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(71) Applicant: **Unione Srl**
23900 Lecco (LC) (IT)

(72) Inventor: **Buzzi, Pier Francesco**
23851 Galbiate (Lecco) (IT)

(74) Representative: **Pozzi, Andrea**
KEMIA SA
Via Senago 23
6915 Pambio-Noranco / Lugano (CH)

(54) Plant for the selection of batteries and method which uses the plant

(57) A plant for the selection of batteries comprising: a screening station (1); a device for evacuating non-pertinent material (2); a conveyor belt (5,8,10) for conveying the screened material; at least an identification station (6a-6e) for generating at least one signal indicative of a group to which the batteries belong; at least a selection station (7a-7e) for picking up from the conveyor belt the batteries belonging to said group, wherein a brushing station (20) downstream the screening station (1) is provided.

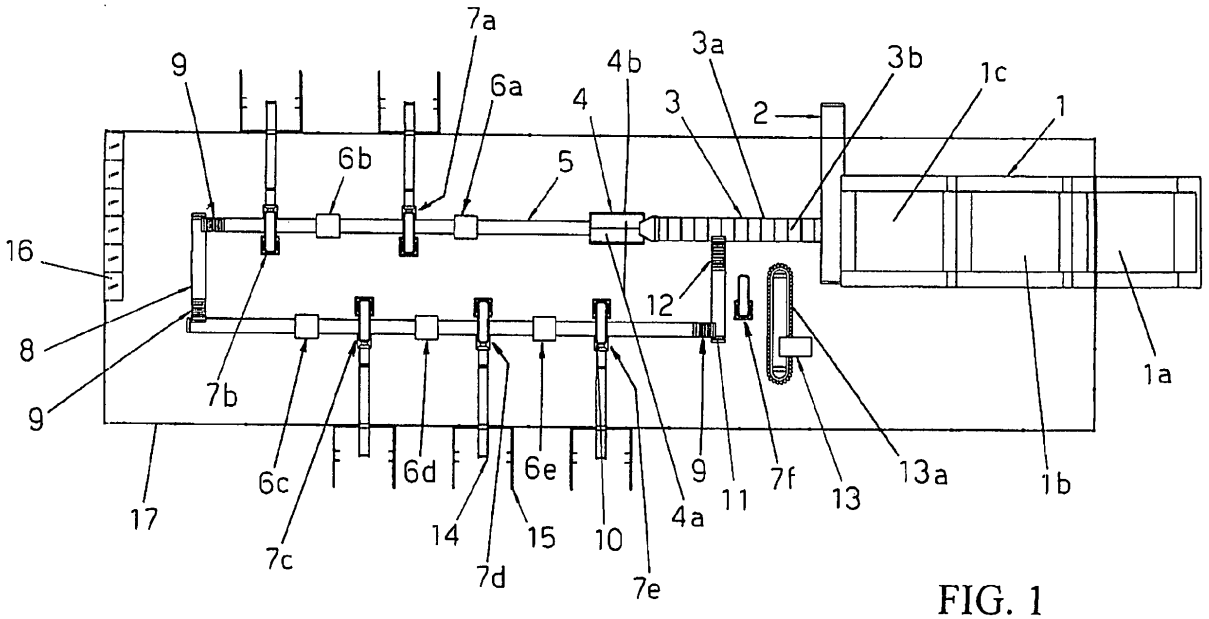

FIG. 1

EP 2 397 234 A1

Description

Technical Field

[0001] The present invention concerns a plant for the selection of batteries and a selection method which uses the plant.

[0002] More precisely, the invention concerns an automated plant for the selection of spent batteries, for instance coming from the separate waste collection, and a selection method which uses the plant.

[0003] Even more precisely, the invention concerns a plant of the aforesaid kind, which allows the division of batteries into groups or families depending on the type thereof.

Known Art

[0004] The need for selecting and dividing the different typologies of batteries in order to direct them to recycling or disposal is highly perceived at present.

[0005] Such need is mainly due to the considerable consumption of batteries and to their content of dangerous and polluting material.

[0006] At present selection and division of batteries into groups or families is a work manually carried out by operators who inspect the material coming from the separate waste collection.

[0007] In the existing plants the material is arranged on a motorised belt having a width of about 800 mm, and the operators try to visually identify and pick up possible foreign bodies (plastic bottles, syringes, paper, cellophane bags, and so on), mobile-phone and computer batteries and rechargeable batteries. Clearly such an operation is highly harmful for the operators' health (acids released from the often rusty batteries, highly toxic components of the batteries themselves, material coming from the landfill) and dangerous (syringes and broken glass pieces, and so on).

[0008] Moreover, the manual process does not allow to certify the quality of the processed material that, if wrongly selected, can cause considerable problems to the final disposal plants. The rechargeable batteries in case present, for instance, react to heating by exploding and, consequently, they can damage a plant in which non-rechargeable batteries are burnt.

[0009] Automated plants for dividing batteries into homogeneous groups for the following recycling and/or disposal are also known.

[0010] IT 1278410 (B1) discloses an electro-pneumatic industrial plant, used for separating exhausted batteries of the button-type from the other kinds of batteries; the separation takes place depending on the batteries thickness.

[0011] KR 20040099658 (A) suggests a separator for exhausted batteries, which operates depending on the shape and on the kind of batteries (manganese, alkaline, and so on batteries) in order to facilitate the recycling of the same ones. The separator comprises a control unit for the inlet quantity; an alignment unit for aligning the batteries along a direction; a size selection unit for recognising the batteries size; a weight sensor for measuring the batteries weight; a transfer unit for transferring the batteries; and a discharge unit for transferring the batteries to corresponding places.

[0012] EP 1077093 concerns a device for dividing batteries depending on their size. It comprises a disc with a rotating guide unit, which is arranged horizontally inclined, and an extractor located on the disc and extending from the disc centre to periphery. Around its perimeter, the disc has a ring with openings spaced around the perimeter.

[0013] CA 2294571 (A1) describes the separation of batteries and button cells wherein an initial step of coarse screening of ferrous materials is provided.

[0014] FR 2787043 (A1) describes a selection automatic machine of used batteries comprising a conveyor for carrying out a size separation with respect to a specific diameter of the batteries. A second conveyor is equipped with test means comprising a weighing system for determining the weight representing the electrochemical composition of each battery and a device measuring the voltage at the ends of each battery. A robot is connected to said test means through an electrical connection. A series of activators drive corresponding ports for distributing the batteries to separate collection means.

[0015] EP 0761311 (A1) describes a method for identifying the single batteries through optical analysis means in order to separate the batteries into homogeneous classes. The optical analysis is performed with the help of a camera and of at least a computer connected thereto. The features of the image of each battery are compared with those of known batteries stored in the computer. The image obtained by the camera for each battery is digitalised, converted into a simplified image or into a set of parameters and compared with the stored image or with the stored set of parameters.

[0016] FR 2736565 (A1) describes a plant comprising a hopper for receiving batteries in random bulk. The hopper comprises devices for selecting batteries depending on their size. A conveyor conveys the batteries from the hopper to a selection unit having rollers of different diameters that operate a selection of the batteries depending on their diameter. DE 4310862 (A1) refers to a separation method of the exhausted batteries wherein the batteries, through a series of separation steps comprising sieves and selection rails or selection cylindrical drums, are separated depending on their shape and size and also depending on their weight. In this way, groups of homogeneous batteries are created.

[0017] US 2002030000 (A1) describes an apparatus and a method for separating used batteries that comprises a receiving station, an exit station and a pre-selection station arranged between the receiving station and the exit one. The pre-selection station is connected to a first and to a second re-selection stations. The two re-selec-

tion stations are arranged for the manual inspection and for the removal of the unwanted batteries and further objects, as well as for the manual selection of batteries and other objects arrived to the re-selection stations during the apparatus operation.

[0018] WO 9425992 (A1) describes a method for separating exhausted batteries of different shape, size and chemical composition; the method provides for the measuring of some physical parameters. For each type of battery or accumulator, an identifying signal or a signature is generated consisting of a typical combination of the digital values of the measured parameters and, depending on said signal, a separation signal is determined depending on the chemical composition of the battery or accumulator.

[0019] The known plants and methods, however, suffer from inaccuracy in the selection of the battery typologies. Particularly, the known plants are frequently unable to distinguish between non-rechargeable batteries and rechargeable batteries or accumulators. Consequently the result of the selection carried out with the known plants does not allow to achieve satisfying results. Such results, moreover, tend to be worst when there are particularly deteriorated batteries, for instance rusty or covered with foreign materials, and when the separate waste collection has not been correctly performed.

[0020] The main object of the invention is therefore to provide a plant for the selection of batteries assuring the protection of the operators' health and being substantially free from errors in the selection, so as to allow the certification of the processed material.

[0021] Another object of the invention is to provide a plant of the aforesaid kind that can be managed with low costs.

[0022] A further object of the invention is to provide a plant of the aforesaid kind that can be easily adapted, and therefore with low costs, to the different typologies of batteries as they are introduced on the market.

[0023] A not least object of the invention is to provide a plant of the aforesaid kind that can be implemented with low costs.

[0024] A further object of the invention is to provide a method for the selection of batteries employing the aforesaid plant.

Disclosure of the Invention

[0025] The aforesaid and other objects are achieved with the plant and the method as claimed in the appended claims.

[0026] The plant for the selection of batteries according to the invention substantially comprises a screening station; at least a device for evacuating non-pertinent material located downstream the screening station; a conveyor belt for conveying the screened material; at least an identification station for the batteries able to generate at least one electrical signal indicative of a group to which the batteries belong; at least a selection station associated with said identification station for picking up the batteries belonging to said group and a brushing station located downstream the screening station.

[0027] The plant according to the invention is advantageously modular, i.e. it can be expanded as the quantity of product to be processed increases, flexible, i.e. it can be easily adapted to the change of distribution in composition and concentration of the material to be processed, and it needs a sole operator for the management thereof thanks to the high automation degree.

[0028] The modularity is advantageously obtained thanks to the use of robotised units that can be added or removed as the material to be processed increases or decreases.

[0029] The plant can incorporate a reduced number of robots, which will be used for the selection of many product families, thus reducing the implementation expenses while maintaining the possibility of adding further robots in future in order to increase the productivity.

[0030] The plant advantageously develops according to a linear scheme and it does not require the presence of a crane nor the realisation of foundations and excavations, and it needs a simple and quick maintenance.

[0031] The closed cycle of the plant, determined by the return of the material that have not been selected on the forward line, allows, for instance in case of a robot malfunction, to maintain the plant in operation, even though with a reduced productivity.

[0032] A not least advantage results from the fact that the plant substantially eliminates any risk of mixing rechargeable batteries and conventional batteries.

[0033] This advantage is mainly achieved thanks to the implementation of different technologies for the identification of the material: laser readers, infrared, vision systems with different kinds of video-cameras. These apparatuses, arranged in cascade series in the plant, allow the processing of crossed data (size, shape, three-dimensional image) so as to obtain an unambiguous final data allowing to have the certainty of the group to which each inspected battery belongs.

[0034] Such advantage is achieved thanks to the provision of a mechanised cleaning station and preferably of a brushing station.

Brief Description of the Drawings

[0035] A preferred embodiment of the invention will be described hereinafter by way of nonlimiting example with reference to the appended drawings in which:

- Figure 1 is a schematic plan view of the plant;
- Figure 2A is a top view of the brushing machine;
- Figure 2B is a section taken along a plane passing through line B-B of Figure 2A;
- Figure 2C is a top perspective view of the brushing machine of Figure 2A;
- Figure 3 is a top perspective view of the infrared analysis machine.

Description of a Preferred Embodiment

[0036] With reference to the preferred embodiment shown in Figure 1, the plant according to the invention substantially comprises: a screening station 1; an evacuation belt for non-pertinent products 2; a conveyor belt for the screened material 3; a selection station for button batteries 4; a forward side selection belt 5; identification stations or boxes 6a-6e, for instance having laser video-cameras; robotised stations 7a-7e; a connecting belt 8 from the forward side to the return side; rolling shutter belts 9 and 12; a return side selection belt 10; a recirculation belt 11; a fine selection island 13 for identifying the batteries that have not been recognised along the forward belts 5, the connecting belts 8 and the return belts 10; discharge belts 14 for the selected product; suspension systems 15 for bags ("big bag"), a control electric panel 16, a safety protection 17.

[0037] In the shown example the identification stations 6a,6b and the robotised stations 7a,7b are arranged along said forward side selection belt 5 and the identification stations 6c,6d,6e and the robotised stations 7c, 7d,7e are arranged along said return side selection belt 10. Preferably the screening station 1 comprises a corresponding three-stage sieve and the robots of the stations 6a-6e are "SCARA" ("Selective Compliant Assembly Robot Arm") geometry robots.

[0038] The three-stage sieve 1 is a machine aiming at removing those non-pertinent products contained in the collection big bags, which are particularly damaging objects for the following machines such as plastic bags, paper bags, bottles and other objects typically having a size bigger than the batteries to be selected.

[0039] The first stage 1 a of the screening machine is also used as a collection hopper into which the content of the big bag coming from the separate waste collection will be poured. The size of the hopper will be calculated depending on the quantity of material on average delivered to the plant. The following stages 1b,1c of the screening machine will have sieves for selecting and discarding objects with gradually smaller size.

[0040] Downstream sieve 1 an evacuation belt for non-pertinent products 2 is provided. It is a motorised belt aiming at carrying outside the plant the materials discarded by sieve 1, delivering them to a container (not shown), for instance a bin or a large case, placed outside protection 17. Said belt 2 is preferably oriented perpendicularly to the forward direction of the material in sieve 1.

[0041] Always downstream sieve 1 the conveyor belt for the screened material 3 is also provided. It is a belt starting from below the sieve 1 and picking up the screened material to be directed to the following processing steps. Advantageously, belt 3 will be made of a material resistant to the acids released by the deteriorated batteries and it will be provided with laterally vulcanised, trapezoidal, longitudinal profiles 3a for containing the material as well as with transversal draggers 3b suitably spaced along the belt.

[0042] The material carried by belt 3 is conveyed to a selection station for button batteries 4. Such station comprises a conveyor belt 4a having a "V" transversal section with the vertex facing downwards and open inferiorly with an adjustable opening angle. Belt 4a is inferiorly open so as to define a longitudinal slot 4b with adjustable width, for instance of about 5 mm. Through such opening 4b the batteries with thickness lower than the slot width, i.e. the button batteries exclusively, will drop into an underlying container (not shown).

[0043] Downstream the selection station 4 a selection conveyor belt develops that, in the shown example of plant, comprises a forward portion 5, a return portion 10 and a connecting portion 8. The conveyor belt 5,8,10 gradually delivers the material to the identification stations 6a-6e and to the robotised stations 7a-7e. It is a controlled-speed motorised belt with horizontal sliding, made of a material resistant to the possible acids released by the deteriorated batteries and having laterally vulcanised trapezoidal profiles for containing the material. Each portion of the conveyor belt 5,8,10 ends with a corresponding rolling shutter belt 9 for transporting the material from a portion of the conveyor belt to another one. Belt 9 is a motorised transportation belt having an inclined development, made of a material resistant to the possible acids released by the deteriorated batteries and having laterally vulcanised trapezoidal profiles 9a for containing the material as well as rolling shutter profiles 9b for raising the material and making it to drop on the following belt. Stations 6a-6e are each equipped with a high resolution video-camera contained in a box suitably sized and impermeable to the outside lighting, in order to avoid reflections and lighting changes, and having a led inside lighting so as to help the image sharpness.

[0044] The robotised stations 7a-7e are equipped with "SCARA" robots with a working head fitted to pick up a kind of specific product from the conveyor belt.

[0045] According to a plant embodiment, stations 7a-7e are articulated in this way:

- station 7a for removing mobile-phone batteries and 3R12A 4.5V flat batteries, equipped with a multiple head comprising a Venturi group for vacuum generation and gripping suction caps;
- station 7b for removing notebook batteries, equipped with a multiple head comprising a Venturi group for vacuum generation and gripping suction caps;
- station 7c for removing 9V square batteries, with separation of the rechargeable-type ones;
- stations 7d and 7e for removing cylindrical batteries (style, torch, all sizes) with separation of the rechargeable ones.

[0046] The conveyor belt 5,8,10 ends with a rolling shutter belt 9 that discharges the remaining material, i.e. not removed during the preceding selection steps, in a recirculation belts 11. Such recirculation belts 11 comprises a motorised transportation belt having a horizontal

development, made of a material resistant to the possible acids released by the deteriorated batteries, having laterally vulcanised trapezoidal profiles for containing the material and ending with a rolling shutter belt 9 for delivering the material again to the conveyor belt 3 for screened material.

[0047] The plant further provides an identification station 13 for the batteries not selected before. It is a station aiming at assigning each battery not recognised with the preceding systems to the group to which it belongs and, therefore, it is a fundamental part of the plant. Station 13 substantially consists of a horizontal development chain 13a whose rotation is drive by an electric motor. The chain is equipped with a series of mechanical closure pliers. The batteries loading takes place through a robot 7f.

[0048] The chain takes a step forward at each loaded battery. In doing so, with a series of following steps the chain moves towards station 13 in which a high resolution video-camera with a 360° vision system stores a whole image of the battery. At this point the management software tries to identify the type to which the object belongs. If it is not possible to interpret the image (dirt, rust or model not contained in the database), operator intervention is required through a light/acoustic signal. The operator, by looking at the image on a screen, may assign the right belonging group and, as a result of his choice, the processor will store the image in the database. In case of absolute impossibility to recognise the battery, the same will be discarded.

[0049] Each robotised station 6a-6e is equipped with a discharge belt 14 of the selected product. It is a "swan neck" motorised transportation belt that shall raise the selected batteries to a sufficient height (for instance about 2,000 mm) to discharge them into a destination big bag. The destination big bag is housed in a big bag suspension system 15 comprising a lift frame allowing to lift the handles of the big bag to spread it and make it available to pick the product up to its complete filling.

[0050] The plant is completed by a control electric panel 16 inside which the control apparatuses of the system, PLC and PC are housed.

[0051] With reference to Figures 2A,2B,2C, according to a preferred embodiment of the invention, the plant is provided with a brushing station 20. In some cases, indeed, the delivered batteries, for instance coming from the separate waste collection, can be dusty and partially covered with rust or other materials or encrusted with now dry deposit due to the partial release of acids.

[0052] Both rust and mainly the deposit particles of the acids are toxic and dangerous for the environment products, and furthermore they can jeopardise the classification of the batteries in the following processing steps.

[0053] Washing batteries with water containing detergents of any kind is little indicated since, once the liquid mass has exhausted its washing potential, it should be treated in turn as a special waste because it contains acids and quite likely also particles of heavy metals dispersed from crushed and broken batteries.

[0054] Therefore, the plant according to the invention has been equipped with a brushing station in order to obtain the cleaning of the batteries surface through a mechanical action generated by fixed or rotating brushes.

[0055] The mass of batteries exiting the sieve 1 is conveyed by the conveyor belt 3 towards the brushing station 20.

[0056] At the entrance of the brushing station a sheet chute 21 drives the batteries in the station towards a carpet with perforated bottom 22 realised with very thick, short bristles of medium-high stiffness so as to avoid that the batteries can get stuck and to allow the removed rust to fall below the carpet by gravity.

[0057] On carpet 22 the batteries are trapped by a series of brushes rotating in counter directions. The rotating brushes help the batteries to move forward and to be cleaned as well as to remove the dust and rust present on their surface. Such rollers are made up by wrapping a thick carpet of synthetic bristles of appropriate stiffness and length around a central core. According to a preferred embodiment of the invention the rotating brushes will be arranged in the following way:

- rollers with brushes forming a complete volume with no gaps between them 24 have bristles gradually decreasing in stiffness from medium-hard to soft as one goes from the inlet area to the outlet area of station 20;
- brushes having a helicoidal pattern 23 uniformly distribute batteries on the carpet 22, eliminate the possible overlapping of the same and simultaneously make them to move forward to the exit of station 20.

[0058] The alternate arrangement of brushes 23 and 24, the alignment of their rotation axes parallel to the advancing direction of the batteries, together with the opposed rotation direction of a brush with respect to the following one help the friction of the batteries surfaces on the bristles so as to remove residues, dust or possible rust formed on the surfaces.

[0059] After having been subjected to this brushing operation, batteries are discharged from station 20 through a chute 26 having a fine mesh net bottom 26, through which the dust falls into a conveyor 27.

[0060] In order to avoid that batteries carry part of the dust with them, before exiting for being positioned on the following transportation belt, a fixed brush having many rows of bristles 25 provides for brushing the surface thereof.

[0061] This dust, upon falling in the conveyor 27, will be directed toward a collection container 28 so as to be subsequently disposed in a suitable way.

[0062] With reference to Figure 3, according to a preferred embodiment of the invention, the plant is further equipped with a selection station 30 for round or square batteries, said station employing a non-destructive system based on the infrared analysis.

[0063] Downstream the selection station for button batteries 4, preferably immediately downstream station 4, batteries are distributed on a conveyor carpet 31 passing through an induction heating hood 32. The translation speed and the current intensity in the heating coil of the induction hood determine the temperature at which batteries are heated up. Such temperature will be enough below the point at which the printing on the coverings would deteriorate and, all the more true, well below the explosion point.

[0064] The different materials react in a different way to these induced currents: magnetic materials heat more easily than non-magnetic ones, due to the magnetic hysteresis effect. Magnetic materials offer a natural resistance to the quick change of the magnetic fields around the inductor. The resulting friction produces an additional heat thereof (hysteresis heating) that adds to the heating due to the stray currents.

[0065] As a consequence, the different metals forming the different typologies of batteries react (are heated) in different ways.

[0066] These different reactions and conditions generate different thermal spectra.

[0067] By framing batteries with an infrared video-camera 33 placed at the exit of the hood 32 and arranged for generating at least one signal indicative of the temperature of the batteries, so-called "false colour" images are obtained, i.e. the different temperatures are represented according to a preset colour scale.

[0068] Advantageously, this station allows to classify batteries depending on two conditions:

- the different arrangements of the components inside the battery;
- the different chemical composition of the different typologies of batteries.

[0069] This allows to identify the object typology, depending on the different temperatures reached by its components. This image processed by the dedicated software classifies the different batteries that will be then taken by the robot. By comparing these data with those stored in a database it will be possible to classify batteries depending on the group to which they belong.

[0070] Hereinafter the functioning of the plant according to the invention will be described.

[0071] With a fork-lift or other suitable apparatus the content of the big bag is discharged in the first stage 1a of the sieve 1. The passage of the material from the first to the second and then the third stage of the sieve 1 allows to remove all non-conforming material. The removal takes place by size and then there always exists the possibility that some objects having a shape similar to the batteries pass through the sieve meshes. The material trapped over the sieve will be removed through the belt 2 for evacuating non-pertinent materials. In a preferred embodiment of the invention, downstream the sieve 1 there is advantageously provided the brushing station 20, which cleans the batteries thus making the following identification more reliable.

[0072] The screened and brushed material is transferred onto the conveyor belt 3 for the screened material, which delivers it to the selection station for button cells 4.

[0073] Always according to a preferred embodiment of the invention, downstream station 4 there is provided the selection station 30 for round or square batteries.

[0074] Then the material reaches the forward side selection belt 5 on which it is uniformly distributed across the whole width. The belt 5 drives the material through the identification stations 6a,6b in which the video-camera scans the product in terms of size. With these data it is possible to have useful information for the first two robots 7a,7b in order to pick up mobile-phone and computer batteries as well as 3R12A 4.5V flat batteries. These batteries have indeed well distinguishable shapes and in the first two cases they are all of the rechargeable kind while in the third case they are all non-rechargeable batteries. Subsequently, the batteries remained on the conveyor belt are transferred onto the connecting belt 8 and then onto the return conveyor belt 10 of the plant.

[0075] The material is then uniformly redistributed on belt 10 before passing through the identification stations 6c-6e equipped with video-cameras, which will send data to the relevant next robotised station 7c-7e properly equipped for picking up the batteries of different types.

[0076] Then the last robot 7f will pick up from the recirculation belt 11 the round and rectangular batteries not previously recognized in order to direct them to the self-learning station 13 previously described.

[0077] The material in transit on belt 11 and that the robot 7f was not able to pick up, for instance because busy or because the station 13 was occupied, will be taken back again on the conveyor belt 3 exiting the sieve 1 for being processed again.

[0078] The plant and the method as described and illustrated are subject to many variants and modifications, which fall within the same inventive principle.

Claims

1. A plant for the selection of batteries comprising:

- a screening station (1);
- a device for evacuating non-pertinent material (2);
- a conveyor belt (5,8,10) for conveying the screened material;
- at least an identification station (6a-6e) for generating at least one signal indicative of a group to which the batteries belong;
- at least a selection station (7a-7e) for picking up the batteries belonging to said group, **characterized in that** it comprises a brushing station (20) downstream the screening station (1).

2. A plant according to claim 1, wherein the brushing station (20) comprises a chute (21) for driving the batteries towards a carpet with perforated bottom (22) realized with very thick, short bristles of medium-high stiffness and a series of brushes (23,24) rotating in counter directions, said rotating brushes being suitable to move forward the batteries and clean them by removing the dust and rust present on their surface.

3. A plant according to claim 2, wherein said rotating brushes comprise rollers made up by wrapping a carpet of thick bristles of appropriate stiffness and length around a central core.

4. A plant according to claim 2 or 3, wherein the rotating brushes comprise rollers (24) with brushes forming a complete volume with no gaps between them with bristles of stiffness decreasing from the inlet area to the outlet area of the brushing station, said rollers being alternated with rollers (23) equipped with brushes having a helicoidal pattern.

5. A plant according to any of the preceding claims, wherein the brushing station (20) comprises a chute having a fine mesh net bottom (26), through which the dust falls into an underlying conveyor (27).

6. A plant according to any of the preceding claims, wherein a fixed brush having a series of rows of bristles (25) is provided at the exit of the brushing station.

7. A plant according to any of the preceding claims, wherein a selection station (30) is provided comprising a conveyor carpet (31), passing through an induction heating hood (32) and an infrared video-camera (33) arranged at the exit of the hood (32) for generating at least one signal indicative of the temperature of the batteries.

8. A plant according to claim 7, wherein a station for selecting button batteries (4) is provided and wherein the selection station (30) is provided immediately downstream the station for selecting button batteries (4).

9. A plant according to any of the preceding claims, wherein there are further provided a forward side selection belt (5), identification stations (6a,6b) and robotized stations (7a,7b) arranged along said forward side belt, a connecting belt (8) between the forward side and the return side, a return side selection belt (10), identification stations (6c,6d,6e) and robotized stations (7c,7d,7e) arranged along said return side belt and a fine selection island (13) for the identification of the batteries not recognized along said forward and return belts.

10. A method for the selection of batteries, **characterized in that** it makes use of a plant as claimed in any of the claims from 1 to 9.

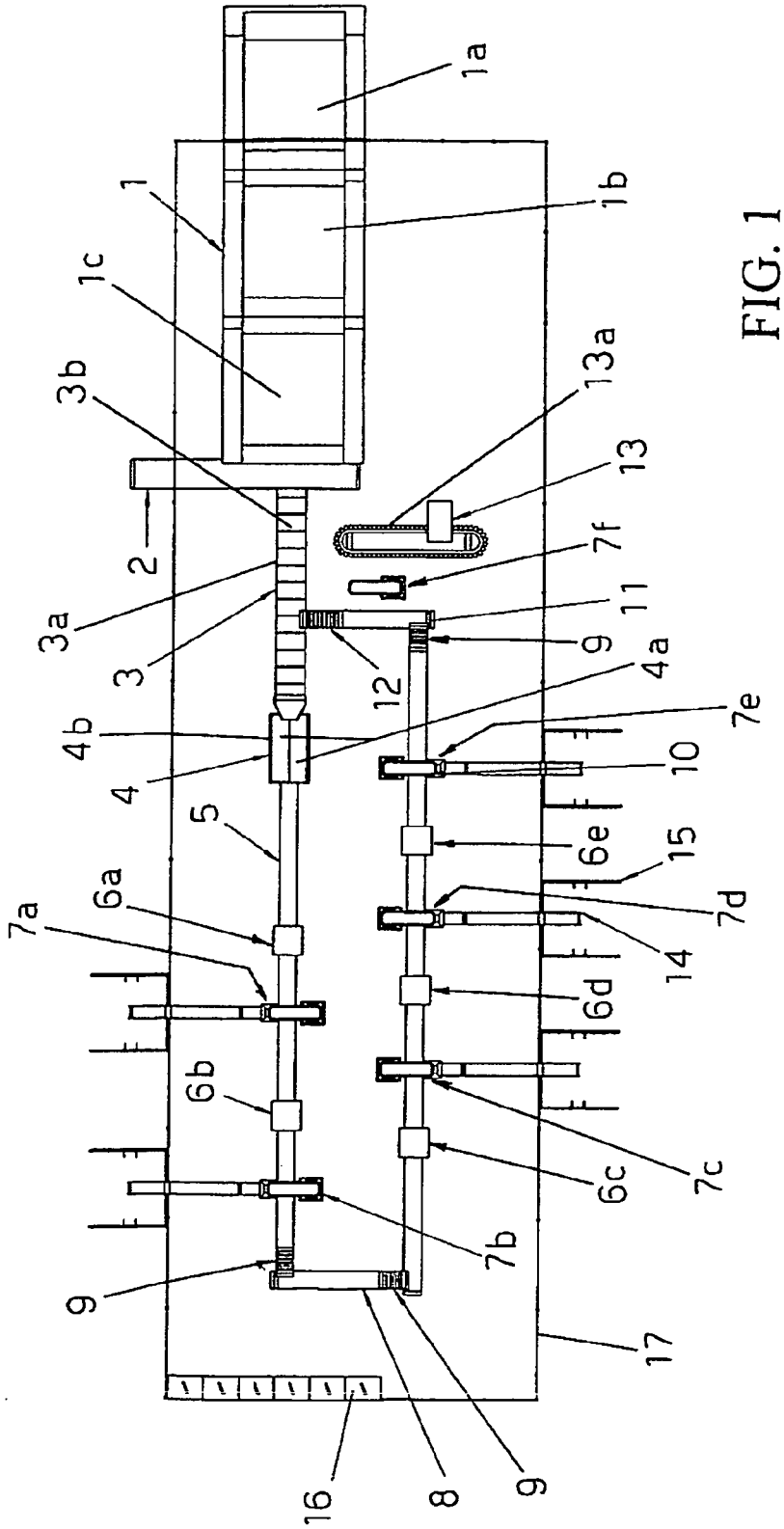
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FIG. 1

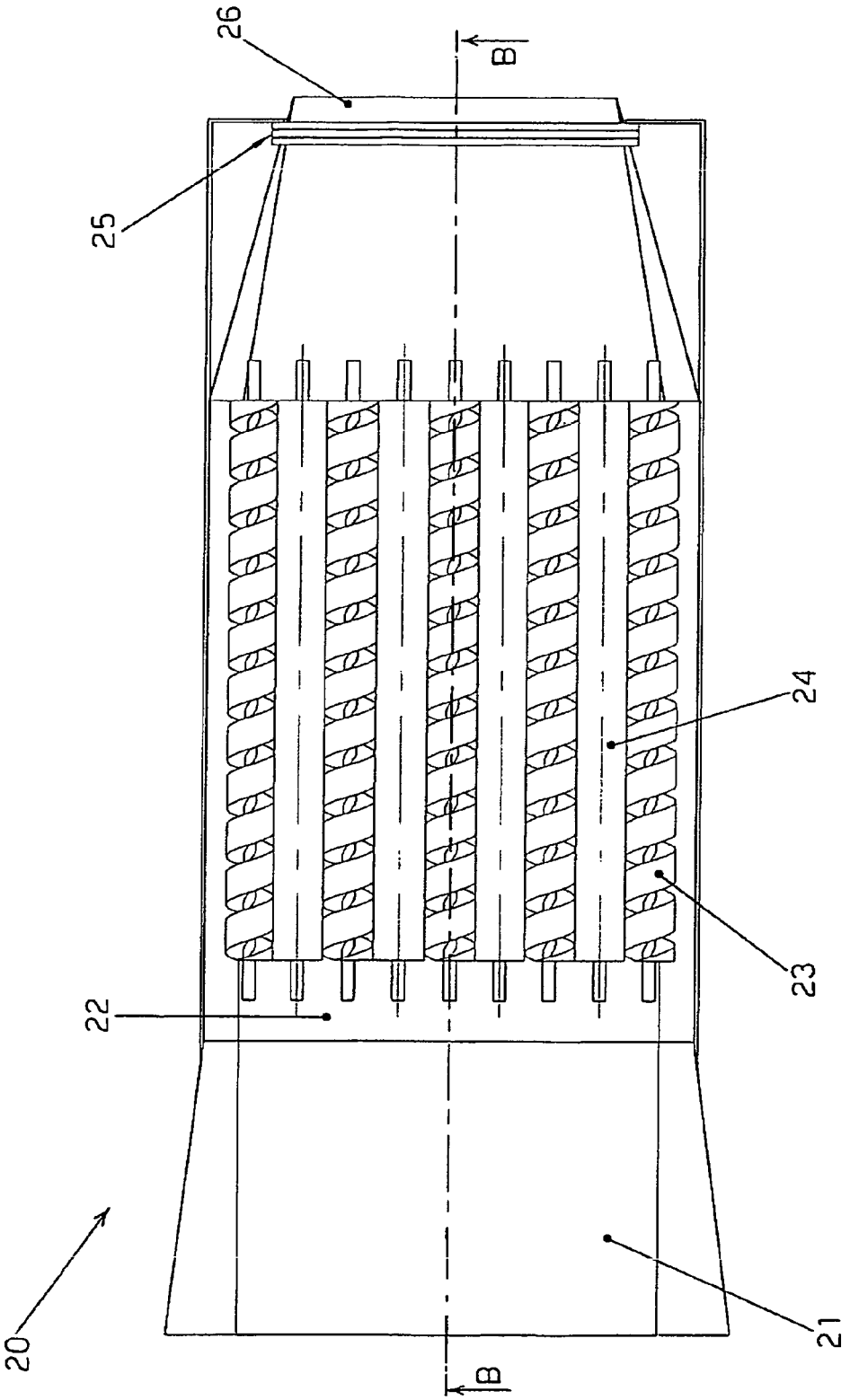

FIG. 2A

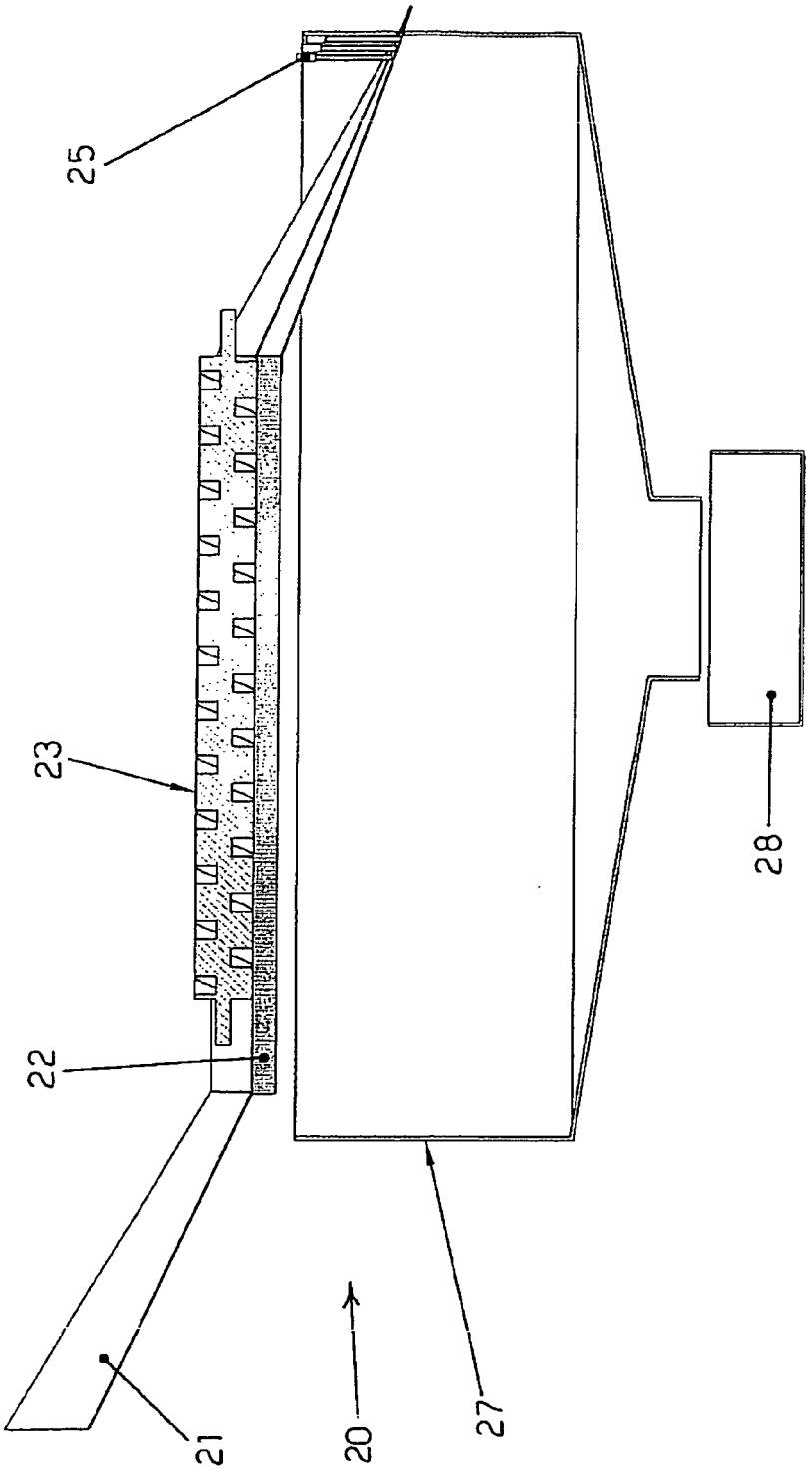

FIG. 2B

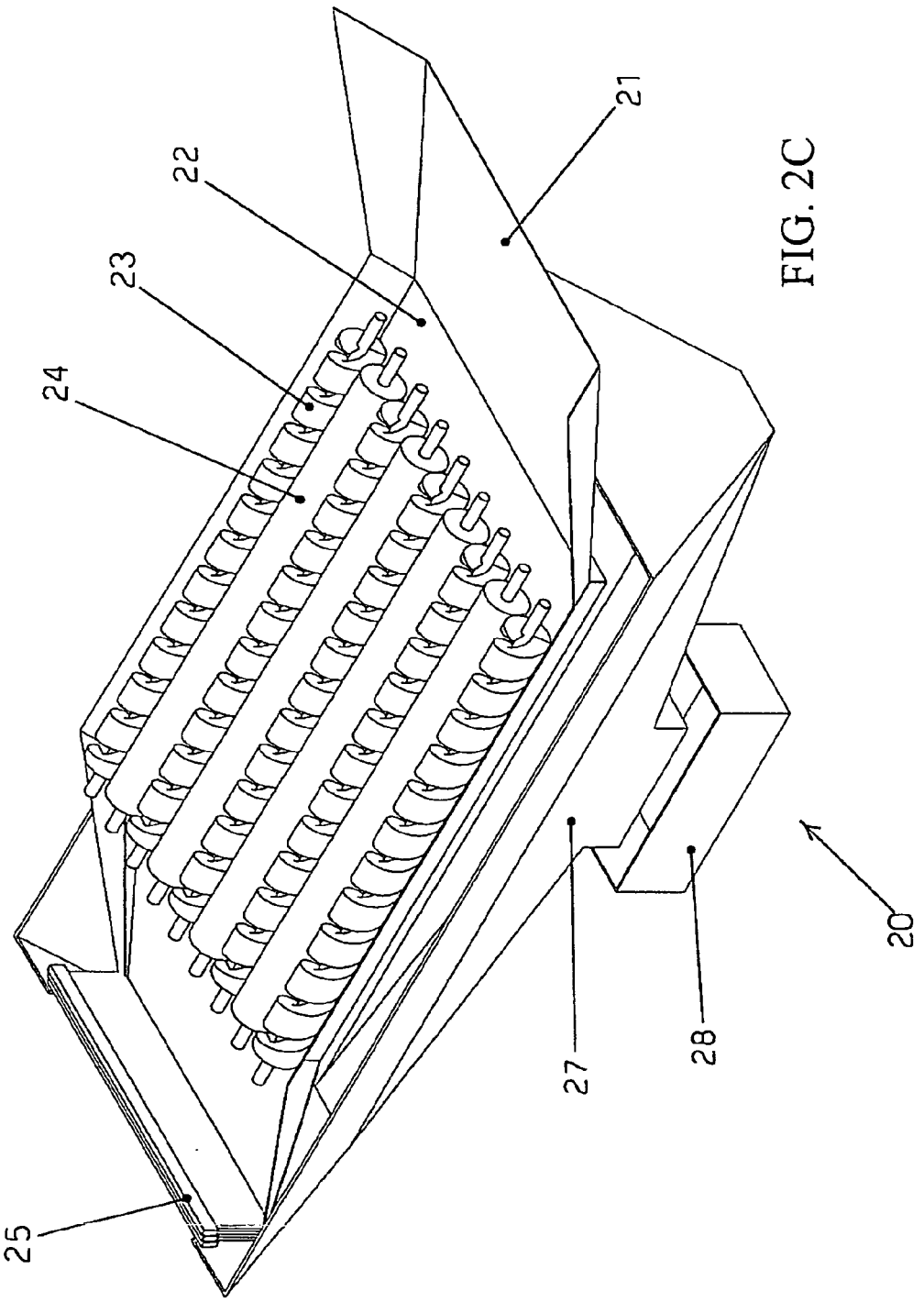

FIG. 2C

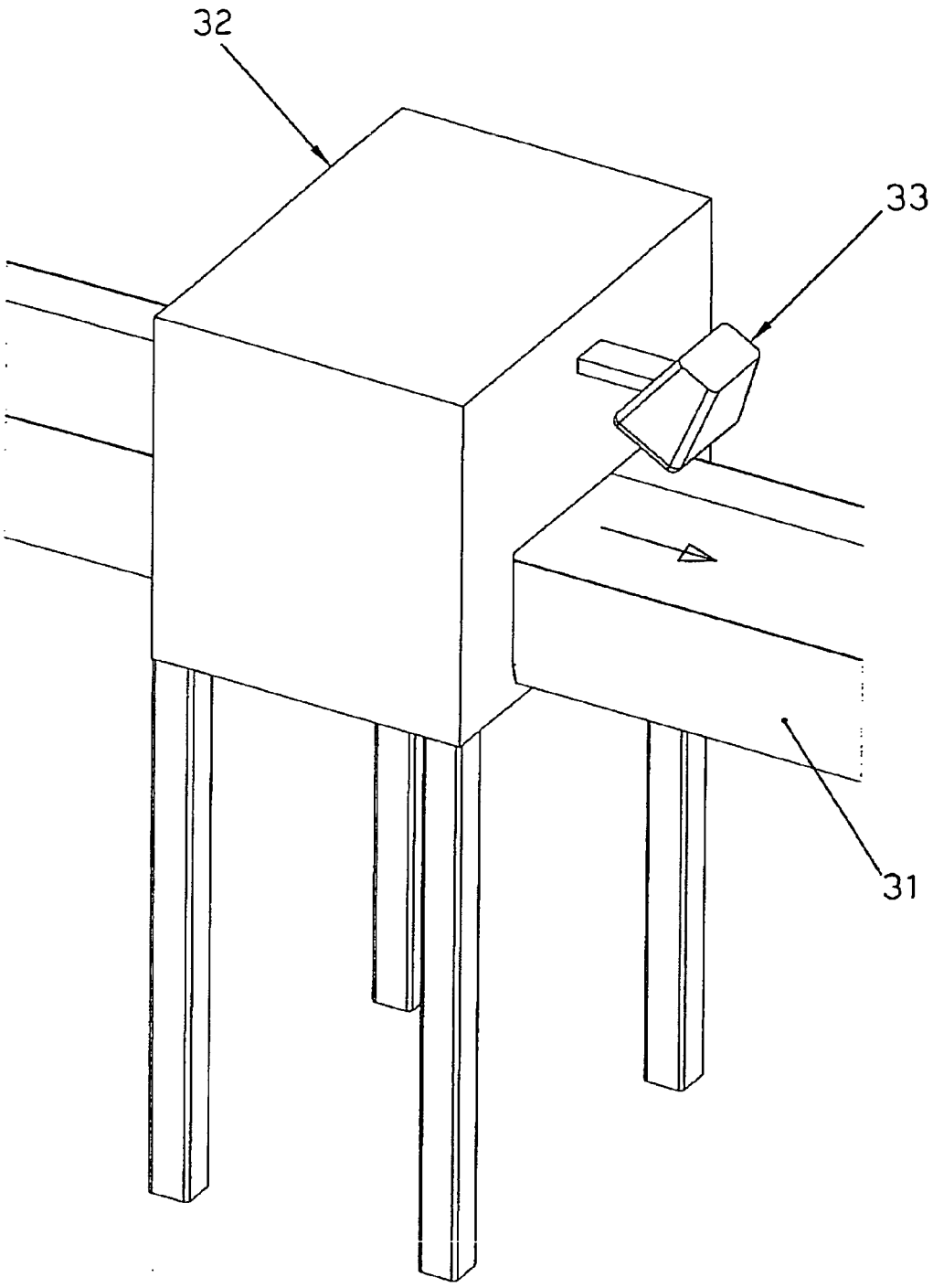

FIG. 3

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European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 10 01 6126

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 0 761 311 A1 (WESTAB ENGINEERING GMBH [DE] WESTAB HOLDING GMBH [DE]) 12 March 1997 (1997-03-12) * column 2, line 44 - line 48; figure 1 *	1-10	INV. B07C5/02
A	WO 2008/143471 A1 (INTEKPLUS CO LTD [KR]; LIM SSANG-GUN [KR]; LEE SANG-YUN [KR]; CHOI HO-) 27 November 2008 (2008-11-27) * paragraph [0022] *	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

B07C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 August 2011	Wich, Roland

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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