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(71) Applicant: **Kvaerner Metals Continuous Casting
Limited**
Sheffield S9 4EX (GB)

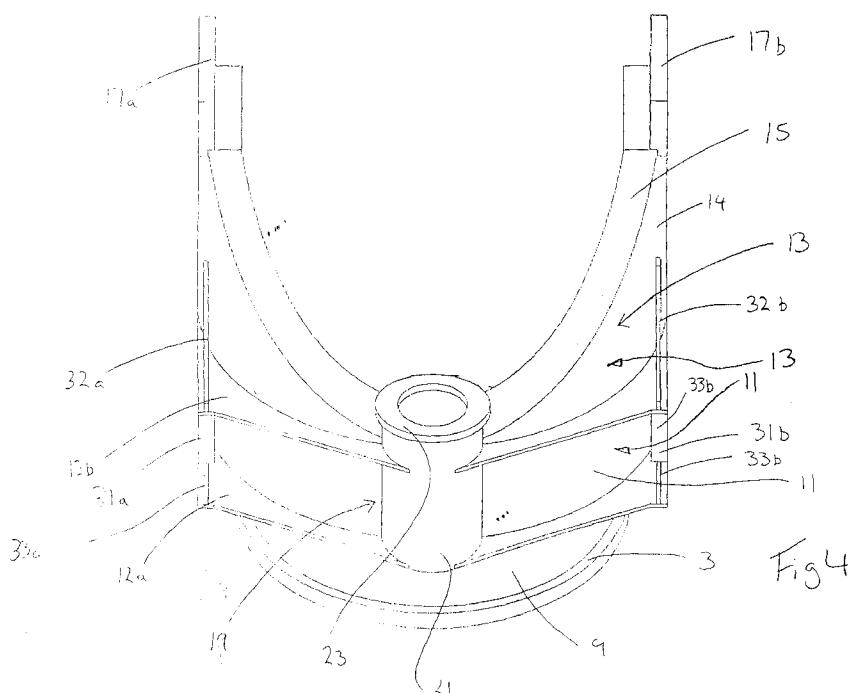
(72) Inventor: **Hetherington, Adrian,**
Kvaerner Metals C.C. Ltd.
Sheffield S9 4EX (GB)

(74) Representative: **Pawlyn, Anthony Neil**
Urquhart-Dykes & Lord,
Tower House,
Merrion Way
Leeds, West Yorkshire LS2 8PA (GB)

(54) Improvements in and relating to the transportation and discharge of molten materials

(57) A transfer means for a ladle of molten metal is provided having beneficial lightness, mechanical properties and versatility. The transfer means comprising a rotatably mounted superstructure, the superstructure being provided with one or more dependant constructs for lifting a ladle, the constructs being pivotally mounted relative to the superstructure in support means, moving

means being provided for moving the dependant constructs, the moving means being mounted on the superstructure in support means and the support means for one or more of the dependant constructs and/or for the moving means being provided on the superstructure such that the support means are positioned substantially directly over the adjoining portion of the superstructure.



EP 0 890 399 A1

Description

This invention concerns improvements in and relating to the transportation and discharge of molten materials, particularly, but not exclusively to the transfer of ladles of molten metal to a pouring position.

Many casting applications use ladles to transfer the molten metal from the melting location, where the ladle is filled, to a casting location, where it is emptied. As the last stage of this process ladle turrets are frequently employed at the casting location to receive the ladle, lift the ladle, carry it whilst the turret rotates through 180° to the emptying location, support the ladle during emptying and return the ladle to the position from which it received it.

The size of the ladles involved and the combined weight with their contents mean that such turrets are substantial pieces of engineering weighing in excess of 100 tonnes and frequently more. The foundations and other supports required for such turrets make them expensive to install. Similarly the level of superstructure involved in supporting the loads presents a large capital cost to the operator of the plant. The present invention seeks to address these and other problems with such turrets.

According to a first aspect of the invention we provide transfer means for a ladle, the transfer means comprising a rotatably mounted superstructure, the superstructure being provided with one or more dependant constructs for lifting a ladle, the constructs being pivotally mounted relative to the superstructure in support means, moving means being provided for moving the dependant constructs, the moving means being mounted on the superstructure in support means and the support means for one or more of the dependant constructs and/or for the moving means being provided on the superstructure such that the support means are positioned substantially directly over the adjoining portion of the superstructure.

In this way the force originating in a support means is directly conveyed to a portion of the superstructure underlying it and to which it is connected.

Preferably the superstructure comprises a substantially vertically arranged element. Most preferably, one or more of the support means are positioned substantially directly over the adjoining portion of this element of the superstructure. The superstructure may be defined by one or more cylindrical elements, preferably right cylinders. Preferably the cylinder and / or its axis is vertically provided. Where more than one cylindrical element are provided preferably they share a common axis and common diameter.

One or more support plates or stiffeners may be provided for the cylinders or superstructure. Preferably the stiffeners are horizontally provided. Preferably the stiffeners substantially or completely encompass or surround the superstructure. Hexagonal cross-section stiffeners may be provided.

Preferably the rotatable mounting is provided by a substantially horizontal bearing, such as a slew bearing. Preferably the superstructure is supported on the bearing surface of this bearing. The superstructure may be provided directly on the bearing surface, or supported thereon by an intervening structure. The intervening structure may, for instance comprise a conical transition piece.

Further details, options and possibilities for this conical transition piece are set out in the second aspect of this invention and elsewhere in this document.

Preferably the dependent constructs comprise one or more rigid arms pivotally mounted to the superstructure at fixed locations and a ladle engaging unit. At least one, and preferably two pairs of arms pivotally mounted on the superstructure and connected to the ladle engaging unit may be provided. Preferably one pair of the arms is provided higher on the superstructure than the other pair of arms. Preferably the arms are pivotally mounted to the ladle engaging unit, most preferably at different locations.

The ladle engaging unit may comprise a pair of limbs spaced from one another by a gap designed to receive the ladle. The limbs of the ladle engaging unit may be separate, or may be joined by a cross piece.

Preferably the arms of the dependent constructs engage the limbs of the ladle engaging unit.

Preferably the limbs of the ladle engaging unit are joined together by a cross piece in proximity to the pivotal engagement of the ladle engaging unit with the upper pair of arms mounted on the superstructure. Preferably the upper arm, lower arm, a portion of the ladle engaging limb and a portion of the superstructure on each side of the transfer means form a variable parallelogram.

Preferably the pivotal mountings are provided in bearing blocks. The bearing blocks may be provided in support means directly provided by the superstructure or by support means depending from a portion of the superstructure.

Preferably the upper arm pivotal mountings are themselves provided directly over the adjoining portion of the superstructure.

Preferably the pivotal mountings for the lower arms are provided on a support means depending from the superstructure, the support means being positioned substantially directly over the adjoining portion of the superstructure. The support means may be provided on a stiffener and / or between two stiffeners. The support means may extend above one or more of the stiffeners.

The support means for the upper arms may comprise substantially vertically aligned plate elements with a pivotal axis passing therethrough, the intersection of the pivotal axis and centreline of the plate member being provided over the centre of the element forming the substantial part of the adjoining superstructure.

Preferably the support means for the lower arms are provided by substantially vertically aligned plates. Pref-

erably the centreline of the plate is tangential to the adjoining superstructure and aligned with the centreline of the portion of the superstructure with which the support means adjoins.

Preferably a portion of the superstructure is cut away between the dependent arms to form a mounting location in support means for the moving means.

The mounting location may be provided substantially directly over the supporting structure.

The mounting location may be provided in support means depending from the adjoining portion of the superstructure. The support means may comprise a beam. The support means may extend across the transfer means superstructure, most preferably from one side to the other. The mounting location may be provided by an aperture in the support means. Preferably the mounting location and / or moving means may be provided entirely within the periphery of the superstructure.

Preferably the moving means act on the ladle engaging unit. Most preferably the moving means act on the cross piece linking the arms of the ladle engaging unit. Further details of the moving means are provided elsewhere in this application, and apply equally to this aspect of the invention also.

The first aspect of the invention may include independently or in any combination the features, options, possibilities and structures set out elsewhere in this document.

According to a second aspect of the invention we provide transfer means for a ladle, the transfer means comprising a superstructure rotatably mounted on a bearing surface, the superstructure being provided with one or more dependant constructs for lifting a ladle and means being provided for moving the dependant constructs so as to lift the ladle, wherein the superstructure is supported on a conical element between the superstructure and bearing surface.

Preferably the conical surface has a larger cross-section or diameter at its junction with the superstructure than its cross-section or diameter at its junction with the bearing surface.

The angle of inclination of the cone surface, relative to its axis, may vary between -45° and 45° and more preferably between 0° and 30° .

The length of the conical element, measured along its conical surface from the top of the bearing surface to superstructure may be between 10mm and 2000mm and more preferably between 250mm and 1500mm.

The superstructure may have a maximum dimension and/or diameter of up to 6000mm.

The bearing surface may have a maximum outer diameter of up to 6500mm and preferably of between 2000mm and 6500mm.

The second aspect of the invention may include independently or in any combination the features, options, possibilities and structures set out elsewhere in this document.

According to a third aspect of the invention we pro-

vide a method of producing a plurality of transfer means for ladles, the transfer means each comprising a superstructure rotatably mounted on a bearing surface, the superstructure being provided with one or more dependant constructs for lifting a ladle and means being provided for moving the dependant constructs so as to lift the ladle, the superstructure being supported on a conical element between the superstructure and bearing surface, the bearing surface diameter being the same in at least two of the transfer means and the size of the superstructure being different in the at least two transfer means, wherein the angle of inclination of the conical element varies between the at least two said transfer means.

The third aspect of the invention may include independently or in any combination the features, options, possibilities and structures set out elsewhere in this document.

According to a fourth aspect of the invention we provide transfer means for a ladle, the transfer means comprising a rotatably mounted superstructure provided on a bearing surface, the superstructure being provided with one or more dependant constructs for lifting a ladle, means being provided for moving the dependant constructs, the moving means being mounted on the superstructure and wherein said moving means mounting the moving means is provided at least 500mm vertically spaced above the top surface of the bearing surface.

By providing such a vertical separation the force is transferred more evenly to the bearing surface.

The moving means mounting may be provided at least 750mm or at least 1000mm vertically above the top surface of the bearing surface, and more preferably at least 1500mm above. Ideally the vertical spacing is at least 2000mm.

The moving means mounting on the superstructure may be provided directly over the adjoining portion of the superstructure. Alternatively the moving means mounting may be provided on an element mounted on the superstructure. The element may comprise a beam. The element may extend across the superstructure from one side to another.

Preferably the mounting comprises a flange on the superstructure which cooperates directly or indirectly with a flange on the moving means. Preferably the flange on the moving means is substantially horizontal.

A flange on the moving means may contact the flange on the mounting through a spherical mounting. In this way movement of, for instance, the axis of the piston relative to the axis of the cylinder can be accommodated. Preferably one surface of the spherical mounting is defined by a portion of the flange on the moving means mounting. Preferably one surface of the spherical mounting is provided by an annular element mounted on the moving means.

Preferably the moving means moves in an axial direction.

The flange on the superstructure may be provided

at the end of a cylinder. Preferably the cylinder is aligned with the axis of the moving means. The cylinder may provide support for the flange and/or provide a housing enclosing the moving means.

The moving means preferably comprises a piston and cylinder in which the piston operates. Preferably the piston is hydraulically driven. Preferably the piston moves the dependant constructs and the cylinder is mounted on the superstructure.

Preferably a flange, directly or indirectly contacting the mounting, is provided on the upper part of the cylinder.

The piston may be provided with a ball joint which engages with the dependant construct. The ball joint may be received in a socket provided on or in the dependant construct. The socket may be corresponding in profile, fully or in part, to the ball joint.

Preferably the piston has a first, fully retracted state, and a second, fully extended state. Preferably in the first state over 50%, more preferably 65%, of the piston length is below the plane of the moving means mounting. Preferably 75%, more preferably 85% of the active volume of the piston cylinder is below the plane of the moving means mounting. In the second state over 75%, more preferably over 85%, of the piston length may extend above the plane of the mounting.

Preferably in a retracted state of the moving means, which may be a fully retracted state, the weight of the dependent constructs and / or ladle is taken up by mechanical stops. Preferably the mechanical stop is provided in association with the moving means support. The mechanical stop may be, or may be provided on, an element supported by the moving means mounting. The mechanical stop may be, or may be provided on, a cylindrical element. The support or cylindrical element may enclose the moving means, such as a piston. The support or cylindrical element may be supported by the flange on which the moving means is supported. The stop may cooperate with an element, such as a flange, provided on or in associated with the cross piece.

The fourth aspect of the invention may include independently or in any combination the features, options, possibilities and structures set out elsewhere in this document.

According to a fifth aspect of the invention we provide a method of transferring a ladle, comprising receiving the ladle on transfer means at a receiving location, lifting the ladle using the transfer means, moving the ladle to a location different from the receiving location, emptying the ladle of its contents, moving the ladle to a location different to its emptying location, lowering the ladle and removing the ladle from the transfer means, wherein the transfer means is provided according to the first aspect of the invention and/or according to the second aspect of the invention and/or according to the fourth aspect of the invention and / or produced according to the method of the third aspect of the invention.

The ladle may have a mass of between 5 tonnes

and 150 tonnes unladen with melt. The ladle may carry between 10 tonnes and 350 tonnes of molten metal.

The ladle may be emptied by pouring of its contents. The contents may be poured over a rim of the ladle or through an aperture in the bottom of the ladle.

The ladle may be emptied by discharge through an aperture in the ladle. The aperture may be blocked during transfer and opened at discharge. The aperture may be provided in the base of the ladle.

The ladle may be emptied into a mould, tundish or other vessel.

The receiving location may receive ladles direct from a melter or via intermediate stages. The different location to which the emptied ladle is transferred may be the same or different to the receiving location. The receiving location and emptying location may be separated by a rotational angle of 180° or any other angle.

The fifth aspect of the invention may include independently or in any combination the features, options, possibilities and structures set out elsewhere in this document.

An embodiment of the invention will now be described, by way of example only, and with reference to the accompanying drawings, in which :-

Figure 1 shows a partial side view of a turret according to an embodiment of the invention;

Figure 2 shows a partial plan view of the turret of Figure 1;

Figure 3 shows a front view of the turret of Figures 1 and 2;

Figure 4 shows a front perspective partial view of the turret of Figures 1, 2 and 3.

Figure 5 shows a side view of a turret according to the present invention, showing both loading and emptying positions;

Figure 6 shows a partial plan view of a turret according to a second embodiment of the invention;

Figure 7 shows a partial front view of the turret of Figure 6;

Figure 8a shows a detail of the superstructure to bearing connection in an embodiment of the invention;

Figure 8b shows an equivalent detail of the superstructure to bearing connection of Figure 8a for a different embodiment of the invention;

Figure 9 illustrates in detail the structure of the lifting and supporting means; and

Figure 10 illustrates the lifting means to support means interlink.

Transfer means for ladles, such as ladle turrets, are used in a variety of casting operations involving the use of ladles to carry molten metal from one location to another. They are frequently employed at casting locations to move the ladle to a discharging position.

In the general scheme of operations the ladle is received at a first location, lifted by the arms of the turret and rotated. The superstructure of the turret is rotatably mounted on a bearing to facilitate this rotation about a vertical axis passing through the turret. Once the ladle has been rotated to the desired location the ladle is emptied into the desired vessel.

The desired vessel may be a casting mould, tundish or the like. The ladle may be emptied by pouring or discharging through an aperture in the ladle, for instance in its base.

Once emptied the ladle is rotated back to the original location and returned for refilling. The process is repeated as necessary.

The ladles involved in this process, particularly when charged with molten metal, are extremely heavy. This calls for a substantial supporting structure from the turret the whole weight of which must be supported on a slew bearing. The levels of weight involved, at least 150 tonnes in the prior art, necessitate expensive bearings and expensive support and foundations for them.

The present invention, for instance as illustrated in the embodiment of Figure 1, allows this weight of superstructure to be significantly reduced, thereby making significant capital cost savings.

The transfer means consists of a turret 1 supported by a slew bearing 3, in turn supported by a foundation frame 5 which engages the ground. The entire weight of the turret 1 is carried by the slew bearing 3.

The turret 1 comprises a conical transition element 9 which engages the slew bearing 3 at its lower surface and supports a lower cylindrical frame 11 at its upper surface. The lower cylindrical frame 11 is provided between two horizontal stiffeners 12a, 12b of hexagonal plan and in turn supports a hollow cylindrical frame 13 which is open at its top end. The cylindrical frame comprises an outer surface defining element 14 which provides the majority of the strength for this component.

The cylindrical frame 13 is scooped out at the front, Figure 3 and 4, so as to define a transition surface 15 extending downward from the upper bearing housings 17a, 17b to the location of the hydraulic lifting means 19. The hydraulic lifting means, described in more detail below, is provided in a cylinder 21 provided with a flange 23 around its top and substantially at the same level as the rear edge of the transition surface 15.

The upper bearing housings 17a, 17b provide mountings on either side of the cylindrical frame 13 for, see Figure 5, the limbs 25 pivotally connected to the lifting arms 27 which engage the ladle 29. The limbs 25

are connected to each other via a tube to restrict relative motion.

Significantly, as shown in Figures 2 and 3, the bearing housings 17a, 17b are provided directly over the centre of the element 14 forming the outer surface of the cylindrical frame 13. In this way the forces transferred to the turret 1 from the lifting arms are transferred directly to the cylindrical frame 13 in the most efficient manner possible. This reduces the weight of superstructure necessary to achieve support for a given ladle and contents weight.

Lower bearing housings 31a, 31b are provided on support elements 33a, 33b which depend outward from the lower cylindrical frame 11 between the stiffeners 12a, 12b. The housings 31a, 31b extend upward in webs 32a, 32b which are joined to frame 13. These housings provide mountings for limbs 34 also pivotally connected to the lifting arms 27 for the ladle 29. However, these elements are provided parallel to one another, tangential to the cylindrical frames 11 and 13 and directly over the hexagonal stiffener 12a, such that the centreline of these bearing housings 31a, 31b are also parallel to one another and lie tangential to the centreline of element 14. In this way and by minimising the extent by which the support elements need project from the cylindrical frame 13, the forces are transferred direct into the frame provided directly under the location receiving the force. The effectiveness of the support is maximised and the weight of the structure is thus minimised.

Also, as shown in Figure 2, the cylinder 21 supporting the hydraulic lifting means 19 via flange 23, is positioned in proximity to the centreline of element 14. The positioning is such that two parts of the cylinder wall, those parts opposing each other by 180°, lie on the centreline of element 14 which forms the outside of the cylindrical frames 11 and 13. In this way, once again, the transfer of force to the superstructure is achieved in the most efficient manner and once again results in a minimising of the weight of support needed.

Each of these three arrangements, whether provided together or separately, provide significant weight advantages and cost savings as a result.

The general operation of the system based around these features is illustrated in Figure 5 which shows in the left hand portion the system in its ladle receiving configuration in cross-section and in its right hand portion the ladle in the dispensing position.

The ladle 29 is lowered onto the arms 27 so that the recess in the arm 27 engages the side bars of the ladle. The arms 27 rest on mechanical stops in this position. The cylinder is then operated to drive up the piston and so lift the cross-bar.

This lift transfers to the arms 27 and lifts the arms 27 and ladle 29 off the stops. The lifting motion driven by the lifting means 19 and is controlled by the geometry of pivoted arms 25, 34 which are mounted 17, 31 in a fixed position on the superstructure 1 at one end and pivotally mounted 50, 52 in a moveable position at the

other end on the arm 27.

Once engaged with the ladle 29 continued lifting elevates the ladle 29 to the desired extent. In this position the entire superstructure and ladle, together with contents, can be swung around the axis Z-Z of the turret to a different position. In this example a swing of 180° is employed.

Once in the new position, right side of Figure 5, the ladle 29 can be emptied into a tundish, not shown, before returning it to the position occupied in the left hand side of Figure 5.

In an alternative embodiment of a turret according to the present invention, illustrated in Figures 6 and 7, once again, significant weight savings are achieved by maximising the effectiveness of the support structure. Whilst the upper bearing housings 17 and lower bearing housings 31 are provided in a similar manner to the first embodiment of the invention, the hydraulic lifting means 19 are located and supported in a different manner.

As with the first embodiment of the invention, the conical transition element 9 which is supported on a slew bearing, supports a lower cylindrical frame 11. The cylindrical frame 11 is provided between 2 stiffener plates 50, 51, and in turn supports a hollow cylindrical frame 13 which is open at its top end.

The cylindrical frame 13 is once again scooped out at its front to define transition surface 15 which extends downwards from the upper bearing housings 17 to the location of the hydraulic lifting means 19. Unlike the first embodiment of the invention, however, the hydraulic lifting means are provided in a cylinder 21 mounted inside the periphery of the supporting frame 13.

Whilst the physical structure of the cylinder 21, flange 23 and the like are substantially the same as for the first invention, and are described in more detail below, in this embodiment, the cylinder 21 is supported by a beam 53 which spans the cylindrical frame 13 across its diameter. The beam 53 is formed of a ?? cross sectional element and extends from the periphery of the cylindrical frame 13 on one side to the periphery on the other. The top surface of the beam 53 cooperates with and supports the flange 23 mounted on the top of the hydraulic lifting means 1a. An aperture through the beam 53 is provided to accommodate the cylinder 21.

By mounting the cylinder 21 in this way the entire hydraulic lifting means 19 are positioned within the circumference of the cylindrical frame 13. As a consequence, whilst the beam 53 still ensures that the weight and load from the hydraulic lifting means 19 are transferred directly to the cylindrical frame 13, the physical space taken up by the turret unit is reduced.

In providing a ladle turret design a substantial amount of design work is involved in ensuring that the various components are suitable for the intended task and in obtaining components to fit that design. This cost would be reduced considerably if substantially equivalent components could be used between one turret unit and the next. Unfortunately the ladles used by plant op-

erators vary significantly in diameter from one plant to the next. The diameter of these ladles tends to fix the arm dimensions, superstructure dimensions and hence bearing dimensions required for the unit. This cost involved in varying these components accordingly is particularly significant in terms of the slew bearing costs; larger diameter bearings involving increased cost.

The embodiments of the present invention illustrated in Figure 8a and 8b illustrate a way around this particular problem. In each of the two embodiments the slew bearing 101 is of the same diameter, but the diameter of the supporting frame 103 which it carries can be varied quite significantly as the angle of the conical transition member 105 can be changed. Thus the wider support structure 103 of Figure 8a is supported by a more flared conical transition member 105 than the narrower support structure 103 of Figure 8b. A consistent slew bearing is thus employed for consistent loads, even though the ladles necessitate different superstructure sizes. The conical transition also allows significantly smaller diameter bearings to be employed than the diameter of the superstructure.

The conical angle may be provided in the alternate direction; a negative angle.

By using an equivalent slew bearing between designs a more standardised component is called for so significantly reducing the cost of producing the slew bearings and the overall unit.

The lifting force to move the arms carrying the ladle to their elevated position is typically applied via a single lifting unit mounted between the arms on the superstructure. This lifting unit typically comprises a hydraulic cylinder attached to the supporting superstructure, the force being transferred to the superstructure at its base, proximate to the slew bearing.

The result of this single lifting location and the force transfer to the superstructure occurring adjacent to the slew bearing is that all of the attendant forces are applied to only a very small area of the slew bearing. Preferential wear and damage occurs to this area as a result significantly reducing the service life of the bearing. Replacement is capital expensive and delays the production plant during downtime.

In the lifting means mounting of the present invention a significant improvement is made.

As illustrated in Figure 9, the lifting means 19 comprises an hydraulically operated piston 200 which acts on the cross-arm 202 linking the two ladle engaging arms, not shown. The engagement between the two is provided by a ball 204 and socket 206 style engagement so as to accommodate limited relative movement. The socket 206 is provided in head piece 207. The position of the piston 200 relative to the cylinder 208 in which it is mounted is controlled by the application of fluid to void 210; the more fluid the higher the arms are lifted.

The cylinder 208 is, however, mounted on the superstructure by means of a collar 212 towards its upper end which transmits the forces arising during lifting

through a sub-collar 214 which has a spherical mounting on a corresponding element provided on the flange 23 which extends from the enclosing cylinder 21. The spherical mounting provides a limited level of relative movement tolerance between the axis of the piston 200 and cylinder 208.

As illustrated in Figure 3, by providing the cylinder to superstructure force transference at this elevated level away from the slew bearing 3 the force transmitted down to the slew bearing 3 has the opportunity to spread, shown schematically by dotted lines 216. This means that the loading over the slew bearing is provided over a far larger area reducing the chances of preferential wear and damage to the slew bearing.

In its lowered state the forces are transmitted through a flange 230, Figure 10, provided on the head piece 207, to mechanical stops 232 supported on a support tube 234. The support tube 234 rests in turn on flange 23 so ensuring a consistent route of force transference between the load and the superstructure, via mounting flange 23. This provides for the previously discussed spreading benefits and also removes the load from the piston whilst in the resting, retracted state.

Claims

1. Transfer means for a ladle, the transfer means comprising a rotatably mounted superstructure, the superstructure being provided with one or more dependant constructs for lifting a ladle, the constructs being pivotally mounted relative to the superstructure in support means, moving means being provided for moving the dependant constructs, the moving means being mounted on the superstructure in support means and the support means for one or more of the dependant constructs and/or for the moving means being provided on the superstructure such that the support means are positioned substantially directly over the adjoining portion of the superstructure.
2. Transfer means according to claim 1 in which the superstructure comprises a substantially vertically arranged element, one or more of the support means being positioned substantially directly over the adjoining portion of this element of the superstructure.
3. Transfer means according to claim 1 or claim 2 in which one or more support plates or stiffeners are provided for the superstructure, the stiffeners being horizontally provided and substantially or completely encompassing or surround the superstructure.
4. Transfer means according to any preceding claim in which the rotatable mounting is provided by a substantially horizontal bearing and the superstructure

is supported thereon by an intervening structure comprising a conical transition piece.

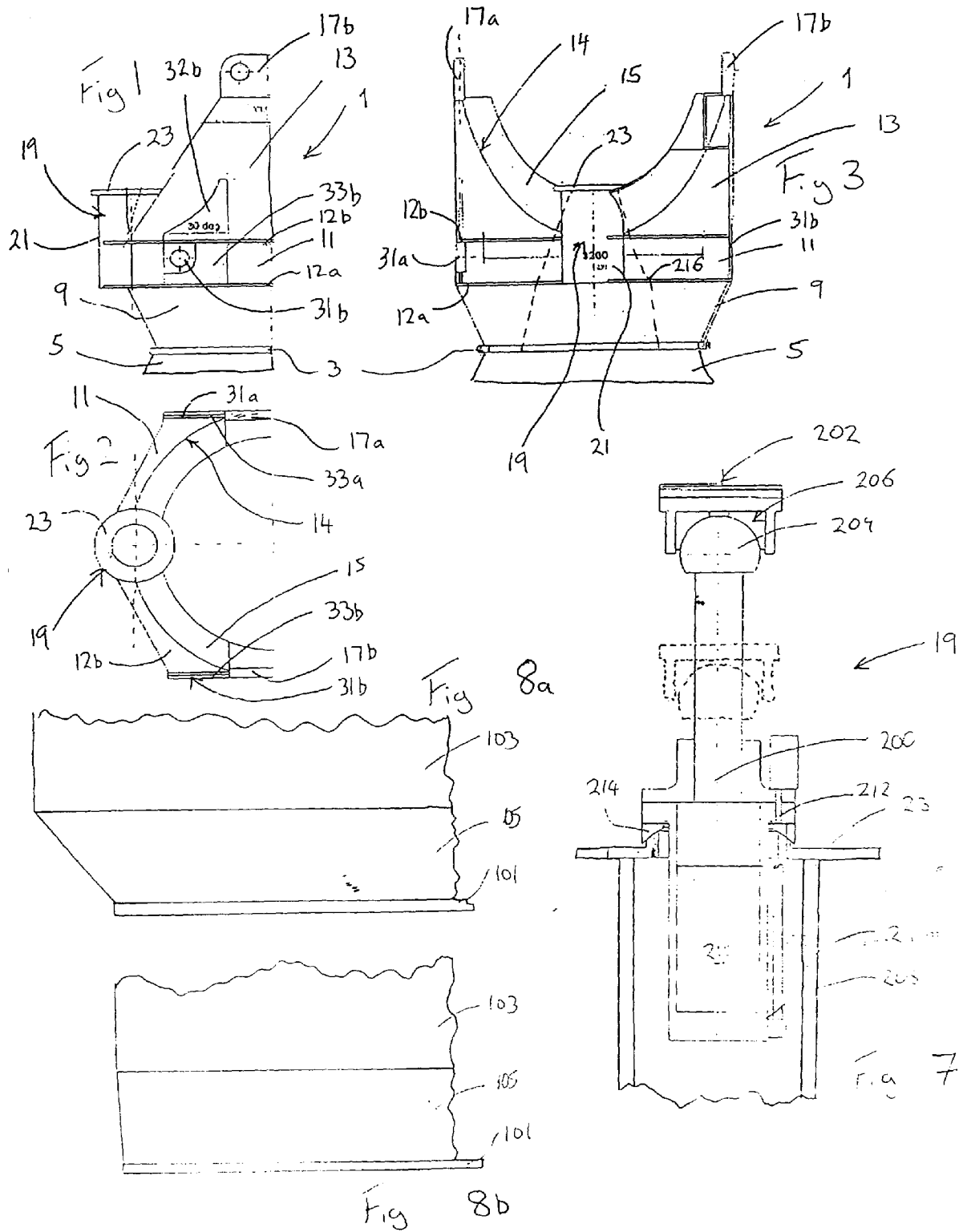
5. Transfer means according to any preceding claim in which pivotal mountings for the dependent constructs are provided in bearing blocks, the bearing blocks for the upper arm pivotal mountings being provided directly over the adjoining portion of the superstructure and / or the bearing blocks for the lower arm pivotal mountings being provided on support means depending from the superstructure, the support means being positioned substantially directly over the adjoining portion of the superstructure.
6. Transfer means according to claim 5 in which the support means for the upper arms comprise substantially vertically aligned plate elements with a pivotal axis passing therethrough, the intersection of the pivotal axis and centreline of the plate member being provided over the centre of the element forming the substantial part of the adjoining superstructure.
7. Transfer means according to claim 5 or claim 6 in which the support means for the lower arms are provided by substantially vertically aligned plates, the centreline of the plate being tangential to the adjoining superstructure and aligned with the centreline of the portion of the superstructure with which the support means adjoins.
8. Transfer means according to any preceding claim in which a portion of the superstructure is cut away between the dependent arms to form a mounting location in support means for the moving means, the mounting location being provided substantially directly over the supporting structure.
9. Transfer means for a ladle, preferably according to any of claims 1 to 8 in which the transfer means comprising a superstructure rotatably mounted on a bearing surface, the superstructure being provided with one or more dependant constructs for lifting a ladle and means being provided for moving the dependant constructs so as to lift the ladle, wherein the superstructure is supported on a conical element between the superstructure and bearing surface.
10. Transfer means according to claim 9 in which the conical surface has a different diameter or cross-section at its junction with the superstructure than its cross-section or diameter at its junction with the bearing surface.
11. Transfer means according to claim 9 or claim 10 in which the angle of inclination of the cone surface,

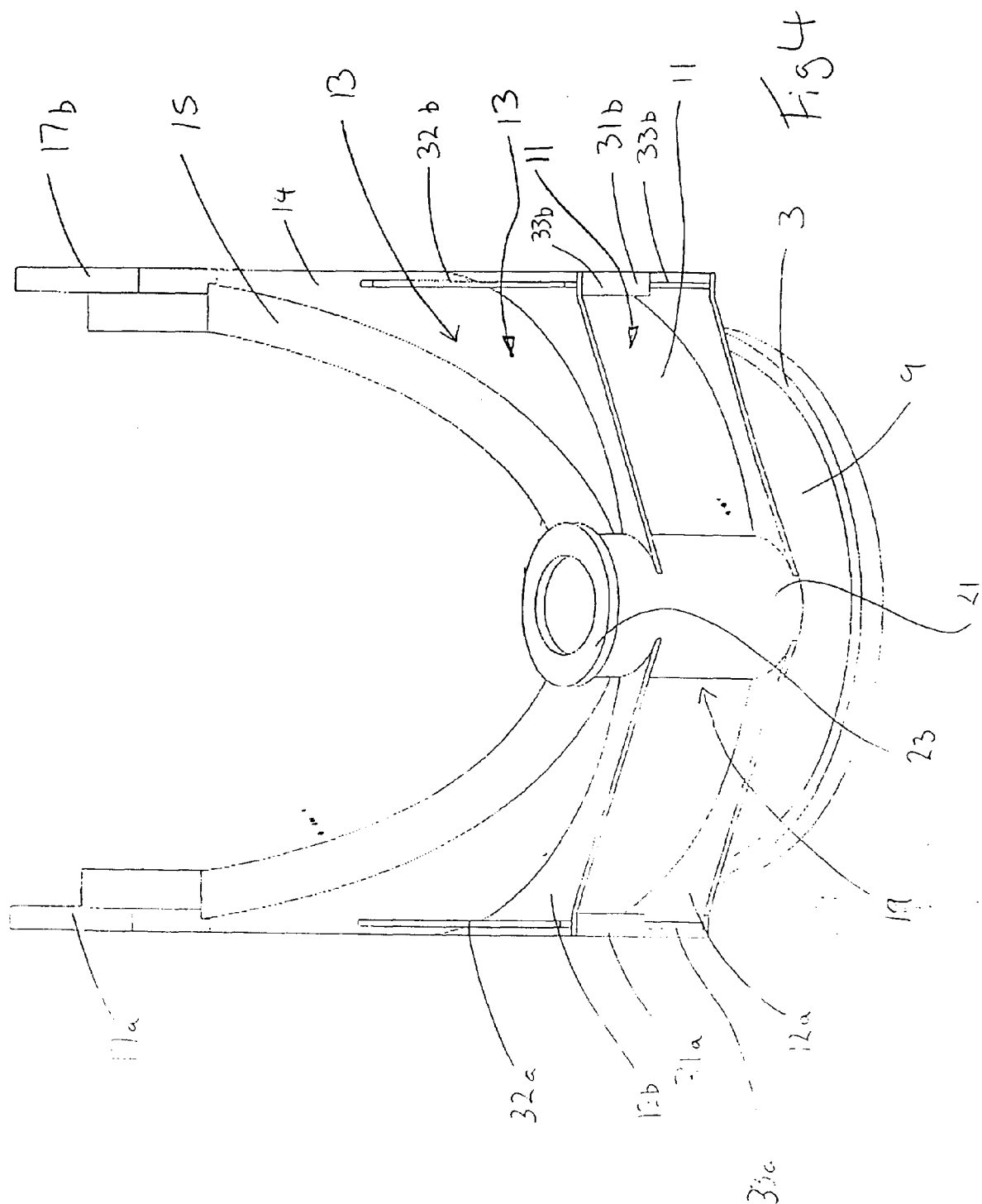
relative to its axis, is between -30° and $+30^\circ$.

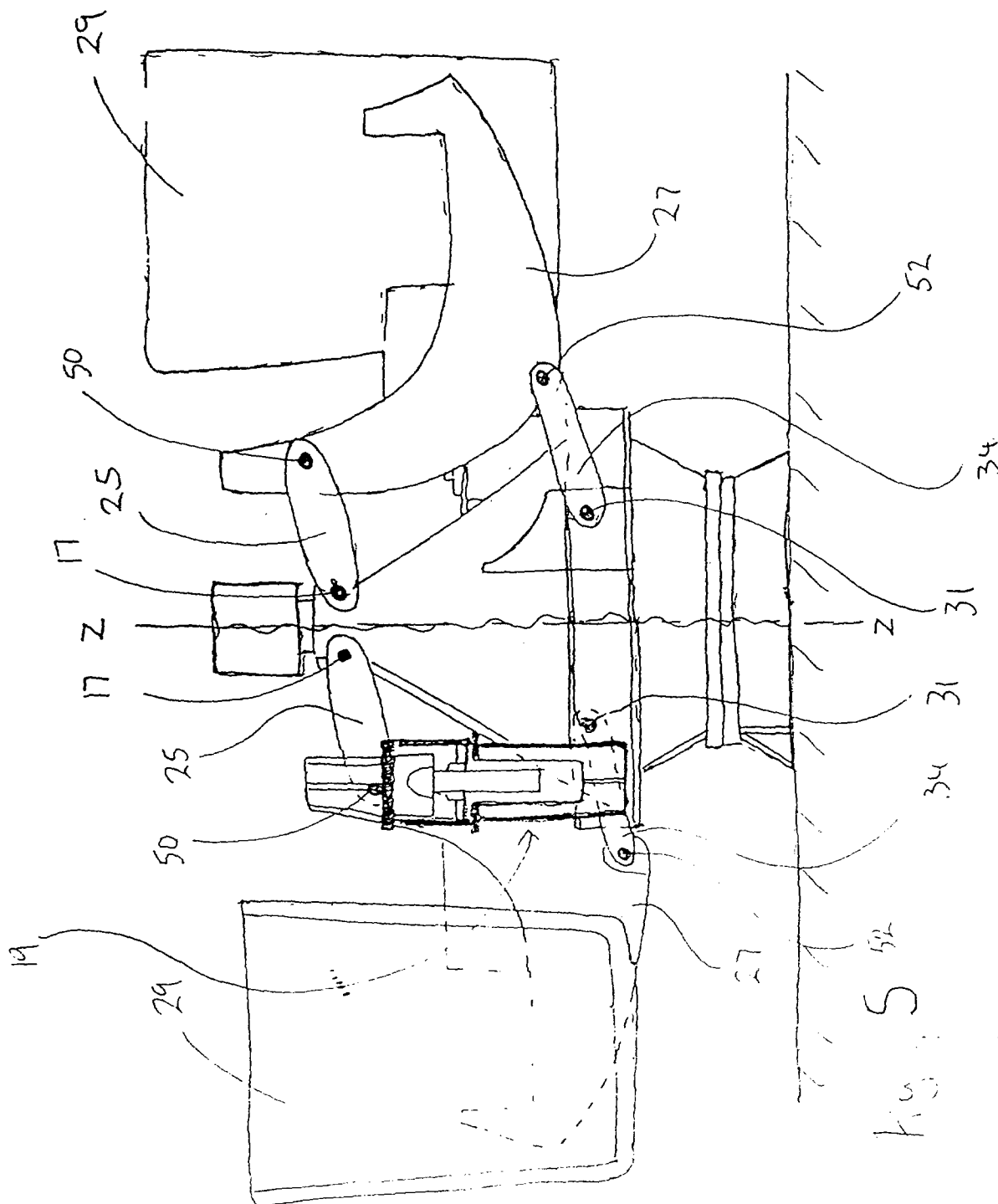
12. Transfer means for a ladle, preferably according to any of claims 1 to 12, in which the transfer means comprising a rotatably mounted superstructure provided on a bearing surface, the superstructure being provided with one or more dependant constructs for lifting a ladle, means being provided for moving the dependant constructs, the moving means being mounted on the superstructure and wherein said moving means mounting the moving means is provided at least 500mm vertically spaced above the top surface of the bearing surface. 5
13. Transfer means according to claim 12 in which the moving means mounting is provided at least 1500mm vertically above the top surface of the bearing surface. 10
14. Transfer means according to claim 12 or claim 13 in which the moving means mounting on the superstructure is provided directly over the adjoining portion of the superstructure. 15
15. Transfer means according to claim 12 or claim 13 in which the moving means mounting is provided on an element mounted on the superstructure, the element extending across the superstructure from one side to another. 20
16. Transfer means according to any of claims 12 to 15 in which the mounting comprises a flange on the superstructure which cooperates directly or indirectly with a flange on the moving means, the flange on the moving means contacting the flange on the mounting through a spherical mounting. 25
17. Transfer means according to claim 16 in which the flange on the superstructure is provided at the end of a cylinder, the cylinder is aligned with the axis of the moving means and the cylinder provide support for the flange and/or provide a housing enclosing the moving means. 30
18. Transfer means according to any of claims 12 to 17 in which in a retracted state of the moving means, which may be a fully retracted state, the weight of the dependent constructs and / or ladle is taken up by mechanical stops. 35
19. A method of producing a plurality of transfer means for ladles, preferably in which the transfer means are provided according to any preceding claim, the transfer means each comprising a superstructure rotatably mounted on a bearing surface, the superstructure being provided with one or more dependant constructs for lifting a ladle and means being provided for moving the dependant constructs so 40

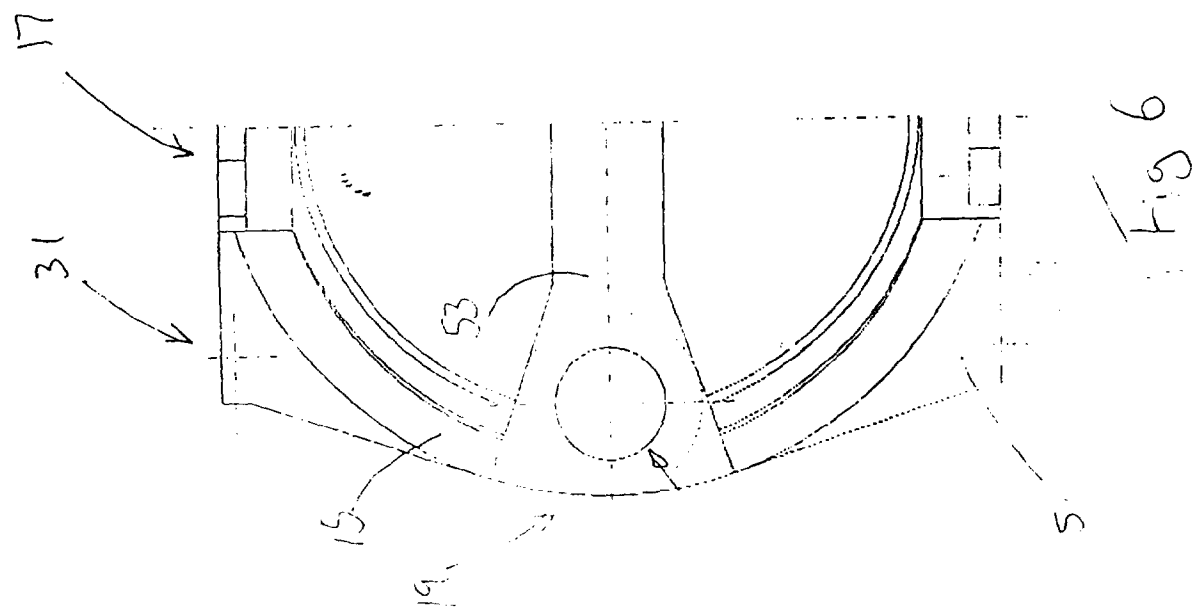
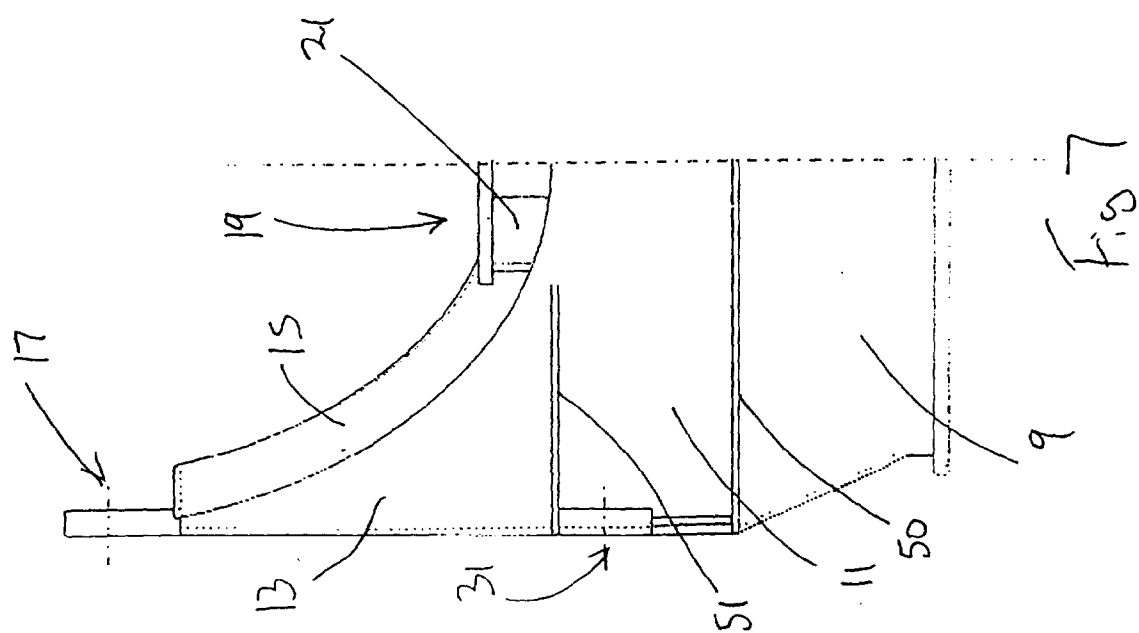
as to lift the ladle, the superstructure being supported on a conical element between the superstructure and bearing surface, the bearing surface diameter being the same in at least two of the transfer means and the size of the superstructure being different in the at least two transfer means, wherein the angle of inclination of the conical element varies between the at least two said transfer means.

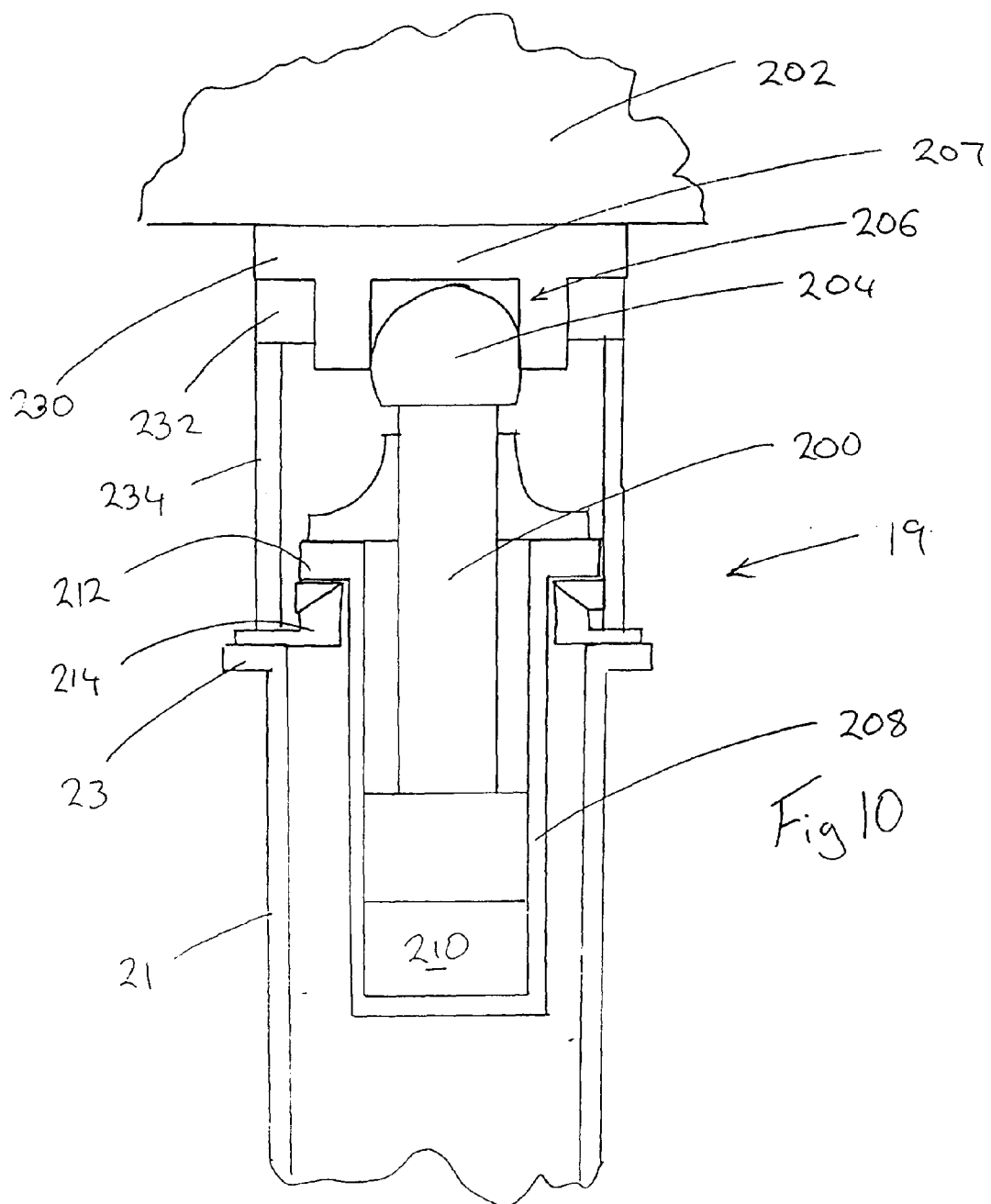
20. A method of transferring a ladle, comprising receiving the ladle on transfer means at a receiving location, lifting the ladle using the transfer means, moving the ladle to a location different from the receiving location, emptying the ladle of its contents, moving the ladle to a location different to its emptying location, lowering the ladle and removing the ladle from the transfer means, wherein the transfer means is provided according to any of claims 1 to 18 or is produced according to claim 19. 45













European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 30 5536

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 4 946 142 A (VATANT ROBERT, SAINT CHAMOND, FR) 7 August 1990 * column 2, line 46 - line 56 * * column 3, line 60 - column 5, line 48 * * figures 1,2 *	1-3,5-8, 20	B22D11/10
A	---	12-19	
A	PATENT ABSTRACTS OF JAPAN vol. 097, no. 010, 31 October 1997 & JP 09 164456 A (NIPPON STEEL CORP), 24 June 1997 * abstract *	4,9-13, 19	
A	---	4,9-11, 19	
	DE 20 28 078 A (SCHLOEMANN AG, DÜSSELDORF, DE) 16 December 1971 * page 2, line 1 - line 7 * * figure 1 * -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B22D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		2 October 1998	Peis, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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