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 Device for separating solids from liquids by means of flotation

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DEVICE FOR SEPARATING SOLIDS FROM LIQUIDS BY MEANS OF FLOTATION

ABSTRACT

The invention relates to a device for separating solids from liquids by means of flotation, particularly for separating impurities and ink particles
5 from fibre suspensions, with several injectors 10, which are provided inside a flotation cell 1. It is mainly characterised by the injectors 10 being arranged in one row.

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COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

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Invention Title:

Device for Separating Solids from Liquids by Means of
Flotation

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

DEVICE FOR SEPARATING SOLIDS FROM LIQUIDS BY MEANS OF FLOTATION

The invention relates to a device for separating solids from liquids by means of flotation, particularly for separating impurities and ink particles from fibre suspensions, with several injectors, which are provided inside a flotation cell.

- 5 Deinking flotation is a mechanical process for separating impurities and ink particles from fibre suspensions, particularly those produced in waste paper treatment. This process is linked to generating a suitable amount of gas bubbles over an appropriate range of bubble sizes. By changing the gas-liquid flows and the distribution of bubble sizes, ores, etc. can also be
10 separated from low-grade, unusable material. A similar principle is applied in solid-liquid separation, e.g. in waste water.

Hydrophobic solids or such solids as ink particles or stickies (e.g. also coal as accept material) that have been made hydrophobic by applying
15 surface-active substances are carried to the surface of the liquid by the gas bubbles adhering to them and can then be removed there as foam.

In the pulp and paper industry, this method of using self-priming injectors – mainly comprising a propulsion jet nozzle, mixing pipe or impulse
exchange chamber and diffuser – has proved successful in generating
gas bubbles and mixing them into the pulp suspension. These individual
20 diffusers are usually assembled in small, round diffuser units (up to 12 individual diffusers). At the exit from the diffuser used for energy recovery a fibre stock bubble dispersion forms.

Processes of this type are known in numerous geometric modifications, e.g. from DE 41 16 916 C2, EP 0 211 834 B1 or AT 408 957, and have
25 reached a high technical standard. Nevertheless, two disadvantages arise when using this process in large-scale industrial applications:

The suction effect of the diffuser units known suffers negative influence if there are eight injectors per unit or more because some of the injectors on the inside have a shorter supply of gas due to the injectors surrounding

them. As a result of this short supply, there is a lower overall gas loading, which can lead to the propulsion jet being scattered. This reduces the operating reliability and/or the desired distribution of bubble sizes widens, which leads to a drop in efficiency in selective flotation or to higher losses.

- 5 The aim of the invention is thus to put together flotation cells that operate independently of the number of injectors, with the same suction effect and optimum bubble size distribution for each individual injector, for use in flotation, mainly in deinking and waste water applications.

The invention is thus characterised by *the injectors being arranged in one*
10 *row*. This provides efficient and easy gas access, which is present to the same extent for each individual nozzle. This applies to all injectors or nozzles regardless of the number of suction points.

If, this leads to favourable placement of the injectors within the flotation cell, distributed over the surface area, and thus to a better overall flow
15 concept.

In an advantageous embodiment the rows are arranged in axial direction in the flotation cell. As a result, this achieves an even flow of foam over the entire cell length in the direction of the overflow weir. Furthermore, the accept or pulp to be aerated again can be removed by suction while
20 largely avoiding short circuit flows.

In a flotation cell with a foam channel, the injector rows are arranged on the side of the flotation cell opposite the foam channel, which ensures complete flow through the entire flotation cell.

It has proved particularly advantageous if the injector rows are arranged in
25 the middle of the flotation cell if there are two foam channels. This guarantees even loading of the overflow weirs and foam channels.

The invention will now be described using the examples in the drawings, where Fig. 1 shows a diagram of how the invention is applied, Fig. 2 shows a variant of the invention, Fig. 3 illustrates how a variant of the

invention is installed, Fig. 4a contains a flotation cell embodiment according to the invention with one foam channel and Fig. 4b a flotation cell embodiment according to the invention with two foam channels, Fig. 4c illustrates an embodiment of a flotation cell according to the invention with three foam channels, and Fig. 5 shows a further embodiment according to the invention.

Figure 1 shows a diagram of a flotation unit in which the device according to the invention is installed. The flotation cell 1 is filled for the most part with suspension 2, on the surface 3 of which a layer of foam 4 forms, containing as large a portion as possible of the impurities and ink particles to be removed by flotation. The foam 4 can drain off through a foam channel 5 as overflow U. The fibre stock suspension S enters cell 1 through the nozzle unit (injector bundle) 6. The dispersion of bubbles and fibre stock leaves the diffuser 9 after impinging on an impact plate 8. The bubbles adhere to the hydrophobic impurities and carry them to the surface 3. The cleaned suspension leaves the flotation cell as accept G.

In Fig. 2 a diagram illustrates a possible variant of a line diffuser bundle 6 according to the invention, each with 6 individual injectors 10. In this case, the number of injectors can be varied and the requirements adapted hydraulically or according to production. If the air is offered to the open jet as evenly as possible from all sides at the lowest possible pressure loss in the first injector part, the line arrangement provides a correspondingly even distribution of bubbles in the blow-out sector of the injector impact plate. There is a much lower agglomerating tendency by the bubbles in the impact and blow-out sector of the injector units, and the narrow bubble size distribution generated can also be retained into the flotation sector thanks to the more favourable flow path after the mixing chamber, leading into the impact chamber and blow-out sector. Thus, overall aeration can be performed in a more favourable bubble size spectrum – avoiding fine bubbles but without the risk of larger bubbles agglomerating. The width of

distribution and the selective setting for optimum coverage of the desired impurity grain size is thus maintained.

Figure 3 illustrates installation of a device according to the invention as a line injector bundle 6 in a flotation unit 1, where the plant can be operated at any desired high throughput. The illustration shows two consecutive cells, n and $n+1$. By increasing the length of the overflow weirs 11, the specific overflow speed of the pulp to be flotated can be reduced. In order to ensure even loading of the overflow weirs 11, the line diffusers 6 are installed in a central position in relation to the suspension surface 3. The diffuser bundles 6 can be arranged such that the suspension flows into the flotation chamber from above, from the side, or from below.

Figures 4a, 4b and 4c show a horizontal projection of two consecutive cells in each case, with different arrangements of injector blocks 6. Straddling the module diffusers in axial direction requires on the one hand an even flow of foam over the entire cell length towards the overflow weir 11, and on the other hand, the accept or the stock to be aerated again can be removed by suction while largely avoiding short-circuit flows. In this way the fibre stock losses can be reduced. The device according to the invention is also capable of introducing more air and thus improves removal of impurities. Figure 4a shows a flotation cell 1 with a foam channel 5, where the diffuser blocks 6 are arranged here at the side 12 facing the overflow channel 5. In flotation cells 1 with two foam channels 5, as shown in Fig. 4b, the diffuser blocks 6 are arranged in the middle so that there is an even flow of foam on all sides and with short flow paths. The variant in Fig. 4c shows two parallel flotation cells which have three foam channels 5, where the two cells can also be mounted one behind the other, however this is used preferably to increase the throughput as a parallel arrangement.

Figure 5 now shows an arrangement of the injector blocks 6 in a way that the flow 13 of suspension through the flotation cells is deflected through

the injector blocks 6 in the direction 13', which thus extends the flow path and with it, the retention time. Here, one or more injector blocks 6 can be arranged in one flotation cell 1. In Fig. 5, the broken line 14 indicates that it is possible to divide individual flotation cells.

The claims defining the invention are as follows:

1. Device for separating solids from liquids by means of flotation,
particularly for separating impurities and ink particles from fibre
5 suspensions, with several injectors, which are provided inside a
flotation cell, characterised by the injectors (10) being arranged in one
row.
2. Device according to Claim 1, characterised by several rows of
injectors, preferably two to four, being combined in a block (6).
- 10 3. Device according to Claim 1 or 2, characterised by the rows being
arranged in the flow direction of the suspension through the flotation
cells, particularly in axial direction, inside the flotation cell (1).
4. Device according to Claim 3, characterised by the injector rows (6)
being arranged on the side (12) of the flotation cell (1) opposite the
15 foam channel (5) in a flotation cell (1) with a foam channel (5).
5. Device according to Claim 3, characterised by the injector rows (6)
being arranged in the middle of the flotation cell(s) (1) in a flotation cell
with two foam channels (5) or more.
6. Device according to Claim 1 or 2, characterised by the injector blocks
20 for flow control (6) being located inside the flotation cell (1) or flotation
cells (1).
7. A device for separating solids from liquids substantially as hereinbefore
described with reference to any one of the embodiments as that embodiment is shown in
the accompanying drawings.

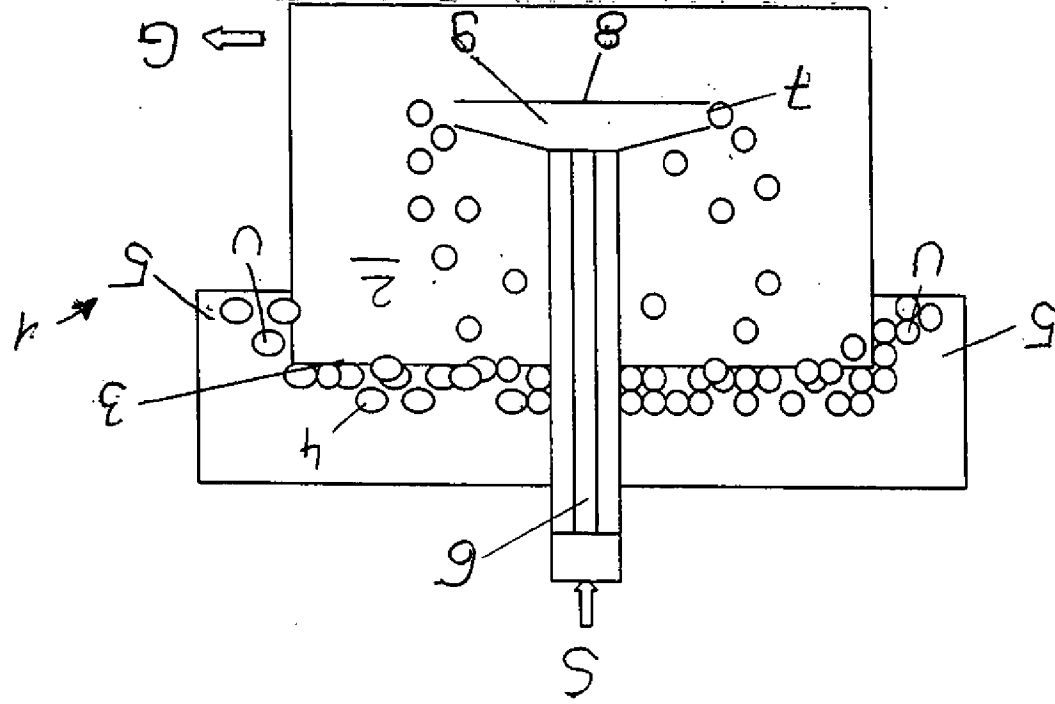
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Fig. 1



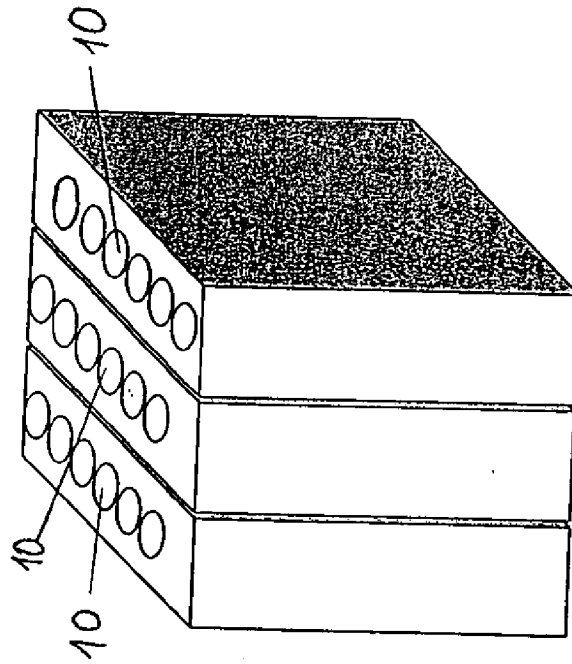


Fig. 2

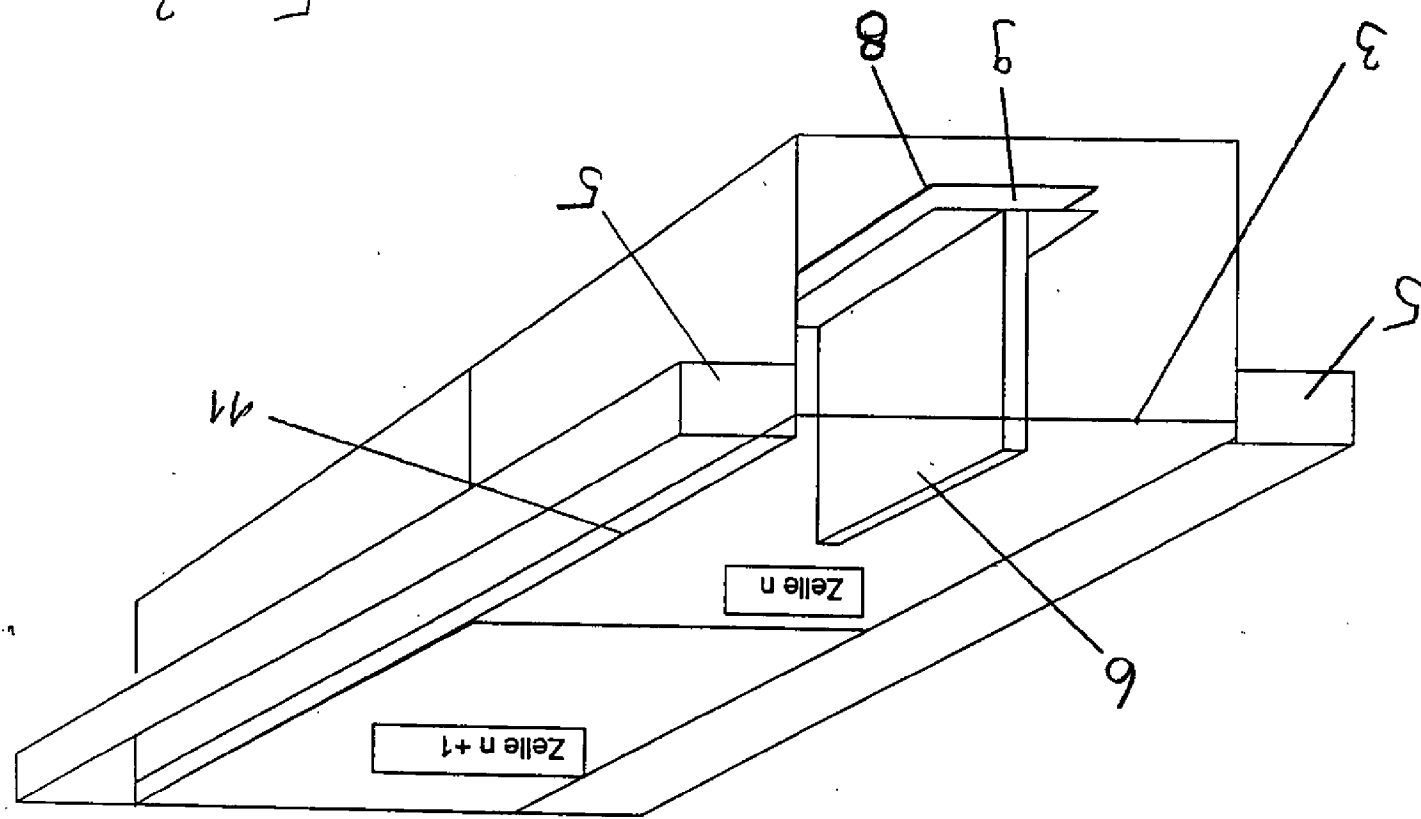


Fig. 3

Fig. 4a

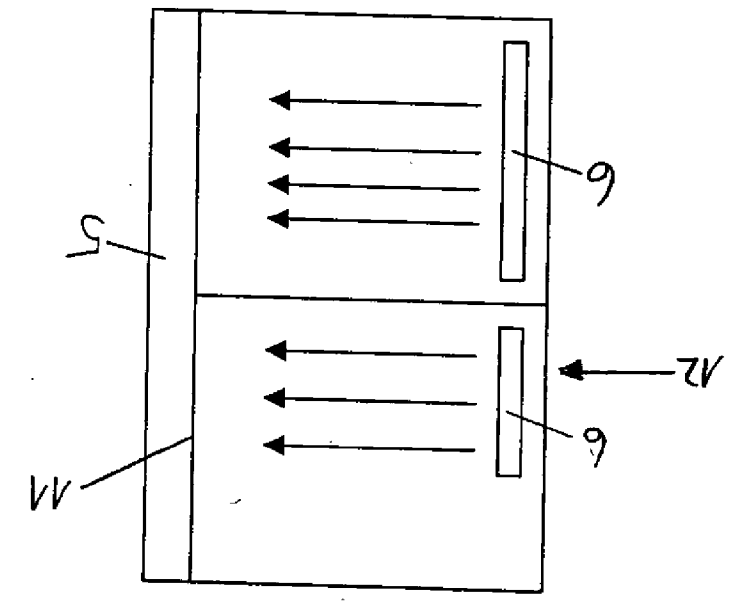
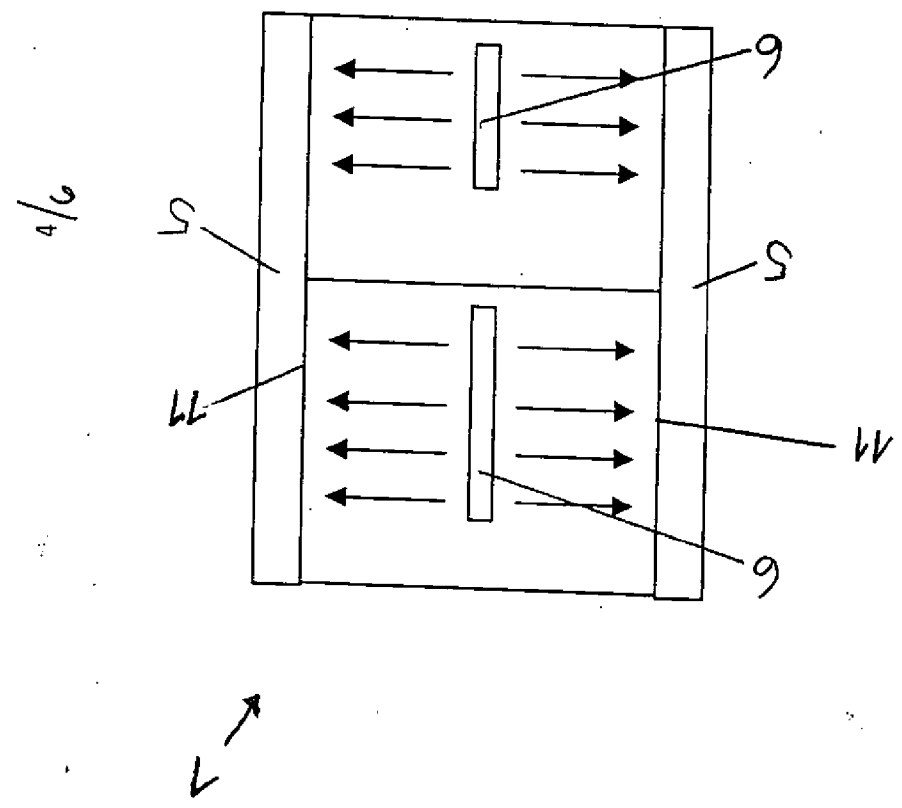


Fig. 4b



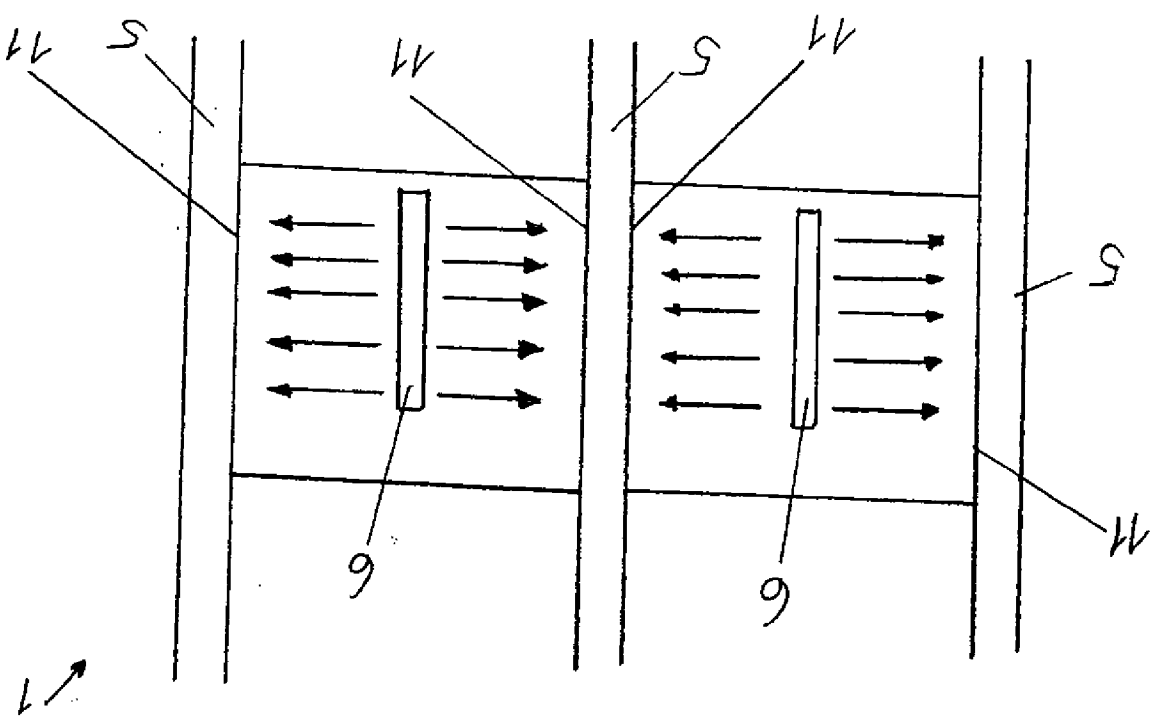


Fig. 4c

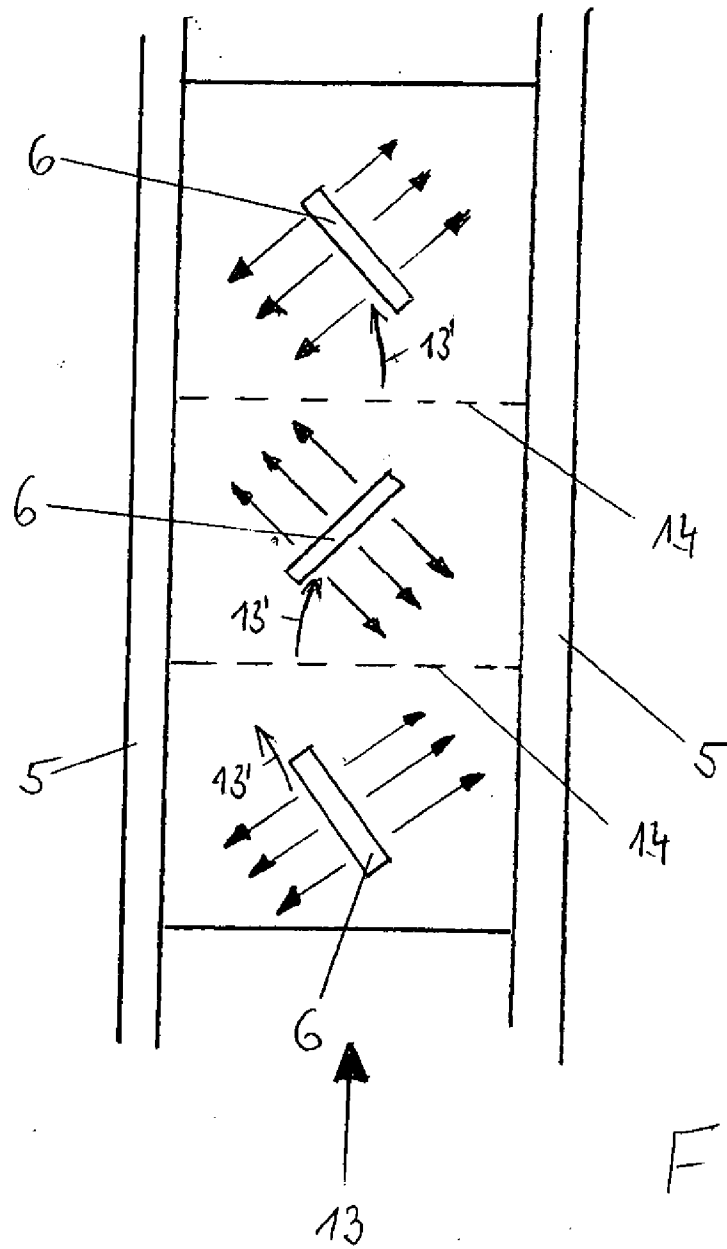


Fig. 5