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(54) **FEED UNIT FOR FEEDING SHEETS TO A PACKING LINE**

(57) A feed unit (1) for feeding sheets (2) to a packing line, wherein a pickup device (6) engages a withdrawal opening (5), formed in a vertical hopper (3) housing a stack (4) of sheets (2), to withdraw a single sheet (2) from the stack (4) and feed the sheet (2) to the packing line; two rollers (11) are located on opposite sides of the stack (4) at the withdrawal opening (5) in the hopper (3), and each has a lateral surface (12), on which rests a bottom portion of the stack (4), and rotates continuously about a respective longitudinal axis (14) of symmetry in such a direction as to push the sheets (2) in the stack (4) upwards.

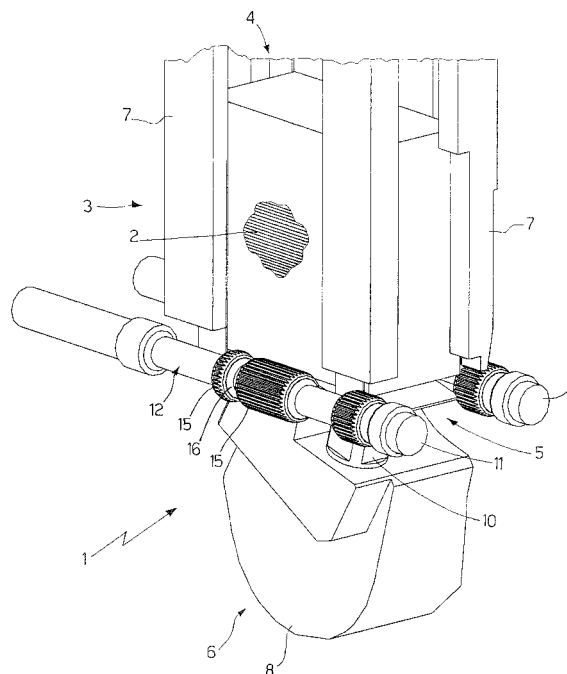


Fig.1

Description

[0001] The present invention relates to a feed unit for feeding sheets to a packing line.

[0002] An automatic product packing machine comprises at least one feed unit for supplying a packing line on the machine with a succession of sheets used in the packing process. The feed units may supply the succession of sheets either by cutting the sheets off a continuous web unwound off a reel, or by withdrawing individual sheets from the bottom of a stack housed inside a hopper.

[0003] One example of a feed unit for withdrawing individual sheets from the bottom of a stack housed inside a hopper is described in Patent US-A1-4918908, in which a suction pickup roller is rolled against a sheet at a bottom end of the hopper, so that the sheet winds about the roller; once the sheet is fully wound, the pickup roller is arrested in a release position to release the sheet onto an input conveyor of the packing line; and the input conveyor is normally defined by two pickup rollers parallel and tangent to each other to engage the sheet between them.

[0004] Another example of a feed unit for withdrawing individual sheets from the bottom of a stack housed inside a hopper is described in Patent EP-A1-0970885, in which a wheel, rotating about its axis, feeds a gripping head continuously along an endless path through a loading station, where the gripping head, oscillating with respect to the wheel about an axis parallel to the wheel axis, engages a withdrawal opening in the hopper to withdraw a sheet, and through a follow-up unloading station, where the gripping head, rotating together with the wheel, feeds the sheet to a feed roller.

[0005] Feed units with hoppers as described above function correctly at relatively slow operating speeds. At fast operating speeds typical of modern packing machines, however, the sheets close to the bottom of the hopper tend to be shifted out of correct alignment by the mechanical stress exerted on the stack by the pickup device when withdrawing individual sheets. As a result, each sheet is engaged by the pickup device, and so fed to the follow-up packing line, in the wrong position, thus impairing the overall quality of the finished packages and possibly also jamming the packing line.

[0006] It is an object of the present invention to provide a feed unit for feeding sheets to a packing line, designed to eliminate the aforementioned drawbacks, and which, at the same time, is cheap and easy to produce.

[0007] According to the present invention, there is provided a feed unit for feeding sheets to a packing line, as claimed in Claim 1 and, preferably, in any one of the following Claims depending directly or indirectly on Claim 1.

[0008] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic view in perspective of a feed unit for feeding sheets to a packing line in accordance with the present invention;

Figure 2 shows a front view of the Figure 1 feed unit; Figure 3 shows a side view, with parts removed for clarity, of the Figure 1 feed unit.

[0009] Number 1 in Figure 1 indicates as a whole a feed unit for feeding sheets 2 to a packing line (not shown). Feed unit 1 comprises a vertical hopper 3 housing a stack 4 of sheet 2, and having a bottom withdrawal opening 5; and a pickup device 6 which engages withdrawal opening 5 in hopper 3 to withdraw individual sheets 2 successively from stack 4 and feed sheets 2 to the packing line. More specifically, hopper 3 comprises four fixed, L-shaped sections 7 located at the four corners of stack 4 to retain stack 4 laterally.

[0010] Pickup device 6 comprises a wheel 8 rotating about a respective central axis 9; and a suction gripping head 10 supported by wheel 8 to move cyclically along an endless path through a loading station, where gripping head 10 engages withdrawal opening 5 in hopper 3 to withdraw a sheet 2, and through a follow-up unloading station, where gripping head 10 feeds the sheet to the packing line in known manner.

[0011] In a further embodiment not shown, wheel 8 supports a number of gripping heads 10; and each gripping head 10 may be fitted to wheel 8 to oscillate, under the control of a cam actuating system, about a respective axis parallel to central axis 9 of wheel 8.

[0012] Clearly, pickup device 6 may be formed differently, e.g. as described in Patent US-A1-4918908.

[0013] At withdrawal opening 5 in hopper 3, the feed unit comprises two parallel rollers 11 located on opposite sides of stack 4, and each having a lateral surface 12 on which a bottom portion of stack 4 rests. More specifically, as shown more clearly in Figure 3, two major transverse edges of stack 4 rest on respective lateral surfaces 12 of rollers 11. A known actuating device 13 (shown schematically in Figure 2) is connected mechanically to rollers 11, and rotates each roller 11 about a respective longitudinal axis 14 of symmetry in such a direction as to push sheets 2 in stack 4 upwards (i.e. away from withdrawal opening 5, as shown in Figure 3). An alternative embodiment comprises only one roller 11 on one side of stack 4, and respective bottom end portions of fixed sections 7 are located on the opposite side of stack 4 and on a level with roller 11.

[0014] Actuating device 13 preferably rotates rollers 11 at the same adjustable given constant speed. Typically, the rotation speed of rollers 11 is adjusted as a function of the withdrawal rate of sheets 2 from withdrawal opening 5 in hopper 3 and/or as a function of the number of sheets 2 in stack 4 (and therefore of the weight of stack 4).

[0015] In the preferred embodiment shown in the accompanying drawings, the portion of lateral surface 12 of each roller 11 contacting stack 4 has a high friction

coefficient achieved by knurling comprising a series of grooves parallel to longitudinal axis 14 of symmetry. Alternatively, the portion of the lateral surface of each roller 11 contacting stack 4 may have a covering of elastic material (e.g. rubber). As shown more clearly in Figure 2, each roller 11 is so formed that its lateral surface only contacts part of stack 4. In fact, two knurled portions 15 of each roller 11 only contact part of the extension of stack 4, and are separated by a groove 16.

[0016] As shown more clearly in Figure 3, a window for the passage of each sheet 2 is defined between the two rollers 11, and through which each sheet 2 is drawn by pickup device 6 when withdrawing sheet 2. The window defined between the two rollers 11 is smaller than each sheet 2. More specifically, the minimum distance between lateral surfaces 12 of the two rollers 11, measured in a direction perpendicular to longitudinal axes 14 of symmetry of the two rollers 11, is less than the corresponding dimension of each sheet 2 measured in the same direction.

[0017] Hopper 3 may also comprise at least one fixed horizontal supporting member (not shown) located at withdrawal opening 5 and defining a bottom support of stack 4 to retain stack 4 inside hopper 3.

[0018] Clearly, the retaining sections 7 of hopper 3 need not necessarily be vertical, and may slope with respect to the vertical or be horizontal. In the latter case, feed unit 1 must comprise a push device for gradually feeding stack 4 towards withdrawal opening 5 (in the hopper 3 shown, this is achieved by force of gravity drawing sheets 2 in stack 4 downwards).

[0019] In actual use, suction gripping head 10 engages and exerts force on a sheet 2 to extract sheet 2 from withdrawal opening 5 in the hopper and through the window defined between the two rollers 11; and, since the window defined between the two rollers 11 is smaller than sheet 2, sheet 2 is inevitably deformed elastically to be extracted from hopper 3. Moreover, if bottom supporting members of stack 4 are provided, sheet 2 must be detached from the supporting members by the action of gripping head 10.

[0020] Tests have shown that the action of rollers 11 provides for realigning sheets 2 in stack 4 close to withdrawal opening 5 in hopper 3. That is, if sheets 2 close to withdrawal opening 5 are shifted out of correct alignment by the mechanical stress exerted on stack 4 by pickup device 6 when withdrawing individual sheets 2, the action of rollers 11 provides for realigning sheets 2. The action of rollers 11 has also been found to have a separating effect on sheets 2 in stack 4 close to withdrawal opening 5 in hopper 3, thus assisting detachment of sheets 2 from stack 4. That is, sheets 2 in stack 4 tend to adhere to one another, thus making it difficult to extract each sheet 2 from withdrawal opening 5 in hopper 3. The action of rollers 11, on the other hand, tends to separate sheets 2 close to the withdrawal opening, thus counteracting any adhesion phenomena of sheets 2.

[0021] Feed unit 1 as described above may be used

for supplying sheets 2 of any type, e.g. blanks for producing rigid packages, sheets of wrapping material for producing soft packages, or labels or stamps applied to the inside or outside of packages.

Claims

1. A feed unit for feeding sheets to a packing line; the feed unit (1) comprising a hopper (3) housing a stack (4) of sheets (2) and having a withdrawal opening (5); and a pickup device (6) which engages the withdrawal opening (5) in the hopper (3) to withdraw a single sheet (2) from the stack (4) and feed the sheet (2) to the packing line; the feed unit (1) being **characterized by** comprising, at the withdrawal opening (5) in the hopper (3), at least one roller (11) having a lateral surface (12) on which a portion of the stack (4) rests; and actuating means (13) for rotating the roller (11) about a respective longitudinal axis (14) of symmetry in such a direction as to push the sheets (2) in the stack (4) away from the withdrawal opening (5).
2. A feed unit as claimed in Claim 1, wherein the actuating means (13) rotate the roller (11) at a given constant speed.
3. A feed unit as claimed in Claim 2, wherein the actuating means (13) provide for adjusting the rotation speed of the roller (11).
4. A feed unit as claimed in Claim 3, wherein the actuating means (13) provide for adjusting the rotation speed of the roller (11) as a function of the withdrawal rate of the sheets (2) from the withdrawal opening (5) in the hopper (3).
5. A feed unit as claimed in Claim 3, wherein the actuating means (13) provide for adjusting the rotation speed of the roller (11) as a function of the number of sheets (2) in the stack (4).
6. A feed unit as claimed in any one of Claims 1 to 5, wherein the portion of the lateral surface (12) of the roller (11) contacting the stack (4) has a high friction coefficient.
7. A feed unit as claimed in Claim 6, wherein the portion of the lateral surface (12) of the roller (11) contacting the stack (4) has a covering of elastic material.
8. A feed unit as claimed in Claim 7, wherein the portion of the lateral surface (12) of the roller (11) contacting the stack (4) has knurling.
9. A feed unit as claimed in Claim 8, wherein the knurl-

ing comprises a series of grooves parallel to the longitudinal axis (14) of symmetry.

10. A feed unit as claimed in any one of Claims 1 to 9, wherein an edge of the stack (4) rests on the lateral surface (12) of the roller (11). 5
11. A feed unit as claimed in one of Claims 1 to 10, wherein the roller (11) is so formed that its lateral surface (12) only contacts part of the stack (4). 10
12. A feed unit as claimed in Claim 11, wherein the roller (11) is so formed that two separate portions (15) of its lateral surface (12) contact the stack (4). 15
13. A feed unit as claimed in any one of Claims 1 to 12, wherein two parallel rollers (11) are provided, are located on opposite sides of the stack (4), and each comprise a lateral surface (12) on which a portion of the stack (4) rests; the actuating means (13) rotating each roller (11) about a respective longitudinal axis (14) of symmetry in such a direction as to push the sheets (2) in the stack (4) away from the withdrawal opening (5). 20 25
14. A feed unit as claimed in Claim 13, wherein two parallel opposite bottom edges of the stack (4) rest on the two rollers (11).
15. A feed unit as claimed in Claim 13 or 14, wherein a window for the passage of each sheet (2) and defined between the two rollers (11) is smaller than each sheet (2). 30
16. A feed unit as claimed in Claim 15, wherein the minimum distance between the lateral surfaces (12) of the two rollers (11), measured in a direction perpendicular to the longitudinal axes (14) of symmetry of the two rollers (11), is less than the corresponding dimension of each sheet (2) measured in the same direction. 35 40
17. A feed unit as claimed in any one of Claims 1 to 16, wherein the hopper (3) comprises a number of fixed sections (7) for laterally retaining the stack (4). 45
18. A feed unit as claimed in any one of Claims 1 to 17, wherein the hopper (3) comprises at least one fixed supporting member located at the withdrawal opening (5) and defining a support for the stack (4) to retain the stack (4) inside the hopper (3). 50
19. A feed unit as claimed in any one of Claims 1 to 18, wherein the hopper (3) is a vertical hopper (3); the actuating means (13) rotating the roller (11) about its longitudinal axis (14) of symmetry in such a direction as to push the sheets (2) in the stack (4) upwards. 55

20. A feed unit as claimed in any one of Claims 1 to 19, wherein the pickup device (6) comprises a wheel (8) rotating about a respective central axis (9); and at least one suction gripping head (10) supported by the wheel (8) to move cyclically along an endless path through a loading station, where the gripping head (10) engages the withdrawal opening (5) in the hopper (3) to withdraw a respective sheet (2), and through a follow-up unloading station, where the gripping head (10) feeds the sheet (2) to the packing line.

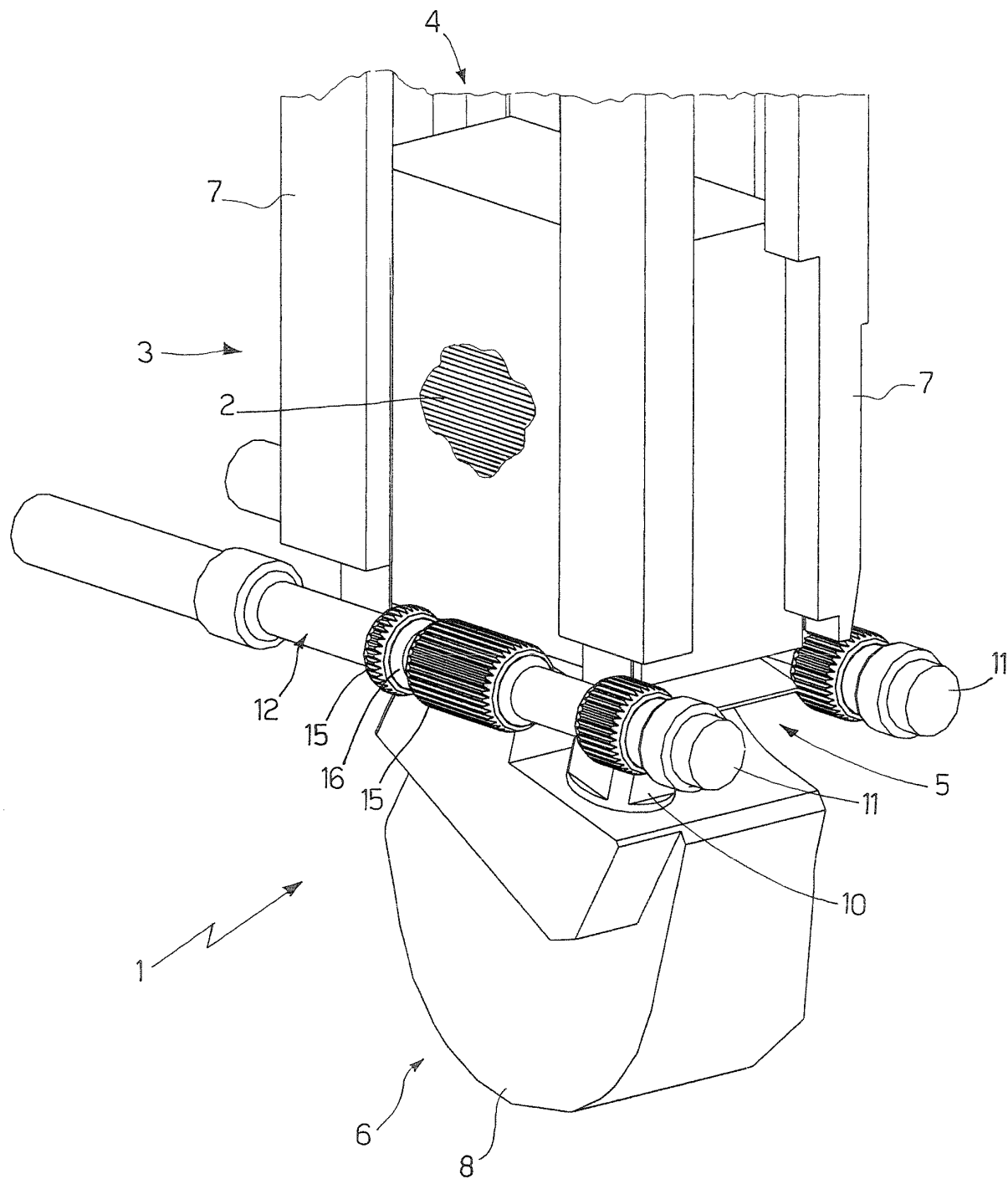
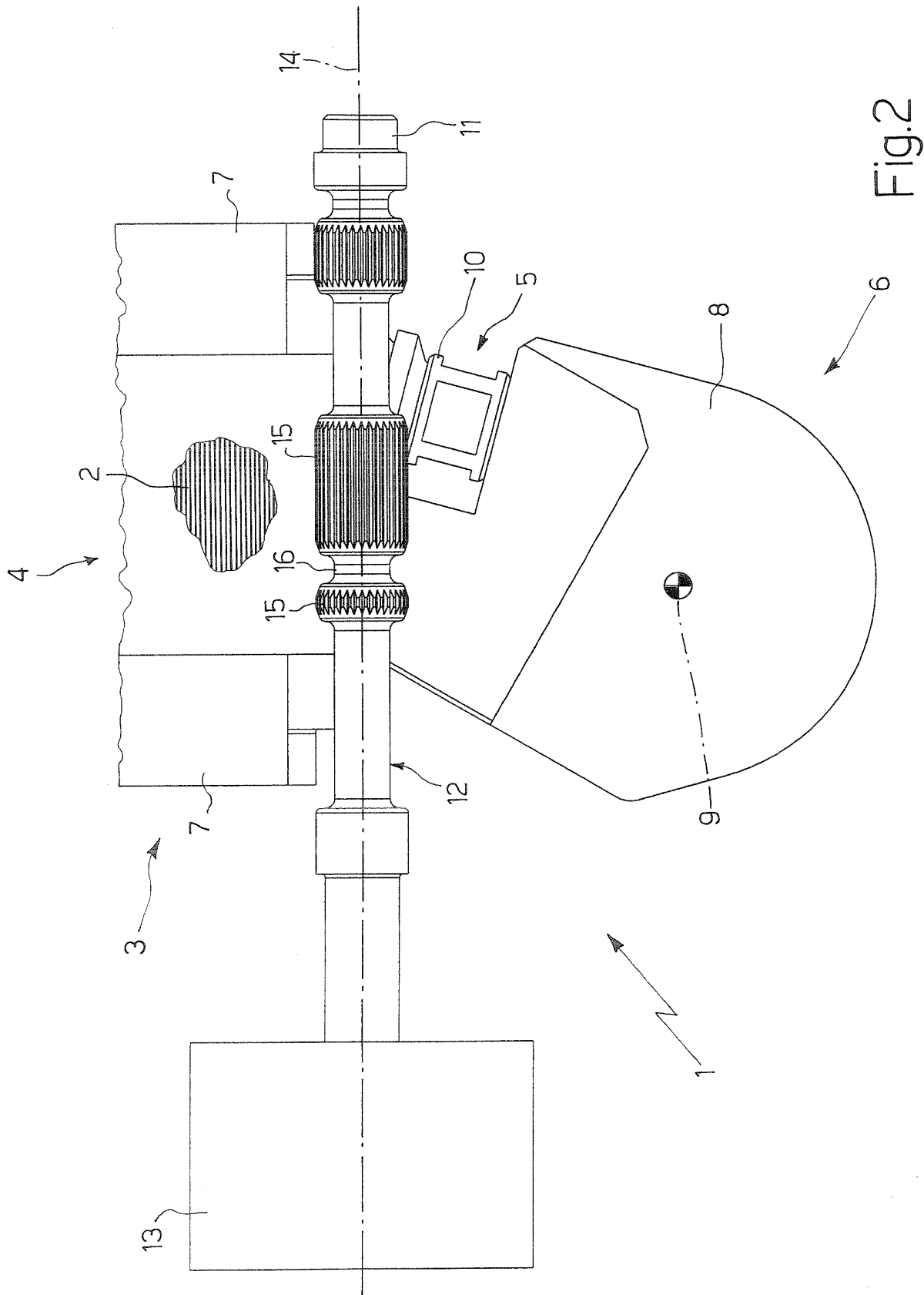
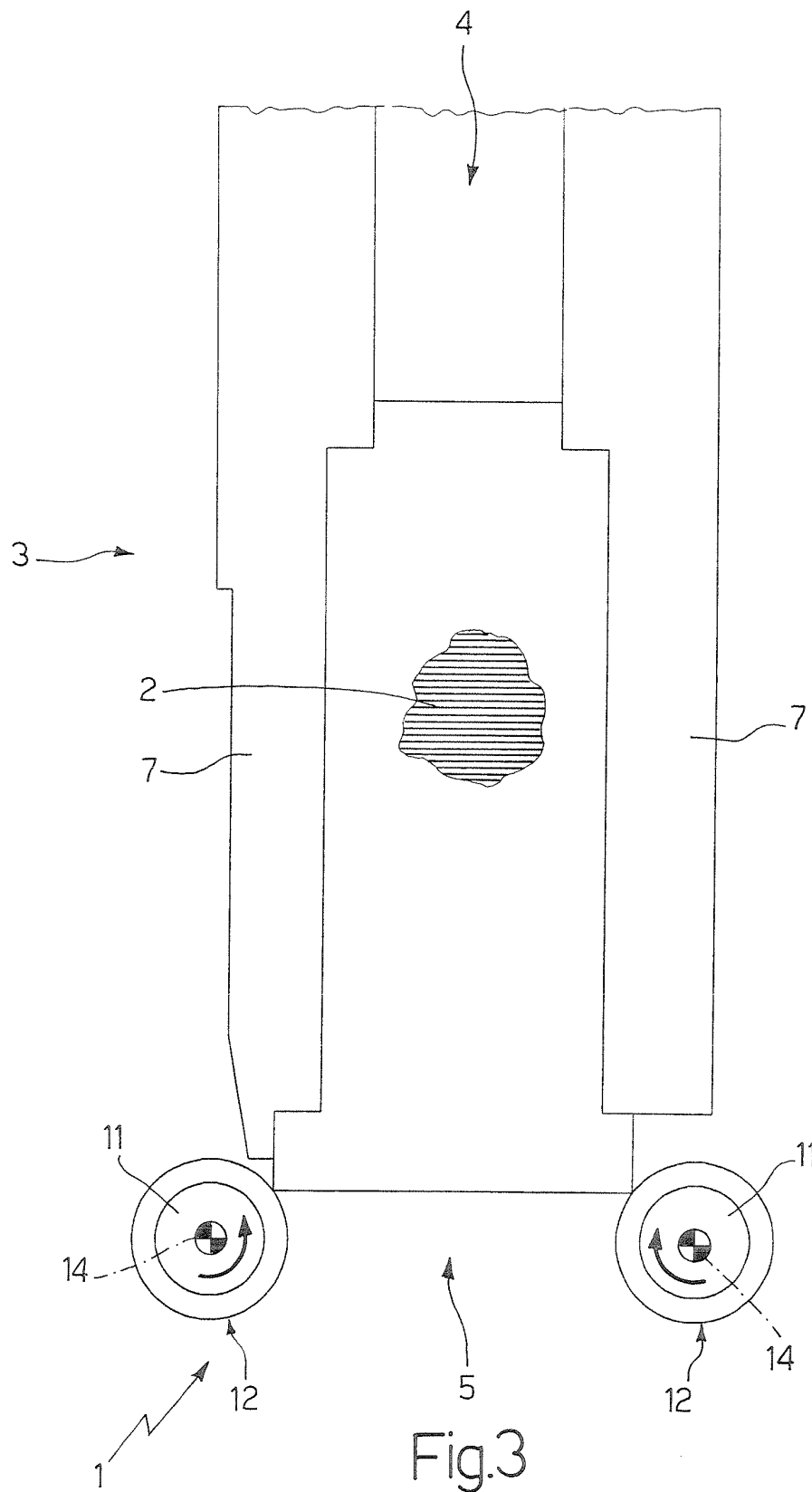


Fig.1







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Application Number
EP 04 10 4560

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Place of search The Hague		Date of completion of the search 15 December 2004	Examiner Jagusiak, A
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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