

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: **85306696.7**

(51) Int. Cl.⁴: **B 22 D 11/10**

(22) Date of filing: **20.09.85**

(30) Priority: **18.03.85 US 713412**

(43) Date of publication of application:
24.09.86 Bulletin 86/39

(84) Designated Contracting States:
DE FR GB IT SE

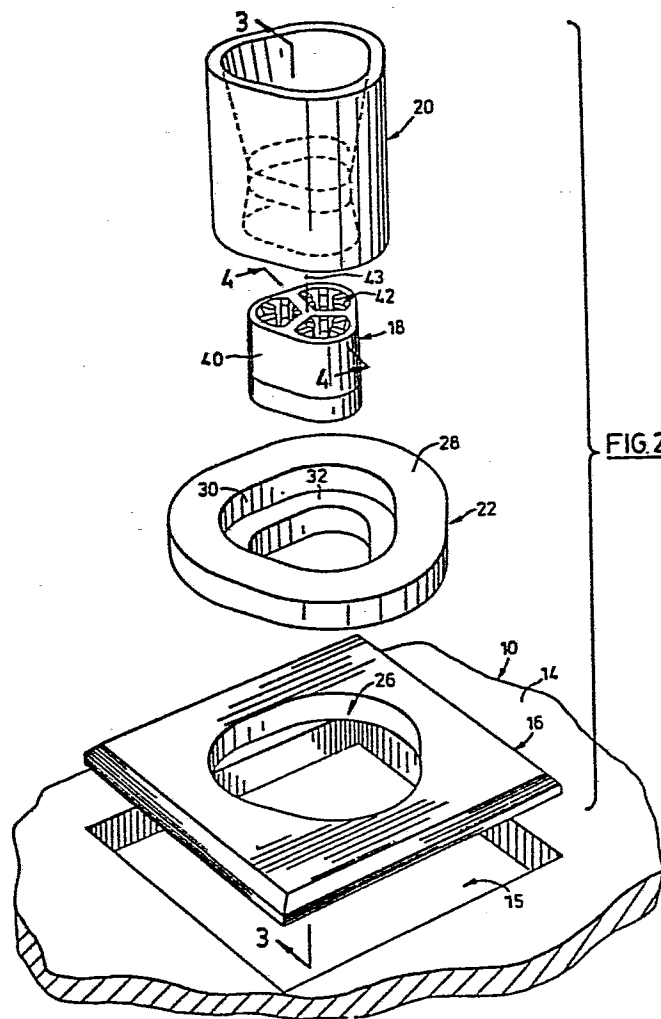
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(54) Tundish outlet means.

(57) A tundish (10) comprises a well block (20) and a nozzle (18) receivable therein. The nozzle (18) has a number of flowthrough passages (42) converging towards the top of a casting mould (not shown). The passages (42) are provided at an inlet portion with inwardly extending fins (48). The well block (20) comprises an inwardly funneled upper portion (34) and an outwardly flared lower portion (38) for receiving the nozzle (18). The well block (20) is supported in a ring (22) comprising an outer rim (28) and an inner ledge (32). The ring (22) contracts a mounting plate (16) welded in an aperture (15) in a bottom (14) of the tundish (10).



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TITLETUNDISH OUTLET MEANSDESCRIPTIONTechnical Field

5 The invention relates to tundish outlet means for use in the continuous casting of metal such as steel. A tundish receives liquid steel from a ladle and feeds it through an outlet to a mould in continuous casting apparatus. In multi-stranded operation, the liquid steel is poured from a ladle into a multi-holed tundish for distributing the liquid metal through outlet nozzles to mould-oscillators which each form a continuous strand of solid metal on cooling.

10 The flow rate of the metal from the ladle is controlled to optimize the level of the metal in the tundish. The oscillators move the moulds up and down to provide a stripping action between the moulds and the billets of solid metal as they are formed. This is followed by a straightener unit which pulls the strands out of the mould at a given rate. To produce a quality billet, the speed of withdrawal from the mould is controlled. As this speed is tied to the level of metal in the mould, the flow of metal

into the mould is critical. The outlet nozzle diameter size controls the flow rate of the metal into the mould. When a nozzle wears due to abrasion of the hot metal or to plugging, either the flow of metal into the mould becomes too great or the stream is not straight and causes a washout or breakout. When this happens the operator must plug off the particular strand and continue casting on the remaining strands. This causes a production loss.

Background Art

The most relevant prior art known to the Applicants are Patent Specifications US 2,193,365, 2,706,365, 3,451,594, 3,566,954, 3,765,572, 3,838,798, 3,850,351, 4,165,026.

The Invention

Outlet means according to the invention comprises a well block and a nozzle receivable therein. The nozzle has a number of flowthrough passages, which preferably converge towards the top of a casting mould. Two or more passages may be provided in the nozzle. On the wearing out or plugging of one passage, the use of the nozzle may be continued by plugging that passage and opening another.

The well block is preferably supported by a ring comprising an outer rim contacting a mounting plate welded in an aperture in the tundish bottom and an inner ledge. The well block also preferably comprises an inwardly funneled upper portion, an outwardly flared lower portion for receiving the nozzle, and a straight neck between.

DRAWINGS

Figure 1 is a plan of a tundish showing a number of outlet holes;

Figure 2 is an exploded perspective view of a tundish outlet means according to the invention;

Figure 3 is a section along 3-3 of Figure 2; and

5 Figure 4 is a section along 4-4 of Figure 2.
Best Mode

10 In Figure 1 a tundish 10 is provided with a circumscribing wall 12 and a bottom 14 having openings 15, each with a mounting plate 16 for an outlet nozzle 18 (Figures 2 and 3) of refractory material such as zirconia. A well block 20 receives the nozzle 18 and is supported by a ring 22. The mounting plate 16 provides a central aperture 26. The ring 22 has an outer rim 28, a shoulder 30 and an inner ledge 32, fits into the aperture 26, and supports the well block 20 which has the same external shape. The well block 20 is generally cylindrical with an inwardly funneled upper portion 34, a straight central neck 36 and a lower portion 38 which flares outwardly at a small angle.

20 The nozzle 18 consists of a body 40 with three flowthrough passages 42 located symmetrically about its central axis 43. Each passage 42 is funnel-shaped with an upper truncated conical portion 44 and a lower cylindrical portion 46. A number of equispaced fins 48 project radially into the upper portion 44 of each passage 42. The outside surface of the body 40 is tapered slightly at its upper portion 50 to match the flare in lower portion 38 of the well block 20.

30 The passages 42 are slightly convergent to meet at a point below the body 40 where the central axis 43 contacts the top of a casting mould (not shown). The

passages 42 should be as close to vertical as possible when installed, so the body 40 is of a generally triangular shape with rounded edges. The inlet end of the body 40 is sectoried so that the inlet end of each passage is pie-shaped and arranged segmentally about the central axis 43.

The nozzle 18 is mounted in the opening 15 of the tundish 10. The mounting plate 16 is welded to the bottom 14 of the tundish 10. The support ring 22 rests on the mounting plate. The well block 20 rests on a ledge 32 of the ring 22. The well block is embedded in a refractory lining 52 of the tundish 10. Then nozzle 18 is wedged upwardly through the opening 15 in the tundish bottom 14 to fit coaxially in the lower portion 38 of the well block 20.

Industrial Application

Initially, two passages 42 of nozzle 18 are plugged using steel plugs and sand, and the third passage is used. When the initially used passage 42 is worn out or blocked, it is plugged, preferably using a copper plug, and one of the other two passages is opened using an oxygen lance to burn off the plug. In the same manner, when the second used passage 42 is blocked or worn out, it is plugged and the third passage is opened.

CLAIMS

1. Outlet means for a tundish (10) comprising a well block (20) and a nozzle (18) receivable therein characterized in that the nozzle (18) has a number of flowthrough passages (42).

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2. Outlet means according to claim 1 in which the passages (42) are funnel-shaped.

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3. Outlet means according to claim 1 or claim 2 in which the axes of the passages (42) converge.

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4. Outlet means according to any preceding claim in which the passages (42) are provided at an inlet portion with inwardly extending radial fins (48).

5. Outlet means according to any preceding claim in which the nozzle (18) is polygonal with rounded corners and a passage (42) in each corner.

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6. Outlet means according to any preceding claim including a ring (22) comprising an outer rim (28) and an inner ledge (32) for supporting the well block (20).

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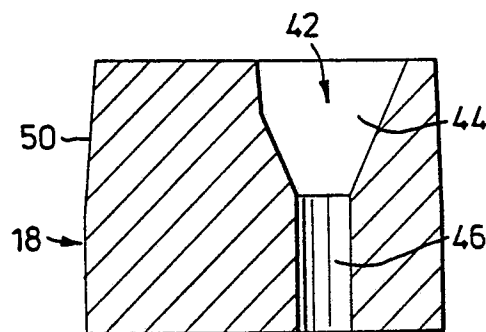
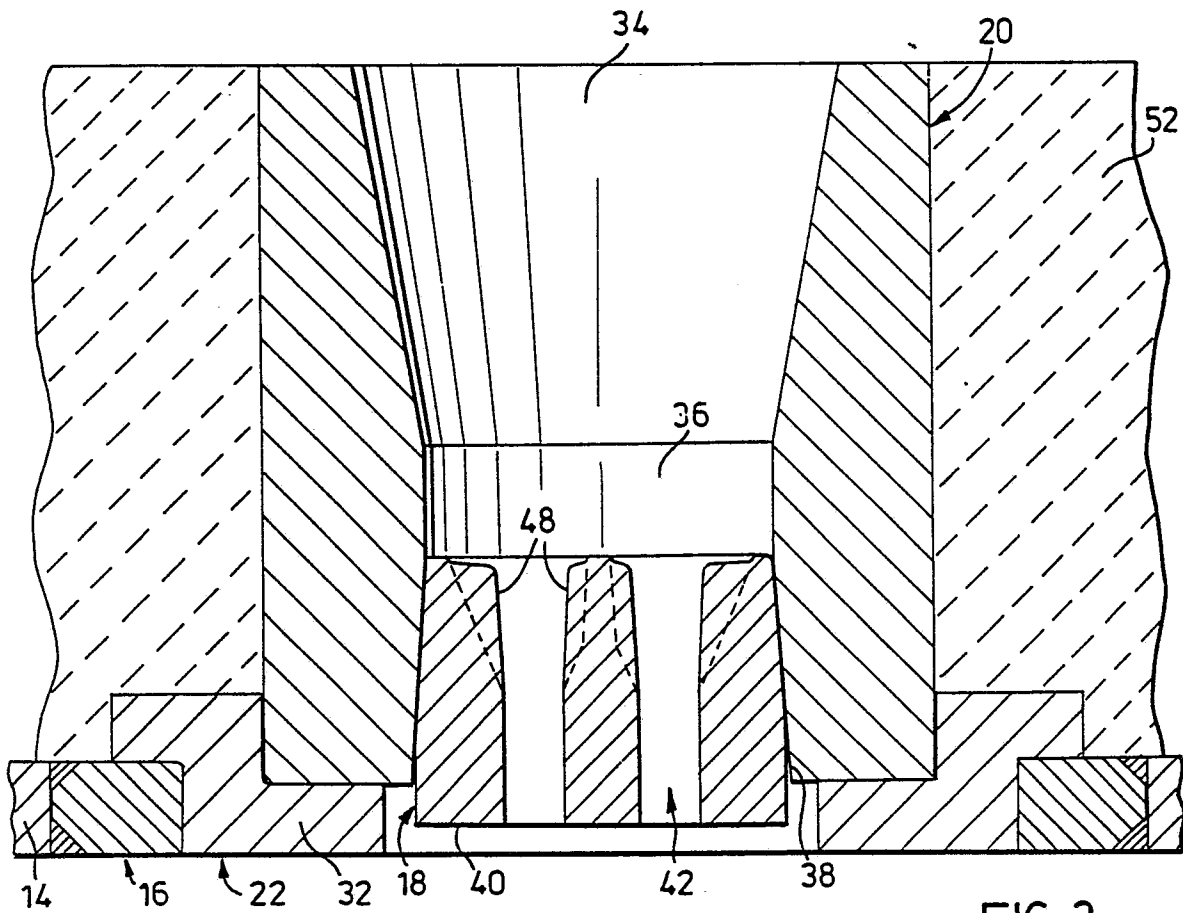
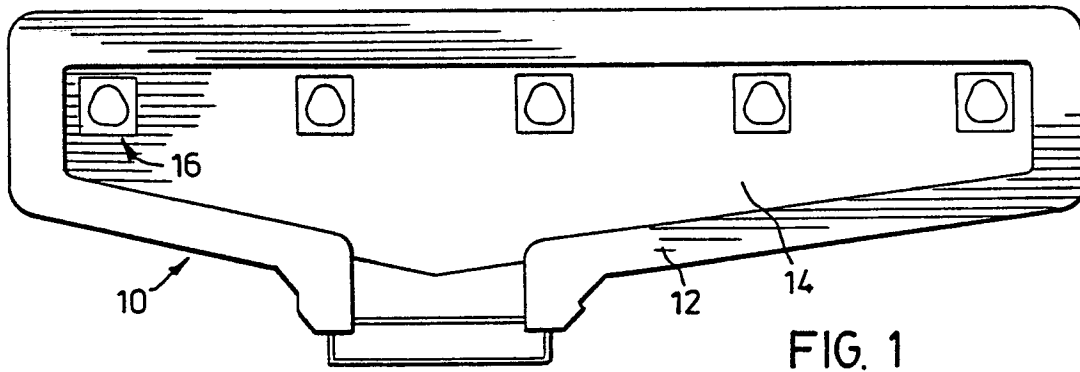
7. Outlet means according to any preceding claim in which the well block (20) comprises an inwardly funneled upper portion (34) and an outwardly flared lower portion (38) for receiving the nozzle (18).

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8. Outlet means according to claim 7 in which the well block (20) comprises a straight neck (36) between the portions (34) and (38).

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