Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2136169 C 2005/05/24

(11)(21) 2 136 169

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(22) Date de dépôt/Filing Date: 1994/11/18

(41) Mise à la disp. pub./Open to Public Insp.: 1995/07/14

(45) Date de délivrance/Issue Date: 2005/05/24

(30) Priorité/Priority: 1994/01/13 (P 44 00 755.8) DE

(51) Cl.Int.^{5}/Int.Cl.^{5} C21D 1/46, B01D 27/04

(72) Inventeurs/Inventors:
WAHL, GEORG, DE;
KREMER, MATTHIAS, DE;
SATO, TOKUO, JP

(73) Propriétaire/Owner:
DURFERRIT GMBH, DE

(74) Agent: DENNISON ASSOCIATES

(54) Titre : FILTRE ET MATERIEL POUR L'ENLEVEMENT DES RESIDUS DANS LES BAINS DE SEL
(54) Title: FILTER UNIT AND EQUIPMENT FOR THE REMOVAL OF SLUDGE FROM SALT BATHS

(57) Abrégé/Abstract:
In a filter unit (25) with equipment for the removal of sludge from salt baths (1) which is at least in part surrounded by the salt bath and which is in operative connection with the upper end of a riser (23), whereby the bath liquid from which the sludge is to be removed can be carried by means of a compressed air stream, for instance, through the riser (23) towards the filter unit (9, 25), the filter mesh pack (10) consisting of a wire mesh and enclosed by a filter frame (14) is made of a non-ferrous metal, preferably an aluminium, nickel or titanium based alloy, whereby the frame (14) is shaped towards the bottom of the container (2) like a flat truncated pyramid shaped funnel (18) whose pointed lower end is provided with an opening (19) which can be closed.

Abstract:

In a filter unit (25) with equipment for the removal of sludge from salt baths (1) which is at least in part surrounded by the salt bath and which is in operative connection with the upper end of a riser (23), whereby the bath liquid from which the sludge is to be removed can be carried by means of a compressed air stream, for instance, through the riser (23) towards the filter unit (9, 25), the filter mesh pack (10) consisting of a wire mesh and enclosed by a filter frame (14) is made of a non-ferrous metal, preferably an aluminium, nickel or titanium based alloy, whereby the frame (14) is shaped towards the bottom of the container (2) like a flat truncated pyramid shaped funnel (18) whose pointed lower end is provided with an opening (19) which can be closed.

Filter Unit and Equipment for the Removal of Sludge from Salt Baths

The invention refers to a filter unit and equipment for the removal of sludge from salt baths which is at least in part surrounded by the salt bath and is in operative connection with the upper end of a riser, whereby the liquid from which the sludge is to be removed by means of a compressed air stream, for instance, is pushed through the riser in the direction of the filter unit.

Salt baths are extensively used, for instance, to harden or nitride metallic materials, in particular ferrous materials. This type of salt baths consist mostly of alkali metal carbonates and cyanates; in part they also contains alkali cyanides. Such fused salt baths are usually operated at an operating temperature of 560° to 600°C.

During the treatment of construction parts made of ferrous materials, these baths accumulate sludge in varying degrees due to the fact that adhering steel particles, like for instance drillings and grinding dust, accumulate on the bottom of the treatment container or remain suspended in a finely distributed form. Likewise, the treatment of scaled or unfinished surfaces (casting or forging skin) causes the contamination of the bath. Finally, a part of the sludge is formed because after several treatments nitride particles peel off the loading accessories such as baskets and racks and remain in the bath. The "sludge" formed in this fashion consists for the most part of iron nitride and oxide.

Other salt baths, like for instance hydroxide based cooling baths, become increasingly viscous due to the formation of insoluble carbonates which increases the fusion point of the baths reducing the cooling effect. For that reason this type of baths must also be cleaned.

Since the sludge content of the nitride bath strongly affects the reproducibility of the intended nitride results, the continuous cleaning of the bath is very important. In practice, different sludge removing devices are used. All previous systems have in

common that the operations have to be interrupted in order to clean the sludge, i.e. the sludge removal must be carried out in a bath without load.

An equipment for the continuous removal of sludge from salt baths is known from patent DE-OS 29 11 222, consisting of a filter unit, a pump which is immersed in the bath and a riser. In this case the filter unit is installed outside the salt bath.

Also known is a device for the intermittent removal of sludge from salt baths intended for the treatment of metals, which consists of a conveying tube, an air supply device and a filter unit (DE 38 36 939), and uses as filter materials iron meshing with a mesh size of 0.05 to 0.5 mm or glass wool.

Filter meshing made of iron wire, however, has the disadvantage that the iron material is strongly affected by the salt bath itself and also by the materials contained in the filter sludge, and for instance gets brittle so that the meshing rips, breaks or gets perforated after only a few hours of operation, with the result that the retained filter sludge flows into the cleaned bath rendering it immediately useless.

The use of anorganic materials, in particular glass or stone wool, is also known for the cleaning of fused salt baths, in particular for the removal of noxious suspension materials and sludge deposits in baths used for the treatment of structures made of materials

containing iron (DAS 27 31 167). These glass or stone wool filters, however, have the disadvantage that it is difficult to dispose of them once they are contaminated, and therefore are not be used in industrial applications for cost reasons.

Finally, a filter with an electro-galvanic structured filter medium is known (DGM 92 00 734.1), where the filter medium is made of nickel or a nickel alloy and is 0.1 to 0.2 mm thick. This known filter medium designed like a screen printing meshing, however, is only suitable for multi-phase separating installations, for instance as a band filter subsequently added to hydro-cyclones.

The purpose of the present invention is to create a filter unit for the removal of sludge from salt baths whose useful life is considerably longer than that of conventional filter units as well as the corresponding equipment, which can be produced at particularly low cost and is highly efficient.

According to the invention this is accomplished with a filter mesh enclosed by a filter basket, consisting of a wire mesh made of a non-ferrous metal, preferably an aluminum, nickel or titanium based alloy. According to the invention, any alloy containing a large amount of any metal - except iron - is suitable for the filter mesh. The equipment required for the filter unit consists of a frame shaped like a funnel towards the bottom of the salt bath, whose pointed lower end has an opening which can be

closed with a stopper rod. Further embodiments and characteristics have been described and identified in the patent claims.

The invention allows a variety of embodiments; one of them has been explained in more detail in the enclosed drawings; the following are shown:

Figure 1 — A filter unit and equipment according to the invention, in perspective view together with the salt bath container;

Figure 2 — The perspective representation of the filter unit itself according to Figure 1;

Figure 3 — A diagrammatical representation of the sludge removing process over 34 batches, indicating in each case the iron content of the batch in percentage.

Figure 4 — An alternative embodiment of a filter unit together with the pump unit and the salt bath container in a perspective representation, and

Figures 5, 6, 7 — The filter unit, the pump unit and the stopper according to the embodiment in Figure 4.

The fused salt bath 1 contained in a tub 2 is continuously carried over a riser 3 into the filter unit 9, where an overflow pipe 7 has

been placed over the upper end of the riser 3.

The fused salt bath 1 is transported by means of the air stream rising from the fused salt bath. The air is supplied through the compressed air supply 4, whereby the intake stacks 5 draw in the sludge from the deepest part of the tub 2. The filter is supported by a stop 8 and can be replaced easily. Below the salt bath level is the riser 3 which is provided with some boreholes 6 which serve to reduce the pressure when the filter 9 and the upper end of the riser 3 are plugged. The boreholes 6, for instance, have a diameter of 2 to 16 mm, according to the diameter of the riser and are located below bath level.

After the fused salt bath current carried upward by the air stream leaves the riser 3, it reaches the inner surface of the bell-shaped overflow pipe 7 and is guided by the same into the pack of aluminum wire mesh 10. After the cleaning process, the fusing current trickling through the filter pack 10 flows back into the fused salt bath.

Figure 2 shows a separate filter unit 9, consisting of a box-shaped frame 11, the aluminum mesh filter pack 10 enclosed by the frame 11, a retaining clip 12 and a trough-shaped depression 13 for the incorporation of the riser 3. The filter unit 9 can be easily removed at any time without tools by pulling it upwards out of the bath or by removing it from the support 8.

Figure 3 shows in the form of a diagram the results of a series of tests in which the salt bath was cleaned with the help of a

filter unit made of pure aluminum wire mesh. The course of the curve shows that the iron particle contamination has remained extraordinary low even after the treatment of 34 batches, and up to approximately the 25th batch shows a very low value equal to 0.011 % iron, in a subsequent phase dropping to an even better value (0.009 % Fe), and only towards the end increasing again to a value slightly higher than the original value. The mesh size used in this test was 400 meshes/cm^2.

In the embodiment according to Figure 4 the aluminum wire mesh filter pack 10 is supported by a frame 14 which in turn is supported on the edge 17 of the salt bath container 2 by means of hooks 15, 16. The frame 14 encloses with both its sides 14a, 14b the mattress shaped filter pack 10 and in addition has a tin funnel 18 pointed towards the bottom which on its lower end is provided with an opening 19 which can be closed with a stopper rod 20 which for this purpose is equipped with a male connecting nipple 21. The side area 14b is equipped with a collecting tank 22 through which the liquid carried through the riser 23 can flow diagonally into the filter pack 10 across the side area 14b. The tin funnel 18 provided below the filter pack serves to collect filter sludge moving down from the filter pack. The collected sludge can be drained out through the opening 19 on the lower pointed end of the tin funnel 18 by lifting the stopper rod 20. The pump (ejector

pump) formed by the riser 23 and the compressed air supply pipe 24 serves to carry the liquid from the container 2 into the reservoir 22.

List of the individual parts:

1	Fused salt bath
2	Salt bath container
3	Riser
4	Compressed air supply
5	Outlet connection
6	Boreholes
7	Overflow pipe
8	Formation
9	Filter unit
10	Wire mesh pack, filter pack
11	Frame
12	Retaining clip
13	Mesh-shaped depression
14	Frame
14a, 14b	Side area
15	Hook
16	Hook
17	Edge
18	Tin funnel
19	Opening
20	Stopper rod
21	Male connecting nipple
22	Collecting tank
23	Riser
24	Compressed air supply
25	Filter unit

Claims:

1. Filter unit and equipment for the removal of sludge from salt baths which is in operative connection with the upper end of a riser, whereby the bath liquid from which the sludge is to be removed is carried through the riser towards the filter unit, characterized in that the filter unit is a filter mesh pack of wire mesh supported by a filter basket or a filter frame consists of a non-ferrous metal and is at least in part surrounded by the salt bath.

2. Filter unit according to Claim 1, characterized in that the non-ferrous metal is an aluminum, nickel or titanium based alloy.

3. Filter unit according to Claim 1, characterized in that the bath liquid is carried by means of a compressed air stream through the riser towards the filter unit.

4. Filter unit according to Claim 1, characterized in that the number of meshes in the filter mesh pack is between 200 and 800 meshes/cm^2.

5. Filter unit according to Claim 4, characterized in that the number of meshes in the filter mesh pack is 400 meshes/cm^2.

6. Filter unit according to Claim 1 and 2, characterized in that the filter mesh pack is made of porous non-ferrous metal.

7. Equipment for the removal of sludge according to Claim 1, characterized in that the filter mesh pack supported by a frame is shaped as a flat truncated pyramid-shaped funnel towards the bottom of the salt bath container, its pointed lower end having an opening which can be closed with a stopper rod.

8. Equipment according to Claim 7, characterized in that the frame carrying the filter pack is connected to a collecting tank provided on one side and into which the riser discharges from above, so that the transported liquid is carried from the riser through the collecting tank horizontally into the filter pack.

2136169

FIG.1

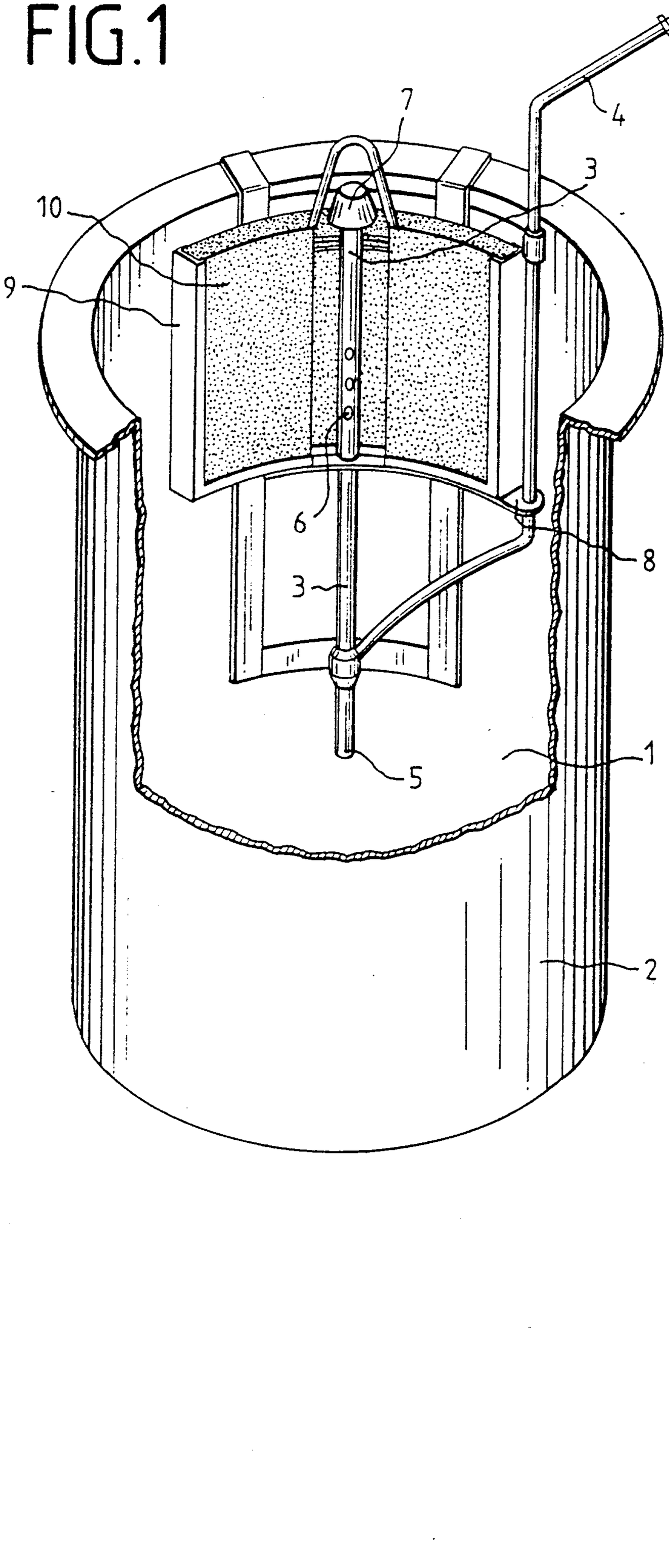

FIG.2

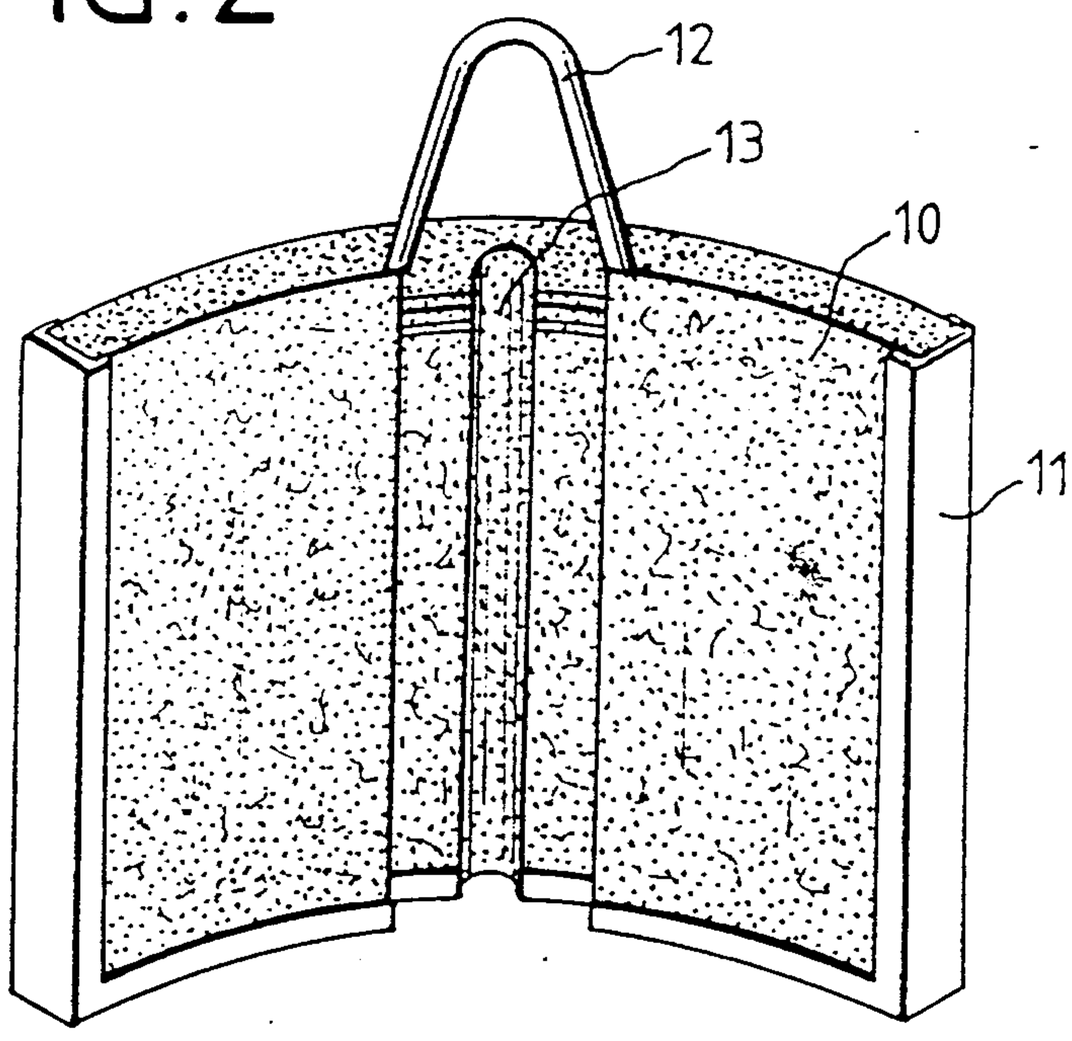
12
13
10
11

FIG.3

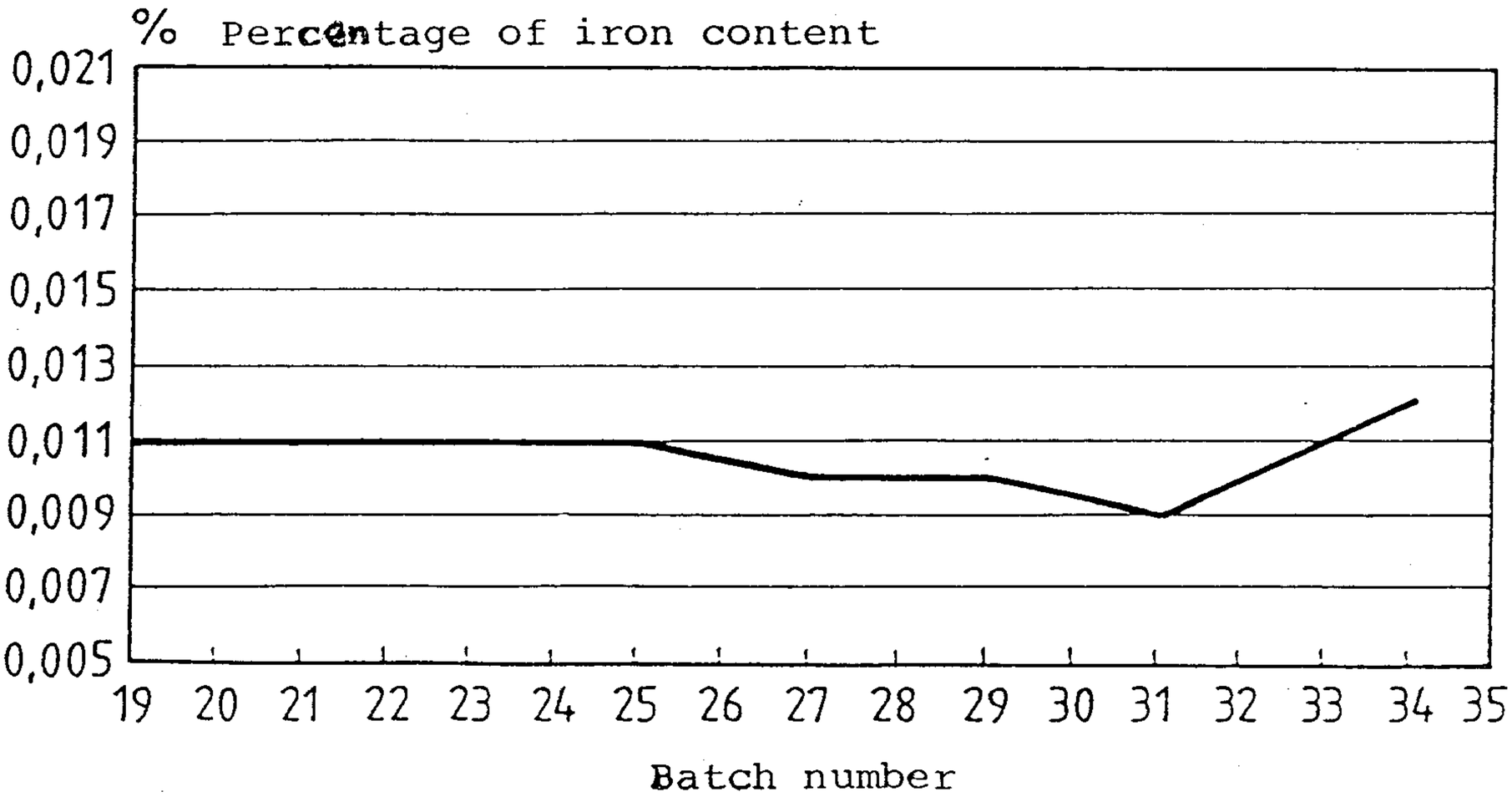
% Percentage of iron content
0,021
0,019
0,017
0,015
0,013
0,011
0,009
0,007
0,005
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
Batch number

FIG.4

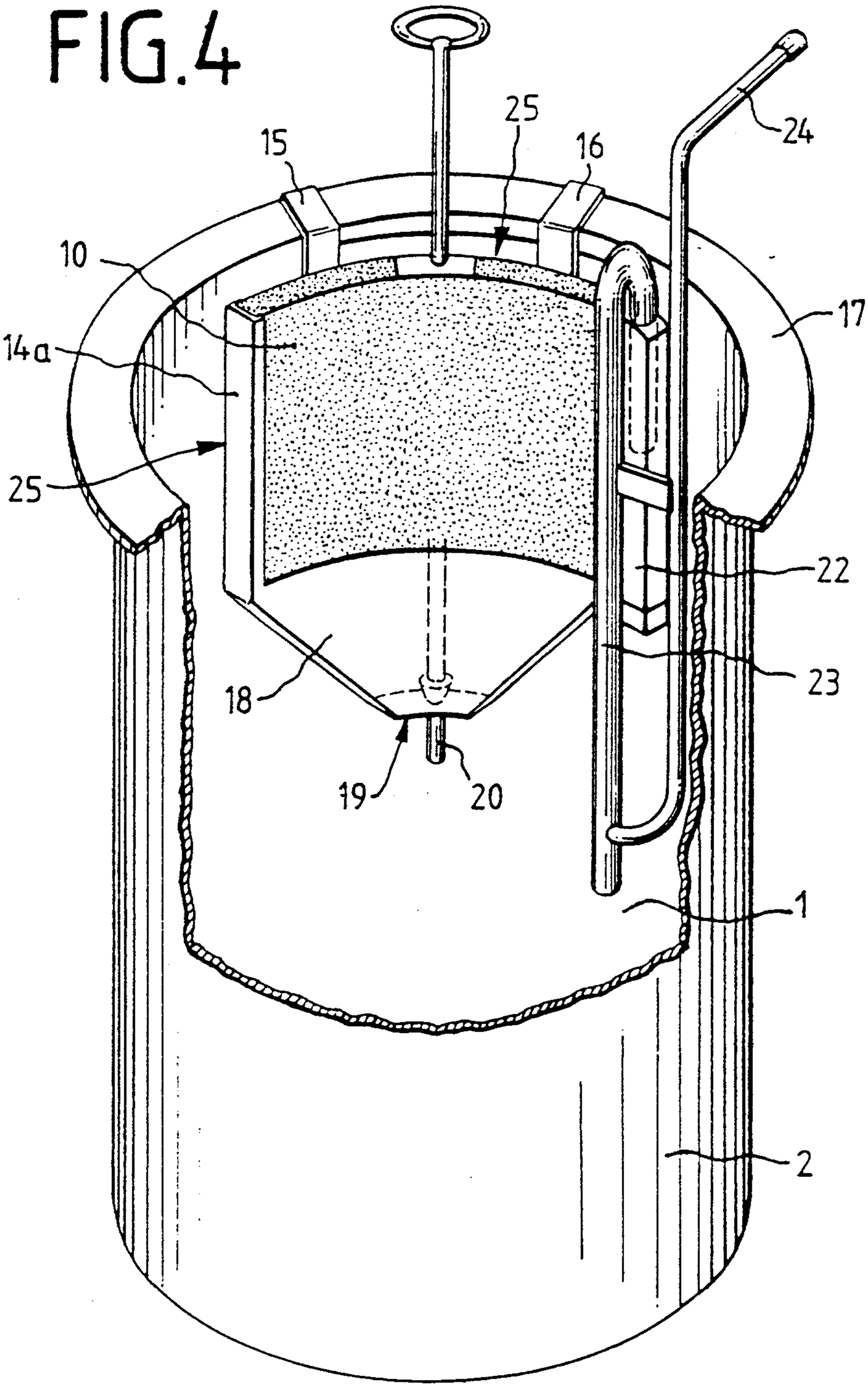

FIG.6

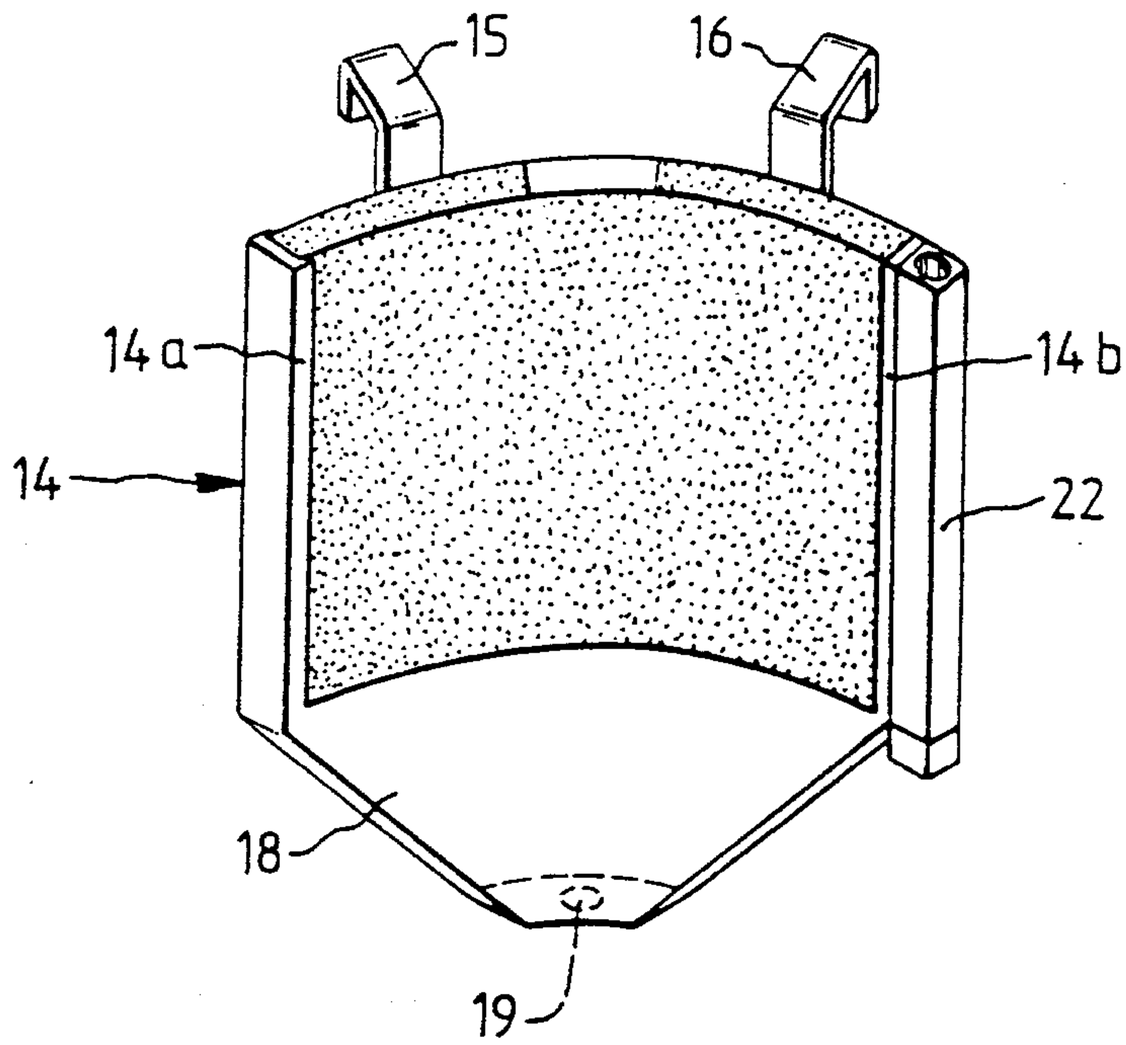

FIG.7

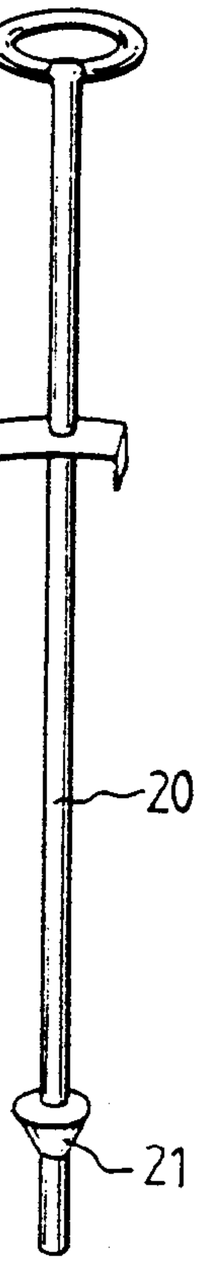

FIG.5