A flotation apparatus contains a lower portion of pulp and an upper portion of froth which drains over an upper horizontal edge of the apparatus. When the ore contains lead and zinc, lead contaminated with zinc will drain off. The object of the invention is to increase the lead content in the froth drained off. This is achieved by allowing the froth to drain upwardly through a channel, preferably one having rectangular cross section and having an angle of inclination less than 90° to the surface of the froth. The froth is also sprayed before it leaves the channel, with at least one jet of water directed towards the part of the channel wall located furthest away in relation to the drainage edge of the channel.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AT</td>
<td>Austria</td>
<td>FR</td>
<td>France</td>
<td>MR</td>
<td>Mauritania</td>
</tr>
<tr>
<td>AU</td>
<td>Australia</td>
<td>GA</td>
<td>Gabon</td>
<td>MW</td>
<td>Malawi</td>
</tr>
<tr>
<td>BB</td>
<td>Barbados</td>
<td>GB</td>
<td>United Kingdom</td>
<td>NL</td>
<td>Netherlands</td>
</tr>
<tr>
<td>BE</td>
<td>Belgium</td>
<td>GN</td>
<td>Guinea</td>
<td>NO</td>
<td>Norway</td>
</tr>
<tr>
<td>BF</td>
<td>Burkina Faso</td>
<td>GR</td>
<td>Greece</td>
<td>NZ</td>
<td>New Zealand</td>
</tr>
<tr>
<td>BG</td>
<td>Bulgaria</td>
<td>HU</td>
<td>Hungary</td>
<td>PL</td>
<td>Poland</td>
</tr>
<tr>
<td>BJ</td>
<td>Benin</td>
<td>IE</td>
<td>Ireland</td>
<td>PT</td>
<td>Portugal</td>
</tr>
<tr>
<td>BR</td>
<td>Brazil</td>
<td>IT</td>
<td>Italy</td>
<td>RO</td>
<td>Romania</td>
</tr>
<tr>
<td>CA</td>
<td>Canada</td>
<td>JP</td>
<td>Japan</td>
<td>RU</td>
<td>Russian Federation</td>
</tr>
<tr>
<td>CF</td>
<td>Central African Republic</td>
<td>KP</td>
<td>Democratic People's Republic of Korea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CG</td>
<td>Congo</td>
<td></td>
<td></td>
<td>SD</td>
<td>Sudan</td>
</tr>
<tr>
<td>CH</td>
<td>Switzerland</td>
<td>KR</td>
<td>Republic of Korea</td>
<td>SE</td>
<td>Sweden</td>
</tr>
<tr>
<td>CI</td>
<td>Côte d'Ivoire</td>
<td>KZ</td>
<td>Kazakhstan</td>
<td>SK</td>
<td>Slovak Republic</td>
</tr>
<tr>
<td>CM</td>
<td>Cameroon</td>
<td>LI</td>
<td>Liechtenstein</td>
<td>SN</td>
<td>Senegal</td>
</tr>
<tr>
<td>CS</td>
<td>Czechoslovakia</td>
<td>LK</td>
<td>Sri Lanka</td>
<td>SU</td>
<td>Soviet Union</td>
</tr>
<tr>
<td>CZ</td>
<td>Czech Republic</td>
<td>LU</td>
<td>Luxembourg</td>
<td>TD</td>
<td>Chad</td>
</tr>
<tr>
<td>DE</td>
<td>Germany</td>
<td>MC</td>
<td>Monaco</td>
<td>TG</td>
<td>Togo</td>
</tr>
<tr>
<td>DK</td>
<td>Denmark</td>
<td>MI</td>
<td>Mali</td>
<td>UA</td>
<td>Ukraine</td>
</tr>
<tr>
<td>ES</td>
<td>Spain</td>
<td>MN</td>
<td>Mongolia</td>
<td>US</td>
<td>United States of America</td>
</tr>
<tr>
<td>FI</td>
<td>Finland</td>
<td></td>
<td></td>
<td>VN</td>
<td>Viet Nam</td>
</tr>
</tbody>
</table>
FLOTATION APPARATUS FOR CONCENTRATING ORES

Various types of what are known as flotation apparatus are used when concentrating ores or separating various minerals. (Separated from gangue.) The concentrate should therefore be as clean as possible. This method is known as flotation.

Air and froth-former are added to the pulp in these apparatus, together with a flocculation reagent. It is this that alters the surface-active properties of the mineral particles so that they cling or adhere to air bubbles. The air bubbles then rise to the surface where they are taken care of in the froth formed. The apparatus presently in existence function well but can be made to function considerably better.

With a machine or apparatus according to the present invention the contents in the concentrate become considerably higher. The novelty of the invention is that the froth is not only allowed to drain off (as now), but is concentrated and then washed with water from a jet striking against an edge of the apparatus. A reaction occurs when the water encounters the bubbles in the froth. The mineral particles react to the water. (Atoms and Ions). The mineral particles are therefore separated by means of this reaction. The water jets act as a catalyst and cannot be compared with nozzles (now used in some apparatus).

CONCENTRATION

In the case of ore containing two different minerals such as lead and zinc, the ore is generally first concentrated to a co-concentrate, e.g. lead and zinc. Next comes the separation (of the different minerals). As pure a concentrate as possible of the two minerals is aimed at. Lead may not be lost to the zinc, for instance, while the
lead content in the lead concentrate shall also be as high as possible.

No zinc in lead concentrate

This is the difficult stage in concentration, the separation stage. Rather a lot of one mineral is often lost to the other mineral.

With an apparatus according to the invention, illustrated in the accompanying drawing, these contents can be considerably improved. The content is greatly improved already in the first stage of the separation, and is further improved in following stages (flotation apparatus).

In longitudinal direction the apparatus has two horizontal walls almost reaching each other (gap of 30 cm). The wall over which the concentrate will flow is inclined more than the other. This is in order to get the froth that has collected below the wall 2 up to the wall 1, continuing from there up to the cleaning process.

The wall 2 inclines steeply towards wall 1 and air pipes are therefore required below wall 2 enabling the air bubbles to be forced or blown up to the gap where cleaning takes place. The air pipes only blow in the froth (not in the pulp) with the object of keeping this wall free from splinters of wood, for instance, that might otherwise become lodged there.

The gap where the froth collects has an opening 30 cm wide. The froth from wall 2 thus passes over to wall 1 where cleaning takes place. Since the air bubbles follow the inclined walls cleaning takes place there. Cleaning of the bubbles is effected by a water jet 3 striking against a plate of hard rubber or ceramic, thereby expanding and flushing clean the froth located between wall 1 and wall 4.
The pressure of the water jet is not high (the pressure can be varied). Wall 4 has the same inclination as wall 1. Four water pipes are used for each apparatus. The water jet 5 can also be used on wall 4 to provide additional cleaning. Slimmer dimension. The use of water pipes minimizes the risk of their becoming clogged (often a problem). (Not to be compared with ordinary water nozzles). The dimension of the water pipes may vary according to the size of the apparatus. Water nozzles used in previous apparatus are unnecessary with this method.

The inclination of wall 4 is the same as for wall 1 so that a gap is formed and the froth can ascend easily after cleaning. The wall 6 is detachable to enable the apparatus to be opened for cleaning or repair work on the rotor, for instance. During operation the apparatus is almost entirely closed, only the gap being open.

The rotor 7 distributes air in the apparatus and causes currents in the pulp - necessary if the apparatus is to function and a froth bed be formed. Rotor dimensions vary from apparatus to apparatus depending on the size of the apparatus. The airflow 8 is controlled by a valve or tap. The level of the pulp 9 is controlled by slats which can be removed or replaced by more. The concentrate formed flows on the upper side of wall 2 which has an extension at the top to enable the concentrate to run down more easily for collection in a container 11.

The water jets 3 function not only to clean the froth bath, but also cause a reaction between different mineral particles so that they separate (when separation of minerals is the object). The PH value or degree of acidity also plays a part. A different PH value is required to separate several minerals from gangue. The water jet in the
apparatus must be exactly positioned in relation to the wall 1. The pipe through which the water jet is expelled is therefore made stepless so that the jet can be adjusted up or down. It must not be altered sideways. The pipe is fitted straight against wall 1.

The reaction with the water give the bubbles with the concentrate great acceleration upwards.

The following indicates which components in the apparatus the designations in the drawings refer to.

1 Wall
2 Wall
3 Water jet
4 Wall
5 Water jet
6 Detachable part
7 Rotor
8 Air
9 Pulp
10 Concentrate
11 Concentrate collection container
12 Water pipe
13 Motor
14 V-belt drive
15 Bearing housing
CLAIMS

1. A device in a flotation apparatus so constructed that a lower portion of pulp is obtained in a container, said pulp preferably containing the minerals zinc and lead, and an upper portion of froth which drains over an upper edge of the container, characterised in that the container has an upper wall consisting of two parts (1 and 2) that are directed inwardly, i.e. are inclined towards each other to form an opening, a first part (1) extending past the opening and forming a wall part outside the opening and the free end of a second part (2) being provided with an upwardly directed wall part opposite the exterior wall part of said first part (1) to form a channel, one or more water jets also being directed towards said exterior wall part (1) in the channel and the upper edge of the upwardly directed wall part of said second part (2) acting as drainage edge.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: B03D 1/14
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)

IPC5: B03D

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

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>US, A, 5039400 (JOUKO O. KALLIOIINEN ET AL), 13 August 1991 (13.08.91), column 3, line 13 - line 17, figures 1,2, abstract</td>
<td>1</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C. 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
  - "B" earlier document but published on or after the international filing date
  - "C" 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)
  - "D" document referred to in the context of priority claims
  - "P" document published prior to the international filing date but later than the priority date claimed

- 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

- 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

- 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: 3 May 1993

Date of mailing of the international search report: 10 -05- -1993

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
Ulf Nyström
Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SE-A- 8803386</td>
<td>08/04/89</td>
</tr>
</tbody>
</table>