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(54) **Vertical packaging machine with high-speed volumetric batching unit**

(57) A vertical machine for packaging in bags a product with substantially fluid behaviour, comprises a unit (11) supplying product to a batching unit (13) underneath to discharge batches of product into a forming pipe (14) of a unit (15) for packaging into bags. The batching unit (13) comprises two cups (23, 24) supported and driven to be aligned alternatively on the forming pipe (14) and each cup comprises below a discharge gate valve (25, 26) that is driven for discharging vertically into the aligned forming pipe. Above the cups there is a levelling cone (27) that is supplied by the product supplying unit (11) and is movable for being aligned on command alternatively with a cup to fill the cup with product. The cups discharge into the forming pipe the product in a compact format and with a shape that is similar to the shape that it will have in the bag. This greatly increases the operating speed of the machine.

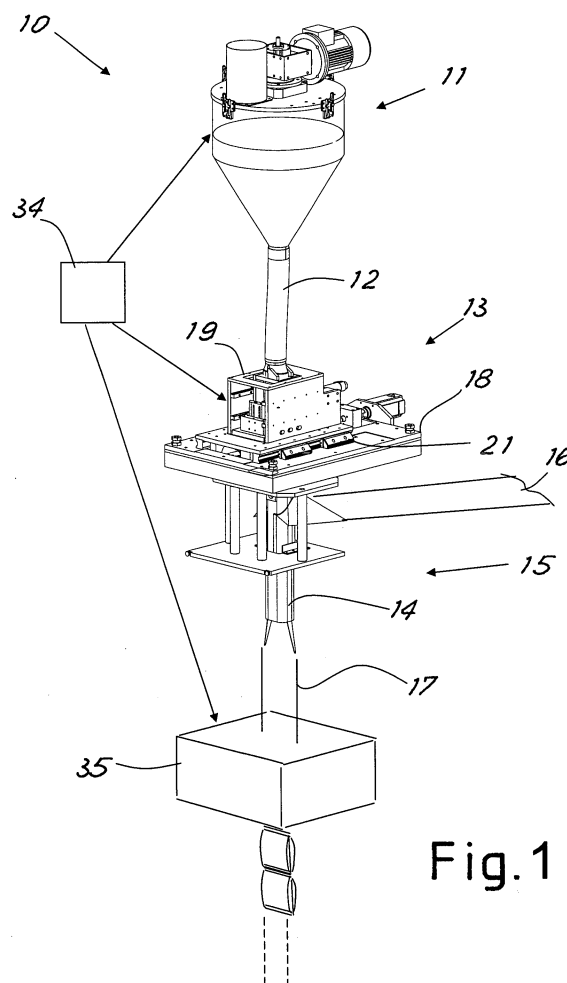


Fig. 1

Description

[0001] The present invention relates to a vertical machine for packaging in bags a product with substantially fluid behaviour.

[0002] In known vertical packaging machines the problems of supplying granular products to bags being formed are known.

[0003] For example, the speed of the machine is greatly limited by the need to wait for the granular product to drop completely, which product is supplied in an inconsistent manner by an upper hopper.

[0004] The general object of the present invention is, *inter alia*, to prevent the aforesaid drawbacks by providing a packaging machine for packaging a product into bags at high frequency owing to a special batching device. The device generates constant and repeatable high volumes of product to be discharged at high frequency inside the bags of the packaging machine in a synchronised and constant manner.

[0005] In view of this object, a vertical machine was devised for packaging into bags a product with substantially fluid behaviour, comprising a unit supplying product to a batching unit underneath to discharge batches of product into a forming pipe of a unit for packaging into bags has been devised according to the invention, characterised in that the batching unit comprises two cups supported and driven to be aligned alternatively on the forming pipe, each cup comprising below a discharge gate valve that is driven for discharging vertically into the aligned forming pipe, above the cups there being a levelling cone supplied by the product supplying unit and which is movable for being aligned on command alternatively with a cup to fill the cup with product, each cup defining an internal volume that is substantially equal to the volume of product per single bag and, along the vertical discharge direction, the cups each having both a surface and a perimeter of the cross section that remain constant, or at most grow, from top to bottom.

[0006] In order to explain more clearly the innovative principles of the present invention and the advantages thereof with respect to the prior art, with the help of the attached drawings, a possible embodiment applying these principles will be disclosed below. In the drawings:

- figure 1 is a schematic view of a packaging machine according to the invention;
- figures 2 and 3 are partially sectioned views of a batching unit of the machine in two different operating positions.

[0007] With reference to the figures, figure 1 shows schematically a vertical packaging machine, indicated generally by 10, made according to the invention. The machine 10 comprises above a supplying unit 11, that discharges the product (through a flexible pipe 12) into a batching device 13 that in turn conveys the product into a forming pipe 14 of a known packaging unit 15.

[0008] According to the prior art, on the forming pipe a web of film 16 is supplied which forms into a longitudinally welded pipe 17 and which after each filling is welded transversely in a known welding unit 35 that comprises special transverse jaws (not shown) for forming the full and sealed bags. The packaging and welding units of the packaging unit are in themselves known and easily imaginable by those skilled in the art and will not therefore be disclosed in detail.

[0009] The supplying unit advantageously comprises a hopper. The supplying hopper is also easily imaginable by those skilled in the art. It has a cylindrical shape that ends below with a cone frustum and has the simple function of containing and constantly mixing the product, in addition to acting as a storage unit kept at a roughly constant level in function of probes that will interact with the hopper loading system.

[0010] As better visible in figure 2, the batching unit 13 comprises a fixed frame 18 on which a movable carriage 19 is mounted that runs horizontally owing to linear sliding blocks 21. A motor 20 can move the movable carriage 19 along the sliding blocks 21 with alternating movement by means of a screw coupling 22. The carriage 19 supports two vertical batching cups 23, 24 placed adjacently in the movement direction of the carriage to move alternatively in the vertical direction of the forming pipe 14. Each cup 23, 24 has a bottom closed by a respective lock 25, 26. The two locks 25, 26 are slideable independently of one another by means of a respective pneumatic actuator 30, 31 to open upon command the bottom of the respective cup and discharge the contents thereof into the forming pipe 14 underneath. The perimeter of the lower outlet of the cup substantially follows the internal upper perimeter of the forming pipe to become juxtaposed thereto.

[0011] Above the cups a single conveying pipe or levelling cone 27 is present that is supported on the movable carriage 19 by means of a slide 28 that is moved alternatively between the two cups by means of an actuator 29 (advantageously a pneumatic cylinder). The conveying pipe is supplied above with product through the flexible pipe 12.

[0012] The coordinated movements of the various actuators (as will be clear below) are controlled by an electronic control device (in general a PLC) 34.

[0013] Along the vertical discharge direction, both the surface and the perimeter of the cross section of the cups remain constant, or at most grow, from top to bottom, in such a way as not to cause fluidodynamic acceleration in the product in transit.

[0014] It has further been found to be advantageous for the shape of the cup to be as similar as possible to the shape that the product will have at the end inside the finished package. This pre-form in fact enables the product not to become decomposed during the drop and the shape thereof not to be modified, thus adapting better to the section of the forming pipe during the descent but above all enables queues or dragging of product between

one discharge and another not to be created.

[0015] The volume contained in each cup substantially has to be the volume of the product to be introduced into a single package. Advantageously, the precise adjustment of the volume of the two cups, anyway by a preset volume that is already near the desired volume, occurs by inserting a wedge 32, 33 more or less deeply that is integral with the respective cup with an adjusting slide system for adjusting the vertical position.

[0016] The product supplied for packaging has substantially fluid behaviour; it is typically to be equated with powders with granulometrically constant and morphologically regular features, such as to enable the product to behave like a fluid through the effect of gravity. The treated product must in general be non-abrasive, dry and non-adhesive due to the mechanical or electrostatic effects.

[0017] During operation of the machine, the product to be batched flows by dropping through the levelling cone 27 into the aligned cup, stopping the flow once the cup has been completely filled. A uniform and compact column of product is thus formed as far as the loading hopper.

[0018] In the meantime, the other cup, which is coaxial with the forming pipe 14, discharges the product with the opening movement of the respective lock. The lock is closed again after a preset time T has elapsed that ensures complete evacuation of the product from the cup.

[0019] After reclosing, the actuator 20 is commanded to move the full cup to a position that is coaxial with the forming pipe 14 whilst the levelling cone 27 is positioned above the other cup by means of the movement of the slide 28 controlled by the actuator 29.

[0020] The cup in the position that was coaxial with the forming pipe is thus ready to be unloaded, with the corresponding opening movement of the lock thereof. After the lock has been opened and the preset time T of complete opening has elapsed, the cycle may start again from the beginning with the opposite movement of the movable carriage 19 and so on.

[0021] Advantageously, the operating logic of the movements is not sequential but takes account only of overriding some simultaneous events: the movement of the movable carriage 19 occurs only after time T has elapsed for the cup that is coaxial with the forming pipe and the certain reclosure of the lock 25 or 26 has been ascertained (advantageously by means of a known suitable sensor, which is not shown); the movement of the slide 28 occurs only if the cups are both shut and if in the meantime a lock opens, which means that the opposite cup has been discharged; the movement of one or the other lock occurs alternatively in function of the position of the movable carriage 19 (thus in function of which cup is coaxial with the forming pipe).

[0022] With the movement of the movable carriage 19 the cup being discharged is kept perfectly centred with the forming pipe, preventing crossovers between the batching system and the forming pipe underneath, which will tend to have a cross section that is surrounded by

the section of the batching cup.

[0023] In this way the use of a hopper is not necessary with the risk of slowing through friction the product in the event of contact. Owing to the fact that the forming pipe is immediately below the discharging cup and receives the product directly without passing through hoppers or other conveying channels, it avoids friction or obstacles to the flow and thus slowing of the drop of the product and the formation of queues that would otherwise slow the productive capacity of the batching/machine system.

[0024] At this point it is clear how the preset objects have been achieved. Owing to the batching unit of the machine according to the invention, a discharge of product from the batching unit to the package is obtained that is the most compact possible, thus enabling the packaging machine to increase the number of strokes over the unit of time. In addition, the absence of product queues enables the packaging machine to weld and cut the film between one bag and the next in a particularly rapid manner. The more space is available between one drop and another, the greater can be the frequency of product discharge (frequent discharges) and consequently the greater can be the speed of the integrated vertical batching unit/machine system. This all occurs with precise and repeatable batches in function of the volume of treated material. The device is supplied by a flexible pipe with a continuous hydrostatic head of product that transfers the product from the hopper to the batching cups in a constant manner to ensure at the same time a high flow and uniform compactness of product in the cup, thus ensuring repeatability and thus batching accuracy.

[0025] Naturally, the above description of an embodiment applying the innovative principles of the present invention is provided merely by way of example of these innovative principles and must not therefore be taken to limit the protective scope of what is claimed herein. For example, the vertical packaging part may be of any type that is known and is easily imaginable by those skilled in the art which has been chosen to make any desired type of package.

Claims

1. Vertical machine for packaging in bags a product with substantially fluid behaviour, comprising a unit (11) supplying product to a batching unit (13) underneath to discharge batches of product into a forming pipe (14) of a packaging unit (15) for packaging into bags, **characterised in that** the batching unit (13) comprises two cups (23, 24) supported and driven to be aligned alternatively on the forming pipe (14), each cup comprising a discharge gate valve (25, 26) below that is driven for discharging vertically into the aligned forming pipe, above the cups there being present a levelling cone (27) supplied by the product supplying unit (11) and which is mobile for being aligned on command alternatively with a cup to fill

said cup with product, each cup (23, 24) defining an internal volume that is substantially equal to the volume of product per single bag and, along the vertical discharge direction, the cups (23, 24) each having both a surface and a perimeter of the cross section that remain constant, or at most grow, from top to bottom.

2. Machine according to claim 1, **characterised in that** the perimeter of the lower outlet of the cup substantially follows the internal upper perimeter of the forming pipe to become juxtaposed thereto. 10
3. Machine according to claim 2, **characterised in that** the shape of the cup is similar to the shape that the product will have inside the bag, so as to form a pre-form for the product. 15
4. Machine according to claim 1, **characterised in that** the supplying unit discharges into the levelling pipe with a constant hydrostatic head of product. 20
5. Machine according to claim 1, **characterised in that** the product supplying unit comprises a hopper (11) that discharges into the levelling cone (27) through a flexible pipe (12) to enable alternating movement of the levelling pipe for alignment on each cup. 25
6. Machine according to claim 1, **characterised in that** each cup (23, 24) is provided with a system (32, 33) for adjusting internal volume. 30
7. Machine according to claim 6, **characterised in that** the volume adjusting system comprises for each cup a wedge (32 or 33) the height of the insertion into the cup of which is adjustable. 35
8. Machine according to claim 6, **characterised in that** the batching unit (13) comprises a carriage (19) that supports the cups made adjacent to one another and which is driven to be movable in the making the cups adjacent direction to command alternatively one or the other cup to align on the forming pipe (14), on the carriage (19) there being supported a slide (28) which also is driven to be movable upon command in the making the cups adjacent direction and which supports the levelling cone (27) to align it alternatively with the inlet of one or the other cup. 40 45
9. Machine according to claim 1, **characterised in that** the machine comprises a controlling device (34) that controls the movement of the cups, of the gate valves and of the levelling cone in such a way that the movement of the cups occurs only when a preset opening time has elapsed of the discharge gate valve of the cup that is coaxial with the forming pipe and after the gate valve has closed again. 50 55

10. Machine according to claim 1, **characterised in that** the machine comprises a controlling device (34) that controls movement of the cups, of the gate valves and of the levelling cone in such a way that the movement of the levelling cone (27) occurs only if the gate valves of the cups are both shut and if in the meantime opening and closing of the lock of the cup in alignment with the forming pipe has occurred and if movement of the one or the other lock occurs alternatively in function of which cup is coaxial with the forming pipe.

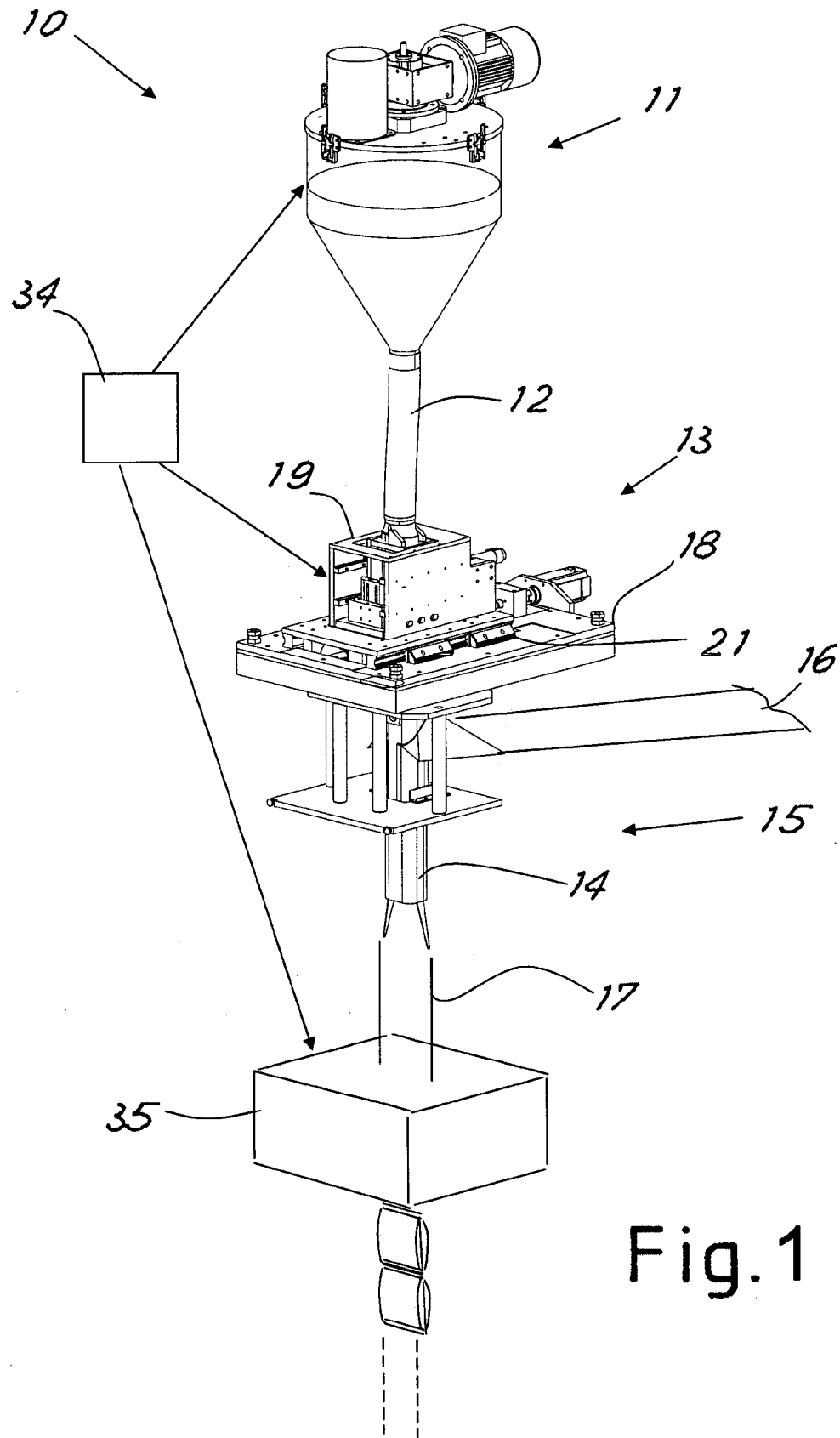


Fig. 1

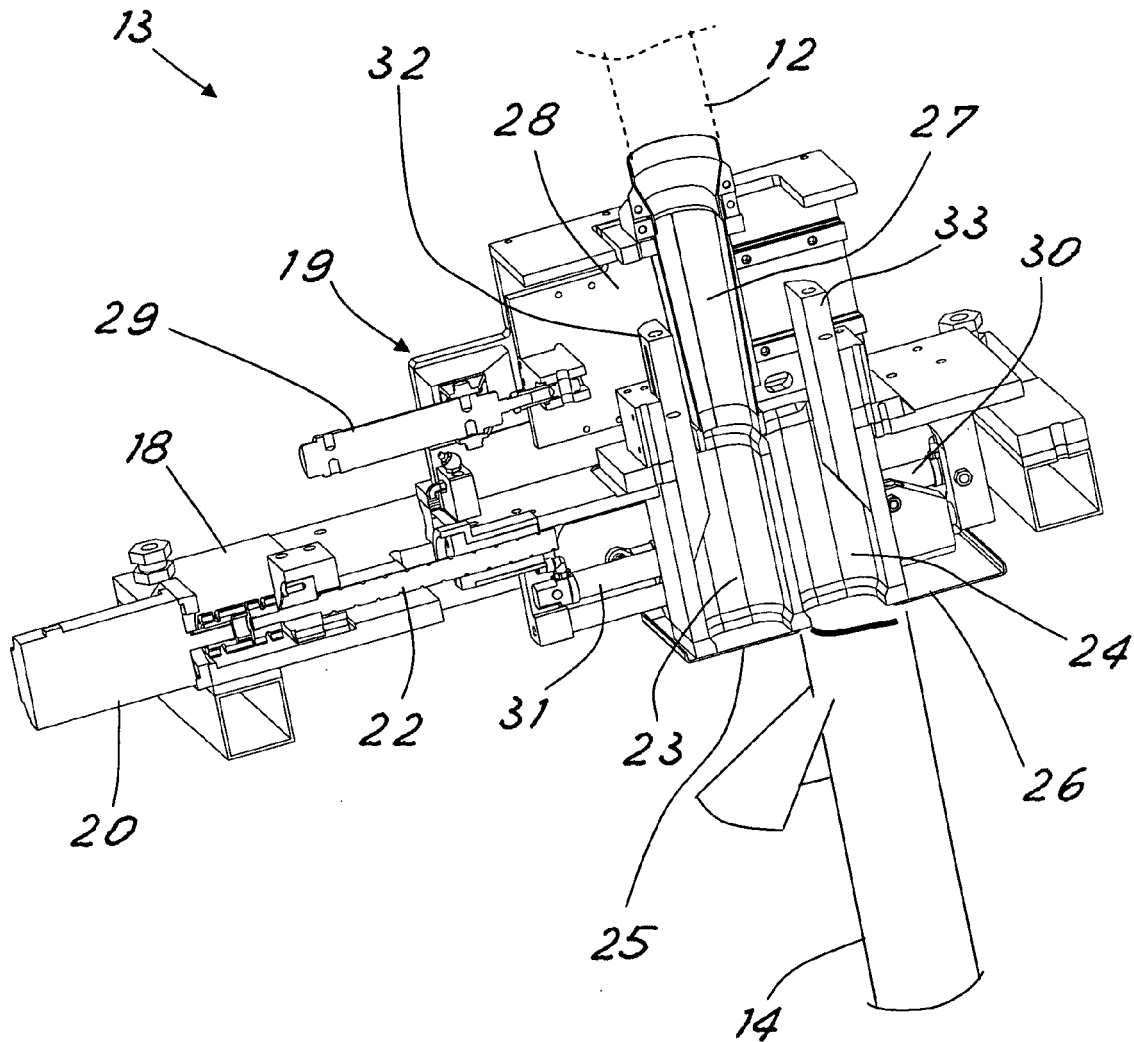


Fig.2

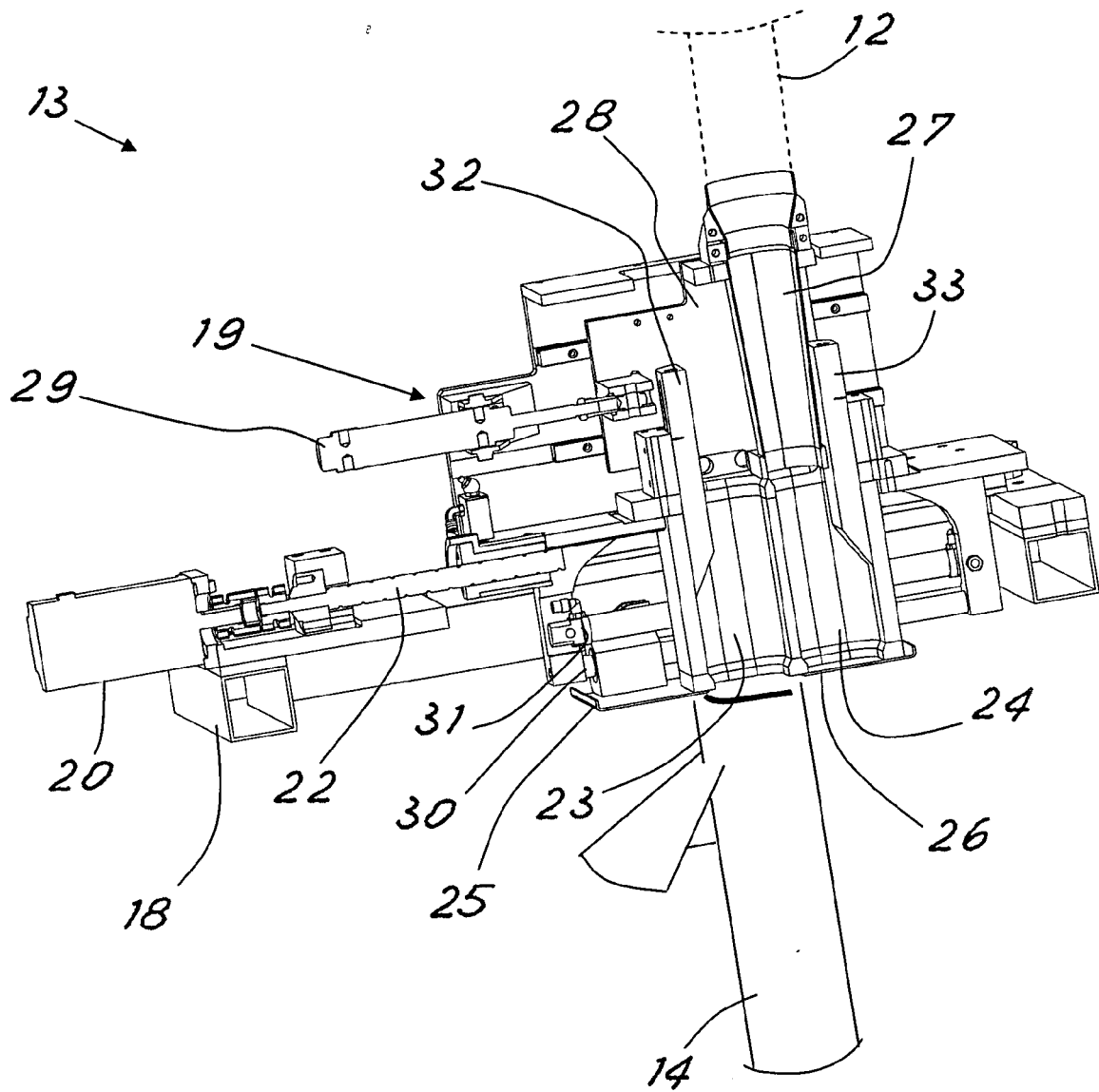


Fig.3



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 07 01 8251

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Place of search		Date of completion of the search	Examiner
Munich		5 February 2008	Ungureanu, Mirela
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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