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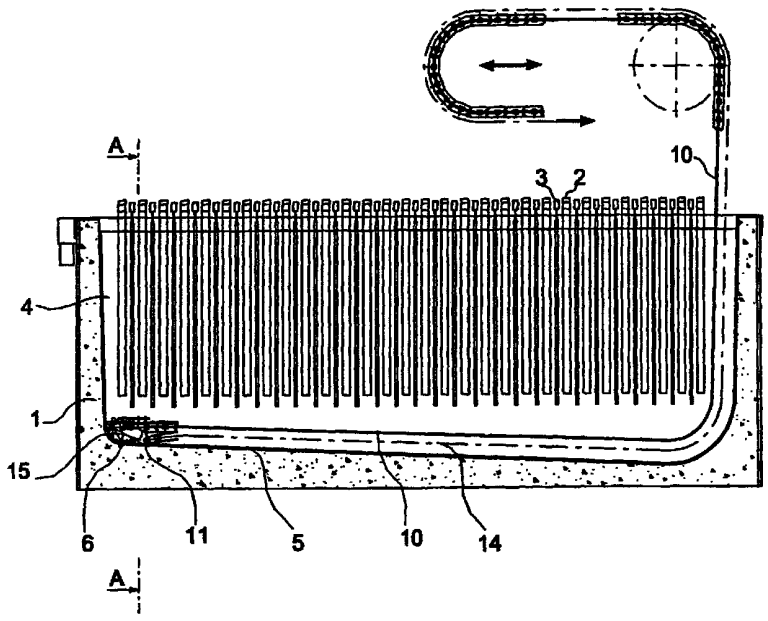
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(54) Title: ARRANGEMENT FOR CLEANING THE BOTTOM OF AN ELECTROLYTIC TANK



(57) Abstract: An arrangement for cleaning the bottom (5) of an electrolytic tank (1) of solids (6) settled on the bottom of the tank, said arrangement comprising elements to be moved along the bottom or at least in the vicinity thereof in order to detach solids from the bottom. The arrangement comprises at least one moveable suction element (11), whereby at least part of the solids (6) accumulated on the bottom (5) is conducted out of the tank (1).

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ARRANGEMENT FOR CLEANING THE BOTTOM OF AN ELECTROLYTIC TANK

The present invention relates to an arrangement for cleaning the bottom of an electrolytic tank of solids settled thereon, said arrangement comprising elements to be moved along the bottom or at least in the vicinity thereof in order to detach solids from the bottom.

In electrolytic processes, metals such as copper, nickel and zinc, are precipitated on the surfaces of cathodes located in the electrolytic tank, starting either with metal anodes that are dissolved into the electrolyte present in the electrolytic tank, or with metal ions that are already dissolved into the electrolyte. However, all solids are not precipitated onto the cathode surfaces, for example precious metals and solid impurities present in the electrolyte. Therefore on the bottom of electrolytic tanks, there are accumulated, along with the metal refining process, various solids that must from time to time be removed from the tank, for instance because said solids contain valuable ingredients, such as precious metals, or because a thicker solids accretion threatens the purity of the cathode obtained from the electrolytic process.

Usually the solids accumulated in the electrolytic tank is are at least partly very finely divided and only somewhat heavier than the electrolyte, wherefore it is difficult to separate the solids from the electrolyte. During the electrolytic process, the circulation of the solids from off the bottom of the electrolytic tank is very harmful, because in that case there is a particularly high risk that the solids proceed onto the cathode, and this would essentially weaken the purity of the metal to be produced.

The removal of the solids accumulated on the bottom of an electrolytic tank usually requires that the whole electrolytic process must be interrupted, which reduces the efficiency per time, i.e. the productivity of the electrolytic plant. Hence the removal of solids must be arranged so that it forms part of the

process of replacing the electrodes, i.e. anodes and cathodes; this, however makes the replacement process complicated and slow, and also restricts the removal of solids to take place in the rhythm dictated by the process of replacement. Moreover, a remarkable amount of the electrolyte must be first removed from the tank and then fed back therein, which generally leads to harmful effects in the electrolyte quality and causes a lot of extra work. Into the solids treatment system, there also flows a remarkable amount of electrolyte, which must be replaced with new and may be harmful in the further treatment of the solids. Moreover, the manual washing of the electrolytic tanks makes the process clearly more labor-intensive and subjects the employees to various health hazards, among others owing to the effects of the ingredients contained in the splashes and spray emanating from the tank. In addition, owing to the personnel required by the washing of the tanks, the automatization of the electrode treatment is often nearly impossible, which further increases the labor demand in an electrolytic plant.

From the international patent application WO 99/11841, there is known a separating element for separating the bottom part of an electrolytic tank from the rest of the tank space in connection with the removal of the solids settled on the tank bottom. In said publication, in the electrolytic tank there are arranged support and control members that form the trajectory of the separating element, so that the separating element can be placed in the electrolytic tank and removed therefrom through a space provided in between at least one end wall and the electrode placed nearest to said end wall. In the separating element, there can be attached means for feeding cleaning agent into the bottom part of the electrolytic tank, or mechanical devices for detaching solids. The detached solids are removed from the tank through an outlet aperture provided in the tank bottom, or by means of a separate pump.

The object of the present invention is to eliminate some of the drawbacks of the prior art and to achieve an improved arrangement for cleaning the bottom of an electrolytic tank of solids settled thereon, said arrangement comprising

means to be moved along the bottom or at least in the vicinity thereof for detaching solids off the bottom. The essential novel features of the invention are apparent from the appended claims.

According to the invention, the arrangement also comprises at least one movable suction element whereby at least part of the solids accumulated on the bottom are conducted out of the tank. By means of the movable suction element, there is achieved an extremely efficient removal of solids from the tank.

The suction element according to the invention is a suction nozzle arranged essentially transversally to the motional direction of the arrangement, said suction nozzle preferably extending essentially along the whole width of the tank and being provided with at least one feed aperture and at least one discharge aperture. When the suction nozzle is placed transversally and extends to the whole width of the tank, there is achieved an extremely intensive suction effect, and the solids are removed by one motion of said suction element, by moving it from one end of the tank to the other end.

The suction element according to the invention comprises a housing, at the bottom part whereof there is formed at least one feed aperture, and in which housing there is preferably formed at least one discharge aperture that can be connected to a suction conduit. According to a preferred embodiment, in the suction nozzle there are made several feed apertures, in which case the apertures can serve as sieve members, thus breaking the solids accretions into smaller parts. According to another embodiment, in the suction nozzle there is made a longitudinal, slot-like feed aperture that extends to the whole width of the suction nozzle. Now the solids can be removed extremely efficiently, and at the same time the blocking of the feed apertures of the suction element can be avoided. According to a preferred embodiment of the invention, in connection with the suction nozzle, there is arranged at least one nozzle for feeding

cleaning agent. By means of the nozzle for feeding cleaning agent, the proceeding of the solids into the suction nozzle can be boosted.

A suction nozzle in a preferred embodiment of the arrangement according to the invention comprises means for pressing the suction nozzle towards the tank bottom. Now an optimal solids removal effect of the suction nozzle can be ensured. The suction nozzle can be provided with mechanical solids detaching means, in which case the cleaning effect created by the suction nozzle is further improved. When the suction element according to the invention is attached to a separating wall element which at the same time serves as a drive element, there is obtained an extremely effective arrangement for removing solids from the bottom of an electrolytic tank.

The invention is described in more detail below, with reference to the accompanying drawings, where

figure 1 illustrates a preferred embodiment of the invention in an electrolytic tank, seen from the side in a partial cross-section,

figure 2 illustrates the embodiment of figure 1, seen in the direction A - A,

figure 3 illustrates a preferred embodiment of the arrangement according to the invention, seen from the side in a partial cross-section,

figure 4 illustrates a fourth embodiment according to the invention, seen in the direction B - B of figure 3,

figure 5 illustrates another embodiment of the invention, seen in the direction B - B of figure 3, and

figure 6 is a simplified illustration of a preferred embodiment of the arrangement according to the invention.

Figures 1 and 2 represent a general illustration of an electrolytic tank 1, where there are in turns placed electrodes, anodes 2 and cathodes 3, and the metal to be produced in the electrolytic process is precipitated onto the cathode by means of an electrolytic solution 4 present in the electrolytic tank. During the

electrolytic process, on the bottom 5 of the electrolytic tank 1 there are settled solids 6 that should be removed from the electrolytic tank from time to time.

The arrangement according to the invention for cleaning the bottom 5 of an electrolytic tank of the solids 6 settled on the tank bottom comprises elements movable along the bottom 5 or at least in the vicinity thereof in order to detach solids from the bottom. In addition, the arrangement comprises at least one movable suction element 11, whereby at least part of the solids accumulated on the tank bottom are conducted out of the tank.

The suction element 11 is an suction nozzle 11a, 11b, 11c, arranged essentially transversally to the motional direction of the arrangement (illustrated by arrows in figures 1, 3 and 7), said suction nozzle preferably extending essentially along the whole width of the tank and being provided with at least one feed aperture 12, 12a, 12b and one discharge aperture 13. In the embodiment of figure 3, the suction element 11 is made of a pipe with a circular cross-section; at the bottom part of said pipe, there is formed at least one feed aperture 12, and in said pipe, there is preferably formed at least one discharge aperture 13, which can be connected to a suction conduit 14. In the embodiment of figure 3, the central point of the aperture 12 is located, with respect to a vertical radius drawn via the contact point of the pipe and the bottom 5, upwardly for an angle α. The size of said angle depends on the dimensions of the pipe used as the suction nozzle housing and of the feed aperture. In one embodiment (figure 4), the suction nozzle 11a is provided with several feed apertures 12a. The size, shape and number of the feed apertures may vary even to a large extent from one embodiment to another.

In another embodiment of the invention (figure 5), the suction nozzle 11b is provided with an elongate, slot-like feed aperture 12b that extends essentially along the whole width of he suction nozzle.

In connection with the suction nozzle, there is provided at least one nozzle 15 for feeding cleaning agent. The nozzle 15 for feeding cleaning agent is directed to carry solids towards the feed apertures 12 of the suction nozzle (figure 3). The cleaning agent may typically be a liquid or gaseous agent or a mixture thereof. The nozzle for feeding the cleaning agent can be arranged externally to the suction element 11, but also inside thereof. In the embodiment according to figure 6, the cleaning nozzle 15 is arranged inside the suction nozzle 11c, advantageously in the end part thereof, in which case it is directed to carry solids towards the discharge aperture 13.

The suction nozzle comprises means 16 for pressing the suction nozzle towards the tank bottom 5. Typically the means 16 are for instance spring members, which are at their first end arranged in the drive arrangement 10 and at their other end in the suction element 11, 11a, 11b, 11c.

In a preferred embodiment (figure 6) of the arrangement according to the invention, in connection with the suction nozzle 11c, preferably at the front edge 17 thereof, there are provided means 18 for the mechanical treatment of solids, such as cogs. The housing of the suction nozzle 11c is made of a rectangular pipe, where in the side facing the bottom 5, there is made an aperture 12, and in the front wall 17, at the bottom edge thereof, there is made a cogging 18.

The solids conducted from the tank bottom to the suction element 11 are advantageously removed from the tank along the conduit 14.

The suction element is attached to a separating wall 10, which at the same time serves as a drive element. In connection with the electrolytic tank, preferably in the side walls 7, 8 of the tank, there are arranged support and control members 9. By means of said support and control members 9, the separating element is supported when the separating element is placed in the electrolytic tank 1, and controlled when it is being placed in the electrolytic

tank, so that the created trajectory is mainly defined by said support and control members. Typically the support and control members 9 are recesses formed in the opposite walls 7, 8 of the tank, in which recesses the side edges of the separating element 10 are arranged to fit. A preferred embodiment of the separating wall is specified in the publication WO 99/11841.

For a man skilled in the art, it is obvious that the invention is not restricted to the above described embodiments exclusively, but it can be modified within the appended claims. Thus the arrangement may comprise several different suction nozzles, even placed transversally to the motional direction of the arrangement.

CLAIMS

1. An arrangement for cleaning the bottom (5) of an electrolytic tank (1) of solids (6) settled on the tank bottom, said arrangement comprising elements to be moved along the bottom or at least in the vicinity thereof in order to detach solids from the bottom, **characterized** in that the arrangement comprises at least one movable suction element (11) whereby at least part of the solids (6) accumulated on the bottom (5) are conducted out of the tank (1).

2. An arrangement according to claim 1, **characterized** in that the suction element (11) is a suction nozzle (11a, 11b, 11c) arranged essentially transversally to the motional direction of the arrangement, said suction nozzle extending preferably along the whole width of the tank and being provided with at least one feed aperture (12, 12a, 12b) and at least one discharge aperture (13).

3. An arrangement according to claim 1 or 2, **characterized** in that the suction element (11) comprises a housing (11a, 11b, 11c), the bottom part thereof being provided with at least one feed aperture (12), and that in said housing, there is preferably formed at least one discharge aperture (13) which can be connected to a suction conduit (14).

4. An arrangement according to any of the preceding claims 1 - 3, **characterized** in that in the suction nozzle (11a), there are formed several feed apertures (12a).

5. An arrangement according to any of the preceding claims 1 - 4, **characterized** in that in the suction nozzle (11b), there is formed an elongate, slot-like feed aperture (12b) extending essentially along the whole width of the suction nozzle.

6. An arrangement according to any of the preceding claims 1 - 5, **characterized** in that in connection with the suction nozzle, there is provided at least one nozzle (15) for feeding cleaning agent.

7. An arrangement according to claim 6, **characterized** in that the nozzle (15) for feeding cleaning agent is directed to carry solids towards the feed apertures (12) provided in the suction nozzle.

8. An arrangement according to claim 6, **characterized** in that the nozzle (15) for feeding cleaning agent is directed to carry solids towards the discharge apertures (13) provided in the suction nozzle.

9. An arrangement according to any of the preceding claims 1 - 8, **characterized** in that the suction nozzle comprises elements (16) for pressing the suction nozzle towards the tank bottom (5).

10. An arrangement according to any of the preceding claims 1 - 9, **characterized** in that in connection with the suction nozzle (11c), preferable at the front edge (17), there are provided means (18) for the mechanical treatment of solids, such as a cogging.

11. An arrangement according to any of the preceding claims 1 - 10, **characterized** in that the suction element (11) is attached to a movable separating wall (10).

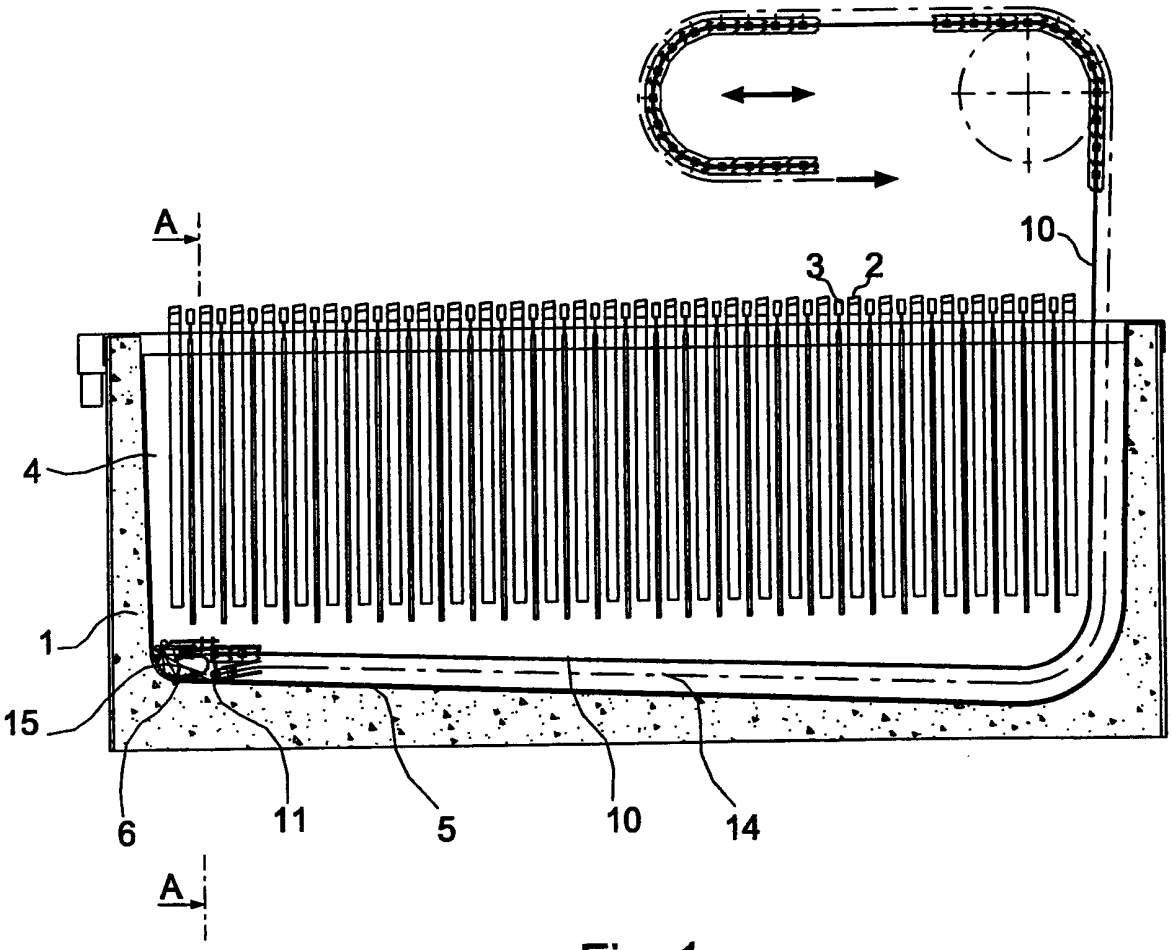


Fig. 1

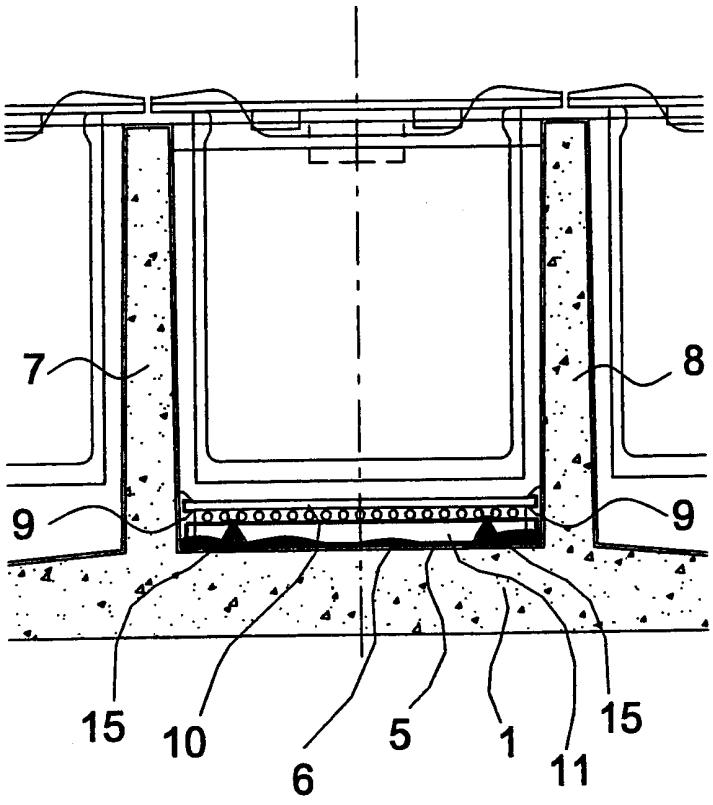


Fig. 2

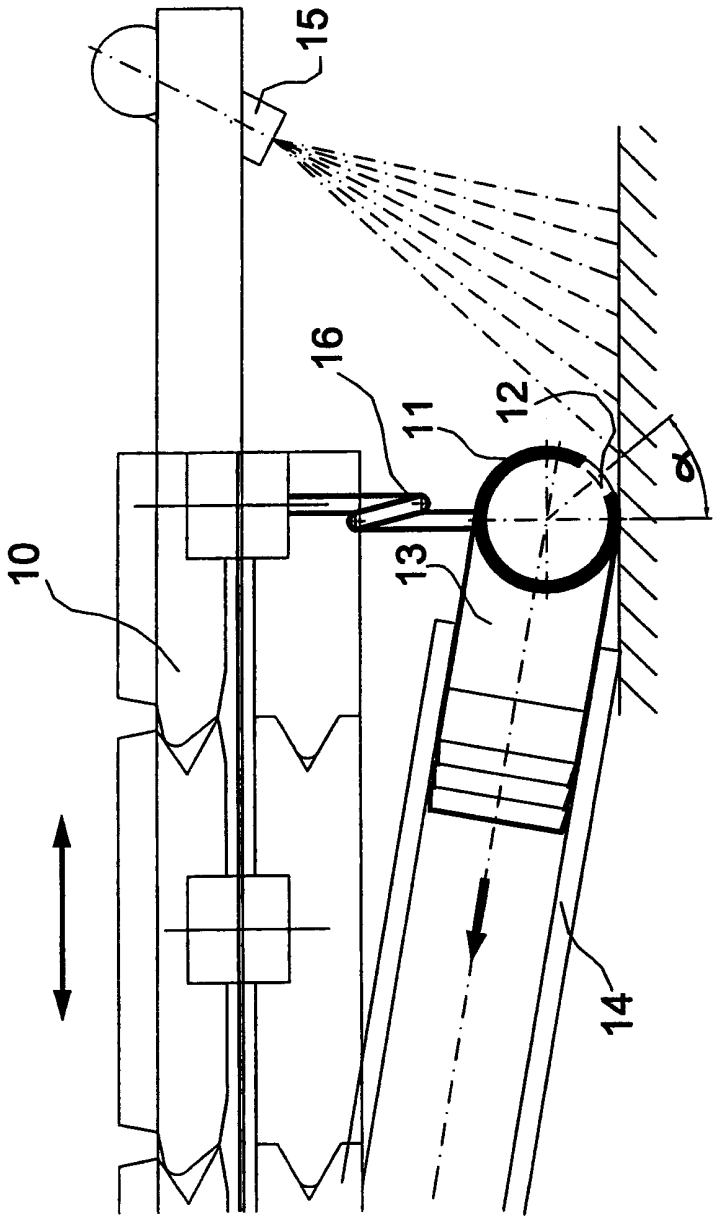


Fig. 3

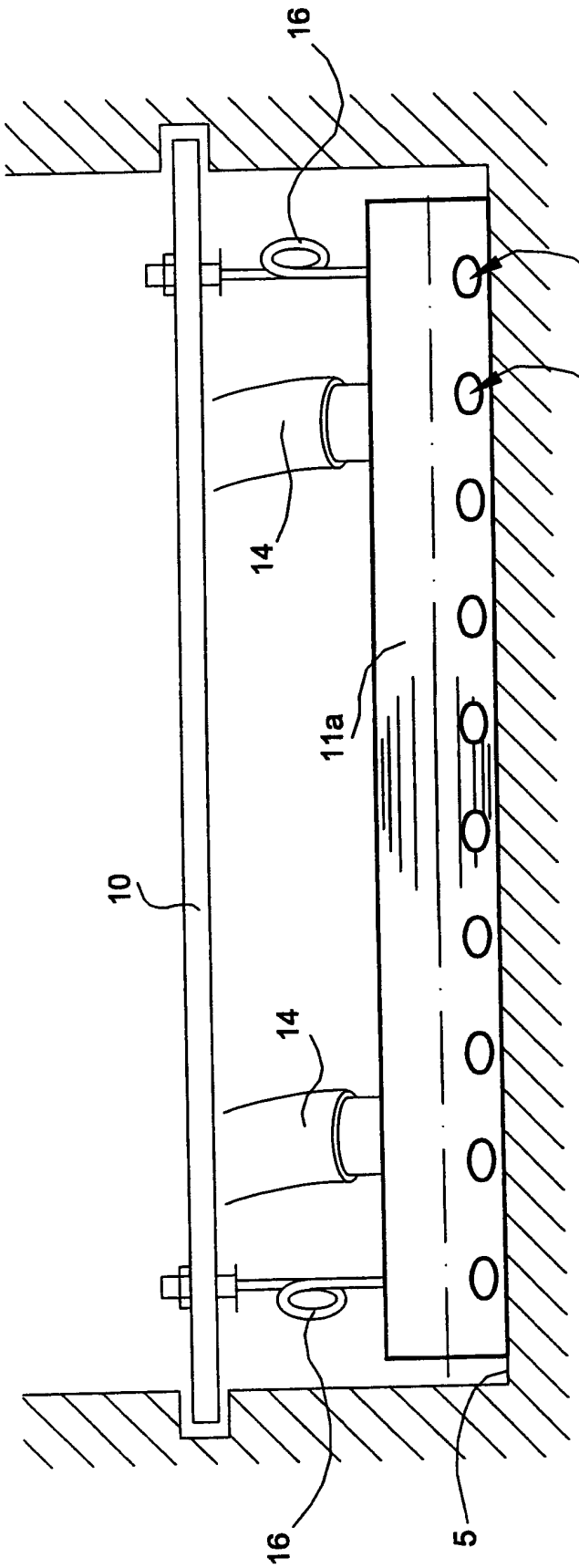


Fig. 4

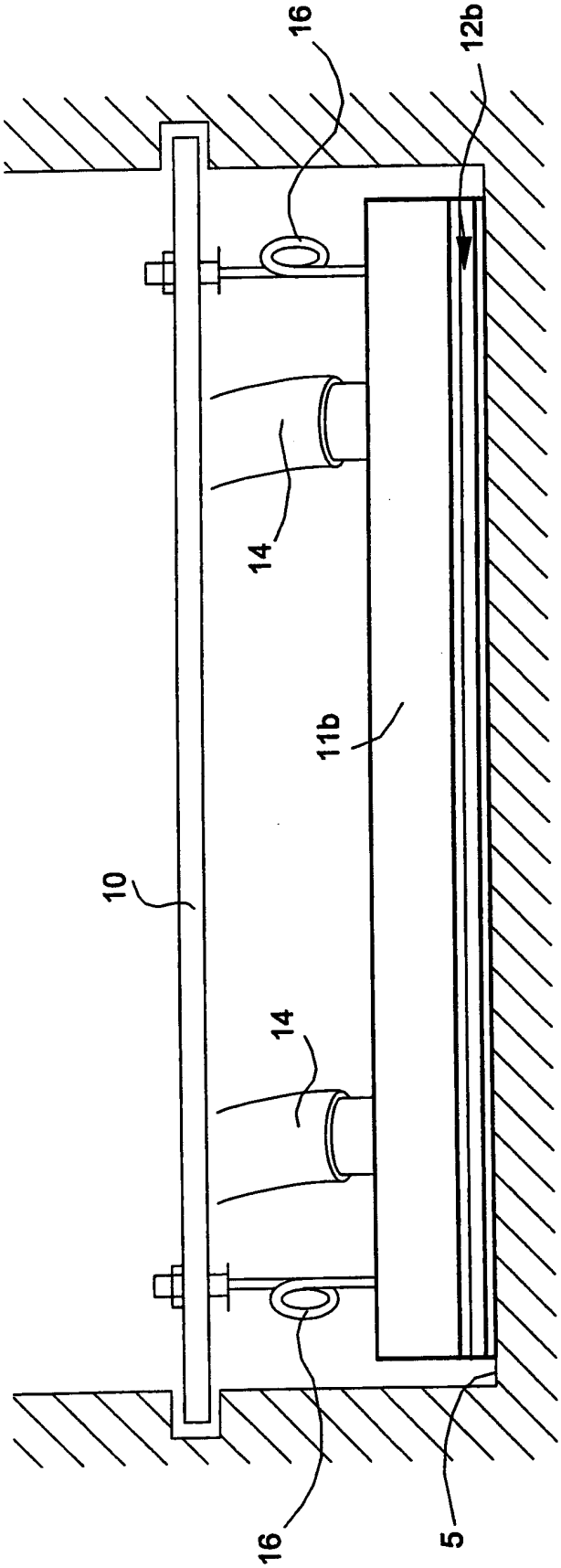


Fig. 5

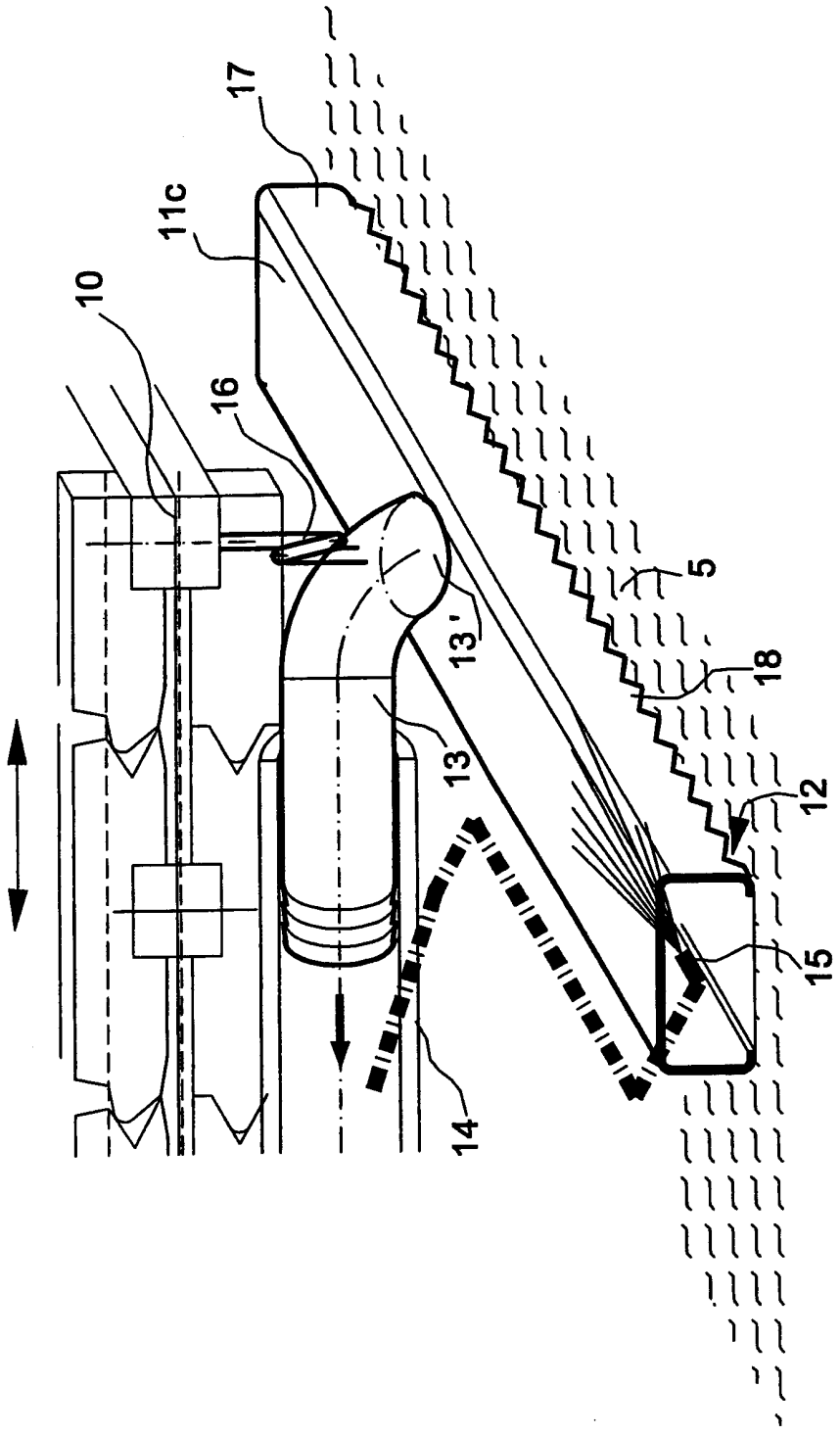


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00481

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: C25C 7/00, C25C 7/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: C25C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 3890214 A (SIGBJORN KLEVELAND), 17 June 1975 (17.06.75), column 1, line 21 - line 40; column 2, line 51 - line 66, figure 1, abstract --	1,9,11

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 Sept 2000	02 -10- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Ulrika Nilsson/MP Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

01/08/00

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