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(54) **A taphole drill**

(57) A taphole drill is provided with a mounting arrangement including a jib arm which may be slewed about a primary pivot. The jib arm is pivoted itself to provide a first and a second limb and a control arm is included which is attached to the second of the limbs and the primary pivot. The control arm sets the angle of the first and second limbs as the arrangement is slewed. A pivoting link is provided to link the control arm to the primary pivot.

As rotation about the primary pivot occurs the link pivots to provide two pivoting positions for the control arm. This increases the angle between the first and second limbs and extends the arrangement until the drill is in a drilling position. Rotation in the opposite direction retracts the arm until the arrangement is in a parked position. This reduces the floor area taken up by the taphole drill.

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Description

[0001] This invention relates to a taphole drill for opening a blast furnace taphole.

[0002] At the lower region of a blast furnace used in iron production, a taphole is provided which is sealed and un-sealed as the furnace is operated to release molten metal from the furnace. The hole is sealed with clay which hardens with the heat of the furnace and this has to be drilled using a large pneumatic or hydraulically powered rotary percussion drill when sufficient metal has gathered at the furnace bottom.

[0003] An example of a blast furnace taphole drill is described in US6086816.

[0004] It will be appreciated that blast furnaces are large items of equipment (a typical blast furnace might produce tens of thousands of tonnes of metal per week). The furnace is housed in a correspondingly large building or complex of buildings. However, notwithstanding this, the floor space about a furnace is often constrained as it will include troughs and runners for receiving the molten metal when the furnace is tapped.

[0005] A taphole drill is itself a very large item of equipment which requires a substantial support structure which also allows movement of the drill by a foundry worker from a "parked" position to a drilling position where the drill bit is centred on the taphole. There are two current arrangements for mounting a taphole drill. In a first arrangement, a slewing jib arm is provided having a parallel linkage connected to a control arm. The jib slews (rotates) about a primary pivot. A second arrangement does not have a control arm but a single linkage to a drill guide. Both arrangements occupy a large area of the foundry workshop floor and hamper access to the taphole.

[0006] The present invention arose from a desire to provide a taphole drill which permits good access to the taphole when the drill is placed in a stowed (parked) position.

[0007] According to the invention there is provided a taphole drill comprising a primary pivot to which a jib arm is mounted at a first end which jib arm divided into a first and a second part at a pivot point, a drill guide fixed to an end of the second part; a control arm link connect to the second part of the jib arm at a position intermediate the pivot point and the end to which the drill guide is fixed wherein the other end of the control arm is connected to a dual position pivot point which is moveable from a first pivot position when the drill is in a parked position to a second pivot position different to the first when the drill is in the drilling position.

[0008] This arrangement is compact and allows good access to the taphole when the drill is in the parked position.

[0009] Preferably, the first pivot position is located at a first distance from the primary pivot and the second pivot position is located at a second distance greater than the first distance from the primary pivot.

[0010] Preferably, the control arm is pivotably connect-

ed to a link by a control arm pivot which link being connected to the primary pivot by a second pivot such that as the jib arm is rotated about the first pivot the link pivots about the second pivot to move the control arm pivot from the first pivot position to the second pivot position.

[0011] Preferably, the primary pivot has a stop to limit the motion of the link and thus to set the second position.

[0012] Preferably the link comprises a rear and a front wherein the front abuts a second stop to define the first pivot position and rear abuts the first stop to define the second position.

[0013] A specific embodiment of the invention will now be described, by way of example only, with reference to the drawing in which:

Figure 1 shows a taphole drill in accordance with an embodiment of the invention;

Figure 2 shows a pivot arrangement used in the taphole drill of figure 1;

Figure 3 is a perspective view of a link used in the pivot arrangement; and

Figure 4 is an illustrative figure showing a slewing trajectory of the taphole drill.

[0014] As is shown in figure 1, a taphole drill 1 in accordance with the invention comprises a drill motor 2, a drill guide 3 and a drill bit shaft 4 fixed to the end of a jib arm 5. The jib arm 5 has a jib arm pivot 6 at an intermediate position. The arm may therefore be considered to be formed of a first limb 5a and a second limb 5b. The limb 5b extends a primary pivot 7 to which it is mounted to allow rotational movement thereabout. Thus the taphole drill 1 is able to be rotated or slewed about the primary pivot 7.

[0015] The taphole drill 1 also includes a control arm 8 which is attached to the first limb 5a at a position intermediate the jib arm pivot 6 and the other end to which the drill motor 2 is mounted. The control arm 8 is fixed by means of a pivot 9. The other end of the control arm 8 is attached to a link 10 by means of a link first pivot 11. The link 10 is attached to the primary pivot 7 by means of a link second pivot 12. This is more clearly shown in figure 2.

[0016] The primary pivot 7 includes a radial extension 13 welded to its surface which includes a hole through which a pivot pin for the pivot 12 is located. As is shown in the figure, as the taphole drill 1 is rotated clock-wise about the pivot 7, the link 10 moves from a parked drill position shown in broken outline to the drilling position shown in solid outline. Both positions are defined by the link abutting respective shim stops 13a and 14 carried on the pivot surface. It will be seen that a radial distance A of the pivot 11 to the axis of the pivot 7 in the stowed or parked position is shorter than the radial distance B when the pivot 11 is in the drilling position. The link has

the indicated trajectory 15 as movement about the pivot 7 occurs leading to the pivoting of the link 10 about the pivot 12.

[0017] The link 10 is shown in greater detail in figure 3. It can be seen that it comprises an upper and lower plates 15 and 16 which have a generally triangular shape when viewed in plan. Each plate is provided with holes that are aligned with corresponding holes in the other which accept the pivot pins. The plates are held in spaced-apart alignment by a central body 17.

[0018] Figure 4 shows in a schematic way the taphole drill slew trajectory as movement occurs between the drill parked position of figure 4a, to an intermediate position of figure 4b and then to the drilling position of figure 4c. It will be seen that as the drill is slewed about the primary pivot 7 the distance between the primary pivot 7 to pivot 11 is increased causing an extension in the radial distance C1 to C2 between the pivot 7 and the drill guide 4. Movement in the opposite direction results in the arrangement folding in on itself to provide a more compact footprint than is possible with other prior art arrangements.

[0019] In figure 4a it will be seen that when in the parked position there is a clearance labelled "T" between the closest part of the taphole drill (pivot 12) and the taphole 20 of furnace 21. This clearance is larger than would be possible with prior art arrangements permitting good access to the taphole 20.

[0020] In the mid-point position in figure 4b, it will be seen that the rear of the drill guide 4 is at its greatest backward extent at a distance B from the taphole. This is termed the "back-swing" and it is shorter than prior art arrangements.

Claims

1. A taphole drill comprising a primary pivot to which a jib arm is mounted at a first end which jib arm divided into a first and a second part at a jib arm pivot point, a drill guide fixed to an end of the second part; a control arm link to the second part of the jib arm at a position intermediate the jib arm pivot point and the end to which the drill guide is fixed, and the other end of the control arm being connected to a dual position pivot point which is moveable from a first pivot position when the drill is in a parked position to a second pivot position different to the first when the drill is in the drilling position.
2. A taphole drill as claimed in claim 1 wherein the first pivot position is located at a first distance from the primary pivot and the second pivot position is located at a second distance greater than the first distance from the primary pivot.
3. A taphole drill as claimed in claim 1 or 2 wherein the control arm is pivotably connected to a link by a control arm pivot which link being connected to the pri-

mary pivot by a second pivot such that as the jib arm is rotated about the first pivot the link pivots about the second pivot to move the control arm pivot from the first to the second pivot position.

4. A taphole drill as claimed in claim 3 wherein the primary pivot has a stop to limit the motion of the link and thus to set the second pivot position.
5. A taphole drill as claimed in claim 4 wherein the link comprises a rear and a front wherein the front abuts a second stop to define the first pivot position and rear abuts the first stop to define the second pivot position.

FIG 1

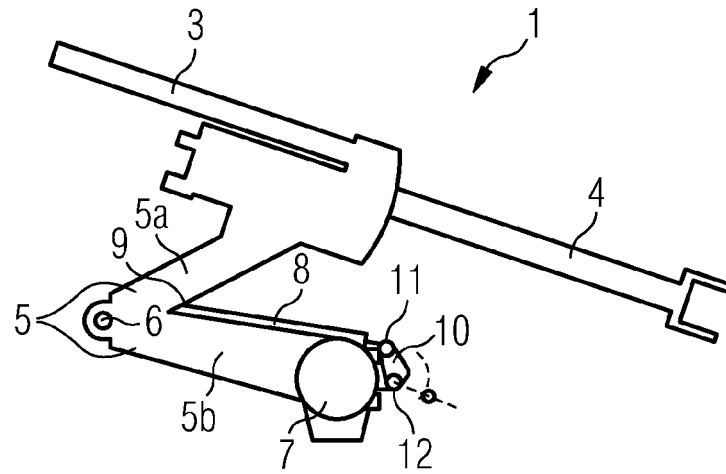


FIG 2

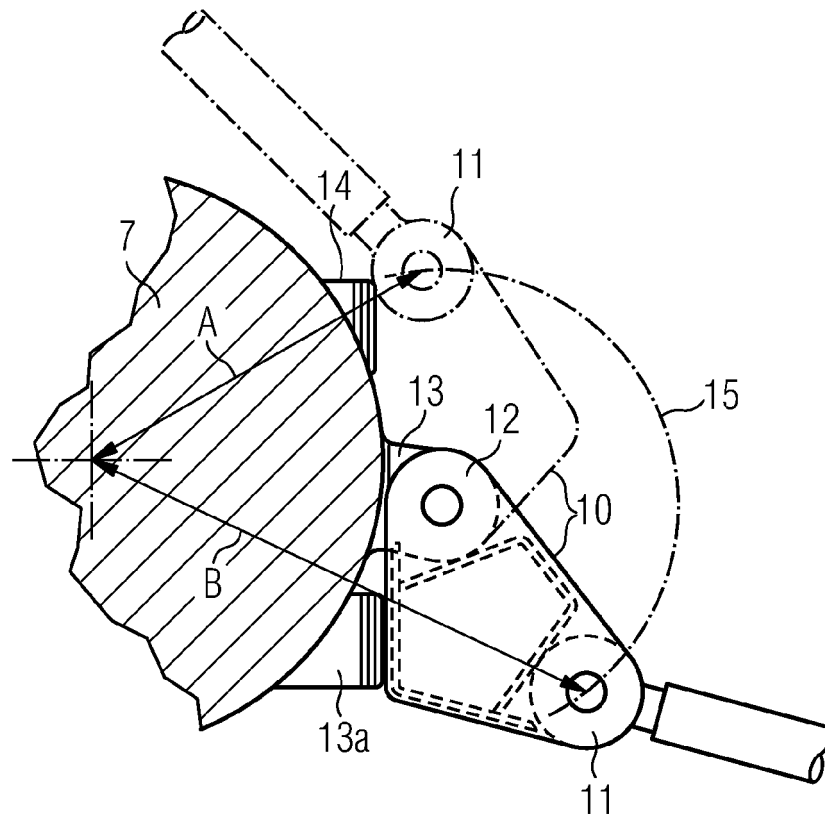


FIG 3

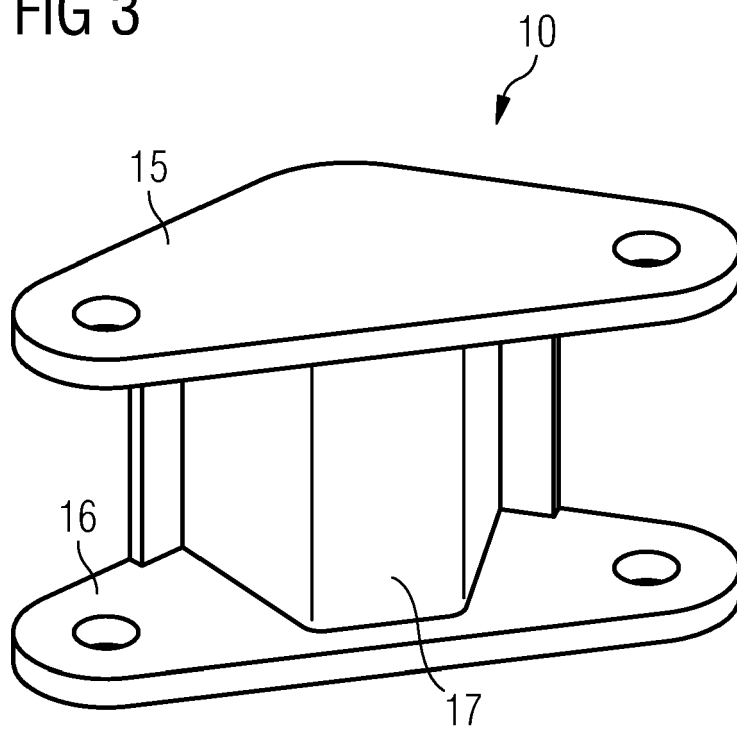


FIG 4A

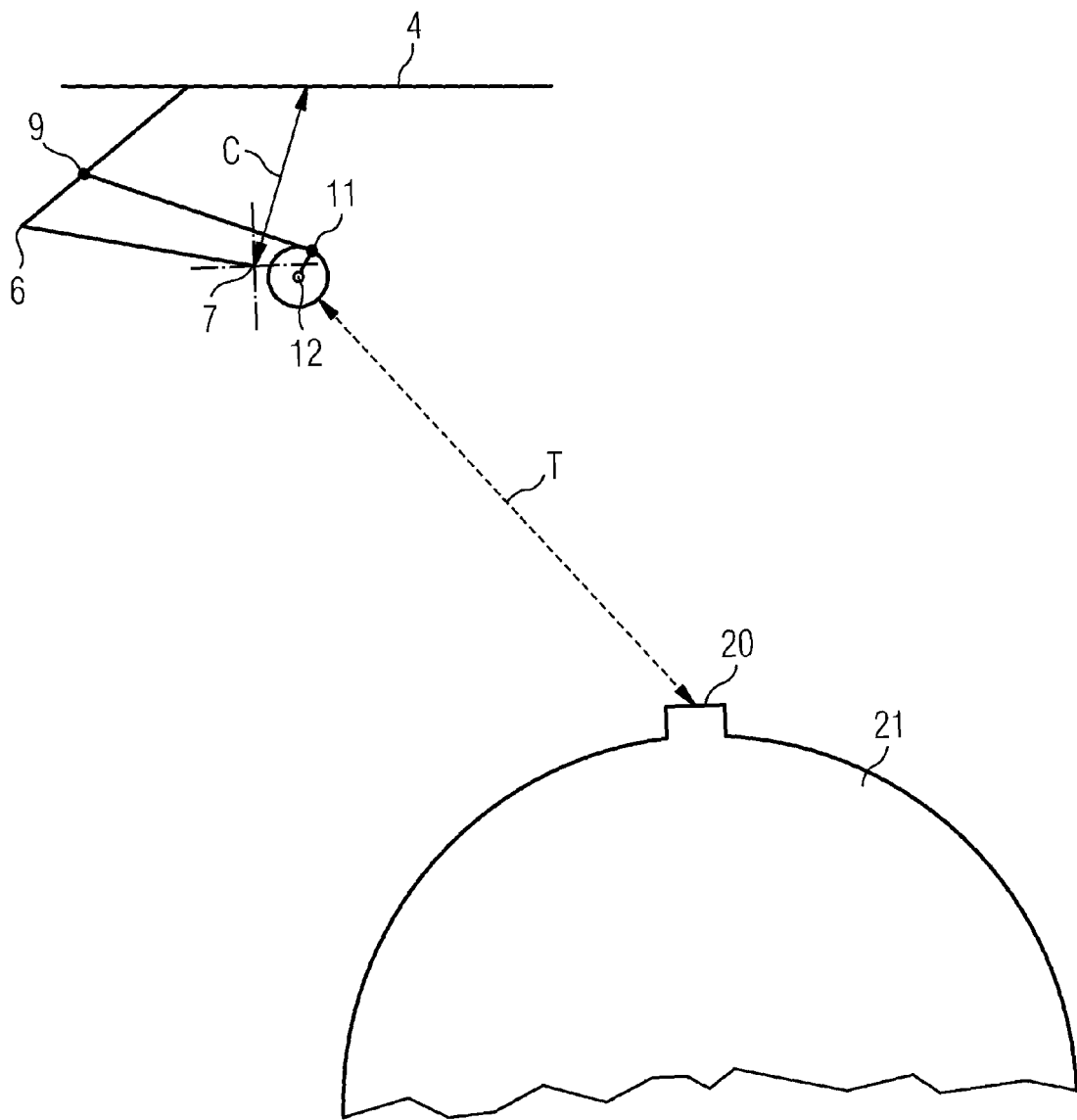


FIG 4B

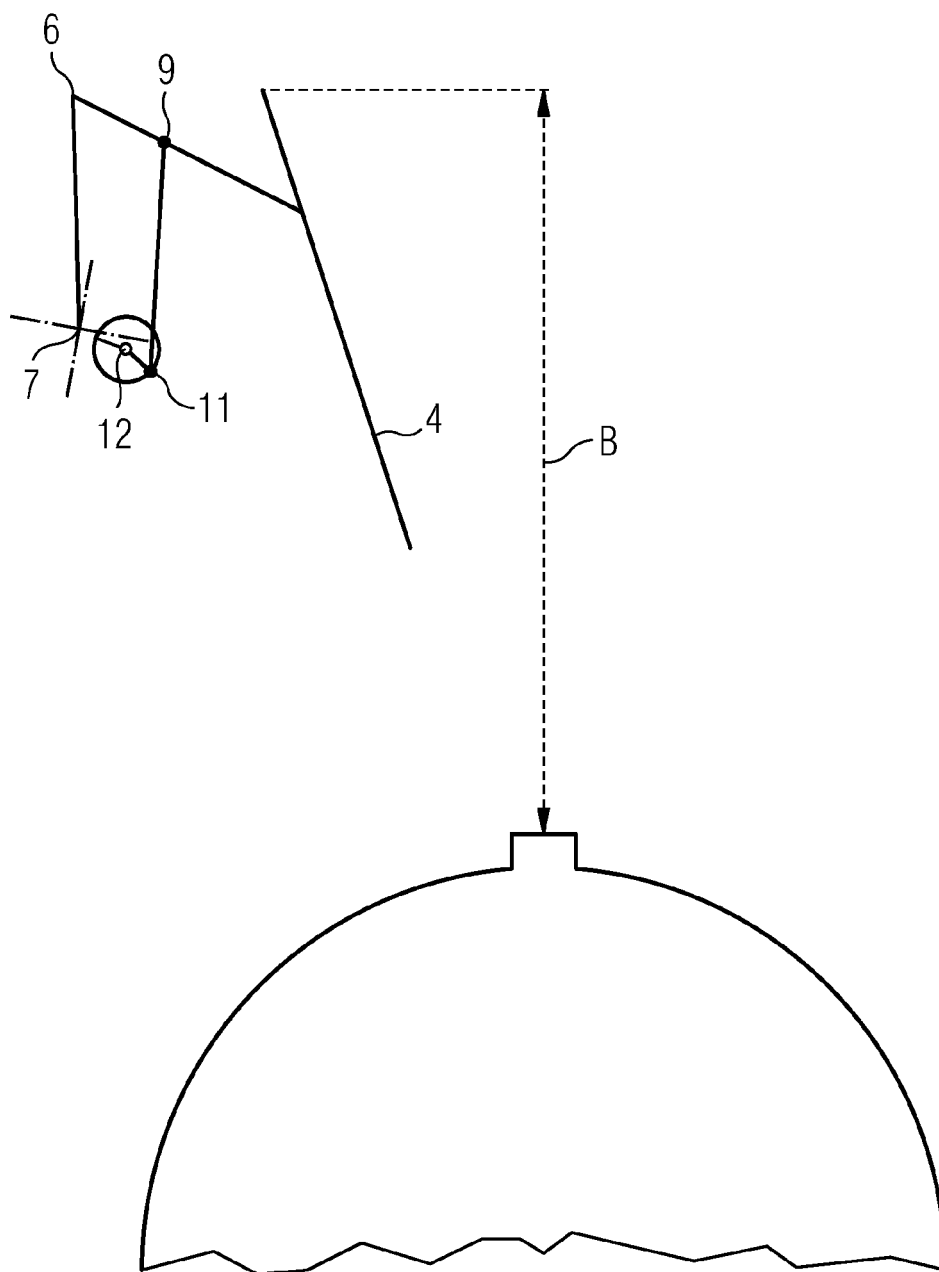
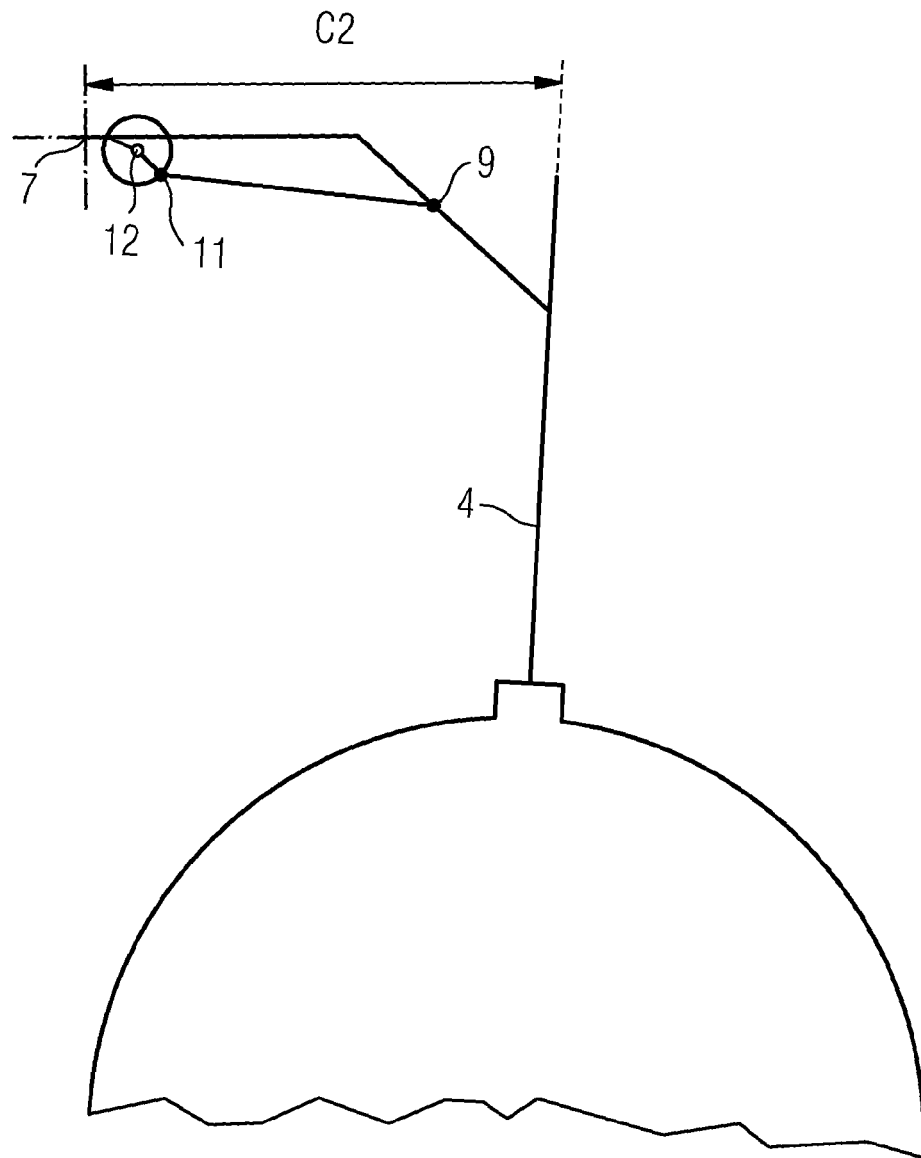


FIG 4C



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6086816 A [0003]