolt are eliminated and the likelihood of the connecting means entering into contact with the molten metal are largely reduced.

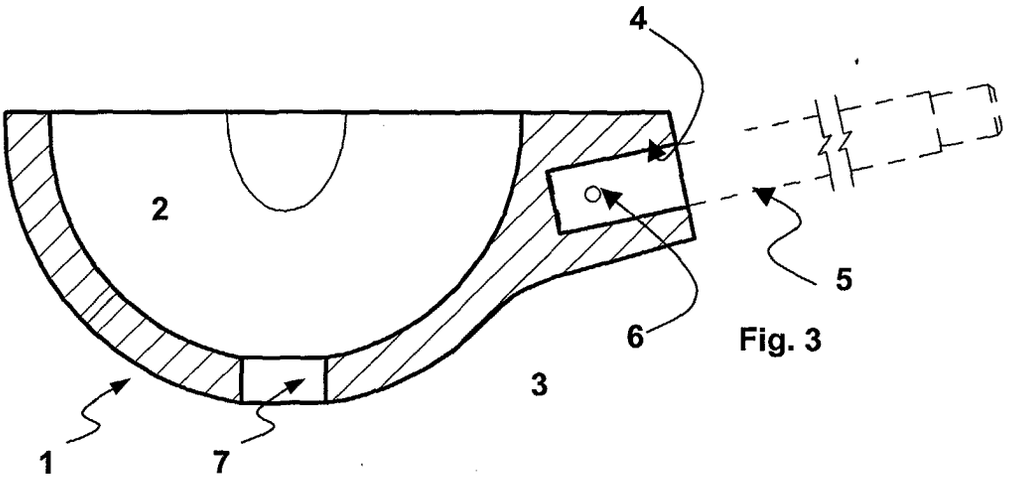

Fig. 3

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Description

[0001] The present invention relates to a tool for use with molten metal, to an assembly of such a tool with a handle and to a method for the attachment of such a tool to a handle.

[0002] The present invention relates to the field of ferrous or non-ferrous foundry. When metal is fused in crucibles, it is frequently necessary to stir it - as, for instance, to produce a proper mixture when forming an alloy - or to skim it. Since metal tools for these purpose are quickly destroyed by the molten metal and since, furthermore, it is undesirable in handling some metals and alloys to get any foreign metal into them - as might be the case when the stirring and skimming tools are made from metal - such tools are usually made from graphite or from compositions of which graphite is a principal ingredient such as clay-graphite compositions. In some cases, densified fused silica tools have also proven very useful. In general, the tool part which is intended to contact the molten metal is made from a refractory material.

[0003] Such refractory tools, while obviating the objections arising from the use of metal tools, are in themselves objectionable because of the brittleness of the materials from which they are made which render them liable to become broken.

[0004] For this reason and others, it is well known in the art to use an assembly of a tool with a handle made from a different material which is less liable to be broken. In particular, it is well known in the art to use a tool attached to a metal handle. The prior art tool assembly will now be described with reference to figures 1 and 2.

[0005] Figure 1 and 2 show respectively a longitudinal cross section and a top view of a prior art tool assembly. The tool comprises a bowl portion (1) made from a refractory material which defines an inner region (2) and an outer region (3) and means for connecting the bowl portion to a handle. The means for connecting the bowl portion to a handle comprises a threaded bolt (8). The head (9) of the bolt (8) is flattened to prevent it from turning in use. The bowl portion has a round bore (10) with a rectangular shaped counter bore (11) from the inner region (2) of the bowl (1). The bolt (8) is fitted from the inside, the thread end (12) coming out through the flange end or shank (13) of the bowl and the flattened head (9) locating in the rectangular counter bore (11). The counter bore hole (11) is then patched with cement (14).

[0006] Such an assembly is not fully satisfactory yet. A first disadvantage of this design is the number of manufacturing steps involved into its production (drilling of a round bore and a square bore, introduction of the bolt, patching of the cement) which makes it expensive. Moreover, in some application, the cement patch can become damaged in use so that the threaded bolt enters into contact with the molten metal and eventually bends and fails.

[0007] Therefore, there is still a need for a tool which would not present the above disadvantages. The present invention address these problems. To facilitate a better understanding of the invention, it will now be described with reference to figure 3 showing a longitudinal cross-section illustrating a particular embodiment of the invention, without however limiting the invention in any way.

[0008] Accordingly, the invention provides a tool for use with molten metal comprising a bowl portion (1) made from a refractory material and defining an inner region (2) and an outer region (3) and means for connecting the bowl portion to a handle. According to the invention, the connecting means are located in the outer region (3). Therefore, contrarily to the conventional assemblies (figures 1 and 2), which have connecting means (8,9) located in the inner region (2) of the bowl portion, there is no bore (11) ending into the inner region of the bowl portion. The problems relating to cement patching for the threaded bolt are eliminated and the likelihood of the connecting means entering into contact with the molten metal are largely reduced.

[0009] Advantageously, the outer surface of the bowl portion is provided with a shank (13), preferably extended, and the connecting means are located in the shank (13). This further improves the strength and keep the connecting means away from any molten metal.

[0010] According to a particularly advantageous embodiment, the connecting means comprise

i) a bore (4) in the outer surface of the bowl portion (1) suitable for receiving a rod end (5) of a handle and

ii) a cross-bore (6), the axis of which intersects the axis of the bore (4), suitable for receiving a cross-pin.

[0011] It is to be understood that any stirring or skimming tool are encompassed within the scope of the present invention. The invention is however particularly adapted for a skimming tool such as a ladle bowl used in the ferrous industry. In such a tool, an orifice (7) is present in the bottom of the inner region (2) of the bowl portion (1).

[0012] According to another of its aspects, the invention relates to an assembly of a tool as above defined, with a handle and a cross pin, the handle having a rod end (5) provided with a perpendicular bore extending all along its width, the rod end (5) being engaged into the bore (4) of the outer surface of the bowl portion (1), and the cross pin being engaged into the cross-bore (6) and the rod end (5) bore.

[0013] Mortar or cement can be patched in the cross-bore (6) on both ends of the cross-pin. This will protect the cross pin. Alternatively, the end of the shank (13) can be sufficiently remote from the bowl portion so that the cross-pin does not need cement patching. In this case, reuse of the rod end and cross-pin is facilitated.

[0014] In another of its aspects, the invention relates to a method for assembling a tool as above defined to a handle having a rod end (5) provided with a perpendicular bore extending all along its width comprising the steps of

i) engaging the rod end (5) of the handle into the bore (4) of the outer surface of the bowl portion (1) of said tool; and
ii) engaging a cross-pin into the cross-bore (6) of the tool and the rod end (5) bore.

[0015] According to a variant of the method of the invention, the method comprises a further step of iii) patching mortar or cement in the cross-bore (6) on both ends of the cross-pin.

Claims

1. Tool for use with molten metal comprising a bowl portion (1) made from a refractory material and defining an inner region (2) and an outer region (3) and means for connecting the bowl portion to a handle, **characterized in that** the connecting means are located in the outer region (3).

2. Tool according to claim 1, **characterized in that** the outer surface of the bowl portion (1) is provided with a shank (13) and **in that** the connecting means are located in the shank (13).

3. Tool according to claim 2, **characterized in that** the connecting means comprise

   i) a bore (4) in the outer surface of the bowl portion (1) suitable for receiving a rod end (5) of a handle and
   ii) a cross-bore (6), the axis of which intersects the axis of the bore (4), suitable for receiving a cross-pin.

4. Tool according to any one of claims 1 to 3, **characterized in that** an orifice (7) is present in the bottom of the inner region (2) of the bowl portion (1).

5. Assembly of a tool as defined in claims 3 or 4, with a handle and a cross pin, the handle having a rod end (5) provided with a perpendicular bore extending all along its width, the rod end (5) being engaged into the bore (4) of the outer surface of the bowl portion (1), and the cross pin being engaged into the cross-bore (6) and the rod end (5) bore.

6. Assembly according to claim 5, **characterized in that** mortar or cement is patched in the cross-bore (6) on both ends of the cross-pin.

7. Method for the attachment of a tool as defined in any one of claims 2 to 4 to a handle having a rod end (5) provided with a perpendicular bore extending all along its width comprising the steps of

   i) engaging the rod end (5) of the handle into the bore (4) of the outer surface of the bowl portion (1) of said tool; and
   ii) engaging a cross-pin into the cross-bore (6) of the tool and the rod end (5) bore.

8. Method according to claim 7, **characterized in that** the method comprises a further step of

   iii) patching mortar or cement in the cross-bore (6) on both ends of the cross-pin.

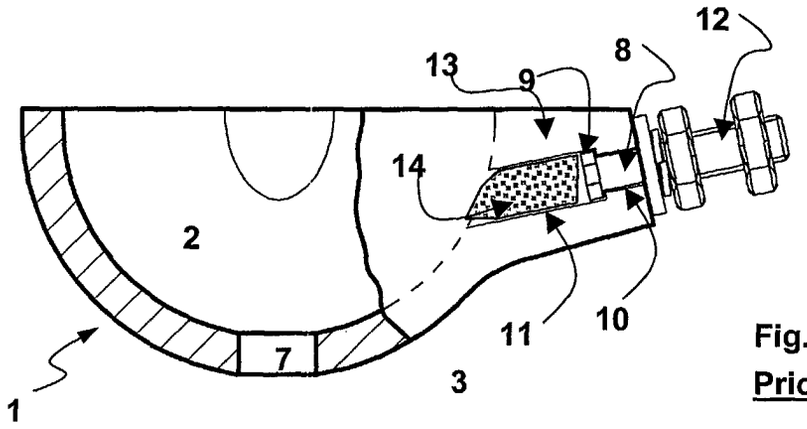

Fig. 1
Prior art

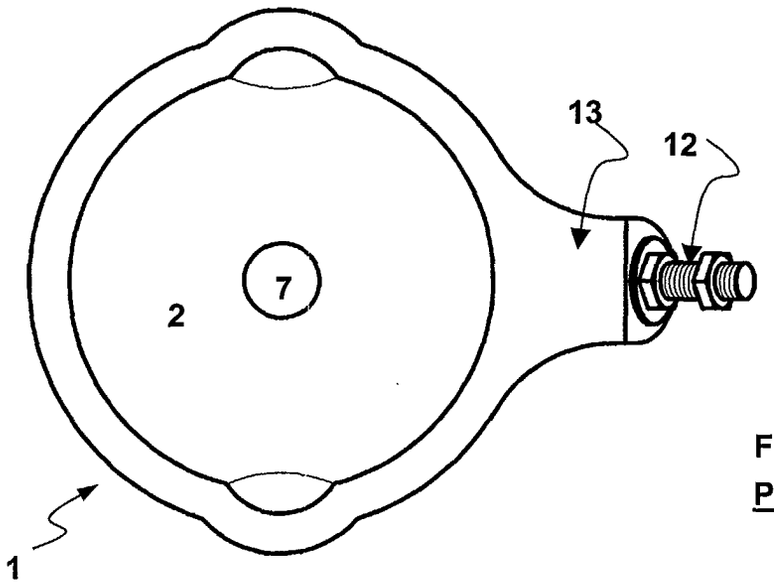

Fig. 2
Prior art

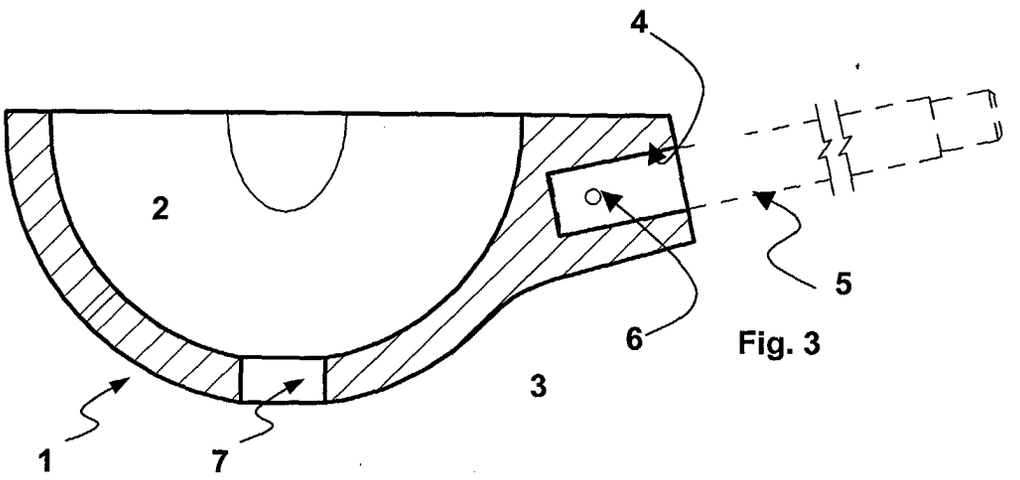

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 02 44 7255

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	7 May 2003	Mailliard, A

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X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 44 7255

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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