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(54) **Particle sorting device**

(57) The invention relates to a particle sorting device which focuses its features on the use of several screening units (1-2), arranged in series or in "tandem", each of which has its corresponding sieving elements (4a) to (4e) and (5a) to (5e), located at different levels, such that the sorting is not done in a single screening unit, as conven-

tionally occurs, but rather is done in successive phases throughout the different units. Each unit has its own independent vibrating means (6). The size, weight and complexity of the drives are thus reduced and the increased weight and centrifugal forces of conventional vibrators is thus prevented, allowing increasing the production capacity to above the capacity of known systems.

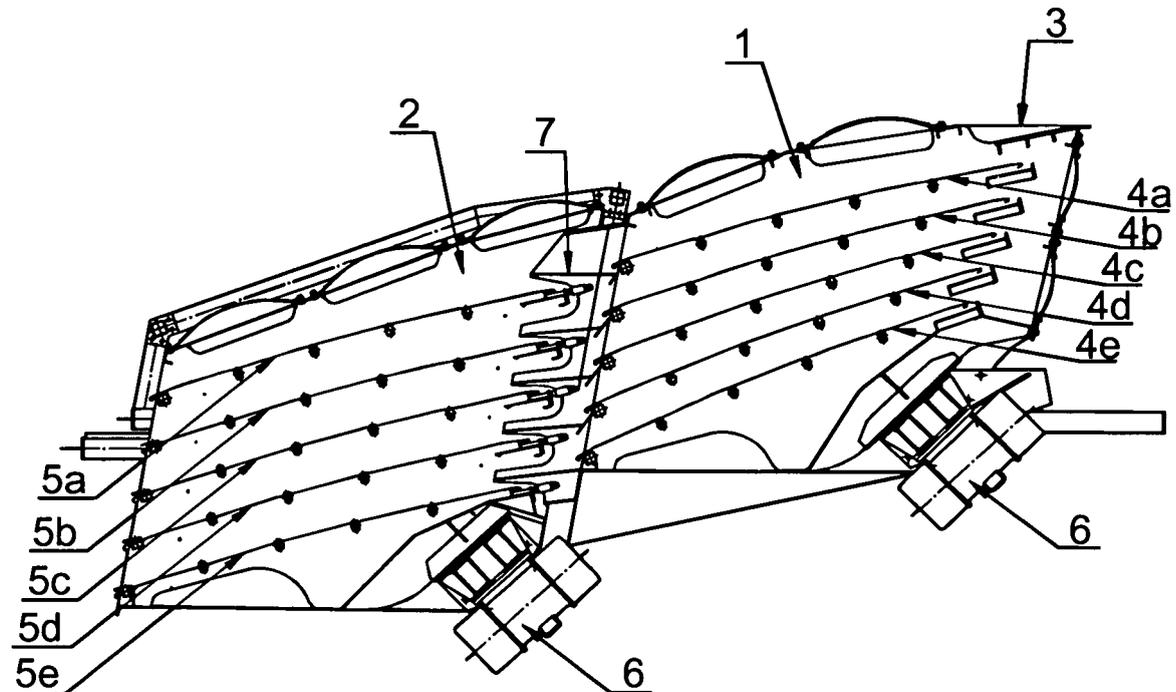


FIG. 1

Description

Object of the Invention

[0001] The present invention relates to a device for sorting particles according to their size, of the type incorporating sieving elements, sieves or screens located at different levels and for particles with different grain-size distribution, through which the product laterally moves or passes as a result of a vibrating effect.

[0002] The object of the invention is to achieve a considerable simplification of the facility, energy savings and improved maintenance operations in terms of the down time and operator safety.

Background of the Invention

[0003] Particle sorting devices are known which are made as vibrating sieving apparatus, commonly referred to as screens, which handle the material to be sieved mainly in a free vertical flow.

[0004] Screens of this type are described, for example, in patent US 3710940, or in Swedish patent 367935. In these cases the apparatus consists of a rigid body having installed therein the sieving elements and vibrating as a single solid as a result of the centrifugal force usually generated by the rotating eccentric masses of one or several drive systems. This is a considerable drawback in several aspects that is made worse the larger the production capacity and, accordingly, the larger the machine has to be.

[0005] The drawback of these screens is focused on the following aspects:

- The eccentric masses cause accelerations on this rigid unit that exceed several times the gravitational force of the earth and that generate tremendous stress on the actual body of the apparatus and its internal components; it also involves oscillating forces generating fatigue on the materials that the machine is built with. These stresses are greater the heavier the machine, since a larger centrifugal force is required to achieve the accelerations necessary for the machine to perform its function with the required efficacy, in turn requiring a more robust design to withstand the increased mechanical stresses that a larger weight implies, and so on and so forth. It can be said that for a geometric design and certain manufacturing materials there is a weight and size limit for the machine, and if these limits are exceeded there is no solution to the design, such that it is either impossible to achieve the appropriate acceleration, comprising the operating efficacy, or the fatigue failure limit of the materials used to build the screen is exceeded. Another negative consequence of this increased weight of the machine and of the centrifugal force necessary to cause the vibrating movement is reflected in the increased energy consumption and

increased price of the drive system or systems, as well as the increased size and complexity of the components of these systems which often reach dimensions that can only be handled with mechanical means such as cranes, presses or high-torque wrenches which, in addition to their cost, require greater skills of operators and require more safety measures; the maintenance and re-lubrication periods are usually shortened because the components of the drive system or systems are subjected to greater stresses and wear.

- The sieving elements that are installed within the body of the machine are subject to wear due to collisions with the particles of the product to be sorted, and therefore its components must be periodically replaced. Since the internal elements are accessed from outside the body of the machine, the fact that it is a single body, especially if it is large, is an impediment for reaching and handling said elements and therefore is a drawback in terms of accessibility which affects down times for maintenance and also for operator safety.
- In the event that the machine is formed by a single rigid body, the vibrating characteristics such as vibration mode, frequency and amplitude are also unique. These parameters combined with the position of the sieving elements and thickness of the product layer to be screened on the sieving elements affect the probability of passage of the particles of the product to be screened therethrough.

Description of the Invention

[0006] The particle sorting device proposed by the invention solves in a fully satisfactory manner the drawbacks set forth above in relation to each and every one of the different discussed aspects.

[0007] To that end and starting from a classic functional conception in terms of screening by vibrating effect and the superposing of the sieving elements inside the vibrating bodies, from which they receive vibrating movement since they are integral therewith, the device that is herein provided focuses its features on being formed by at least two units of the mentioned type, connected in tandem, such that the entrance of the product to be screened into the device occurs in only one of said units, which could be called the "primary unit" where part of the product is screened or sieved, whereas the rest of the product passes to the adjoining unit, and so on and so forth in the event that there are more than two screening units.

[0008] There must be continuity between the different screening units, and more specifically between each sieving level in order to achieve this effect, for which purpose it has been provided that at least one of the sieving levels of a unit is connected to the corresponding sieving level of the next unit through channeling ducts which will preferably be integrally fixed to the unit closest to the

entry point of the product to be screened.

[0009] Each of these units is provided with its own vibrating means independent of the vibrating means of the other units.

[0010] According to another feature of the invention, the primary unit has guides or rails on which a support carriage of the secondary unit moves, which will further have guides or rails for the movement of the of the carriage corresponding to the tertiary unit, in the event that such unit exists, and so on and so forth. This allows easily spacing out the screening units to facilitate access to and handling of the internal elements of each of them.

[0011] Each screening unit has at least one vibrator placed under and/or behind the obstacle system formed by the sieving elements. Each screening unit preferably has two vibrators screwed on a surface that is approximately normal to the vibration direction, and one on each side of a longitudinal and vertical plane passing through the center of gravity of the unit.

[0012] Nevertheless, the possibility of using a single vibrator in one or several of the units has been provided, such vibrator positioned with its vibration shaft perpendicular to the mentioned longitudinal and vertical plane passing through the center of gravity of the unit, and located under the sieving elements.

[0013] A series of advantages of the described structure in relation to the state of the art are established and can be summarized as follows:

- Once the dimensions of the sieving elements are defined according to the production capacity and the specific sorting application, the size of a machine formed by a single body is divided between 2 or more bodies corresponding to each unit described, with independent drives for each of them. The size, weight and complexity of the drives is thereby reduced and the increased weight and centrifugal force described in the previous section is prevented, thereby reducing the total weight of the system simplifying the structure supporting it and reducing the power consumption for a given production capacity. The size limit of the machine referred to will also disappear, being able to increase production capacity to above that of the systems known until now.
- Access from outside to the sieving elements located inside each vibrating body is aided by the smaller dimensions of each of the units.
- It is possible to subject each of the units to different vibration parameters: mode, frequency and amplitude, for the purpose of optimizing the probability of passage of the particles through the sieving elements fixed in each unit, and thereby optimize production and efficacy of the device as a whole.

Description of the Drawings

[0014] To complement the description being made and for the purpose of aiding to better understand the features

of the invention according to a preferred practical embodiment thereof, a set of drawings is attached as an integral part of said description in which the following is shown with an illustrative and non-limiting nature.

Figure 1 shows a schematic side elevation and section view of a particle sorting device carried out according to the object of the present invention, specifically according to a practical embodiment, in which said device is formed by two screening units, and in which the device is in the working situation. Figure 2 shows according to a view similar to that of the previous figure the longitudinal movement of one screening unit in relation to the other unit to facilitate access to and handling of the internal elements thereof.

Figure 3 shows a general perspective view of the device in the operating position shown in Figure 1.

Figure 4 finally shows another perspective view of the device, now in the spacing position between screening units to facilitate access to its internal elements, which is in turn also shown in Figure 2.

Preferred Embodiment of the Invention

[0015] As just explained, the discussed figures show a typical embodiment of a particle sorting device carried out according to the object of the present invention, in which said device is formed by two screening units, one of them primary (1) and one of them secondary (2).

[0016] The primary unit (1) is the only unit with a feed opening (3), located at its highest end, such that the product to be sorted strikes on the upper sieving element (4a) of said unit, with the inclined arrangement shown in Figure 1, such that according to the features of said sieving element (4a), part of the product will pass through such element, reaching the sieving element (4b) immediately under it, whereas the rest will slide through the ramp defined by the actual element (4a). This sorting effect is repeated through the following different sieving elements (4a), (4b), (4c), (4d) and (4e), like in any conventional screen.

[0017] The product which is not able to pass through each of the aforementioned sieving elements (4a) to (4e) due to its grain-size distribution level passes on to the secondary unit (2), where different sieving levels determined by respective sieving elements (5a), (5b), (5c), (5d) and (5e) are in turn arranged.

[0018] The five sieving elements or sieving units or sieving levels existing both in the primary unit (1) and in the secondary unit (2) correspond to a mere practical embodiment, such that said number can vary up or down without this affecting the essence of the invention.

[0019] In any case, these screening units (1) and (2) are driven independently by respective vibrators (6), and the material is transferred from one unit to the other with the collaboration of channeling ducts (7) which, as can be especially seen in Figure (1), receive the product from

each of the sieving elements (4a) to (4e) of the primary unit (1), and channel it towards the corresponding levels of the secondary unit (2), i.e. the sieving element (4a) pours the product onto sieving element (5a), element (4b) onto element (5b), and so on and so forth.

[0020] As previously stated and according to another feature of the invention, the primary unit (1) and the secondary unit (2), or where appropriate the rest of the units participating in the device, can be longitudinally spaced as shown in Figures 2 and 4, starting from the coupling situation shown in Figures 1 and 3, for providing easy access to the internal mechanisms of each of them.

[0021] In this sense the secondary unit (2) is provided or installed on a carriage (8), movable on guides or runners (9), conveniently integral to the structure of the primary unit (1), as especially observed in Figures 2 and 4, such that the secondary unit (2) can pass from the working position shown in Figures 1 and 3, to the inoperative position shown in the mentioned Figures 2 and 4, where such spacing position is indicated with reference number (2a) compared to the working position (2) of the unit.

[0022] Obviously, in the event that there is a tertiary unit, which case is not shown in the drawings, the guides of the secondary unit (2) would be equivalent to aforementioned guides (9), and the tertiary unit would in turn have a carriage, similar to aforementioned carriage (8), for movement or spacing in relation to the secondary unit.

[0023] It can be deduced from the described structure that the working capacity of the machine is determined by the number of units interconnected in series and provided with their own vibration units instead of being determined by the size of a single screening unit, which generates the wide variety of advantages described above.

Claims

1. A particle sorting device, of the type incorporating a plurality of superposed sieving elements, such that a part of the product to be sorted passes from one to another of such sieving elements, whereas another part is sorted because it cannot pass through the corresponding sieve, **characterized in that** it is formed by at least two screening units (1-2), only one of which incorporates the access opening (3) for the product to be sorted, such that with such screening units connected in series, respective successive sorting phases occur in such units.
2. A particle sorting device according to claim 1, **characterized in that** each screening unit has its own independent vibration means (6).
3. A particle sorting device according to the previous claims, **characterized in that** the sieving elements (4a), (4b), (4c), (4d) and (4e) of the screening unit (1) receiving the product through the opening (3), or

at least one of them is continuous with the sieving elements (5a), (5b), (5c), (5d) and (5e) of the adjoining unit (2).

4. A particle sorting device according to the previous claims, **characterized in that** with the exception of the first screening unit bearing the access opening (3) for the product, the screening units (2), are supported by respective carriages (8) sliding on guides or rails (9) fixed to the structure of the immediately preceding screening unit in order to allow direct coupling between units in the operative situation of the device, and spacing between them for maintenance operations.
5. A particle sorting device according to claim 3, **characterized in that** the continuity between screening units (1), (2), and more specifically between the sieving elements (4) and (5), is done through a series of channeling ducts (7) receiving the product that does not pass through each of the sieving elements (4a) to (4e) of the first unit, and channel the product to the beginning of the sieving elements (5a) to (5e) of the second screening unit (2), and so on and so forth.
6. A particle sorting device according to claims 1 and 2, **characterized in that** each screening unit (1), (2) has one or more vibrators (6) placed under and/or behind the obstacle system formed by the sieving elements (4-5).
7. A particle sorting device according to claim 6, **characterized in that** at least one of the screening units has two vibrators installed therein screwed on a surface that is approximately normal to the vibration direction and one on each side of the longitudinal and vertical plane passing through the center of gravity of the unit.
8. A particle sorting device according to claim 6, **characterized in that** at least one of the units has a single vibrator installed therein positioned with its rotating shaft perpendicular to the longitudinal and vertical plane passing through the center of gravity of the unit, and located under the sieving elements.

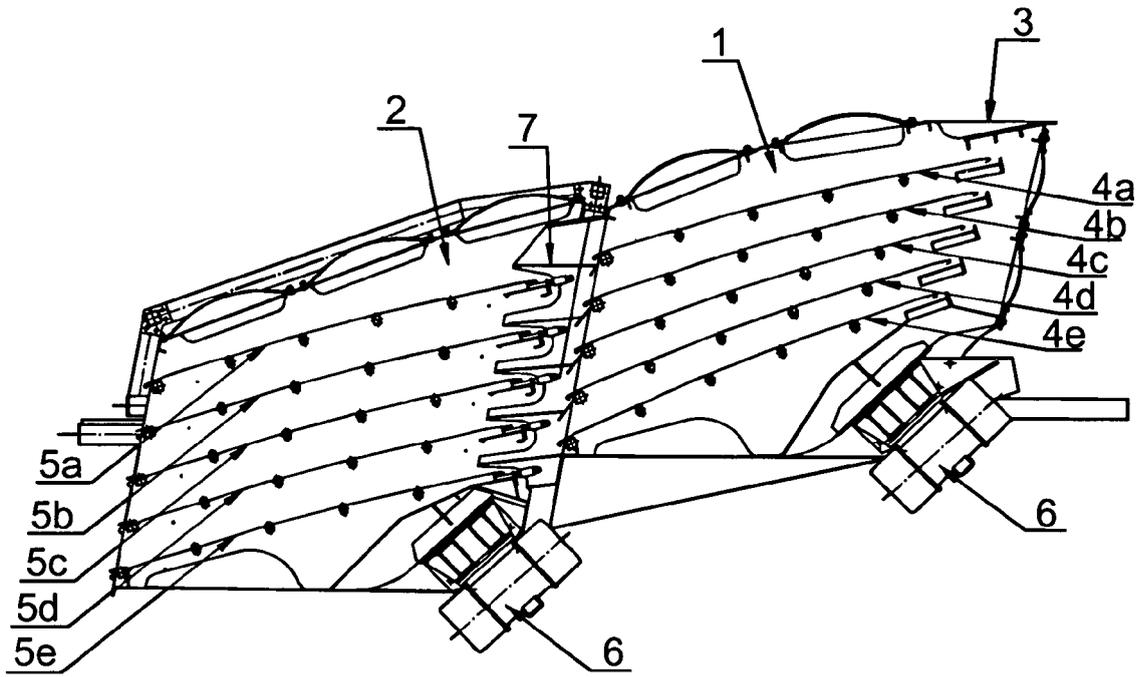


FIG. 1

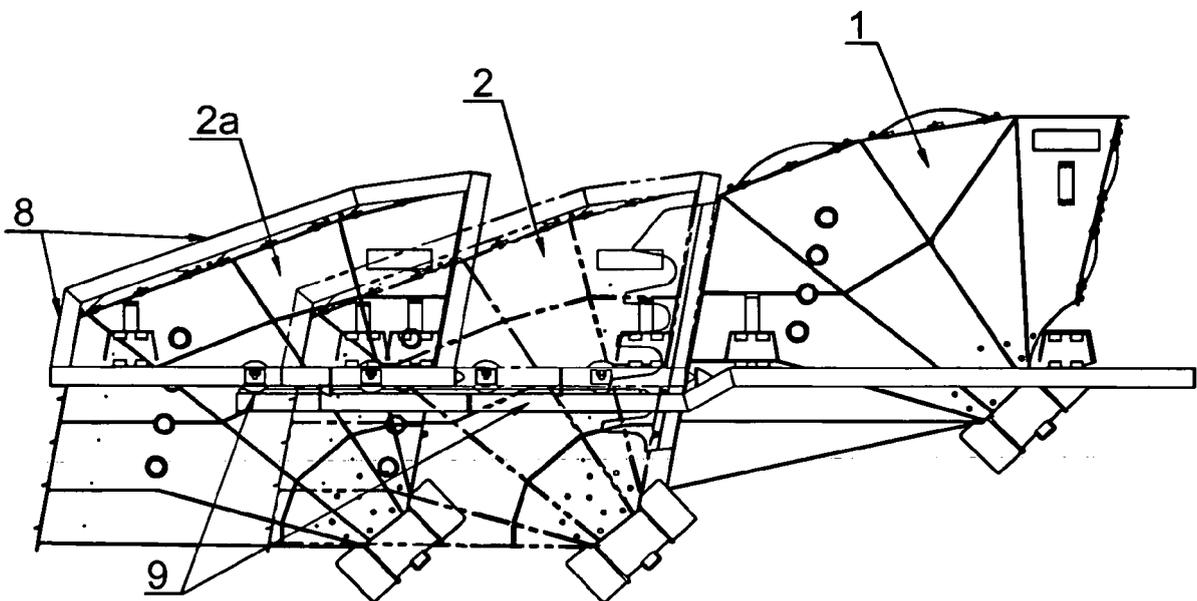


FIG. 2

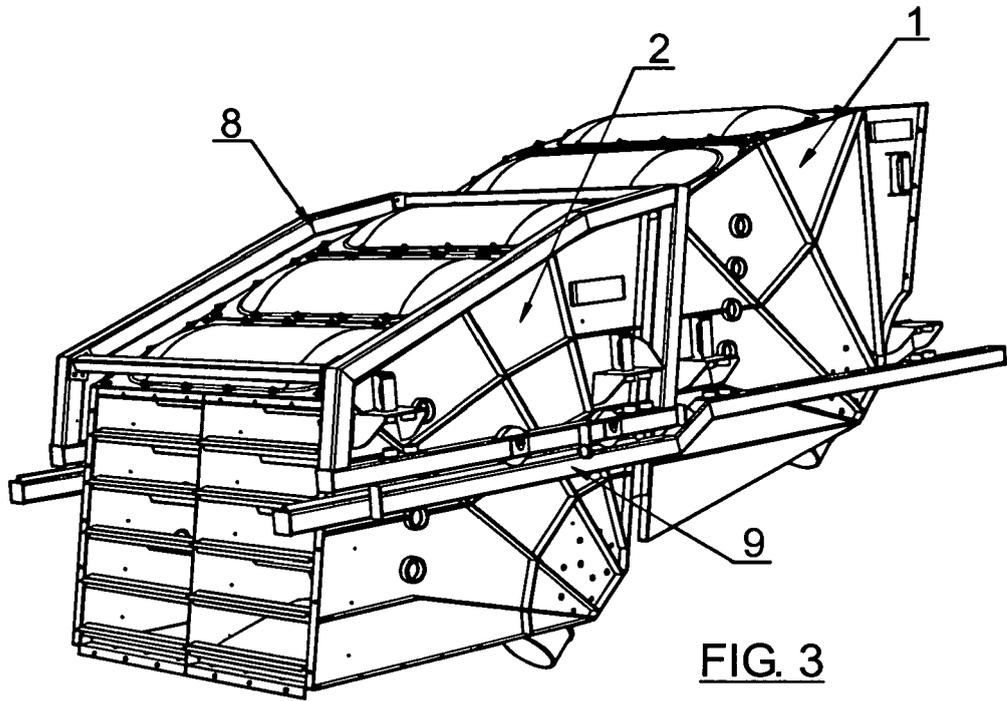


FIG. 3

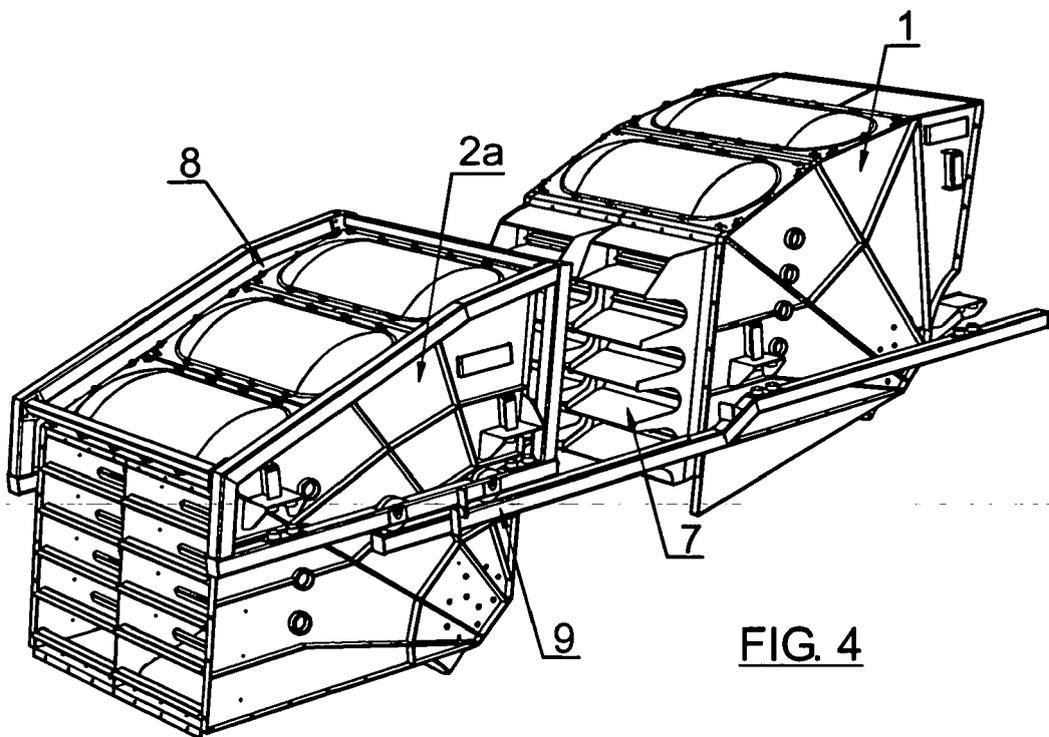


FIG. 4



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 511 459 C (ROBERTS AND SCHAEFER COMPANY) 30 October 1930 (1930-10-30) * claim 1; figure 1 * -----	1	INV. B07B1/38 B07B1/28
X	GB 1 082 780 A (KURT MULLER) 13 September 1967 (1967-09-13) * sentences 58-65; figure 1 * -----	1	
A	FR 2 424 770 A (BUEHLER AG GEB [CH]) 30 November 1979 (1979-11-30) * claim 1; figure 1 * -----	1-8	
A	WO 02/094445 A (HORSTMANN GMBH & CO KG [DE]; BUESCHENFELD SIEGFRIED [DE]; NOLTING STEP) 28 November 2002 (2002-11-28) * claim 1; figure 1 * -----	1-8	
A,D	US 3 710 940 A (MOGENSEN N) 16 January 1973 (1973-01-16) * abstract * -----	1-8	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B07B
Place of search		Date of completion of the search	Examiner
Munich		29 September 2008	Devilers, Erick
CATEGORY OF CITED DOCUMENTS		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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EPO FORM 1503 03.82 (P04C01)

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

EP 08 38 0131

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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29-09-2008

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 511459	C	30-10-1930	NONE	
GB 1082780	A	13-09-1967	DE 1201160 B	16-09-1965
FR 2424770	A	30-11-1979	AR 218124 A1	15-05-1980
			AU 525848 B2	02-12-1982
			AU 4530579 A	08-11-1979
			BR 7902128 A	04-12-1979
			CH 631092 A5	30-07-1982
			CS 216657 B2	26-11-1982
			DE 2823623 A1	15-11-1979
			ES 476920 A1	16-05-1979
			GB 1602756 A	18-11-1981
			IT 1110838 B	06-01-1986
			JP 1357519 C	13-01-1987
			JP 54146070 A	14-11-1979
			JP 61024072 B	09-06-1986
			SU 912036 A3	07-03-1982
			US 4260481 A	07-04-1981
			ZA 7807058 A	28-11-1979
WO 02094445	A	28-11-2002	DE 10292156 D2	15-04-2004
			DE 20216261 U1	23-01-2003
US 3710940	A	16-01-1973	AT 307340 B	25-05-1973
			BE 733940 A	17-11-1969
			CA 933491 A1	11-09-1973
			CH 536141 A	30-04-1973
			CS 159247 B2	27-12-1974
			DE 1926143 A1	11-12-1969
			DE 6920627 U	08-06-1972
			DK 132378 B	01-12-1975
			ES 367935 A1	16-04-1971
			FI 50386 B	01-12-1975
			FR 2010110 A5	13-02-1970
			GB 1275623 A	24-05-1972
			HU 164477 B	28-02-1974
			IE 32850 B1	28-12-1973
			JP 55011903 B	28-03-1980
			NL 6908102 A	08-12-1969
			NO 131275 B	27-01-1975
			PL 80142 A5	30-08-1975
			SU 847900 A3	15-07-1981

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 3710940 A [0004]
- SE 367935 [0004]