(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
3 June 2004 (03.06.2004)

PCT

(10) International Publication Number
WO 2004/045360 A1

(51) International Patent Classification[7]: A47L 15/24

(21) International Application Number:
PCT/FI2003/000847

(22) International Filing Date:
7 November 2003 (07.11.2003)

(25) Filing Language: Finnish

(26) Publication Language: English

(30) Priority Data:
20022067 20 November 2002 (20.11.2002) FI

(71) Applicant *(for all designated States except US)*: **ROBOTIIKKA OY** [FI/FI]; Rekitie 1, FIN-26510 Rauma (FI).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **GRÖNLUND, Seppo** [FI/FI]; Avainkimpunkatu 6, FIN-26100 Rauma (FI).

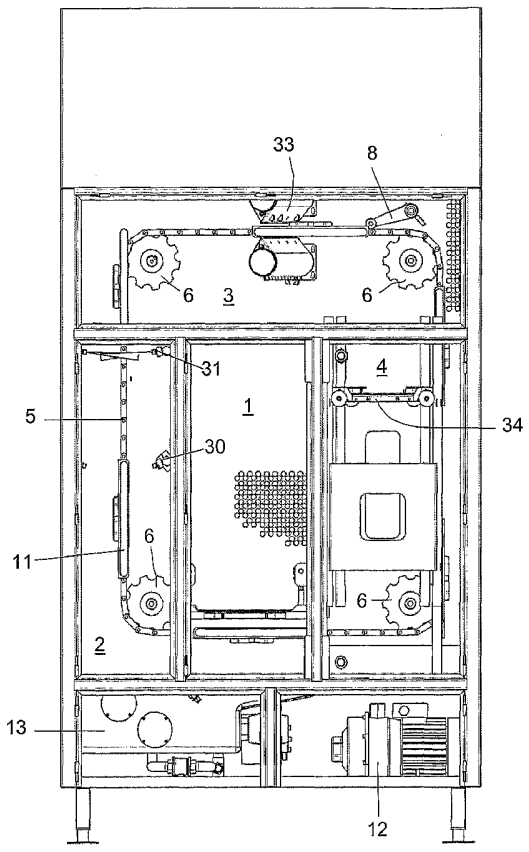
(74) Agent: **FORSSÉN & SALOMAA OY**; Eerikinkatu 2, FIN-00100 Helsinki (FI).

(81) Designated States *(national)*: AE, AG, AL, AM, AT (utility model), AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (utility model), DE, DK (utility model), DK, DM, DZ, EC, EE (utility model), EE, EG, ES, FI (utility model), FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT (utility model), PT, RO, RU, SC, SD, SE, SG, SK (utility model), SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE,

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(54) Title: TRAY WASHING MACHINE



(57) Abstract: A tray washing machine comprises a feeding section (1), washing section (2), drying section (3) and a discharge section (4) as well as conveying means (5) for transporting the trays (10) being washed from the feeding section (1) through the washing sectino (2) and the drying section (3) into the discharge section (4) of washed trays. The conveying means (5) form an endless vertical loop along two substantially horizontal portions of which the feeding section (1) and the drying section (3) are arranged. The washing section (2) and the discharge section 84) are arranged along two substantially vertical portions of the vertical loop. The conveying means comprise a chain (5) onto which one or more tray holders (11) are attached laterally, which tray holders (11) are provided with gripping members for holding the tray (10) in the ray holder (11) as it runs on a side of the chain (5) along a path in the shape of a vertical loop.

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SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Tray washing machine

The invention relates to a tray washing machine comprising a feeding section, a washing section, a drying section and a discharge section as well as conveying means for transporting the trays being washed from the feeding section through the washing section and the drying section into the discharge section of washed trays. The conveying means form an endless vertical loop.

Known tray washing machines have a horizontal or slightly ascending washing line, through which the trays are conveyed, set in a horizontal or vertical position, on the conveyor. Soiled trays are introduced at the feed end of the washing line and the clean trays are discharged from the opposite end of the washing line. A horizontal washing line requires a large amount of floor area. An additional working area is needed at each end of the washing line for feeding and discharging the trays. In tunnel washing machines the washing section and the drying section are usually separated from each other by means of plastic strips or the like that touch the trays as they move from one section to another. This can easily lead to problems with hygiene.

The trays are usually introduced into the washing machine as a stack, from which one tray at a time is released for washing. In *US patent 4,561,144* and *published European application 432 112* the uppermost tray is released by means of suction pads from the stack in order to be moved onto the washing transport belt. The use of suction pads and the moving of the tray are made more difficult by waste matter and dirt on the tray. The distance the tray has to travel supported by the suction pad from the stack onto the conveyor is long. In *published Swedish patent application 454 234* the lowermost tray is released from the stack of trays and dropped in an upright position onto the conveyor below. During the washing the tray, which is in an upright position is supported only by the conveyor belt, which is why the travel of the tray past the washing sprays may be very unstable.

An object of the invention is to reduce the problems relating to known arrangements. A special object is to provide a tray washing machine that does not require much space and that washes the trays automatically and hygienically, at the same time operating without disturbances.

To achieve the afore-mentioned objects the arrangement according to the invention is characterized in what is presented in the characterizing part of claim 1.

In the washing machine according to the invention the feeding section and the drying section are arranged along two substantially horizontal portions of a vertical loop and the washing section and the discharge section are arranged along two substantially vertical portions of the vertical loop. The conveying means comprise a chain onto which one or more tray holders are attached laterally, which tray holders are provided with gripping members for holding the tray in the tray holder as it runs on a side of the chain along a path in the shape of a vertical loop. The invention makes use of room height by arranging the sections required for each handling step in the form of an endless loop and by circulating the trays engaged on a side of the conveyor through these sections, thereby reducing the need for floor area compared with other commercially available tray washing machines.

In an advantageous embodiment of the invention the chain consists of articulated chain elements, and each tray holder is attached onto a side of a chain element by means of one or more attachment rods passing through said chain element. Said chain element is joined in an articulated manner with the adjacent chain element preferably by at least one of said attachment rods. In the most preferable embodiment of the invention there are two attachment rods and they engage the chain element in an articulated manner to the chain element on each side. The attachment of the tray holder to the chain is arranged such that the tray holder will always remain in a position substantially parallel to the plane of the chain element

and turn, in a controlled manner, together with the chain element as the running direction of the chain changes.

In an advantageous embodiment of the invention the tray holder comprises a frame part having at least two gripping members for gripping the tray lip. The gripping members are arranged on at least two edges of the frame part. The tray surface is thus kept almost entirely free for washing.

Advantageously, at least one of the gripping members is spring-loaded and the tray holder has means for moving the spring-loaded gripping member against the force of the spring. In an advantageous embodiment of the invention the tray holder comprises a support beam joined movably to an inner beam, to which the spring-loaded gripping member is attached. The inner beam is in turn provided with a release pin. By acting on the release pin it is possible to move the gripping member relative to the attachment beam. Actuating means can be provided in the feeding section and discharge section for automatic attachment and release of the tray, by means of which actuating means the release pin is positively actuated to reach a position where the spring-loaded gripping member is set against the force of the spring.

The arrangement according to the invention has many advantages, the most important of which is that it requires little space. This is achieved by arranging a previously horizontal washing line to circulate along a vertical path in the form of a loop, thereby enabling the feeding and discharging of trays directly from the front of the machine. In the washing section the trays are washed as they advance from below upwards, attached onto the side of the chain, whereby the spraying waters of the washing zone flow downwards due to the influence of gravity and, at the same time, prewash the next tray to be washed. Waste matter left on the tray does not interfere with the moving or washing of the tray. Since the conveying means are situated on the side of the washing line and the tray is attached to the tray holder only by its lips in an almost point-like manner, it is possible to wash

both sides of the tray at the same time. In the drying step the tray is in an inverted position and the blowing nozzles are arranged so as to ensure removal of water without splashes. Due to gravity and pressure difference no curtains made of plastic strips are needed between the different sections, which improves the hygiene of the wash.

The invention will now be described with reference to the figures of the accompanying drawings.

Figure 1 is a view in perspective of a tray washing machine according to the invention without a front wall.

Figure 2 shows the washing machine seen directly from the front.

Figure 3 is a view in perspective of a chain with tray holders removed from the washing machine.

Figure 4 is a view in perspective of the position of the blowing nozzles relative to the tray.

Figure 5 shows the tray holder with trays seen from below.

Figure 6 is a cross sectional view of the tray holder along the line B-B in Figure 5.

Figure 7 is a top plan view of the tray holder.

Figure 8 shows a tray feed screw in a tray separating position.

Figure 9 shows a tray feed screw in a tray dropping position.

Figures 1 and 2 show a tray washing machine according to the invention without front doors. The washing machine comprises several sections partially separated from each other by means of partition walls. In the middle of the washing machine there is a feeding section 1, into which the trays to be washed are introduced. To the left of the feeding section 1 there is a washing section 2, in which the trays are washed and rinsed. Above the feeding section 1 there is a drying section 3, in which the trays are dried. To the right of the feeding section 1 there is a discharge section 4, through which the washed trays are discharged from the washing machine. Additionally, in the bottom part of the washing machine there is room for a pump 12, a wash water container 13 and for other necessary equipment.

A chain 5 is arranged in the rear section of the washing machine, the chain running past the feeding section 1, washing section 2, drying section 3 and discharge section 4. The chain 5, illustrated in more detail in Figure 3, is arranged to circulate along a path determined by chain wheels 6, the path having substantially the form of a loop. One of the chain wheels 6 is connected with a drive means 7, providing the movement of the chain 5. The tension of the chain 5 is controlled by means of a tensioning device 8. The chain 5 is made up of latticeworks, preferably of plastic chain elements 15, joined together by means of connecting shafts 9 such that the chain 5 forms an endless loop flexible at the joints. A plurality of tray holders 11 is attached laterally (i.e. on a side) to the chain 5, which tray holders have gripping members for gripping lips of a tray 10. The tray holder 11 and its attachment to the chain 5 are arranged such that the tray 10 remains, during the entire wash circulation, substantially parallel to the plane of the chain 5, on the side of the chain.

The trays 10 to be washed are set as a stack on support and feeding members located in the feeding section 1. The lowermost tray 10 is released from the stack by means of the feeding members and it is allowed to drop in a horizontal position onto a tray holder 11 moved below. The gripping members in the tray holder 11

lock the tray 10 in place. The tray 10 engaged to the tray holder 11 moves with the chain 5 to the washing section 2, through which it advances vertically from below upwards. In the washing section 2 washing sprays are first directed to the tray 10 from washing nozzles 30 arranged to its both sides and after this, rinsing sprays are directed to the tray from rinsing nozzles 31 arranged to its both sides. The waters used for washing and rinsing flow downwards in the washing zone 2, thereby prewashing the next tray to be washed and possibly removing waste matter left on the tray. This waste matter is finally removed during washing. The waste matter stays on a screen 32 in the bottom part of the washing zone 2, through which screen the wash water and rinsing water flow into a wash water container 13. The screen 32 is cleaned when necessary.

After washing and rinsing the tray holder 11 connected to the chain 5 moves the tray 10 into the drying section 3 above the feeding section 1, through which drying section the tray 10 is guided horizontally in an inverted position. Blowing nozzles 33 are arranged on both sides of the path of the tray 10, from which nozzles air jets are directed to the surface of the tray 10. It can be seen in Figure 4 that the blowing nozzles 33 are arranged in an oblique angle, e.g. of about 10°, relative to the direction of movement of the tray 10, whereby the air jet forces the drops of water to the far corner of the tray 10 and there is only a minimal amount of splashing of water onto the portion of the tray which has already been dried. The blowing nozzles 33 are provided near the surface of the tray 10 such that the blow is directed almost perpendicularly against its surface so as to ensure efficient water removal. As the tray is dried in an inverted position, the formation of water-gathering pockets can be prevented.

After the drying section 3 the chain wheel 6 guides the chain 5 downwards, whereby the tray holder 11 conveys the washed and dried tray 10 into the discharge section 4. At this point the automatics of the machine release the tray 10 in a later-described manner from the tray holder 11 and guide it onto the stack of washed trays on a receiving rack 34. The receiving rack 34 is preferably spring-

loaded such that the uppermost tray of the stack is always at about the same height.

Figures 5-7 illustrate in more detail the structure of the tray holder 11 and how it is connected with the chain 5. The tray holder 11 comprises a U-shaped loop 16 and an attachment beam 17, to which both ends of the loop 16 are attached. The attachment beam 17 is in turn attached to the chain 5. A space somewhat greater than the outer dimensions of the tray 10 is left between the attachment beam 17 and the loop 16. The tray holder 11 is additionally equipped with two rods 35 extending across the loop 16, the curvature of which rods preferably corresponds to that of the bottom of the tray 10. The attachment beam 17 comprises first gripping members 22 and on the opposite edge of the loop 16 there are second gripping members 23, which grip the lip of the tray 10 in order to hold it in place inside the circumference formed by the loop 16 and the attachment beam 17.

The chain 5 is made up of easily washable plastic chain elements 15, both edges of which have a row of finger elements 18 having a hole in the middle. The chain elements 15 are joined to form the chain 5 by means of the connecting shafts 9 illustrated in Figure 3, which connecting shafts pass through the finger elements 18, arranged in an intermeshed relation, of two adjacent chain elements 15. The attachment beam 17 is connected with the chain 5 by means of two attachment rods 19 extending not only through the finger elements 18 of the chain element 15 but also through the attachment beam 17 connected with the tray holder 11. In addition, the attachment rods 19 are connected with each other at the front and rear edge of the chain element 15 by means of connecting bars 21. This connection between the chain element 15 and the tray holder 11 ensures that the tray holder 11 always remains parallel to the plane of the chain element 15 to which it is connected by means of two connecting rods 19.

An inner beam 20 is arranged inside the attachment beam 17, to which inner beam the gripping members 22 are attached such that they extend through openings in

the wall of the attachment beam 17. The inner beam 20 is connected with the attachment beam 17 so as to make it possible to move the inner beam 20 relative to the attachment beam 17, whereby the gripping members 22 also move. Both the attachment beam 17 and the inner beam 20 have a U-shaped cross profile. Both side walls of the inner beam 20 have three openings, through which the above-mentioned two connecting rods 19 and a support rod 25 extend. These three rods connect the inner beam 20 with the attachment beam 17 in a way that prevents the inner beam 20 from moving in the longitudinal direction relative to the attachment beam 17 but does not limit its cross-directional movement inside the attachment beam 17. A spring 24 is wound around the support rod 25, which spring extends from the first (on the side of the chain) wall of the attachment beam 17 through an opening in the first wall of the inner beam 20 to the second wall of the inner beam 20. In rest position the spring 24 forces the inner beam 20 against the second (on the side of the tray) wall of the attachment beam 17. The gripping members 22 attached to the inner beam 20 are then in their outermost position.

On the upper surface of the attachment beam 17 there is an elongated opening 28 and in the corresponding place of the upper surface of the inner beam 20 there is a pin 26 extending through the opening 28. When the pin 26 is moved in the opening 28, the inner beam 20 and the gripping members 22 move inside the attachment beam 17 against the force of the spring 24. When it is desired to retract the gripping members 22, a force is applied to the pin 26, which force moves the inner beam 20 against the force of the spring 24 and closer to the chain-side wall of the attachment rod 17. When the effect of the external force ceases, the inner beam 20 returns, by the action of the spring 24, to its initial position and the gripping members 22 extend outwards. The force moving the pin 26 is provided by means of an actuator, which may be positively actuatable, situated along the path of travel of the chain 5. The actuator can be, for example, a wedge-shaped object gripping a support part 27 in the attachment beam 17 and the pin 26 in the inner beam 20 and forcing the pin 26 to slide closer to the support part 27.

In the feeding section 1 the tray 10 is dropped from the feeding members onto the transverse rods 35 of the tray holder 11. Somewhat earlier the release pin 26 has been positively actuated to come closer to the support part 27, at which point the movable gripping members 22 have been moved so much as to allow the lips of the tray 10 to settle between the retracted gripping members 22 and the fixed gripping members 23. When the force acting on the release pin 26 ceases, the gripping members 22 return, by the action of the spring 24, to their initial position and the gripping members 22 and 23 on the edges of the tray holder 11 keep the tray 10 attached to the tray holder 11. In the discharge section 4 there is a similar arrangement, by means of which the attachment of the tray 10 to the tray holder 11 is released.

Figures 8 and 9 illustrate means, located in the feeding section 1, for supporting the stack of trays and for releasing the lowermost tray 10_A from the stack. The stack of trays rests on two or more feed screws 36 supporting the lowermost trays 10_A-10_C of the stack from two or more sides. The feed screws are rotated about their vertical axis by means of power transmission shafts 37 and 38. If necessary, the stack of trays may be additionally supported by support wheels (not shown) arranged on the sides of the stack. The feed screws and support wheels are then preferably rotated at the same rate.

A ridge 39 encircles the cylindrical surface of the feed screw 36, the width of which ridge increases from the tip 40 towards the bottom part of the cylindrical surface until the ridge 39 ends at the lower edge of the feed screw 36. As the feed screw 36 rotates about its axis, the tip 40 of the ridge enters between two superjacent trays 10_B and 10_C separating them from each other. The lip flange of the tray 10_B slides downwards in a groove 41 between two ridges 39 as the feed screw 36 continues its rotary motion. The gap between the two superjacent trays 10_A and 10_B increases as the width of the ridge 39 separating them grows. The increase in the width of the ridge makes it possible to separate trays that are possibly attached to each other from one another. This way it can be ensured that only the lower-

most tray of the stack is dropped onto the tray holder. When the lowermost tray 10_A reaches the point where the ridge 39 ends, the tray 10_A is released from the groove 41 and falls onto the tray holder waiting below.

In addition to the tray holder described above other arrangements for the attachment of trays may also be used, providing they reliably hold and support the tray laterally on the side of the chain. Instead of two attachment rods, the tray holder may be attached to the chain by means of only one attachment element, providing it is ensured that the tray always remains substantially in the same direction with the chain. Instead of one broad chain two narrower chains moving at the same rate may be used. In such a case it is possible to provide one of the chains in the front section of the washing machine and the other in the rear section, whereby the tray is supported in the area between the chains.

The tray washing machine may be equipped, in a manner known per se, with sensors that start up the conveying and washing mechanism when there are enough trays to be washed in the feeding section.

With the washing machine according to the invention it is also possible to wash, in addition to trays, several other objects that share a similar shape and that are handled in great numbers.

Claims

1. A tray washing machine comprising a feeding section (1), a washing section (2), a drying section (3) and a discharge section (4) as well as conveying means (5) for transporting the trays (10) being washed from the feeding section (1) through the washing section (2) and the drying section (3) into the discharge section (4) of washed trays, which conveying means (5) form an endless vertical loop, **characterized** in that the feeding section (1) and the drying section (3) are arranged along two substantially horizontal portions of the vertical loop and the washing section (2) and the discharge section (4) are arranged along two substantially vertical portions of the vertical loop, and the conveying means comprise a chain (5) onto which one or more tray holders (11) are attached laterally, which tray holders are provided with gripping members (22, 23) for holding the tray (10) in the tray holder (11) as it runs on a side of the chain (5) along a path in the shape of a vertical loop.

2. A washing machine according to claim 1, **characterized** in that the chain (5) consists of articulated chain elements (15), and each tray holder (11) is attached onto a side of a chain element (15) by means of one or more attachment rods (19) passing through said chain element (15).

3. A washing machine according to claim 2, **characterized** in that at least one of said attachment rods (19) engages said chain element (15) in an articulated manner with an adjacent chain element.

4. A washing machine according to claim 2, **characterized** in that each tray holder (11) is attached onto a side of one chain element (15) by means of two attachment rods (19) engaging said chain element (15) in an articulated manner to the neighbouring chain elements.

5. A washing machine according to any one of the preceding claims, **characterized** in that the tray holder (11) comprises a frame part (16, 17) having at least two gripping members (22, 23) for gripping the lip of the tray (10), which gripping members (22, 23) are arranged on at least two edges of the frame part (16, 17).

6. A washing machine according to claim 5, **characterized** in that at least one of the gripping members (22) is spring-loaded and the tray holder (11) has means (26) for moving the spring-loaded gripping member (22) against the force of the spring (24).

7. A washing machine according to claim 6, **characterized** in that the tray holder (11) comprises a support beam (17) joined movably to an inner beam (20), to which the spring-loaded gripping member (22) is attached, and the inner beam (20) is provided with a release pin (26), by means of acting on which release pin (26) it is possible to move the gripping member (22) relative to the attachment beam (17).

8. A washing machine according to claim 7, **characterized** in that actuating means are provided in the feeding section (1) and discharge section (4), by means of which actuating means the release pin (26) is positively actuated to reach a position where the spring-loaded gripping member (22) is set against the force of the spring (24).

9. A washing machine according to any one of the preceding claims, **characterized** in that the feeding section (1) is equipped with two or more feed screws (36) supporting, from at least two sides, the stack of trays (10_A, 10_B, 10_C) to be washed, and said feed screws (36) are arranged to rotate about their vertical axis, as a result of which rotary motion the lowermost tray (10_A) of the stack is released from the support of the feed screws (36) so that it falls onto the tray holder (11) waiting below.

10. A washing machine according to claim 9, **characterized** in that a ridge (39) encircles spirally the outer surface of each feed screw (36), which ridge has a narrow tip (40) able to enter between two superjacent trays (10_B, 10_C) separating them from each other, the width of the ridge (39) increasing towards the bottom part of the feed screw (36) until the ridge (39) ends, at which point the lowermost tray 10_A resting on the ridge is released from the support of the ridge (39).

11. A washing machine according to claim 10, **characterized** in that the feeding section additionally comprises at least one support wheel provided on the side of the stack of trays and arranged to rotate about its vertical axis touching the trays, whereby the support wheel supports the stack of trays and makes it easier for the tip of the ridge to enter between the trays.

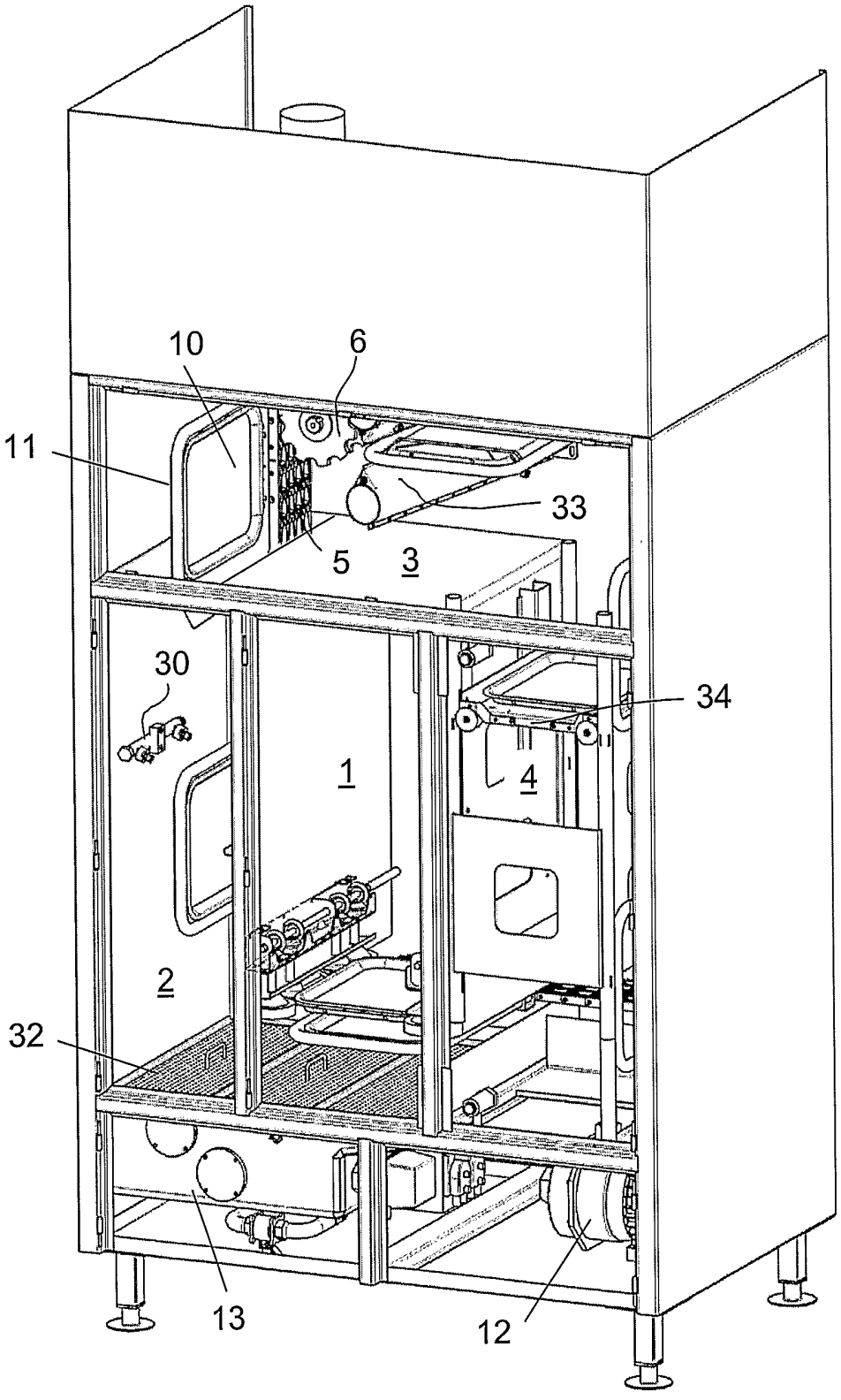


FIG. 1

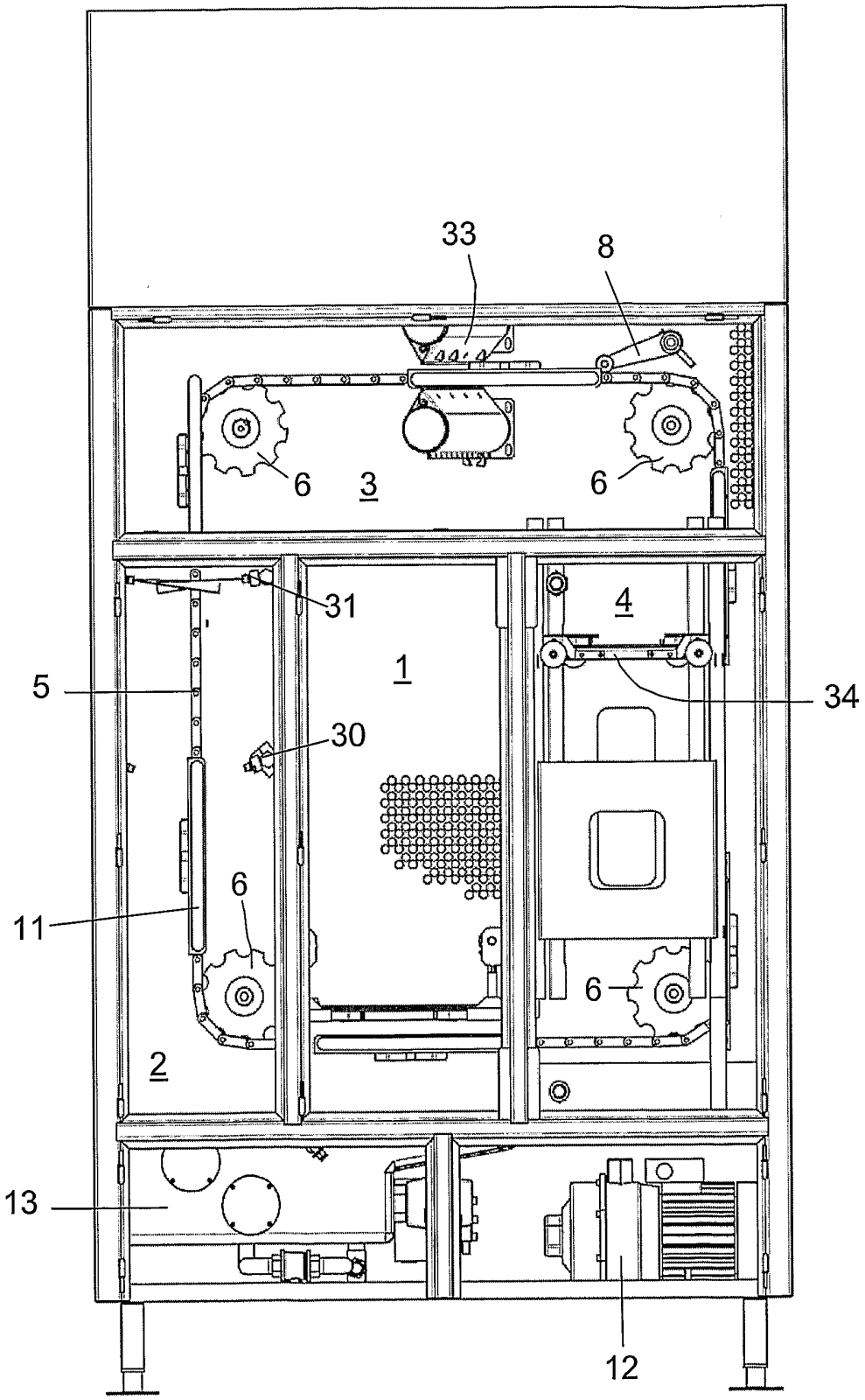
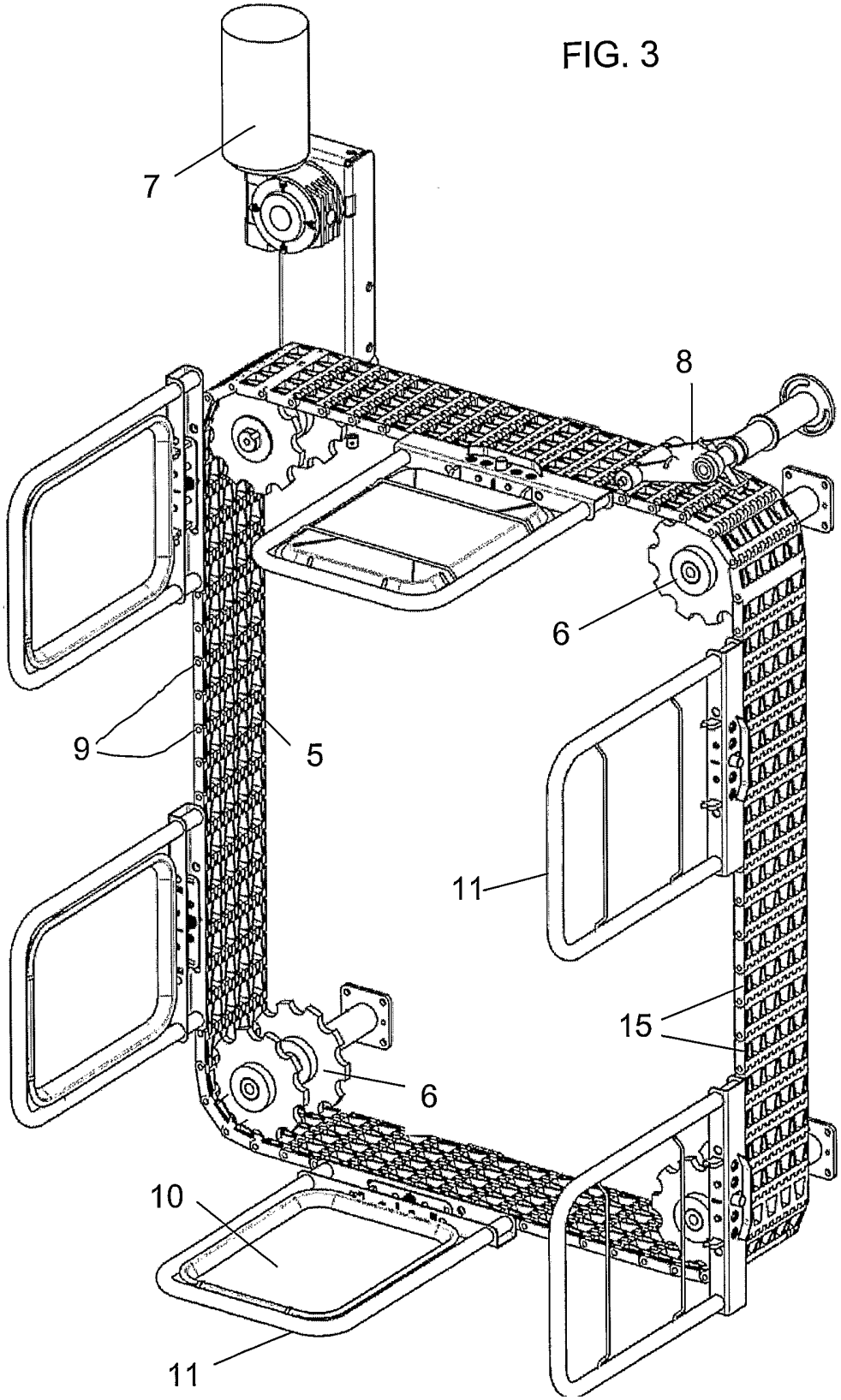


FIG. 2

FIG. 3



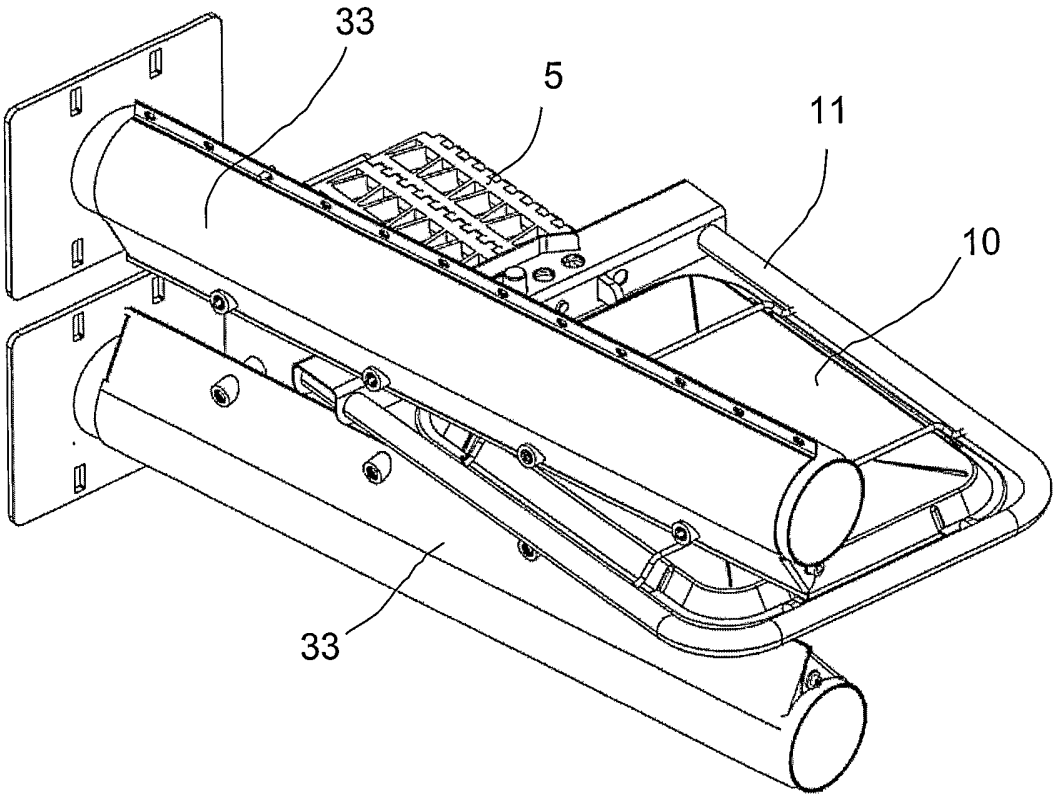


FIG. 4

FIG. 5

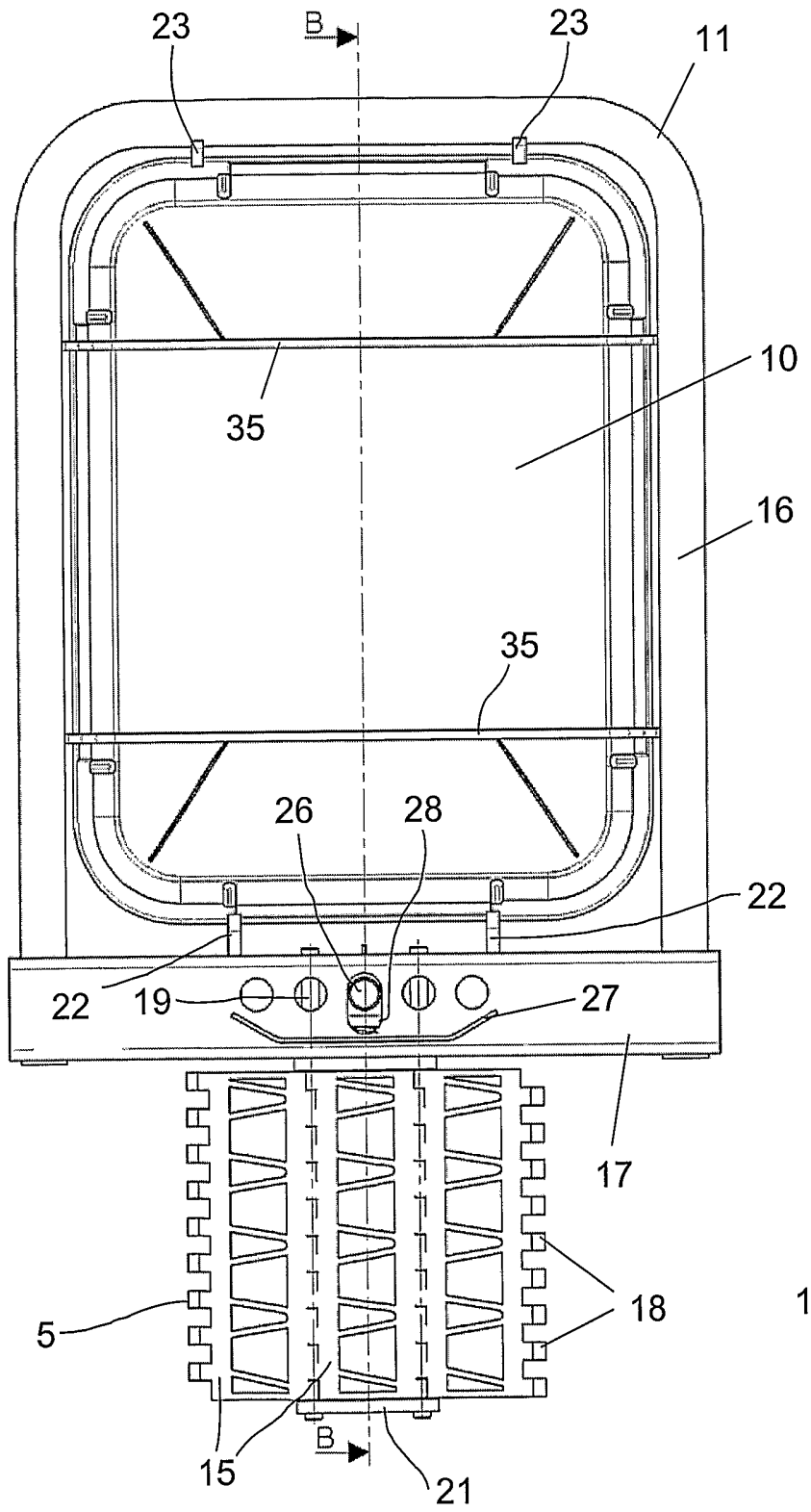
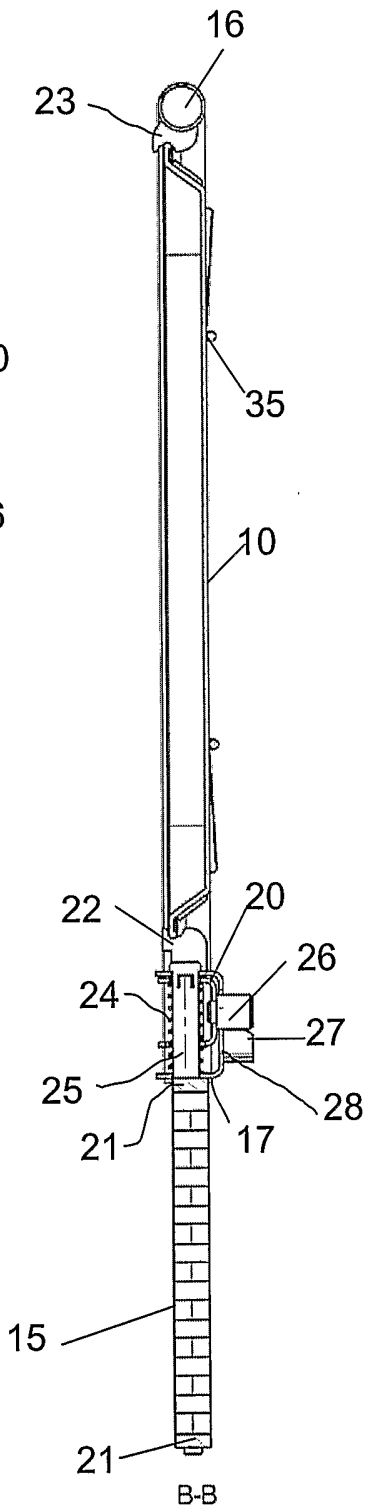

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FIG. 6


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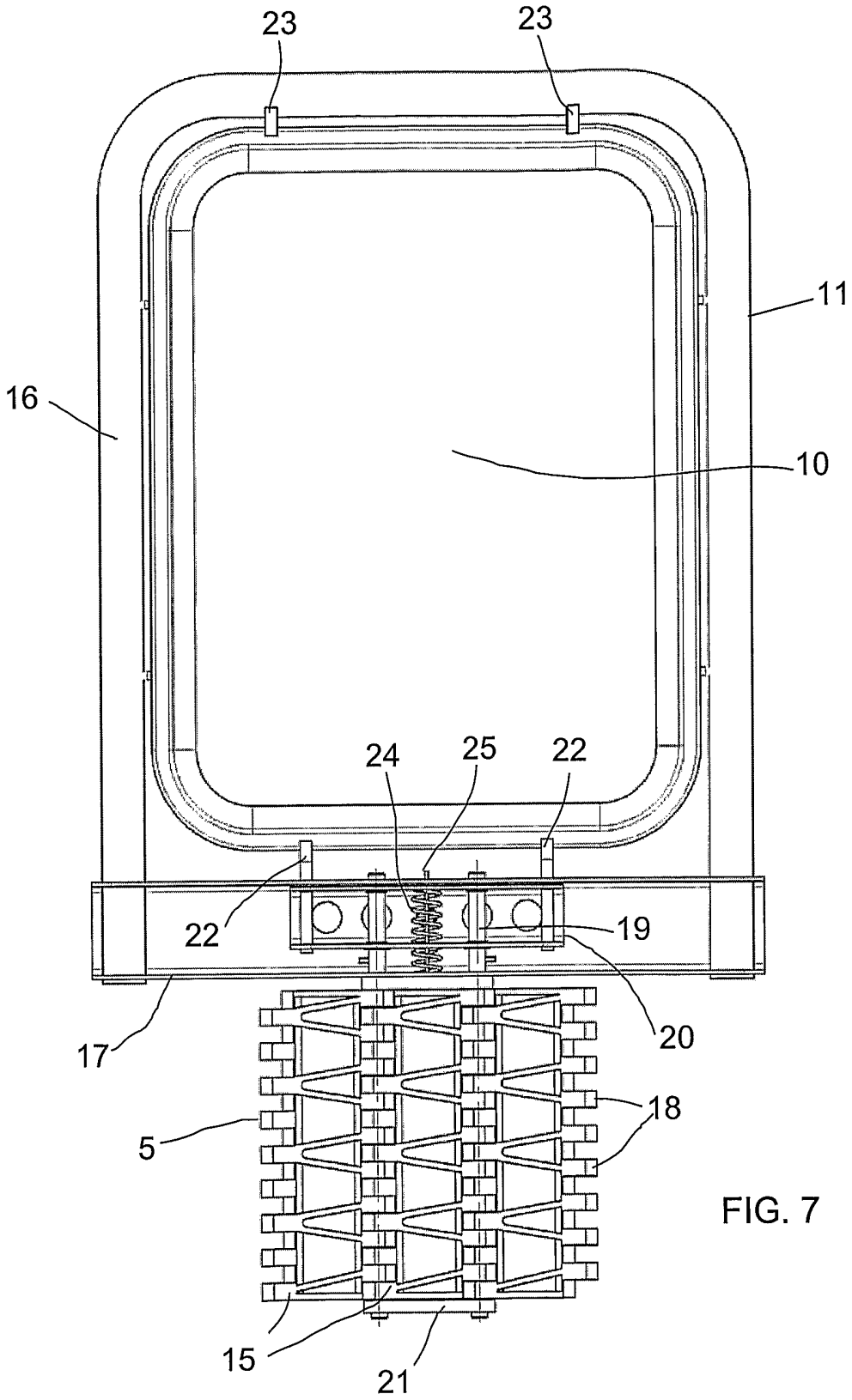


FIG. 7

FIG. 8

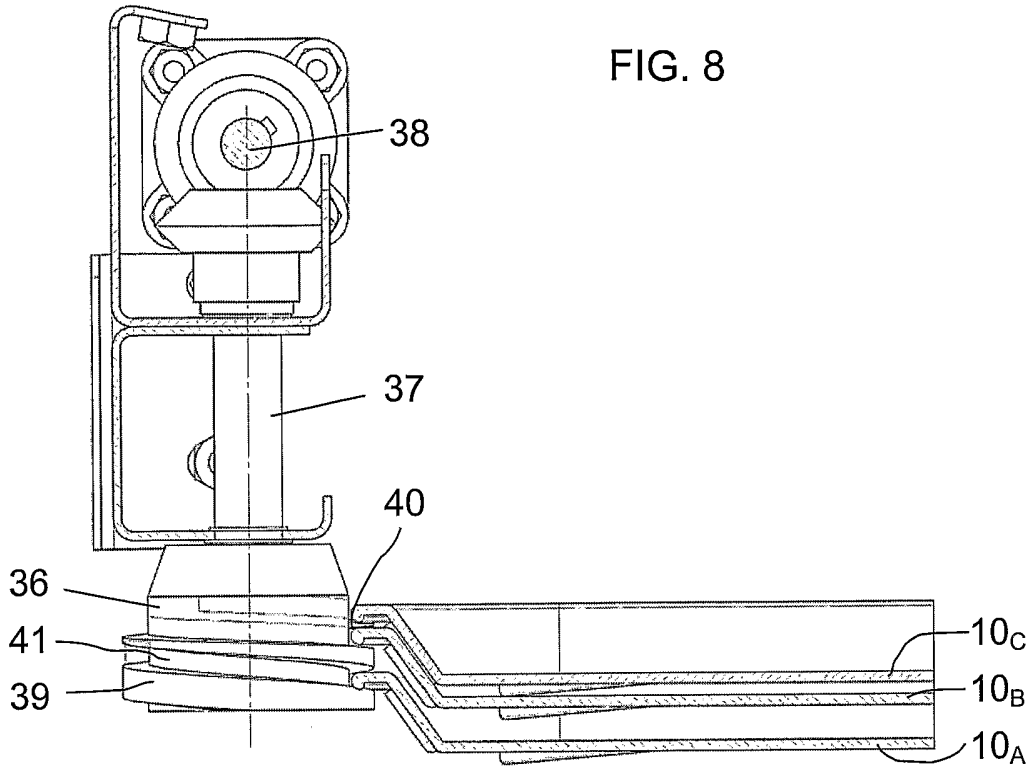
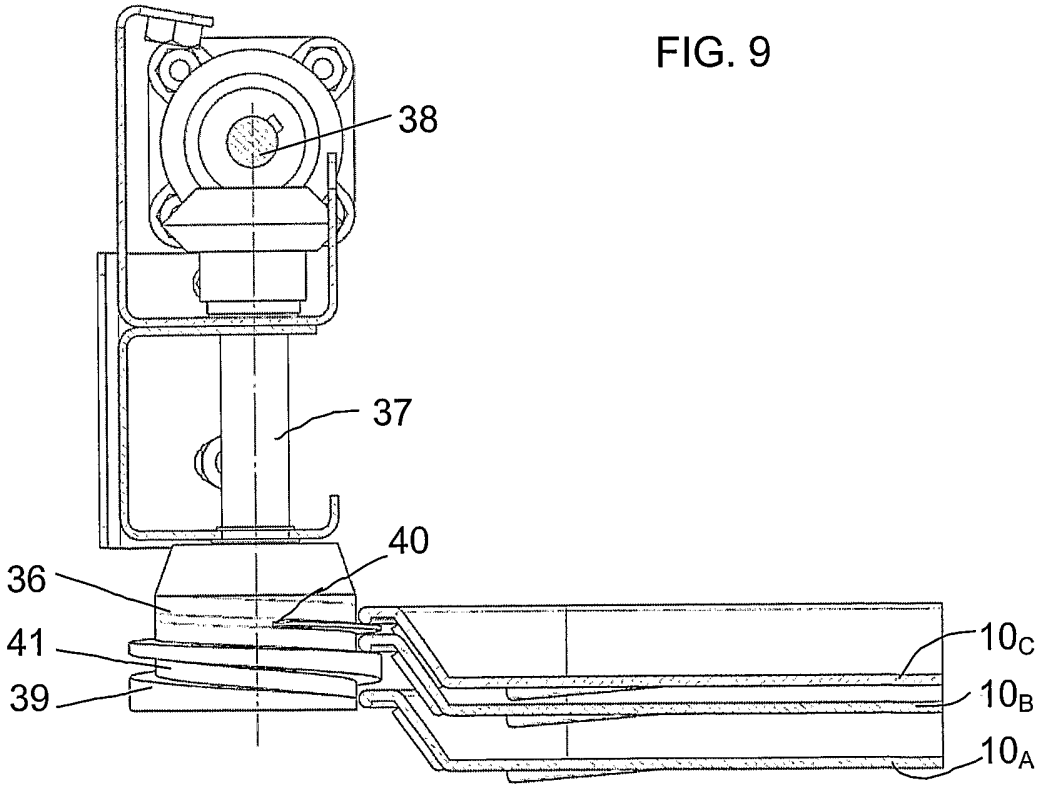


FIG. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 2003/000847

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A47L 15/24
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 9106877 U1 (HASSLER, T.), 25 July 1991 (25.07.1991), page 3, third paragraph - last paragraph ---	1-11
A	CH 73079 A (F.W. BEARDSLEY), 16 August 1916 (16.08.1916), page 4, first paragraph - page 5, first paragraph ---	1-11
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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2 February 2004	04 -02- 2004
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Tommy Blomberg / MRo Telephone No. +46 8 782 25 00

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International application No.
PCT/FI 2003/000847

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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