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(54) **Method, screen and plansifter for sifting products having different particle sizes**

(57) A plansifter sieve that has a first cloth (21) with a given mesh size and at least one second cloth (22) with a finer mesh than the preceding cloth. This provides a method for sifting products having different particle sizes, particularly cereals, in a plansifter that includes at least one channel constituted by sets of mutually stacked sieves; according to the method, the separation of part of the product with fine particle size occurs already in the first sets of sieves of the at least one chan-

nel. By way of the sieve and the method according to the present invention, for an equal flow-rate of product that can be processed by a channel with sufficient screening efficiency it is possible to reduce the overall dimensions of the plansifter and ultimately the masses to be subjected to the planar rotary motion. Conversely, for equal dimensions of the plansifter, the invention allows to process a larger flow-rate of product than allowed with known equipment in this field provided with single-cloth sieves.

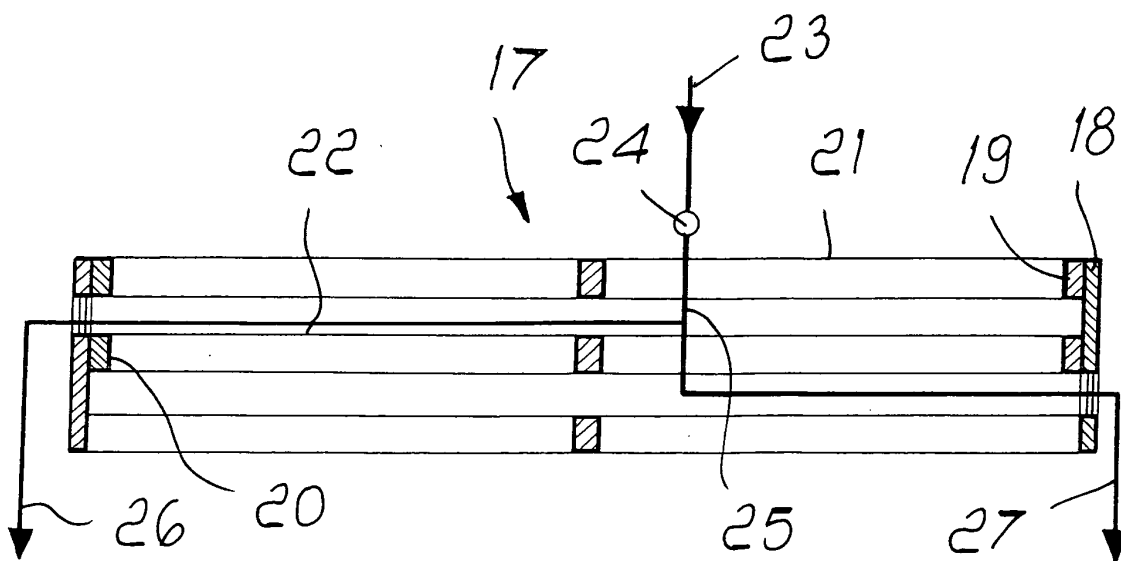


Fig. 4

Description

[0001] The present invention relates to a new method for sifting products having different particle sizes, particularly cereals. The invention also relates to the plansifter sieve for performing the method and to the plansifter provided with the sieve.

[0002] The field of the invention is the field of equipment used in milling to separate, by different particle size, fine products (flour, semolina, et cetera) obtained by milling cereals such as maize, wheat, et cetera, from the by-products having a larger particle size (bran and the like). For the purposes of the present invention, the expression "fine-grained products" is used to designate flours having generally a particle size of less than 200 microns and semolinas having generally a particle size of less than 450 microns.

[0003] These devices are constituted in particular by plansifters, i.e., by a set of sieves stacked inside cabinets, which are in turn subjected to a planar rotary motion in order to obtain throughs (the fraction that passes through the cloths of the sieves) and a reject which is separated at the level of the fabric or of the cloth that composes each sieve.

[0004] Actually, the plansifter is a machine that contains at least one channel-like column of sieves and has a means suitable to keep the column under planar circular oscillation. In this manner, the flow of the material to be sifted on the screening surfaces of the frames (or cloths), and therefore the separation action for which they are intended, are ensured. The cloths of the frames of the sieves of each generic channel, moreover, are generally arranged in decreasing order: the first sieves (i.e., the uppermost ones) of the generic channel have cloths with larger mesh apertures than the subsequent sieves.

[0005] In order to be able to screen the entire stream entering the channel according to the chosen particle sizes, it is necessary to have, for each particle size, a plurality of sieves that have a specific mesh aperture. The sieves of a channel that have the same mesh aperture constitute a "sieve set".

[0006] The generic channel of a plansifter is loaded at the top with products that arrive from one or more milling passes, while the reject and the throughs of the various sieves are conveyed, by using the spaces between the walls of the cabinet and the stack of sieves, either onto lower sieves or toward subsequent milling passes, according to what is specified in the functional diagram. Accordingly, the stream of product entering the channel is divided over the various sieve sets.

[0007] Conventional devices of the type described above have the drawback that for an equal flow-rate of product that can be processed by a channel (i.e., the plurality of sieves stacked inside a cabinet), they are significantly bulky. This bulk in turn has a negative effect on the maximum potential that can be obtained within a building of a given size. Moreover, the large volumes involved by the above described known devices require considerable forces to move the mass of the sifter and undergo equally considerable stresses affecting their structure.

[0008] Plansifters that use sieves with frames that have a larger than usual screening surface have been devised with the goal of overcoming the above noted drawbacks. This solution has already been provided by the leading manufacturers of milling machines but is not free from drawbacks. Structural reasons (stresses) in fact prevent any increase, beyond a certain limit, of the dimensions of the cabinets inside which the channels are accommodated. Moreover, the reduction in the number of sieves required, due to the use of frames having a larger than normal surface, is partially and negatively compensated by a larger footprint of each individual cabinet.

[0009] Another known solution consists in reducing the height of the sieve, by using a single component that acts simultaneously as an ejector of the throughs and as a gasket cleaner. This solution allows to save approximately 14% of the space available in each channel (i.e., it is possible to insert 32 sieves in a channel instead of the usual 28), but it is not feasible for expanding existing facilities unless all the sieves of the various channels are replaced.

[0010] The aim of the present invention is to provide a screening method and a plansifter sieve that are suitable to minimize the total number of sieves and accordingly the number of channels of the sifter while complying with the design constraints imposed by the type of cereal and by the type of finished product to be obtained.

[0011] This aim and other objects are achieved with the method, the sieve and the plansifter according to claims 1, 5 and 8 respectively. Preferred embodiments of the invention are defined in the remaining claims.

[0012] With respect to known embodiments, the method and the plansifter according to the invention offer the advantage that by delegating part of the finer separation also at the level of the first screens of the channel, the streams of product to be conveyed toward the subsequent sieve sets are reduced, and this entails a corresponding reduction in the number of these sets. In this manner, for an equal flow-rate of product that can be processed by a channel with sufficient screening efficiency, according to the invention it is possible to reduce the overall dimensions of the plansifter and ultimately reduce the masses to be subjected to the planar rotary motion. Conversely, for equal dimensions of the plansifter the invention allows to process a greater flow-rate of product than allowed by known devices in the field provided with single-cloth sieves.

[0013] This aim and these and other objects, advantages and characteristics will become better apparent from the description that follows of a preferred embodiment of the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a view of an example of plansifter according to the invention, showing the sieves of one channel;
 Figure 2 is a perspective view of a sieve according to the prior art, of the type with a single cloth;
 Figure 3 is a view of the path of the stream of throughs inside a channel of the plansifter provided with the sieves according to Figure 2;
 Figure 4 is a sectional view of the double-cloth sieve according to the invention; and
 Figure 5 is a view of the path of the stream of throughs inside a channel of the plansifter according to the invention.

[0014] The plansifter of Figure 1, generally designated by the reference numeral 1, is composed of a plurality of cabinets 2, inside each of which a channel 3 constituted by a stack of sieves 4 is accommodated. This set of cabinets 2 is suspended from a support 5 by means of rods 6 and is subjected to a planar rotary motion by way of eccentric masses (not shown). There are also sleeves 7 and 8 respectively for loading the material to be screened and for discharging the screened material.

[0015] The conventional sieve 12, shown in Figure 2, is composed of a peripheral structure 9 that supports a frame 10, over which the screening mesh or cloth 11 of the sieve is stretched and fixed. The assembly of the sieves 12 in the channel 13 of Figure 3 produces a path of the stream of throughs (i.e., of the fine product whose particle size is smaller than the aperture of the mesh of the cloth 11) that is generally designated by the reference numeral 14. In this channel, the throughs that pass through the cloths 11 of the upper sets of sieves is processed further in the subsequent sets of sieves, with a cascade configuration, until it exits entirely from one of the outlets of the bottom 16 of the channel.

[0016] The double-cloth sieve 17 according to the invention shown in Figure 4 is constituted by a peripheral structure 18 and by two frames, designated by the reference numerals 19 and 20 respectively, each of which supports a corresponding cloth 21 that has a given mesh aperture and a cloth 22 that has a smaller mesh aperture than the preceding cloth.

[0017] The initial product (the stream 23 entering the sieve 17) is divided into a stream 25 of the throughs of the first cloth 21 and into a stream 24 of the reject of the same cloth, whose direction is perpendicular to both streams 23 and 25 (i.e., with reference to Figure 4, it exits from the page). The stream 25 of throughs of the first cloth is in turn divided into a stream 26 of the reject of the second cloth 22 and into a stream 27 of throughs of the second cloth.

[0018] In particular, the following items exit from the sieve 17:

- a reject of the first cloth, formed by a stream 24;
- a reject of the second cloth, formed by a stream 26, which is conveyed to the subsequent sets of sieves; and
- throughs of the second cloth, constituted by a stream 27 that is extracted from the channel without being added therefore to the stream of material directed toward the subsequent sieves.

[0019] It is evident that in this manner the amount of material to be processed in one or more sets of underlying sieves is smaller than the amount in the channel that uses the single-cloth sieves 12, i.e., the known kind of sieves.

[0020] This circumstance can be noticed more clearly in the channel of Figure 5, which includes three sets 28, 29 and 30 of single-cloth sieves 12 according to the prior art, and a set 31 of double-cloth sieves 17 according to the invention.

[0021] As shown in this figure, the throughs are extracted directly from the individual sieves 17 of the set 31 (streams 27a, 27b, 27c et cetera, respectively). In this manner, the sieves of subsequent sets 29 and 30 receive an initial quantity minus the preceding streams 27a, 27b, 27c et cetera.

[0022] The invention as described above and as illustrated can be provided according to several variations. For example, the succession of the various sets of sieves might be different from the one shown in Figure 5. Moreover, the sieves 17 are equipped with the conventional means for cleaning the cloths and for expelling the throughs 27.

[0023] The example summarized in the tables that follow shows that for an equal height of the channel (1830 mm) and for an equal channel footprint (cloths with a surface of 0.307 m²), the embodiment of Figure 5 (which includes a set of double-cloth sieves according to the invention) entails a 20.83% increase in the total available screening surface with respect to the surface that would be provided with the embodiment according to Figure 3 (which includes only single-cloth sieves).

TABLE 1:

Embodiment according to Figure 5				
Sieve number	Gasket dimensions (μm)	Sieve height (mm)	Spacer height (mm)	Total height (mm)
1	1400	70	30	100
2	1400	70	20	90
3	1400	70	20	90

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TABLE 1: (continued)

Embodiment according to Figure 5				
Sieve number	Gasket dimensions (μm)	Sieve height (mm)	Spacer height (mm)	Total height (mm)
4	1400	70	20	90
5	1400	70	30	100
6	1400	70	20	90
7	1400	70	20	90
8	1400	70	--	70
9	630	95	--	95
10	132	95	--	95
11	630	95	--	95
12	132	95	--	95
13	630	95	--	95
14	132	95	--	95
15	630	95	--	95
16	132	60	--	60
17	132	60	--	60
18	132	60	--	60
19	132	60	--	60
20	425	60	--	60
21	425	60	--	60
22	425	60	--	60
23	425	60	--	60
--Total channel height = 1830 mm -- Screening surface per sieve = 0.307 m ² /single-cloth sieve = 0.614 m ² /double-cloth sieve -- Screening surface of channel = 17 x 0.307 + 6 x 0.614 = 8.903 m ²				

TABLE 2:

Embodiment according to Figure 3				
Sieve number	Gasket dimensions (μm)	Sieve height (mm)	Spacer height (mm)	Total height (mm)
1	1400	70	30	100
2	1400	70	20	90
3	1400	70	20	90
4	1400	70	20	90
5	1400	70	30	100
6	1400	70	20	90
7	1400	70	20	90
8	1400	70	--	70
9	630	70	10	80
10	630	70	10	80
11	630	70	10	80

TABLE 2: (continued)

Embodiment according to Figure 3				
Sieve number	Gasket dimensions (μm)	Sieve height (mm)	Spacer height (mm)	Total height (mm)
12	630	70	10	80
13	630	70	10	80
14	630	70	10	80
15	132	70	--	70
16	132	70	--	70
17	132	70	--	70
18	132	60	--	60
19	132	60	--	60
20	425	60	--	60
21	425	60	--	60
22	425	60	--	60
23	425	60	--	60
-- Total channel height = 1830 mm -- Screening surface per sieve = 0.307 m ² /sieve -- Screening surface of channel = 24 x 0.307 = 7.368 m ²				

Claims

1. A method for screening products having different particle sizes, particularly cereals, in a plansifter comprising at least one channel constituted by sets of mutually stacked sieves, **characterized in that** it provides for the separation of part of the product having a fine particle size already in the first sets of sieves of said at least one channel.
2. The method according to claim 1, **characterized in that** at at least one sieve (17) at least two throughs (26, 27) and at least one reject (24) are separated, said throughs and said reject all having different particle sizes.
3. The method according to claims 1 or 2, **characterized in that** for an equal flow-rate of product fed into said at least one channel, the number of sieves that compose said channel is smaller than in the channel formed only by single-cloth sieves.
4. The method according to claims 1 or 2, **characterized in that** for an equal number of sieves in said at least one channel, the flow-rate of product processed in the same channel is greater than the flow-rate processed in a channel formed only by single-cloth sieves.
5. The plansifter sieve for performing the method according to one or more of the preceding claims, **characterized in that** it has a first cloth (21) with a given mesh size and at least one second cloth (22) with a finer mesh than the preceding cloth.
6. The sieve according to claim 5, **characterized in that** it has corresponding frames (19, 20) for supporting said cloths (21, 22).
7. The sieve according to claim 6, **characterized in that** said first cloth (21) separates first throughs (25) from a first reject (24), and **in that** said at least one second cloth (22) separates throughs (27) from a second reject (26), the stream of said second throughs (27) being extracted from the channel to which said sieve (17) belongs without being processed in the subsequent sieves of the same channel.
8. The plansifter for separating cereals by particle size, **characterized in that** it comprises at least one channel (3) provided with at least one sieve (17) according to one or more of claims 5 to 7.
9. The plansifter according to claim 8, **characterized in that** it has at least one set (31) that comprises at least one sieve (17).

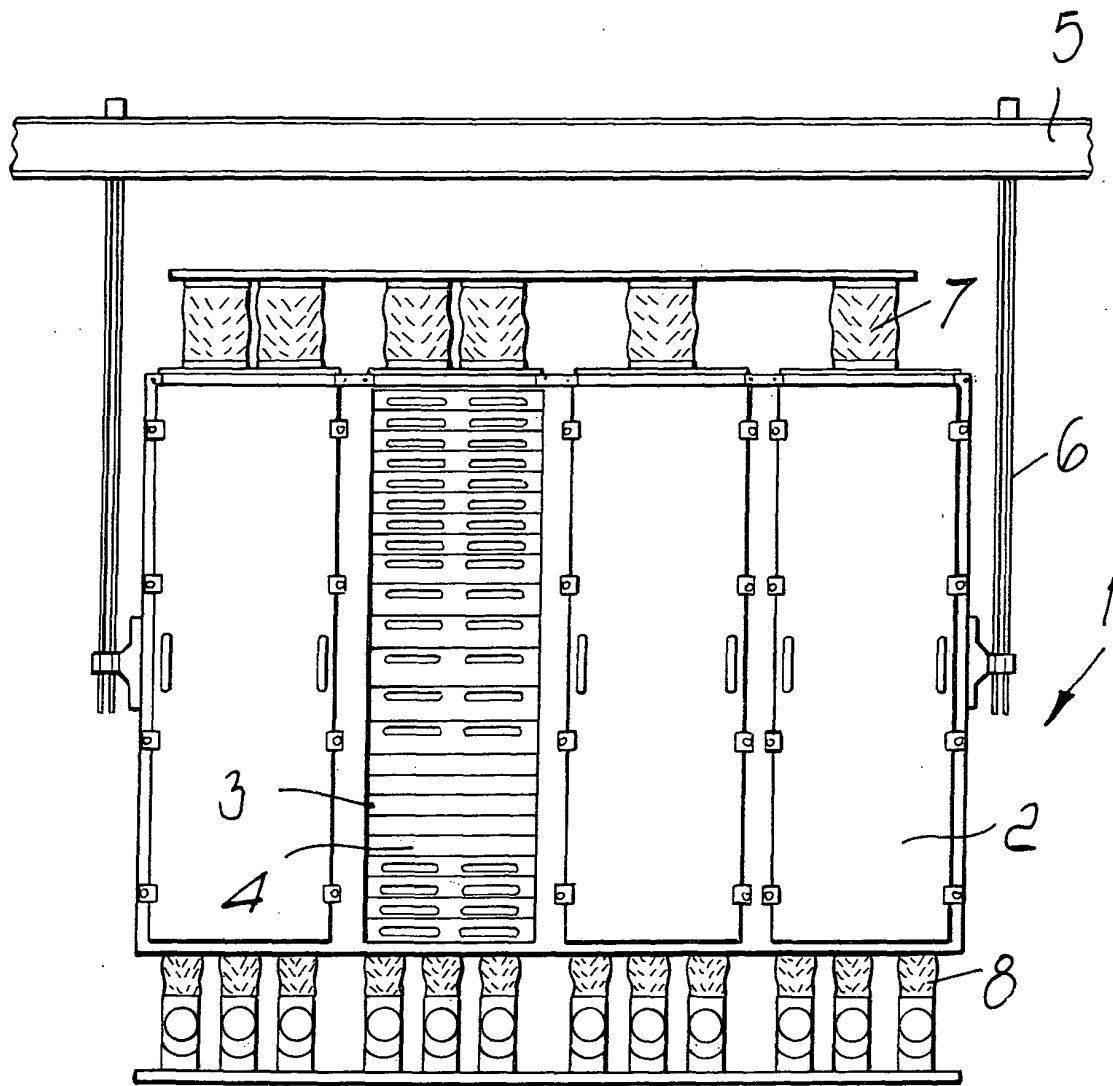
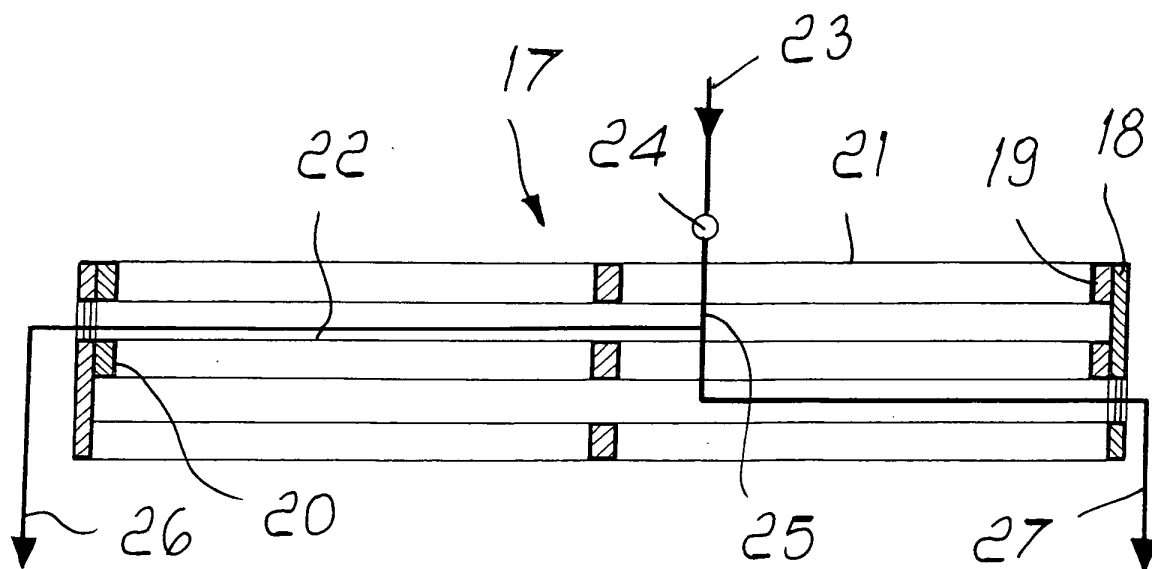
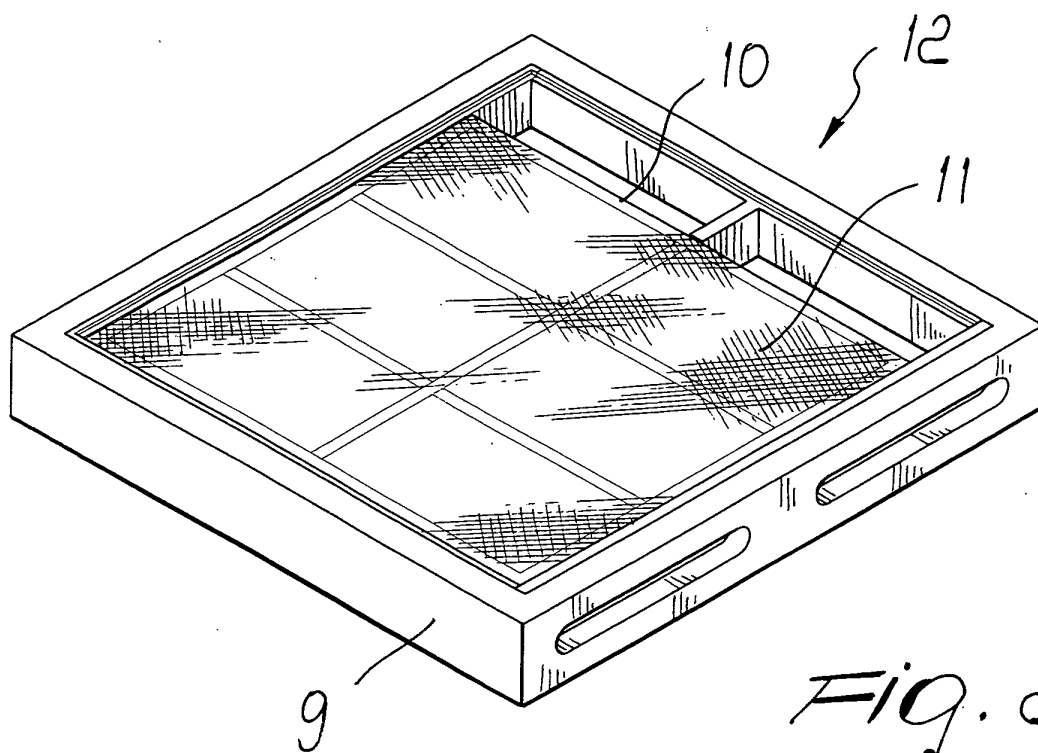


Fig. 1



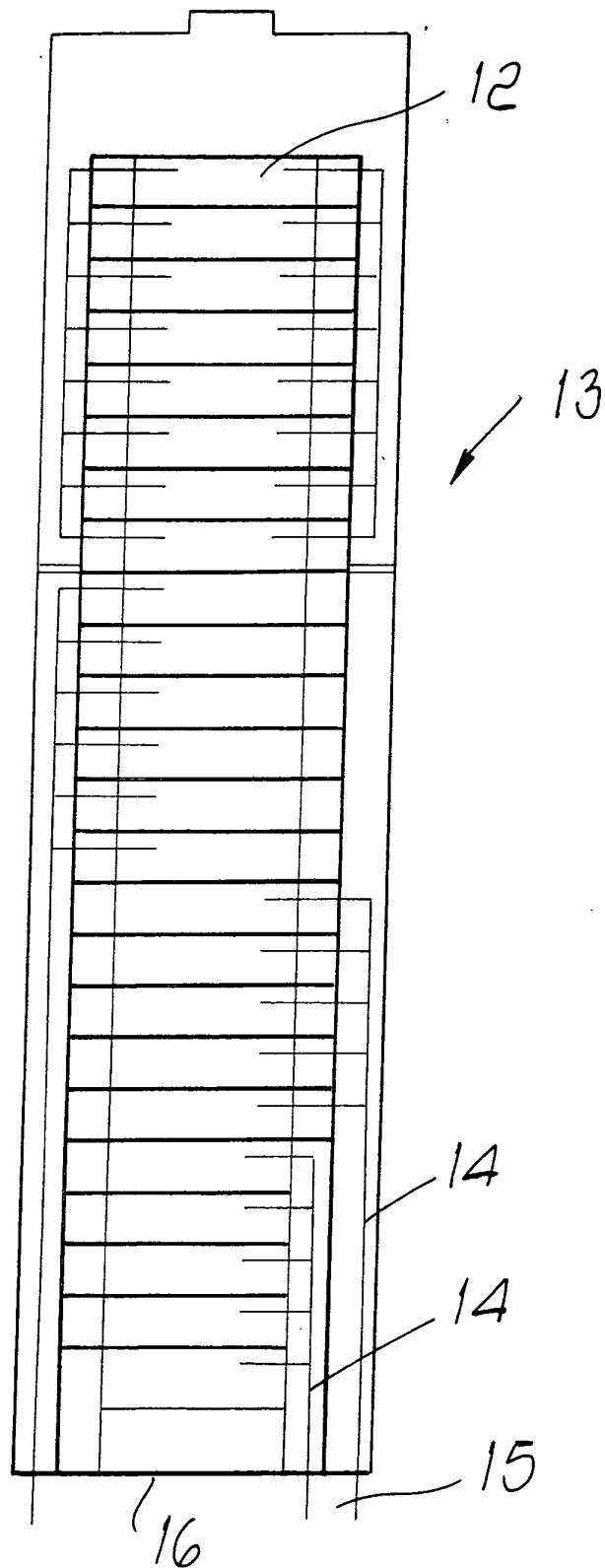


Fig. 3

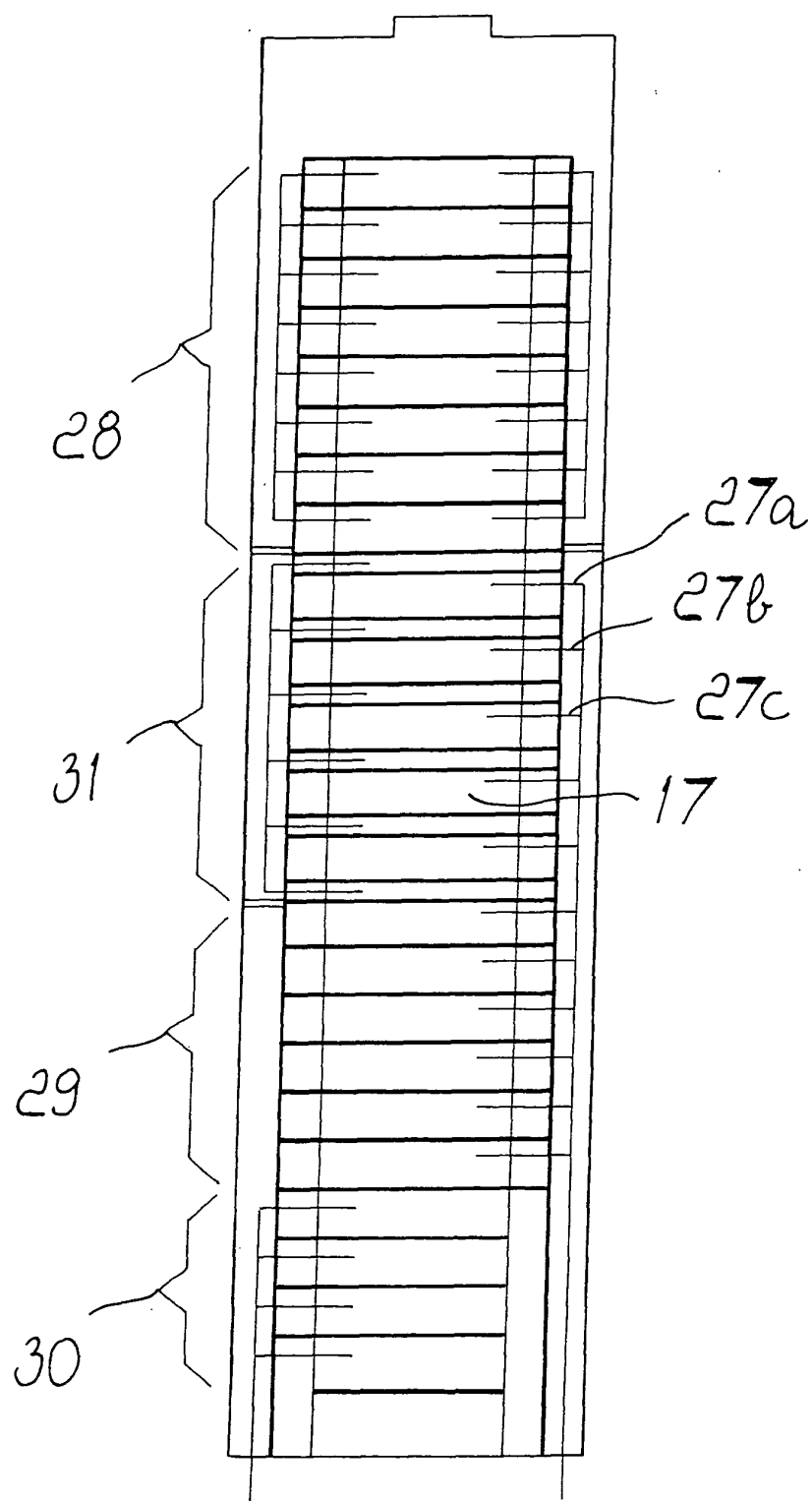


Fig. 5



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 03 01 5357

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.CI.7)
X	FR 600 570 A (L. MERTZ) 10 February 1926 (1926-02-10) * the whole document *	1-9	B07B1/38 B07B1/46
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			TECHNICAL FIELDS SEARCHED (Int.CI.7)
			B07B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		17 October 2003	Laval, J
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 03 01 5357

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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17-10-2003

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