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(54) Machine for filling and sealing containers in a sterile environment

(57) The invention relates to a machine for filling and sealing containers in a sterile environment. A plurality of sacks (5), arranged one following another, advances along a conveyor line (3). Each container is provided with a neck (6) which is closed by a cap and which crosses a tunnel (20), walls of which tunnel (20) afford a steril environment. A sterilization device (42) acts on the necks (6) internally of the tunnel upstream of a filling station (30), also internal of the tunnel (20).

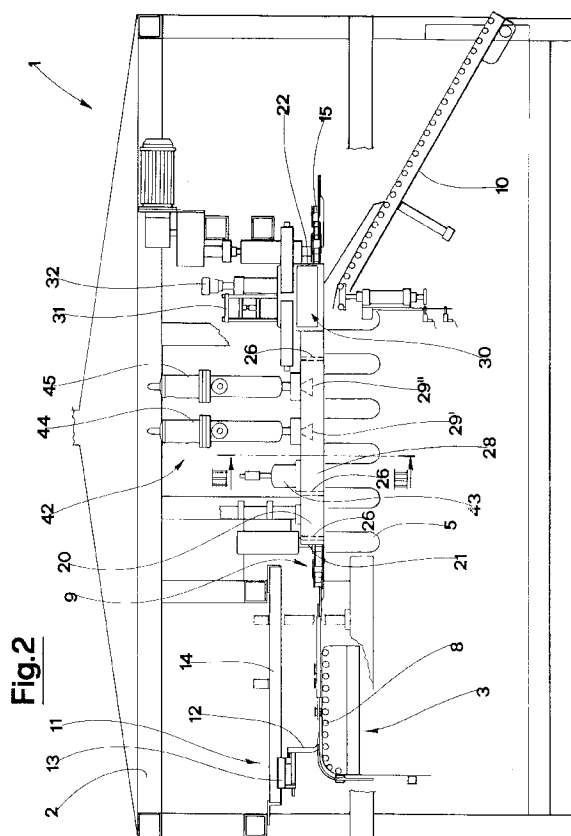


Fig. 2

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Description

The invention relates to a machine for filling and sealing containers in a sterile environment.

The invention can be used in particular for continuous filling of flexible and internally sterilized containers with food products of several natures: fluid, soft, hard, and so on. The containers are provided with a neck previously sealed with a cap. The filling operation must take place in a sterile environment.

The prior art teaches several such machines, which comprise a sterile chamber inferiorly provided with an opening through which the neck is introduced. The cap and the neck are exposed to the outside environment before entering the sterile chamber; hence the sterile chamber must be internally provided with means for sterilizing acting on the external surface of the cap and the neck.

Also provided are means for removing the cap from the neck and replacing it after the container has been filled. A filling head injects the food product into the container. An example of a machine of this type is described in Italian patent no. IT 1187194.

The main problem with the prior art machines, apart from the constant problems associated with maintaining a sterile environment, is productivity rate; fundamentally, it is poor per unit of time.

The main aim of the present invention is to provide a solution to the above problem, by making available a machine capable of filling and capping a high number of containers per unit of time, in a sterile environment.

An advantage of the invention is that it guarantees the necessary sterility during the filling and capping process.

These aims and advantages and others besides are all attained by the machine of the invention, as it is characterized in the following claims, which comprises a sterile tunnel having an entrance and an exit and through which necks of containers, sealed by a cap, transit along a conveyor line.

Further characteristics and advantages of the present invention will better emerge from the detailed description that follows, of an embodiment of the invention, illustrated in the form of a non-limiting example in the accompanying drawings, in which:

figure 1 is a schematic plan view from above of the machine of the invention, with some parts removed better to evidence others;

figure 2 is a lateral view from below of figure 1;

figure 3 is an enlarged-scale view of a section made according to line III-III of figure 2;

figure 4 is a section made according to line IV-IV of figure 3;

figure 5 is an enlarged-scale view of a detail of figure 1, comprising the capping and batching devices, with some parts removed better to evidence others;

figure 6 is a section made according to line VI-VI of figure 5;

figure 7 shows the detail of figure 5 with the capping and batching devices in a different operative configuration.

With reference to the figures, 1 denotes, in its entirety, a machine for filling and capping containers in a sterile environment.

It comprises a frame 2 whereon a conveyor line is mounted. Flexible containers, usually plastic sacks, advance along the line 3 in the direction indicated by the arrow 4. Each sack 5 superiorly bears a neck 6 sealed by a cap 7. The conveyor line 3 comprises a horizontal roller plane 8, a chain conveyor 9 and an inclined roller plane 10.

The chain conveyor 9 comprises a chain 15 wound and stretched on two vertical-axis wheels 16. One of the wheels is driven by a motor 17 of the step-by-step type. A plurality of drawing elements 18 are fixed to the chain 15, arranged one behind another. The chain 15 comprises two curved branches, one front curve 15c and one back curve 15d. A chain-stretcher operates on the inactive branch 15b. The inclined roller plane 10 is positioned at the start of the back curve 15d of the chain 15.

The machine comprises a tunnel 20, parallel to the active branch 15a of the chain conveyor 9, the walls of which tunnel encapsulate a sterile environment. The tunnel is provided with an entrance 21 and an exit 22. The bottom wall of the tunnel 20 is provided with an opening 23 which extends longitudinally from the entrance 21 to the exit 22, through which at least a portion of the necks 6 passes through the tunnel.

Each drawing element 18 affords a front recess 37a and a back recess 37b, each of which comprises half a circumference of the necks 6.

Let us first consider the front recess 37a of a drawing element 18 and the back recess 37b of an immediately preceding drawing element 18, with reference to the advancement direction of the chain 15. When the elements 18, during chain 15 motion, are situated at straight sections 15a and 15b of the chain 15, said front and back recesses 37a and 37b face each other and together create a full recess 37 shaped to house the neck of the container 6. When the elements 18 are at the curved sections 15c and 15d of the chain 15, recesses 37a and 37b distance one from another.

A sack nudging device 11 is arranged above the horizontal roller plane 8. The device 11 comprises a pusher organ 12 mounted on a chute 13 which is slidable on command along a guide 14. The axis of action of the pusher organ 12 is aligned with the straight section 15a. The pusher organ 12 acts on a sack 5 located on the

roller plane 8 and inserts the sack neck 6 between the back recess 37b of a drawing element 18 arranged in the front curved section 15c, and the front recess 37a of the following element 18 situated at the start of the straight section 15a.

Each recess 37a and 37b has a projection 25 which inserts in a corresponding throat 6a of the neck 6. A second throat 6b, arranged also on the neck 6, inserts in the lateral edges of the tunnel 20 aperture 23.

Each drawing element 18 superiorly exhibits a flat sealing surface 39, a resulting plurality whereof which is arranged externally to the tunnel 20, hugging the lower external surface thereof and sealingly closing the aperture 23. At the active section 15a of the chain each drawing element 18 is consecutively in contact with the adjacent elements 18. The sealing surfaces 39 thus combine to create a sealing element provided with an almost continuous flat sealing surface. The sealing surfaces 39 act on the aperture 23 to guarantee isolation of the tunnel from the outside environment.

The drawing elements 18 rest at one end on a support element 24 solidly constrained to and parallel with the tunnel 20.

The tunnel is subdivided into various zones by bulkheads 26, each of which comprises a gate 27 which is freely hinged (with horizontal axis) at 38 to the tunnel. Two bulkheads 26 are located inside the tunnel 20 near the entrance 21 and the exit 22. Two intermediate bulkheads 26, arranged in the tunnel 20 between the entrance 21 and the exit 22, subdivide the tunnel 20 into three zones.

The temperature inside each zone can be regulated independently of the others.

Each neck 6 transiting in the tunnel 20 passes through a nebulizer station 28, and a first and a second heating station 29' and 29".

At the above-mentioned stations the neck 6 undergoes a sterilization treatment, of known type, by means of a sterilization device 42, which comprises, in order of application, a nebulizer 43, which nebulizes a sterilizing liquid, and two heaters 44 and 45. The first heater 44 optimizes the sterilizing effect of the nebulized liquid.

The second heater 45 acts in combination with means for aspirating, of known type, operating internally of the tunnel, in proximity of the heater 45, to remove the sterilizing liquid.

A sack 5 filling station is arranged in the final part of the tunnel 20.

A known-type capping device 31 uncaps and recaps the neck 6 when it stops at the filling station 30. A batching device 32, also of known type, introduces the food product into the sacks 5.

The devices 31 and 32 are mounted on a common support constituted by a disc 33, having a surface 33a which directly faces the inside of the tunnel 20. The disc 33 is rotatably coupled with a frame 41, which frame 41 is solidly constrained to the tunnel 20, and can rotate on command between a first and a second position. In the

first position the capping device 31 is centred on the neck 6 and the batching device 32 does not interfere with the neck 6; in the second position the batching device 32 is centred on the neck 6 and the capping device 31 does not interfere with the neck 6.

The capping device 31 and the batching device 32 are slidably mounted on the disc 33 on command, and slide parallel to the axis of the neck 6.

Seals 40 operate between the sliding surfaces of said devices 31 and 32 and said disc 33.

A double-acting pneumatic jack 34 is connected to the disc 33 by means of a mechanism comprising a pivot 36 and a groove 35. The pivot 36 is solidly constrained to the disc 33. The groove 35 is solidly constrained to the jack 34. The mechanism allows for transformation of straight alternated drive of the jack into rotary drive (once more alternated) of the support.

The functioning of the machine will now be described, with reference to the operations a single neck 6 undergoes at the various machine work stations.

A sack 5 transiting on the roller plane 8 is brought by the pusher organ 12 to the start of the active section 15a of the conveyor 9. The pusher organ 12 and the conveyor 9 are reciprocally synchronized. The neck 6 of the container is lodged in the space comprised between the drawing element 18 situated at the start of the active section 15a and the immediately preceding drawing element 18.

At this point, the pusher organ 12 retreats, the motor advances the conveyor 8 by one step and the neck 6 is gripped by the two drawing elements 18 and drawn by them inside the tunnel 20.

The sack 5 inserts by its neck 6 into the throat 6b, into the aperture 23 on the bottom of the tunnel. The aperture 23 is sealedly closed by the necks 6 of the containers 5 transiting through the tunnel 20 and by the sealing surfaces 39.

Each neck 6 is sterilized in a first treatment zone comprising the stations 28, 29' and 29".

Subsequently the neck 6 reaches a second treatment zone, downstream of the first, comprising the filling station 30, where the capping device 31 and the batching device 32 act. The disc 33 is in the first position (see figure 5). The capping device 31 removes the cap from the neck 6. The disc 33 moves into the second position (figure 7) and the batching device 32 fills the container.

Then the disc 33 returns into the first position and the capping device 31 replaces the cap in the neck 6. Finally the neck 6 exits from the tunnel 20 and the container is taken on to the inclined ramp 10.

At each step of the conveyor line 3 a completed sack 5 exits from the tunnel.

The time delay between one step and the next of the line 3 depends substantially on the time necessary for performing an opening, filling and closing operation of a sack 5 in the station 30.

The neck 6 arrives already sterilized and the sterilization time does not influence the machine cycle.

Thanks to the invention, especially thanks to the small tunnel 20 dimensions, the whole operation can be performed in a completely sterile environment. Furthermore, any trace of the sterilizing liquid can easily and surely be removed at the end of the sterilization treatment.

A further advantage of the invention is that it permits a particularly efficient sterilization procedure.

Claims

1. A machine for filling and sealing containers in a sterile environment, comprising: a conveyor line (3), along which a plurality of sacks (5) advance in one-by-one sequence, each of which sacks (5) is provided with a neck (6) closed by a cap (7); at least one sterilization device (42), a capping device (31) and a batching device (32), which act on the neck (6) within a sterile environment and which sterilize said neck (6), uncap, fill and recap the sacks (5); characterized in that it comprises: a tunnel (20), which walls afford said sterile environment, which tunnel (20) is crossed, through an entrance (21) and an exit (22), by the necks (6) of the sacks (5) transiting along the conveyor line (3); the tunnel (20) comprises a first treatment zone wherein the sterilization device (42) performs its task, and a second treatment zone, arranged downstream of the first (with reference to the advancement direction of the sacks (5)) whereat the capping device (31) and the batching device (32) act.
2. A machine as in claim 1, characterized in that it comprises: a wall of the tunnel (20) affording an aperture (23) extending from the entrance (21) to the exit (22) of said tunnel (20), through which aperture (23) the necks (6) of the sacks (5) are at least partially inserted internally of the tunnel (20); a plurality of drawing elements (18), one following another, constrained to at least one link of a flexible conveyor and predisposed to act on the necks (6) to cause said necks (6) to advance along the tunnel (20); a sealing surface (39) associated to each drawing element (18) and predisposed on the drawing element (18) for closing, at least partially, the aperture (23), and at least one recess (37a, 37b), couplable to an external surface of the necks (6).
3. A machine as in claim 2, characterized in that: each said drawing element (18) affords two recesses; a front recess (37a) and a back recess (37b) (with reference to the advancement direction of the sacks (5)); the front recess (37a) of an element (18) couples with a neck (6) to which the back recess (37b) of the preceding element (18) is coupled.
4. A machine according to claim 2, characterized in

that: the flexible organ comprises a chain (15) which is ring-wound on wheels (16), of which at least one is driven, and which chain (15) comprises at least one active section (15a), parallel to the tunnel (20); each drawing element (18) is fixed to a link of the chain (15) and is conformed such as to meet laterally, at the active section (15a), with the drawing element (18) adjacent thereto.

5. A machine according to claim 2, characterized in that: the flexible organ comprises at least one curved section (15c) positioned before the entrance (21) to the tunnel (20); a pusher organ (12) is provided, arranged in proximity of said curved section (15c), which acts on the sacks (5) such as to insert the neck (6) between one drawing element (18) and a following drawing element (18).
6. A machine as in claim 2, characterized in that it comprises a support element (24), solidly constrained and parallel to the tunnel (20), on which support element (24) the drawing element (18) rests at one end thereof.
7. A machine as in claim 2, characterized in that each of the front and back recess (37a, 37b) bears a projection (25) for coupling with a corresponding throat (6a) fashioned on the neck (6).
8. A machine as in claim 1, characterized in that it comprises at least two bulkheads (26) located internally of the tunnel (20) in proximity respectively of the entrance (21) and the exit (22), each of which is provided with a gate (27) freely pivoted to the wall of the tunnel (20).
9. A machine as in claim 8, characterized in that it comprises at least a third bulkhead (26), intermediately arranged in the tunnel (20) between the entrance (21) and the exit (22).
10. A machine according to claim 1, characterized in that the sterilization device (42) comprises, in succession, a nebulizer (43) of sterilizing liquid, a first and a second heater (44), (45); means being provided for aspirating, internally of the tunnel (20), in proximity of the second heater (45) to aspirate the sterilizing liquid.
11. A machine according to any one of the preceding claims, characterized in that the capping device (31) and the batching device (32) are both mounted on a support which moves, with respect to the tunnel (20) intermittently between a first position, in which the capping device (31), in which the capping device (31) is centred on a neck (6) and the batching device (32) does not interfere with the neck (6), and a second position, in which the batching device (32) is

centred on the neck (6) and the capping device (31) does not interfere with the neck (6).

- 12.** A machine as in claim 11, characterized in that the support comprises a disc (33) which is rotatably coupled to a frame (41) which frame is solidly constrained to the tunnel (20), which disc (33) has a surface (33a) facing inside the tunnel (20); the disc (33) is commanded to rotate between the first and the second position by a jack (34) connected to the disc (33) by means of a mechanism comprising a pivot (36) and a groove (35); the capping device (31) and the batching device (32) are slidably coupled to the disc (33) and can slide, on command, in a direction which is parallel to the axis of the neck (6); seals (40) are provided, operating between a sliding surface of the capping device (31), the batching device (32) and the disc (33).

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Fig.1

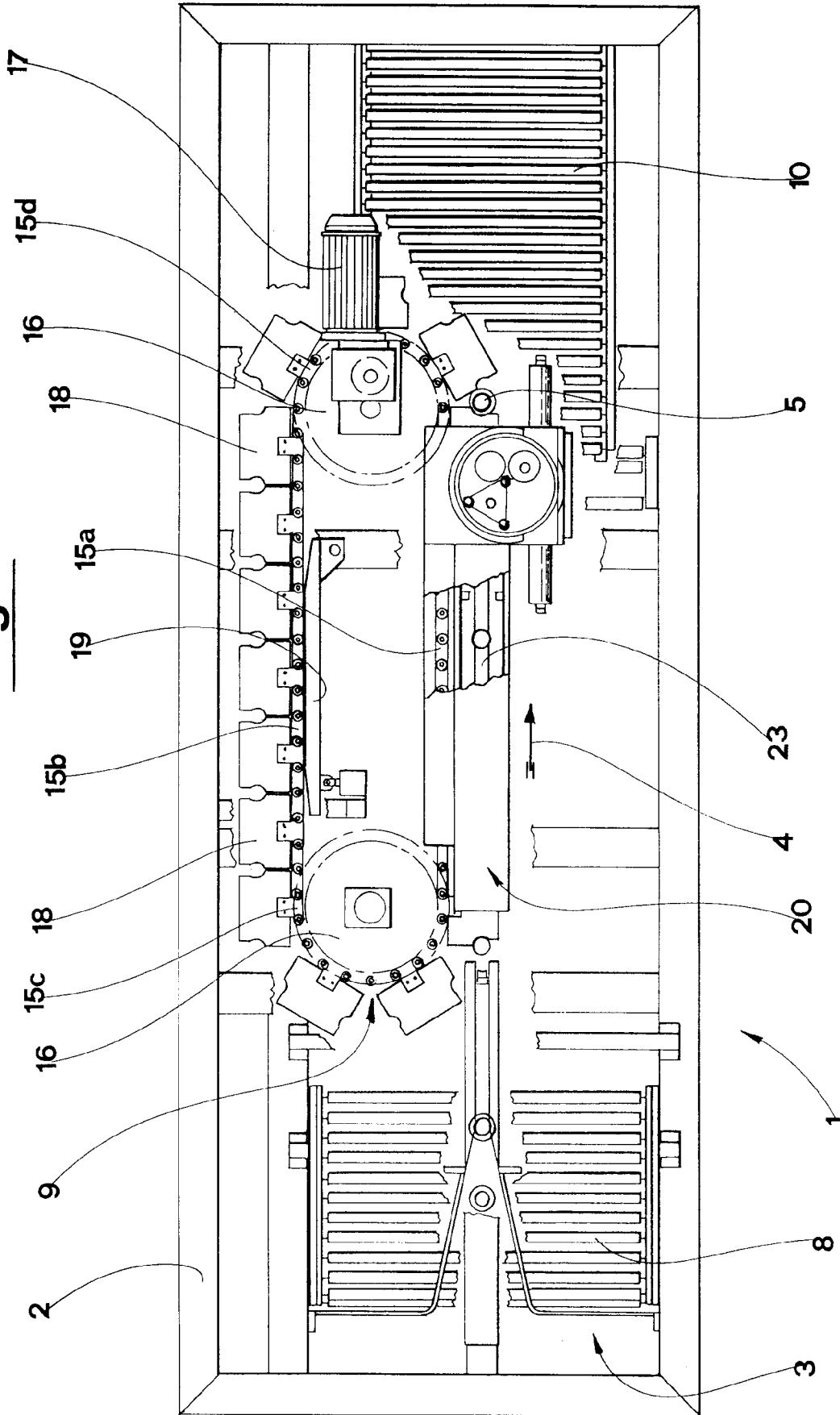


Fig.2

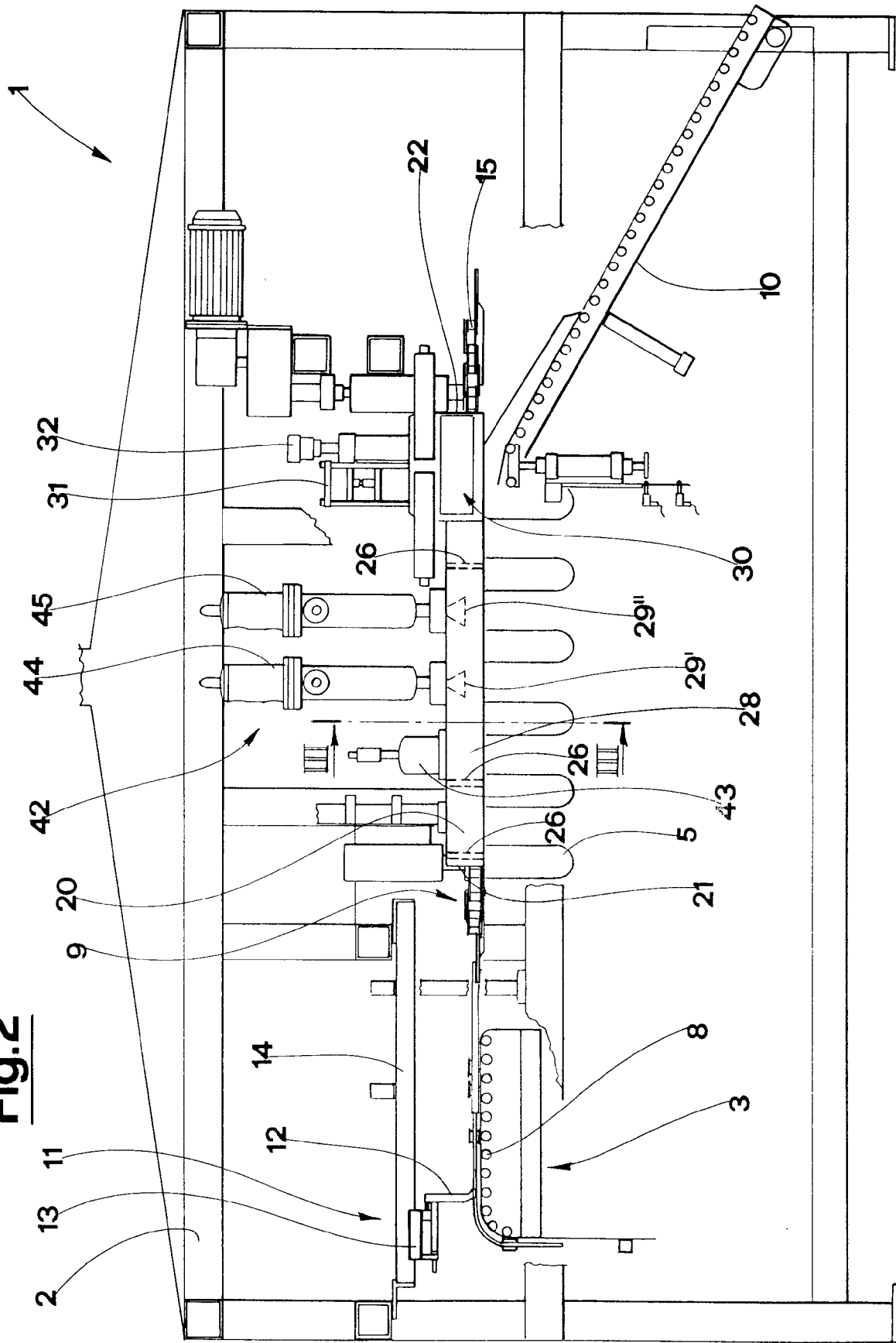


Fig.7

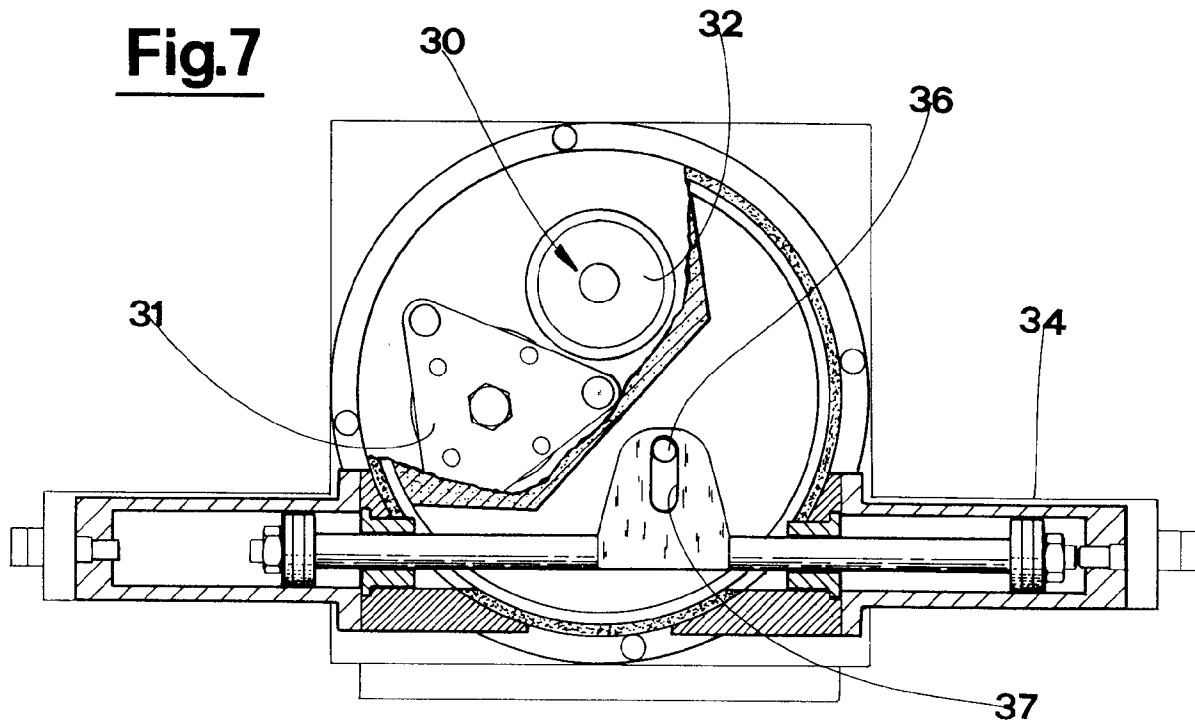


Fig.3

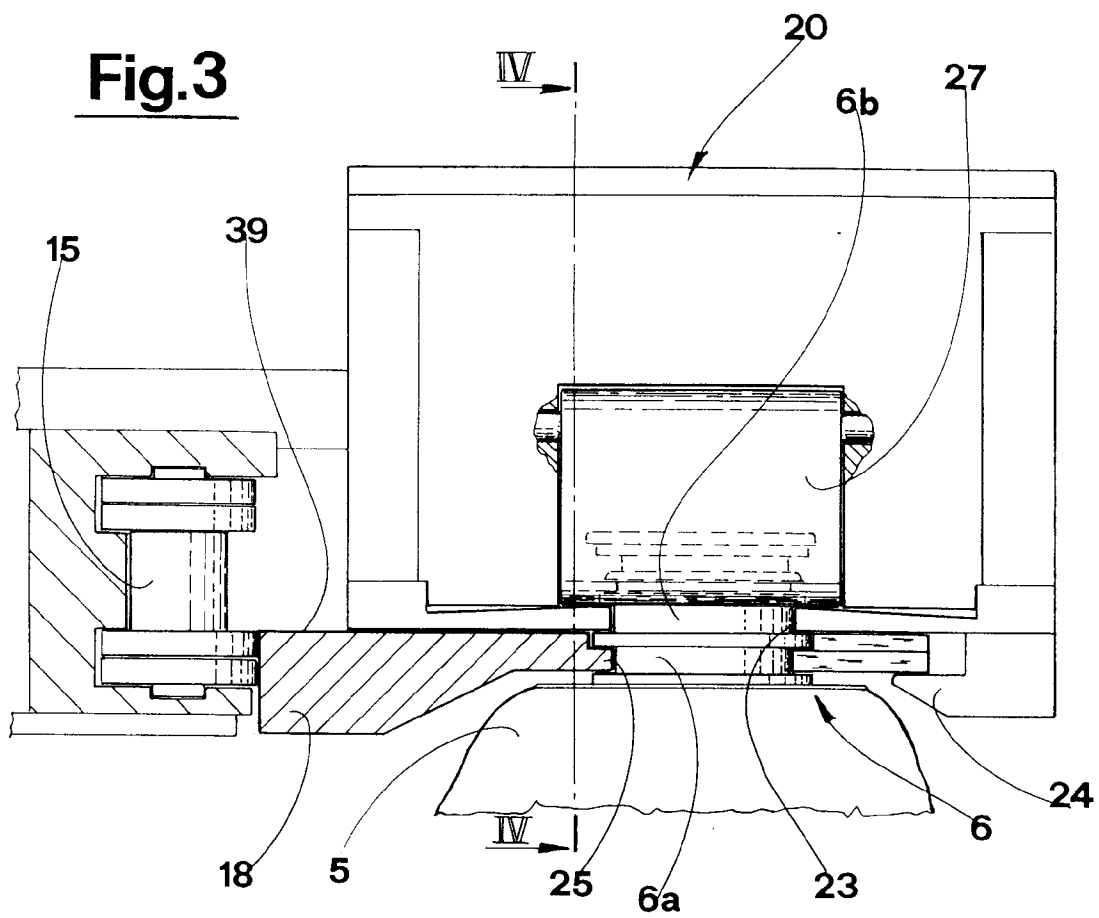


Fig.4

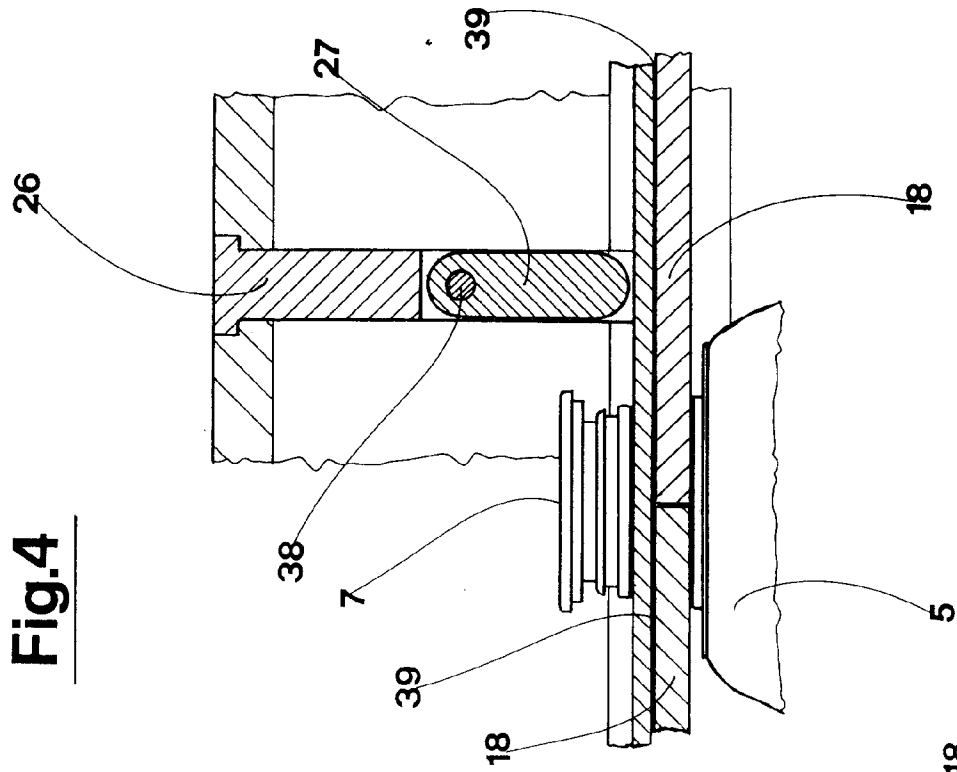


Fig.6

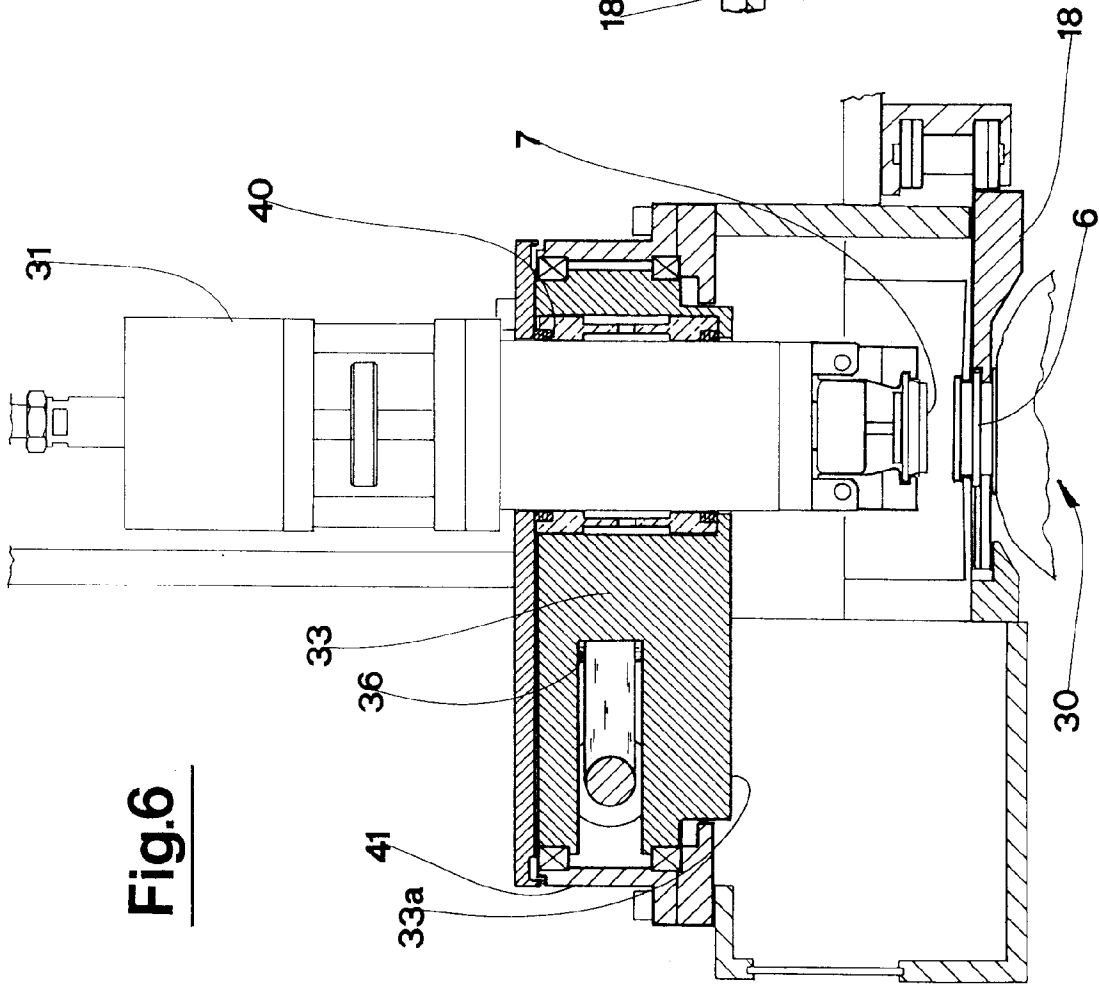
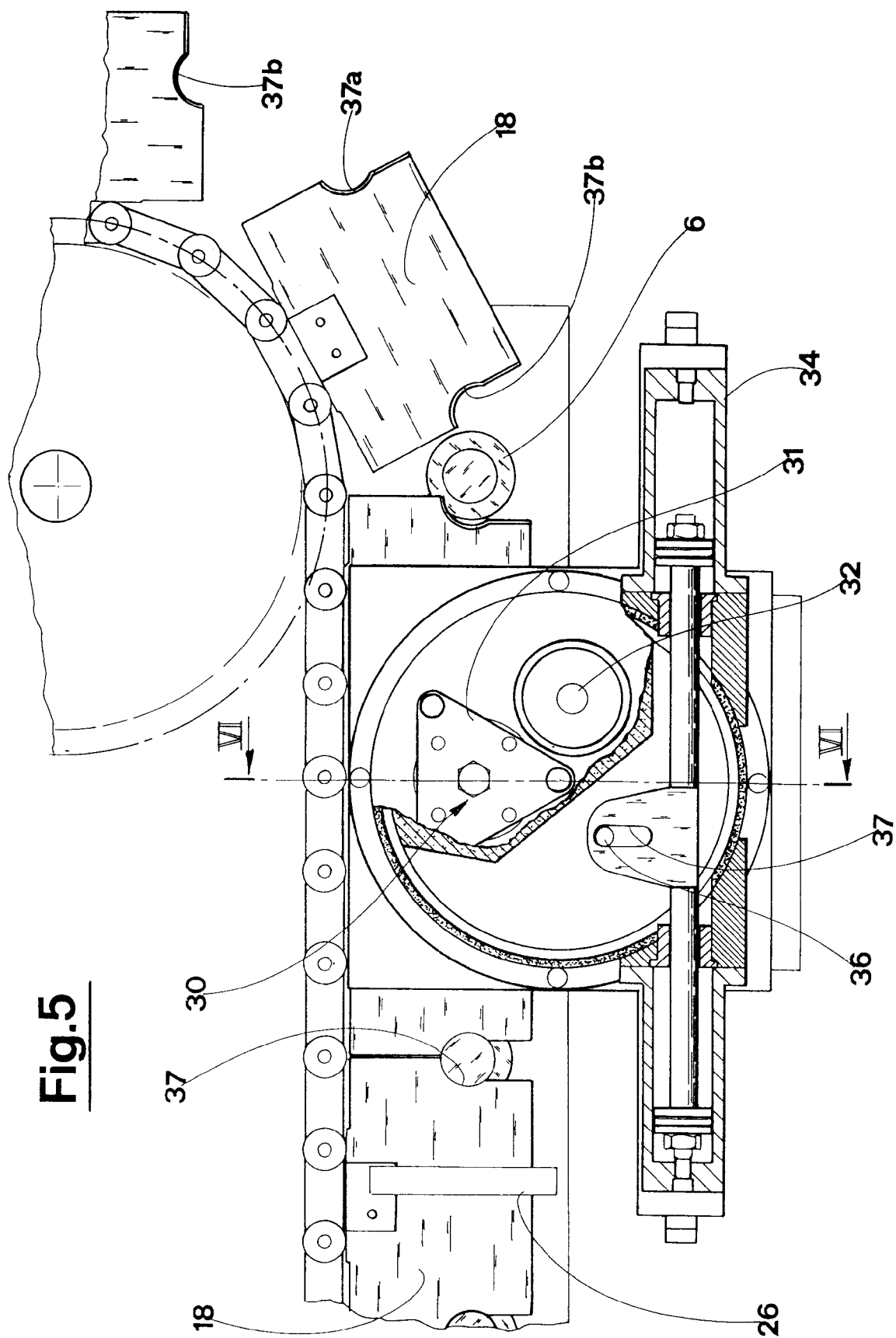


Fig.5





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EUROPEAN SEARCH REPORT

Application Number
EP 95 83 0272

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.6)
X	US-A-5 129 212 (C.L. DUFFEY ET AL) 14 July 1992 * the whole document *	1-10	B65B55/02
X	GB-A-2 112 735 (ACI AUSTRALIA) 27 July 1983 * page 5, line 4-40; figures 1,7,8 *	1,11	
X	WO-A-82 03832 (SCHOLLE CORP.) 11 November 1982 * page 14, line 7 - page 15, line 28; figures 1-6 *	1	
A		8-10	
X	EP-A-0 232 985 (CORRUGATED PRODUCTS) 19 August 1987 * column 1, line 33 - column 3, line 35; figures 1,2 *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B65B
Place of search		Date of completion of the search	Examiner
THE HAGUE		17 November 1995	Grentzius, W
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