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(71) Applicant: **Dorigo, Oddino**
Via Cadore, 15
I-20135 Milano(IT)

(72) Inventor: **Dorigo, Oddino**
Via Cadore, 15
I-20135 Milano(IT)

(74) Representative: **Vatti, Paolo, Dr. Ing. et al**
Fumero-Studio Consulenza Brevetti
Franz-Joseph-Strasse 38
D-80801 München (DE)

(54) Apparatus for the continuous treatment particularly by means of liquids, of small size materials fed in bulk.

(57) Machine for the continuous treatment by means of liquids of small objects fed in bulk, comprising a substantially horizontal rotating container (1) formed of a plurality of coaxial elements (2, 13) positioned tail-to-head, inclined vanes (3) projecting from the inner walls of said elements (2, 13) for the mechanical advancement of the objects (10) being treated, and said elements (2, 13) being reciprocally connected with the interposition of gaps (4, 14) to discharge the treatment liquids; fixed pipelines (5) run along the inside of said container (1) and are provided with nozzles (6) to spray the liquids onto said objects (10).

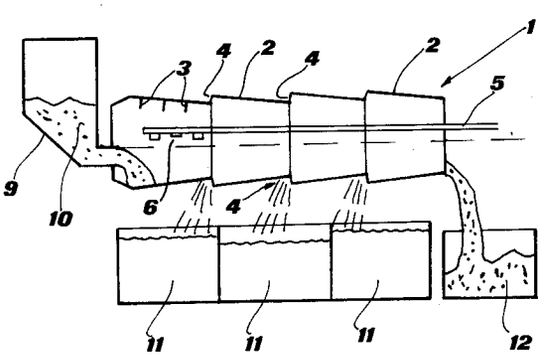

FIG.2

EP 0 557 672 A1

In modern industry, the mass production or treatment of small parts or objects plays a very important rôle, both in terms of quantity and for quality requirements. This can involve the industrial production of small metal and non-metal objects, as for example medals, springs, spring washers, rings for rolling bearings, pintles, balls, small disks and, above all, bolts, screws and nuts; but it can also involve the industrial treatment of agricultural or alimentary products, as for example seeds, grains and cereals, rice, fresh and dried legumes, slices or pieces of various food products, and so on.

In either cases, it is often necessary for such small objects to be treated in bulk with liquids.

For example, the aforespecified industrially produced objects are often manufactured making use of molding machines, as die-presses and rolling machines. Other objects are produced by automatic turning or by other machining operations which usually require the use of lubricating means. Still other pieces are treated in quenching baths, wherein oily substances are normally used as quenching means.

All these products are hence more or less covered with polluting substances, and sometimes they are even dripping with oil, whereby they are generally not fit for use in the state in which they are. Cleaning operations are thus required, especially if the pieces have to undergo successive treatments, as electroplating, varnishing, and the like.

Of course, there could be many other requirements - even of considerably different type - for treating small objects fed in bulk by means of liquids, both in the specific field of industrial products and, all the more reason, in the agricultural and alimentary field.

Owing to the high unit costs involved in carrying out said treatments by manual cleaning operations or, in any case, by means of special hand-tools, the requirement has since long arisen - in modern industry and, especially, in certain industrial sectors (as the production of small metal objects) - to create machines apt to continuously perform said operations by mechanical and automatic means, and include such machines - whenever possible - in the normal continuous production cycle.

Nevertheless, up to date, no fully satisfactory machines of this type have yet been set up - in spite of the great attention dedicated to this problem by the spheres concerned - probably due to the difficulty in combining simplicity and efficiency, which are simultaneously required from such machines.

In actual fact, up to date, the most interesting and widespread achievement has been, and is, a "washing" machine comprising (see fig. 1 of the accompanying drawings) a cylinder A of perforated plate, positioned horizontally - or slightly inclined in respect of the horizontal plane - and revolving about its axis, said cylinder housing helical vanes B forming a worm.

The material in small pieces C to be treated, loaded in bulk in the dosing hopper D, is gradually poured into the lower part of the cylinder A, the rotation of which causes - thanks to the helical vanes B - the foward motion of said pieces (from left to right in the drawing), until they are finally discharged into E.

Jets of treating liquid under pressure (consisting for instance - in the case of pieces covered in oil or grease - of one or more, normally alkaline-based, detergent solutions) are sprayed on the material to be treated, along its travelling path, through a set of nozzles G from a pipeline F inside the cylinder A.

After the washing treatment, the liquid drops by gravity through the holes provided in the cylinder A, collecting into the underlying tanks H, L, M.

The detergent solutions are generally at least partially recycled, after eventual purification and regeneration.

A function, similar to that of the pipeline F, is performed by the pipeline N with the nozzles P, to carry out rinsing as well as other operations (for example, an anti-rust treatment).

Machinery conceived on the basis of the aforedescribed principle has been used for years - no better solutions being available - in the mass production of small objects, currently classified as "small metal components".

Nevertheless, the above solution involves considerable drawbacks, determined by the size and geometry of the holes of the cylinder A, in relation to those of the objects being treated, especially when these last ones have projections or grips. It is in fact often difficult to find a compromise between the section of the holes and the geometry of the pieces.

If the holes of the cylinder A are larger than the objects being treated, these are likely to partially or totally fall through. Whereas, if the holes are of smaller size, the inconveniences arising are equally serious. The use of hot detergent solutions (normally heated to 60 °C), in combination with the fats adhering to the objects, causes in fact saponification, thereby gradually reducing the sections of the holes up to full occlusion thereof. Occlusions are also favoured by the filing residues and by burrs and other foreign matters, as impurities, which stick to the soapy layer, thereby preventing or hampering the outlet of the liquids.

It is thus necessary to frequently stop the machinery - so as to provide for its cleaning which

has to be done manually - with heavy maintenance costs, which weigh on the operating expenses.

Another problem of this machinery involves the treatment of delicate steel objects, which become fragile as they come out from the quenching baths after the hardening process; such objects, whose projections or grips can get stuck into the holes of the cylinder A, may easily break due to the weight of the overlying material.

Very serious problems can also arise in treating screws and self-threading or self-tapping screwing products: if some of these get stuck into the cylinder holes, they may come out at a later stage and mix up with those of a different lot, in a successive treatment. This must be positively avoided in case of supplies to industries (especially in the motoring field, with high degree of automation) which, now-a-days, subject the supplier to the "high-quality" clause - having given up, for reasons of costs, the quality control upon receipt of the goods - and which therefore lay on the supplier the responsibility for said control.

An additional drawback of the described machinery having a cylinder of perforated plate, lies in the fact that the treatment liquids, after having performed their task, are not keept separate, whereby it is impossible or anyhow unsafe to use them again, and this weighs once more on the operating costs.

The present invention now finally solves this ancient and important problem in a brilliant way, by supplying a machine which can be used in a very wide range of applications, from the mechanical industry (where this requirement is particularly felt in various sectors and no doubt calls for an immediate use) to the agricultural and food industry, as well as in other different fields.

The invention is based on the principle that the main inconveniences of washing machines used so far, and described heretofore, are determined by the presence of holes in the rotating cylinder, and that such inconveniences should consequently be overcome by providing solutions which - though still adopting the principle of the continuous advancement by worm means inside a container rotating about its axis, of the material to be treated with showers of detergent solutions and rinsing waters - eliminate the presence of holes for discharging the liquids at the end of the treatment.

This object is achieved with a machine for the continuous treatment by means of liquids of small objects fed in bulk, characterized in that it comprises: a substantially horizontal rotating container formed of a plurality of coaxial elements positioned tail-to-head, inclined vanes projecting from the inner walls of said elements for the mechanical advancement of the objects being treated, and said elements being reciprocally connected with the interposition of gaps to discharge the treatment liquids; and fixed pipelines running along the inside of said container, provided with nozzles to spray the liquids onto said objects.

With this machine, the small objects to be treated, fed in bulk, are moved forward in an upward direction - thanks to an external mechanical force - onto the solid surfaces of the rotating container, and the sprayed liquids are caused to drop spontaneously through the gaps formed between the various interconnected elements of the container.

In the machine according to the invention, the common axis of said elements and of the container can be horizontal or slightly inclined (for example from 5° to 10°).

According to a first preferred embodiment of the invention, said tail-to-head coaxial elements consist of identical, frustoconical or frustopyramidal hollow bodies, all set with their minor base or tail in the feeding direction of the objects being treated. Whereas, according to a second embodiment of the invention, said elements are cylindrical or prismatic hollow bodies, each having a cross section wider than that of the body which precedes it in the feeding direction of the objects being treated.

The rotation of the container, forming part of the machine, can be continuous or intermittent and its speed is adjustable.

The machine also comprises tanks to collect the treatment liquids in correspondence of the connection zones between the elements of the container - and thus of the gaps formed in said zones for discharging said liquids - as well as means, at the outlet end of the container, to receive the treated objects; it can also provide for means to recycle and at least partly recover the treatment liquids, as well as the heat. Said machine can moreover be housed into a vacuum chamber, equipped with smoke and steam filters or cleaners.

The invention is now described in further detail, by mere way of example, with reference to the accompanying drawings, which illustrate two preferred embodiments thereof, specifically designed for treating small metal and non-metal objects of industrial production, but also meant for different application fields (as agricultural and alimentary products). In said drawings:

Fig. 1 diagrammatically illustrates a conventional machine for the continuous treatment, by means of liquids, of small objects fed in bulk;

Fig. 2 diagrammatically illustrates a first embodiment of the machine according to the present invention;

Fig. 3 diagrammatically illustrates a second embodiment of the machine according to the present invention; and

Fig. 4 shows, in further detail, part of the machine illustrated in fig. 2.

With reference to figs. 2 and 4 of the drawings, the preferred embodiment of the machine according to the invention, for the continuous treatment by means of liquids of small objects fed in bulk, comprises a horizontal rotating container 1 (fig. 2), formed of a plurality of hollow coaxial elements 2 of frustoconical or frustopyramidal shape, positioned tail-to-head and housing inclined vanes 3 which project from their inner walls so as to form a screw. The elements 2 (four in fig. 2) are all set in the same direction, so that wide gaps 4 are formed in correspondence of their connection zones. The uniform setting of the elements 2, the inclination of their inwardly projecting vanes 3, and the rotation sense of the container 1, are determined so that the bulk material introduced in said container can move forward from one end to the other end thereof, in the head-to-tail direction (i.e. starting from the major base towards the minor base of said elements 2).

One or more fixed pipelines 5 run inside the container 1, substantially along its rotation axis and/or in proximity and parallel thereto, said pipelines 5 being provided with nozzles 6 to feed one or more treatment liquids into the various elements 2.

The bases of the various elements 2 are open; nevertheless, the major inlet base, or head, of the first element 2 comprises a flange 7 (see fig. 4) which delimits an opening 8 - possibly screened by a baffle - through which is introduced a chute 9 to feed the objects 10 to be treated.

Tanks 11, to collect the treatment liquids, are positioned under the container 1 in correspondence of the connection zones between the elements 2, and means 12 to collect the treated objects, consisting of a vessel (as shown) or of a conveyor, are positioned at the outlet of said container 1.

The rotation of the container 1 can be continuous or intermittent, and of variable speed, according to the requirements of each single treatment, and it can be obtained and adjusted by conventional means.

With a machine of this type, the small objects 10 to be treated are continuously fed from the chute 9 into the first element 2 of the rotating container 1, while the various treatment liquids are sprayed from the nozzles 6 of the pipeline 5 into the various elements 2. The objects move forward into the first element 2 (fig. 4) and are fed, from this latter, into the second element 2, and so forth, thanks to the mechanical action of the vanes 3. While moving forward the objects are thus progressively hit by the jets of the various liquids sprayed from the nozzles 6, and are hence subjected to the required treatments. Furthermore, while said objects are continuously moved forward by the vanes 3, with no possibility to move backward, the various liquids - which are not affected by the mechanical action of said vanes - freely discharge through the gaps 4 interposed between each element 2, and can thus be separately collected, by gravity, into the underlying tanks 11. The objects are instead discharged, after the treatment, at the outlet end of the container 1, into the collecting vessel 12.

This allows to efficiently carry out a continuous treatment with liquids on small objects fed in bulk, with none of the inconveniences of known technique, and to also recover a high percentage of said liquids, in good state, after the treatment.

In the embodiment of fig. 3, the container 1 comprises - instead of a plurality of identical elements 2 with varying cross section - five cylindrical or prismatic elements 13 having a constant section, but each larger than the previous element in the feeding direction of the objects being treated. Also in this case, each element 13 houses inclined vanes to move forward the material fed in bulk and the assembly of side-by-side axial elements forming the container 1 comprises, in correspondence of the connection points between each element 13, gaps 14 to discharge the treatment liquids fed - as in the previous embodiment - from fixed pipelines positioned inside the container 1. Nevertheless, to allow the machine of this embodiment to work correctly, the rotation axis of the container 1 (and thus of the various elements 13) should be slightly inclined in respect of the horizontal plane, for example by at least 8 to 10°.

Both the aforedescribed embodiments of the machine according to the invention can be completed with at least partially automatic means for the recycle, percolation, re-titration and thermal conditioning of the treatment liquids, while both embodiments can be housed into a vacuum chamber equipped with filters and cleaners to prevent the spreading of smokes and harmful vapours, especially in work environments.

The machine according to the invention can also be equipped with an immersion washing system (shown by 16 in fig. 4) to treat the objects in the first element 2 of the rotating container 1, just downstream of the inlet opening 8.

It is understood that the machine according to the invention could be realized in many other different ways. For example, the axis of the container 1, in the embodiment of figs. 2 and 4, could be slightly inclined instead of being horizontal; in both embodiments, the elements 2 and respectively 13 of the container 1 could be of different shapes; and means could be provided to recover the heat from the treatment liquids and/or solutions. It is moreover understood that the elements 2 of the rotating container 1, as well as the pipelines 5 and tanks 11

forming part of the machine, can be of any number according to the requirements of the various treatments having to be carried out by said machine, thereby differing in number from those of the previously described embodiments of the invention.

Claims

1. Machine for the continuous treatment by means of liquids of small objects fed in bulk, characterized in that it comprises: a substantially horizontal rotating container (1) formed of a plurality of coaxial elements (2, 13) positioned tail-to-head, inclined vanes (3) projecting from the inner walls of said elements (2, 13) for the mechanical advancement of the objects (10) being treated, and said elements (2, 13) being reciprocally connected with the interposition of gaps (4, 14) to discharge the treatment liquids; and fixed pipelines (5) running along the inside of said container (1), provided with nozzles (6) to spray the liquids onto said objects (10).

2. Machine as in claim 1), wherein the common axis of said elements (2) and of the container (1) is horizontal.

3. Machine as in claim 1), wherein the common axis of said elements (2, 13) and of the container (1) is slightly inclined in respect of the horizontal plane.

4. Machine as in claim 3), wherein said axis is inclined by 5° to 10°.

5. Machine as in claim 1), wherein said tail-to-head coaxial elements (2) consist of identical, frustoconical or frustopyramidal hollow bodies, all set with their minor base or tail in the feeding direction of the objects (10) being treated.

6. Machine as in claim 1), wherein said tail-to-head coaxial elements (13) consist of cylindrical or prismatic hollow bodies, each having a cross section wider than that of the body which precedes it in the feeding direction of the objects (10) being treated.

7. Machine as in claims 1) to 6), wherein the rotation of said container (1) is continuous.

8. Machine as in claims 1) to 6), wherein the rotation of said container (1) is intermittent.

9. Machine as in claims 1) to 8), wherein the rotation speed of said container (1) is adjustable.

10. Machine as in claims 1) to 9), comprising tanks (11) to collect the treatment liquids in correspondence of the connection zones between the elements (2, 13) of the container (1), and thus of the gaps (4, 14) formed in said zones for discharging said liquids, as well as means (12), at the outlet end of the container (1), to receive the treated objects.

11. Machine as in claims 1) to 10), wherein means are provided to recycle and at least partially recover the treatment liquids, as well as the heat.

12. Machine as in claims 1) to 11), wherein at least the first of said elements (2) of the container (1) comprises means for the immersion washing of the objects being treated.

13. Machine as in claims 1) to 12), wherein the first element (2) of the container (1) is provided with a baffle to dose the inlet of the objects being treated.

14. Machine as in claims 1) to 13), housed into a vacuum chamber equipped with smoke and steam filters or cleaners.

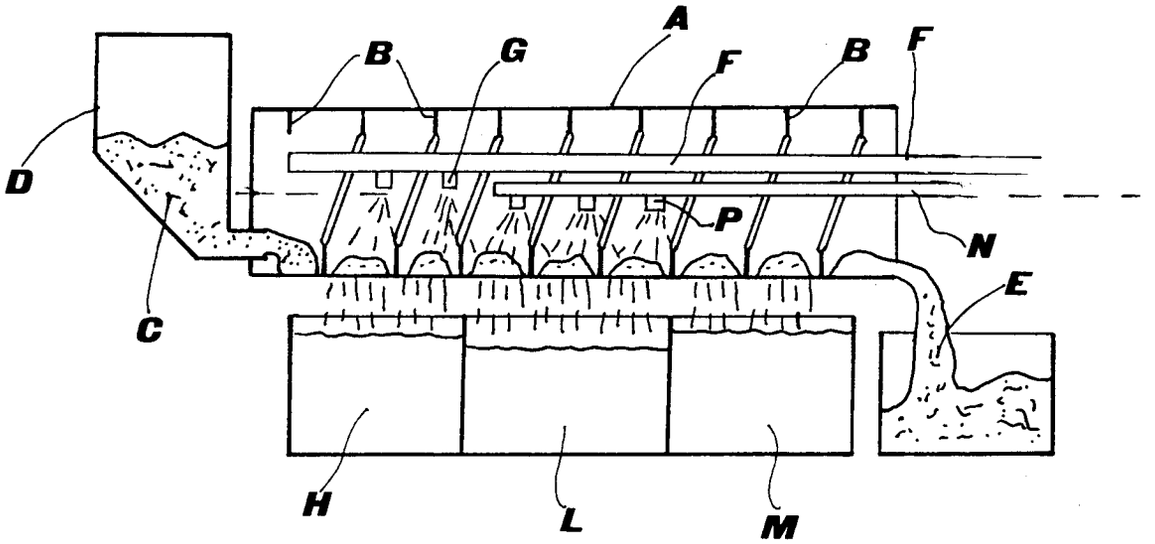

FIG.1

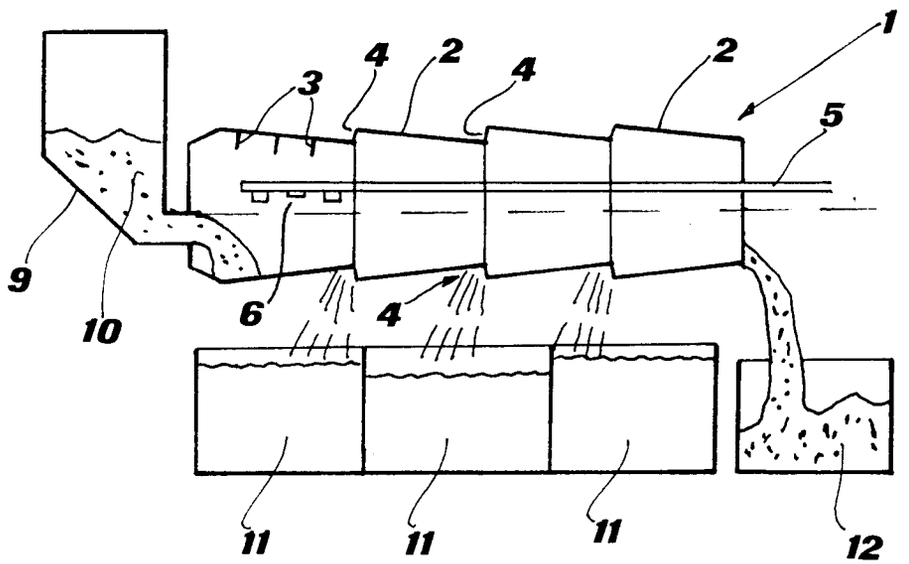

FIG.2

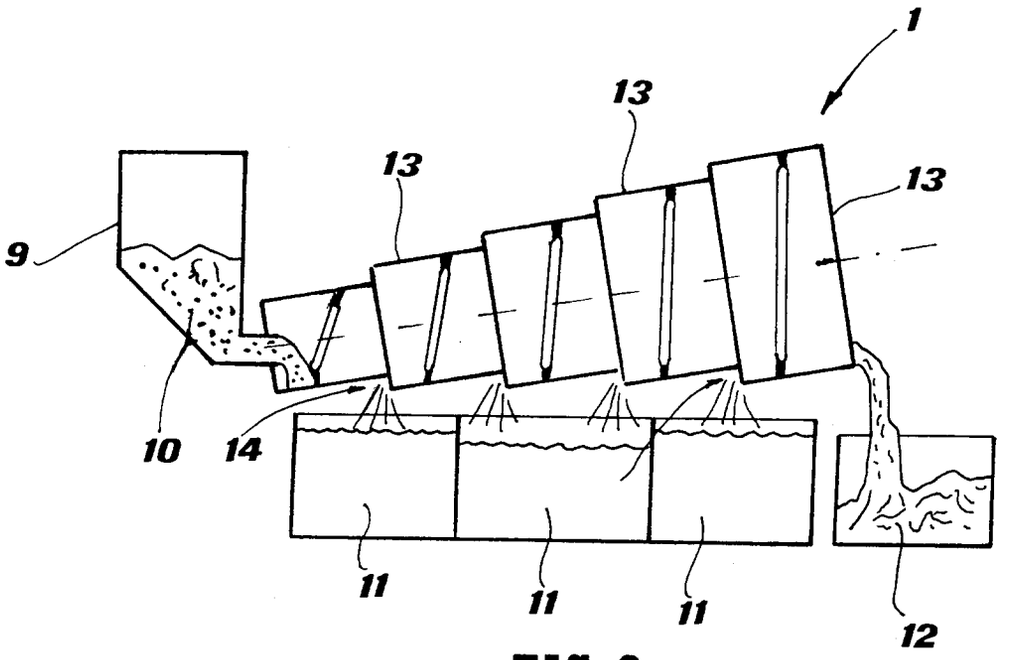

FIG.3

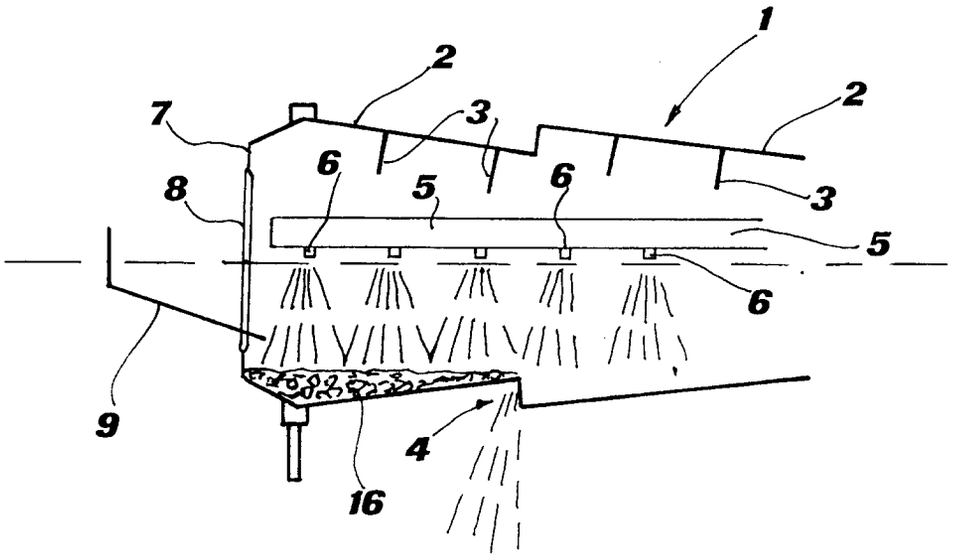

FIG.4

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EUROPEAN SEARCH REPORT

Application Number

EP 92 83 0075

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-2 325 442 (HENRY WIGGIN & CO. LTD.) * the whole document *	1,3,4, 6-11	B05B13/02 B08B3/04
A	US-A-1 383 418 (NEEDHAM) * page 1, line 50 - page 1, line 100; figures 1,4 *	1,2,5, 7-9	
A	EP-A-0 207 538 (FABRIQUE NATIONALE HERSTAL) * column 2, line 17 - column 3, line 30; figures *	1,2,10, 11	
A	EP-A-0 093 264 (RANSOHOFF CO.) * abstract; figures *	1,3,4,7, 10,11	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B05B
B08B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 OCTOBER 1992	GINO C.P.G.

CATEGORY OF CITED DOCUMENTS

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