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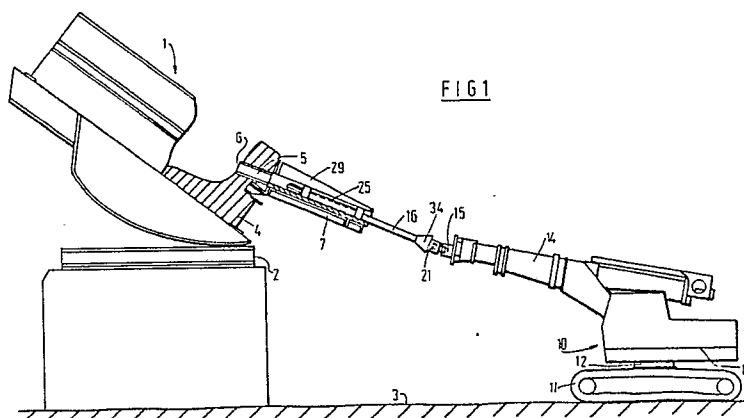
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54 **Treatment of metallurgical vessels.**

57 An elongate drill device (16) is mounted at the end of a pivotally mounted boom (14, 15) and carries a drill head (17) for drilling out the taphole (5) of an electric arc furnace (1). A guide device (25) secured to the outside of the furnace (1) supports the drill device (16) and guides it towards the taphole (5).



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TREATMENT OF METALLURGICAL VESSELS

The invention relates to the treatment of metallurgical vessels, and in particular to the reconditioning of electric arc furnaces for reuse.

It is known to provide a tap hole in a wall of an electric arc furnace, the hole having an insert which must be replaced when the furnace is repaired or reconditioned. It is known to repair the tap hole from the inside when the refractory lining is being treated i.e repaired for reuse. The job is awkward because of the height of the furnace above the ground, and the limited access available around the tap hole and around the furnace.

It is one object of the invention to provide a method and means by which tap hole treatment may be done simply and efficiently from outside the furnace, especially from ground level.

According to one aspect of the invention there is provided a method of drilling the tap hole in an electric arc furnace from outside the furnace, the tap hole being located a substantial height above the floor of the steel works, the method comprising the steps of:

locating a guide device on the outside of the furnace and adjacent the tap hole;

locating adjacent the furnace a pivotally mounted boom, an elongate drill device being connected to the free end of the boom, the drill device including a drill head to be directed towards the tap hole and being configured to be supported by the guide device along at least a portion of its length;

guiding the drill device by means of the guide device towards the tap hole, and rotating the drill head to drill out the tap hole.

Preferably the drill device is connected to the free end of the boom by a quick release coupling. Most preferably, the drill device includes means by which the drill device may be rotated even if the device and the boom are axially misaligned, the means is preferably a pair of non-constant velocity joints.

Because access to the furnace is limited it is preferable to locate the boom upon a turntable on the chassis of a relatively small vehicle of the type which has other uses at the steel plant.

In a preferred embodiment the drill device comprises a drill head which is releasably connected to an elongate drill shank. The guide device preferably comprises a pair of spaced apart collars including inner bearing surfaces and the drill shank rotates within the collars. The guide device is preferably mounted in a frame which is pivotally mounted on one side of a launder which extends outwardly from the tap hole. In an especially preferred embodiment, the drill device and the guide device form an assembly which may be moved into posi-

tion so that the drill device is axially aligned with the tap hole and each furnace has its own assembly. In such a way the tap hole may be cleared simply by swinging the assembly into position, connecting the shank of the drill to the boom of a vehicle and rotating the drill head.

In another aspect, the invention provides a guide device including a frame to be attached to the outside of an electric arc furnace having a tap hole, the device including guide means arranged in use to receive a drill device and to support and guide the drill head thereof towards the tap hole to be treated.

In order that the invention may be well understood it will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is an elevation partly in section of an electric arc furnace about to be treated by the method of the invention,

Figure 2 is a side elevation of a drill device,

Figure 3 is a longitudinal section of the drill device of Figure 2, and

Figure 4 is a transverse sectional view drawn to an enlarged scale taken on the lines IV-IV on Figure 3, showing the drill device in a launder.

As shown in Figure 1 an electric arc furnace 1 is mounted on a horizontal platform 2 above the floor 3 of a melt shop in a steel mill. The furnace 1 comprises a wall 4 having an outer steel skin with water-cooled panels (not shown). The furnace has a lid through which electrodes (not shown) pass. The wall 4 includes a tap hole 5 which receives a replaceable tap hole plug or sleeve 6 made from a refractory material which is cemented in position using e.g a refractory cement. The furnace 1 stands about 40 to 50 metres above the floor of the shop and can be tilted to the condition shown in Figure 1, so that the tap hole 5 is downwardly inclined.

A launder or spout 7 is mounted on the outside of the furnace 1 to convey molten metal from the tap hole 5 into another vessel e.g a 100 ton ladle. As shown in Figure 4 the launder 7 is of generally channel cross section and is formed of a metal shell having an internal replaceable refractory lining 8.

A vehicle 10 of the type used to carry out a number of jobs around the steel mill has an endless track 11 and a chassis 12 on which is mounted a turntable 13. The vehicle has a small turning circle so that it can move in a restricted space. A boom 14 is pivotally mounted on the turntable 13 and is of telescopic construction so that its length may be increased by moving at least one inner

component 15 outwardly. The inner component 15 is arranged to be capable of rotation at a variable speed up to about 14 rpm. By the pivotal mounting, the boom can extend upwardly at an angle of about 45°. The movement of the vehicle and the boom and allied parts are powered by a motor (not shown).

A drill device 16 best shown in Figures 2 and 3 is releasably connected to the free end of the inner component 15. The drill device 16 comprises a drill head 17 which is releasably connected to a drill shank 18. At the trailing end of the shank 18 a transverse pin 19 extends through the shank 18 and is received in a bayonet socket 20 at one end of a coupling 21. A collar 34 is secured to the drill shank 18 forwardly of the pin 19. The collar 34 flares outwardly towards the coupling 21 and ensures that, in use, the socket 20 is guided towards the pin 19 for engagement therewith. The coupling 21 comprises a cylindrical sleeve which at one end engages the drill shank 18 and at the other end a pin 22 extends across the sleeve 21 and through a hole formed across one end of an elongate coupling element 23.

The further end of the element 23 is received within the free end of the inner component 15 of the boom 14, and a further pin 24 is fixed across the end of inner component 15 transversely to the pin 22. The pin 24 extends through a hole formed across the element 23. In this way the shaft 18 is connected to the boom 14 in a flexible way, yet can be rotated and the device is provided with a pair of non-constant velocity joints.

According to the invention, a guide device 25 supports the shank 18 of the drill along its length. The guide device 25 comprises a pair of cylindrical collars 26 which each have an inner steel bearing surface 27. The collars 26 are spaced apart by a cylindrical sleeve 28. The shank 18 is mounted for rotation within the bearings 27. As best shown in Figures 1 and 4, the guide device 25 together with the drill device 16 is secured to a frame 29 which is pivotally mounted on one side of the launder 7. The frame 29 is dimensioned to overlie the launder 7 and is arranged so that in use the guide device 25 is in axial alignment with the tap hole 5. A pivot pin 30 is mounted in brackets 31 which are present at one side of the launder 7.

The pin 30 extends parallel to the launder 7 and through the frame 29. A lifting eye 32 is present on the frame 29 whereby the frame may be swung into the position shown in Figure 4.

In use, the drill device 16 is permanently mounted in the guide device 25. The frame 29 is initially swung outwardly to the position indicated by the dotted lines 33 in Figure 4. The furnace 1 is tilted into the position shown in Figure 1 by means of a crane or the like (not shown). The frame 29 is

then swung into the position shown in Figures 1 and 4 so that the drill is axially aligned with the tap hole 5.

The vehicle 10 is brought to the furnace 1 and the boom 14 is raised and the bayonet socket 20 is urged towards the collar 34 so that the socket 20 may be engaged with the shank 18 of the drill device 16. The drill device 16 is then urged towards the tap hole 5 and is rotated to drill out the sleeve 6. The drill device 16 is then disconnected from the boom 14 and swung out of the way. The debris is removed and a fresh sleeve 6 is inserted and cemented in place.

As indicated, the floor space about the platform is restricted and the tap hole is high up, so that there is no room to locate the vehicle with the boom, drill device and tap hole in strict axial alignment. Such alignment is not necessary in the case of the invention because the presence of the slip joint, i.e. the two non-constant velocity joints, enables the drill head 17 to be axially aligned with the tap hole 5 without aligning the shank 18 with the boom 14. As a result, rotation of the inner component 15 transmits rotation to the drill shank 18.

The method of the invention is simple to operate using readily available equipment. The sleeves 6 of the tap hole 5 may be replaced quickly from the outside of the furnace 1.

The invention is not limited to the embodiment shown. The frame 29 and/or the guide device 25 may be adapted to engage the furnace in the absence of a launder 7, or may form an assembly which is transported from furnace to furnace and may be located on a furnace, e.g. by means of dowels or the like.

Claims

1. A method of drilling the taphole (5) in an electric arc furnace (1) from outside the furnace (1), the tap hole being located a substantial height above the floor (3) of a steel works, the method comprising the steps of;

locating a guide device (25) on the outside of the furnace (1) and adjacent the tap hole (5);

locating adjacent the furnace (1) a pivotally mounted boom (15,14), an elongate drill device (16) being connected to the free end of the boom (15) the drill device (16) including a drillhead (17) to be directed towards the tap hole (5) and being configured to be supported by the guide device (25) along at least a portion of its length; and guiding the drill device (16) by means of the guide device (25) towards the tap hole (5) and rotating the drill head (17) to drill out the tap hole.

2. A method according to Claim 1 characterised in that the drill device (16) is connected to

the free end of the boom (15) by a quick release coupling (20).

3. A method according to Claim 1 or 2, characterised in that the drill device and the boom include means (21, 22, 23, 24) by which the drill device may be rotated when the drill device (16) and the boom (15) are axially misaligned. 5

4. A method according to Claim 3, characterised in that the means comprises a pair of non-constant velocity joints (21, 22, 23, 24). 10

5. A method according to any preceding Claim, characterised in that the boom (14) is mounted on a turntable (13) which is mounted upon the chassis (12) of a vehicle (10).

6. A method according to any preceding Claim, characterised in that the drill device (16) comprises a drill head (17) releasably connected to a drill shank (18). 15

7. A method according to any preceding Claim, characterised in that the guide device (25) comprises a pair of axially aligned cylindrical collars (26) mounted on the outside of the furnace (1) and the shank (18) of the drill is received within the collars (25). 20

8. A method according to Claims 6 or 7, characterised in that the guide device (25) together with the drill device (16) comprise an assembly which is pivotally mounted on one side of a launder (7) which extends outwardly from the furnace (1). 25

9. A guide device for use in a method according to any preceding Claim, the guide device including a frame (29) to be attached to the outside of an electric arc furnace (1) having a tap hole (5), the device (25) including guide means (26) arranged in use to receive a drill device (16) and to support and guide the drill head (17) of the drill device (16) towards the tap hole (5). 30 35

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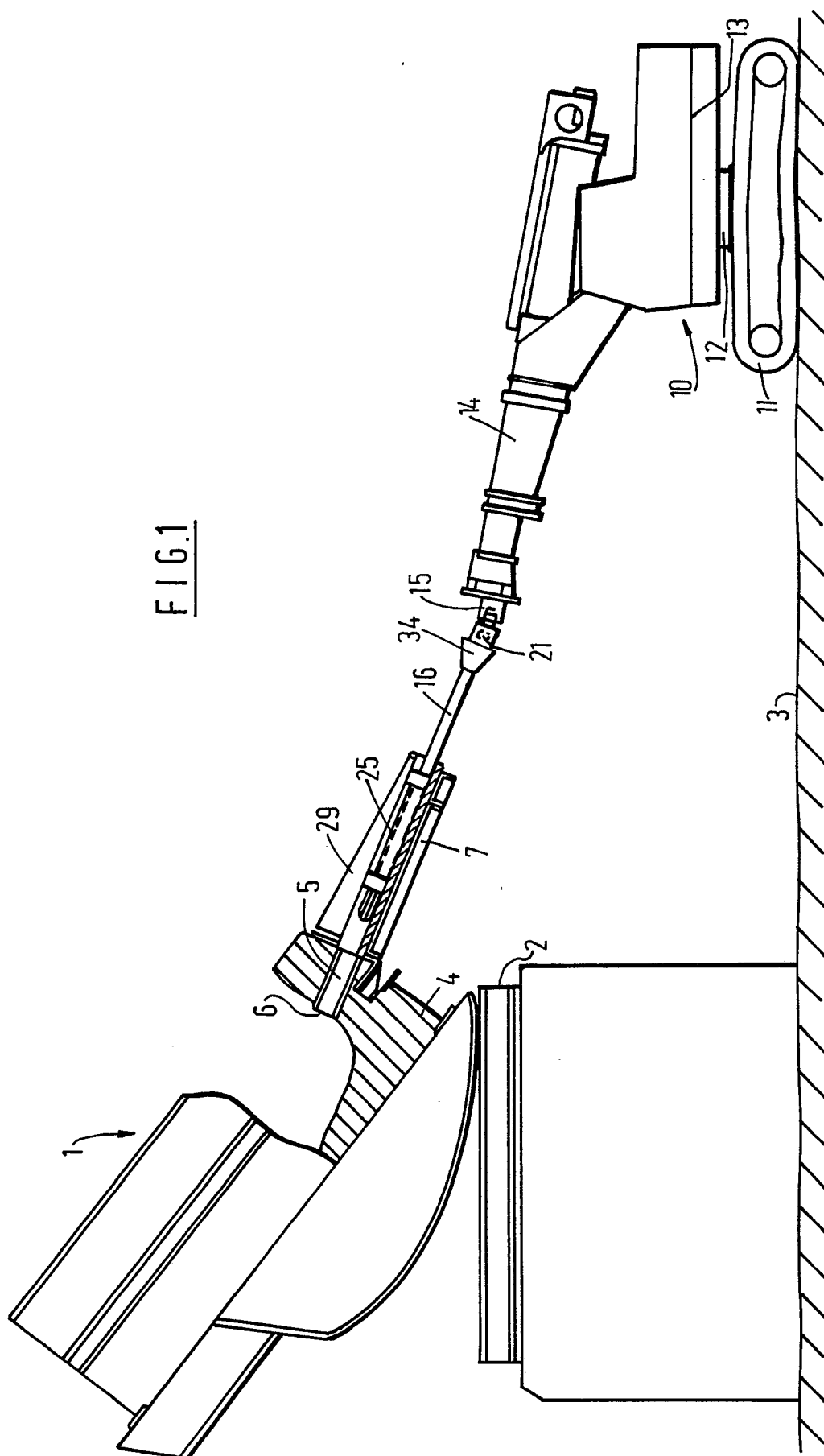
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Neu eingereicht / Newly filed
Nouvellement déposé

FIG.1



May 1990
Nouvellement d'opposé

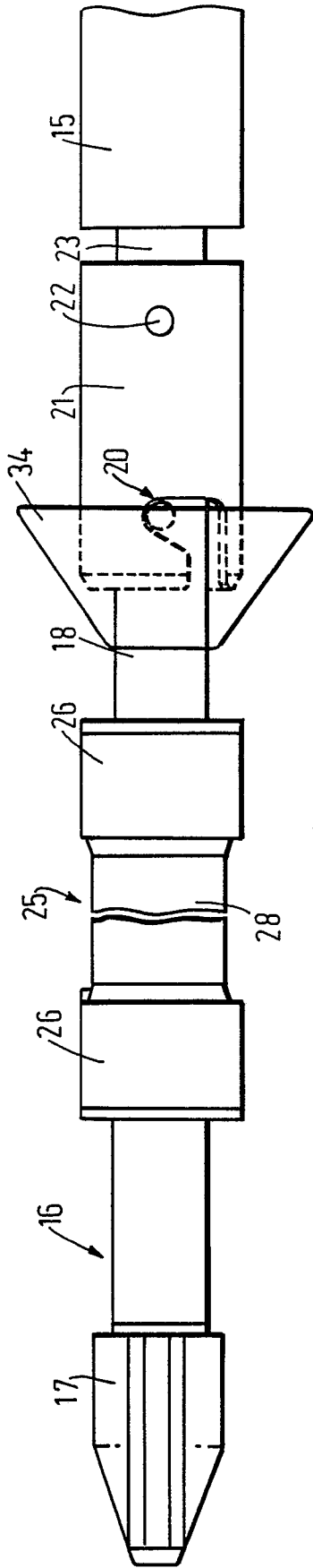


FIG. 2

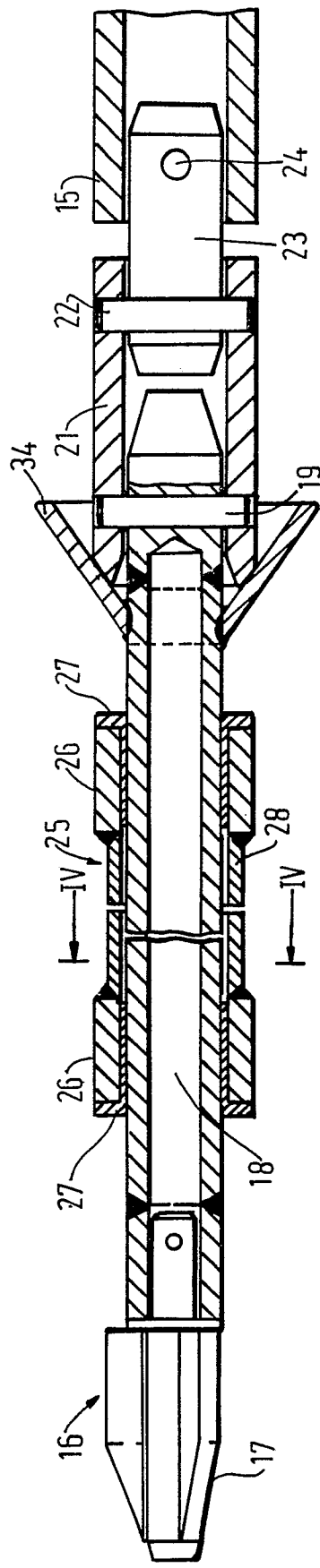
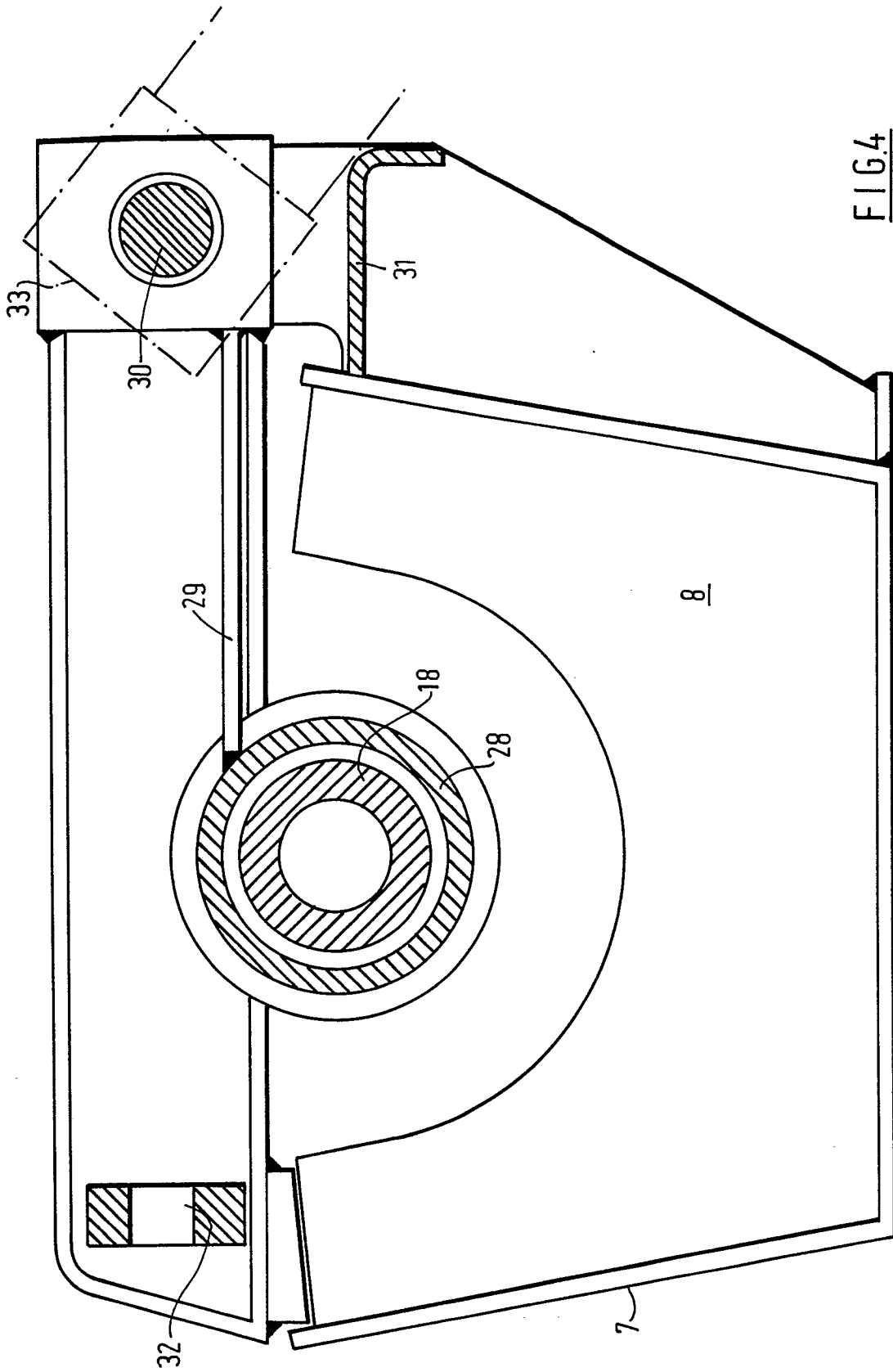


FIG. 3





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.5)
Y	EP-A-0 115 941 (MDS-FURNACE SERVICES) * Abstract; figure; claims * ---	1-9	F 27 B 3/19 F 27 D 3/15
Y	PATENT ABSTRACTS OF JAPAN, vol. 10, no. 123 (C-344)[2180], 8th May 1986; & JP-A-60 248 808 (KUROSAKI YOUNGIYOU K.K.) 09-12-1985 * Abstract * ---	1-9	
A	US-A-4 353 530 (IYAMA et al.) ---		
A	US-A-3 381 762 (LEWIS et al.) ---		
A	DE-U-8 803 548 (HÜTTE & CO.) ---		
A	DE-A-2 630 232 (NIPPON CARBIDE) ---		
E	GB-A-2 210 151 (IMS LYCRETE_Ltd) * The whole document * -----	1-9	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F 27 B F 27 D C 21 B C 21 C E 21 B
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	22-06-1989	OBERWALLENEY R.P.L.I.	
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	