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(54) Machine for cutting soap bars into portions of preset length, with flexible operation

(57) A machine (1) for cutting soap bars into portions of preset length, with highly flexible operation, comprises: a supporting structure (2), which forms a surface (3) for the support and advancement of a soap bar (4) along a longitudinal advancement direction (5); means (6) for detecting the advancement speed of the soap bar (4) along the advancement direction; and cutting means (7). The cutting means (7) comprise at least one blade (11, 12) which is mounted on at least one arm (14) which can rotate about a rotation axis (15) which is substantially parallel to the support and advancement surface (3) and is oriented transversely to the advancement direction (5) the arm being actuated by an actuation motor (16) with a rotary motion about the rotation axis with a variable speed. The actuation motor (16) is controlled by a control and actuation element (13) which adjusts the rotation rate of the arm as a function of the advancement speed of the soap bar and of a preset length of the portions of bar to be cut. The blade (11, 12), as a consequence of the rotation of the arm (14) about the rotation axis (15), can move along a path which is substantially tangent to the support and advancement surface (3) and interferes cyclically with the soap bar (4), cutting it.

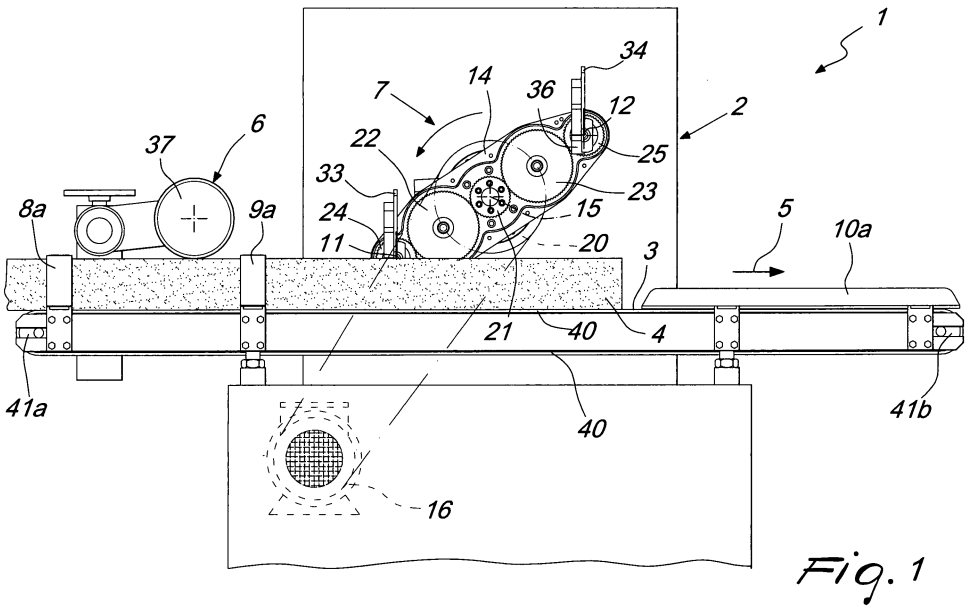

Fig. 1

EP 1 810 798 A1

Description

[0001] The present invention relates to a machine for cutting soap bars into portions of preset length with highly flexible operation.

[0002] As is known, in the manufacture of soap, soap is extruded in continuous bars, which are cut into portions of preset length, which are then molded in order to obtain pieces of soap with sizes and shapes suitable for sale.

[0003] In order to achieve high productivity, the soap bars are generally cut continuously, i.e., without stopping the bar of soap during its advancement along the production line.

[0004] Specifically-made machines are currently used to perform this operation and can be grouped into mechanically-driven machines and electronically-driven machines.

[0005] Mechanically-driven machines generally comprise a supporting structure, which forms a support and advancement surface for the soap bar to be cut, and a plurality of blades, which are mounted on a chain and are mutually spaced with a pitch which corresponds to the length of the portions of bar to be cut. The chain faces, with one of its portions, the soap bar arranged on the support and advancement surface and moves gradually closer, with said portion, to the support and advancement surface so as to gradually make the blades interfere with the soap bar in order to cut it. The actuation of the chain is synchronized with the advancement of the soap bar so as to obtain, for the blades that interfere with the soap bar, an advancement speed, in the direction of advancement of the soap bar, which is equal to the advancement speed of the soap bar.

[0006] These kinds of machines allow to vary the length of the portions of the bar to be cut, i.e., the cutting length, since the blades are connected to the chain by means of kinematic mechanisms on which it is possible to act manually in order to vary the spacing between the blades.

[0007] A first problem which can be observed in these machines is structural complexity, which arises mainly from the presence of the kinematic mechanisms required to change the cutting length, which affects significantly the production costs of these machines.

[0008] Another problem is constituted by low flexibility, since although it is possible to vary the cutting length, said length in any case is constrained within a rather narrow range, which is not always capable of meeting production requirements.

[0009] Moreover, the operation for varying the cutting length is time-consuming and laborious, requires halting the production line, with consequent production losses, and requires the intervention of specialized personnel.

[0010] Another problem of these machines is poor cutting precision.

[0011] Electronically-driven machines also comprise a supporting structure which forms a support and advancement surface for the soap bar to be cut. Such machines are provided with a blade which faces said support and advancement surface and can move on command, with a reciprocating motion, along a direction which is substantially perpendicular to the support and advancement surface. The blade, in some machines, is mounted on an arm which can oscillate about an axis which is parallel to the support and advancement surface and is oriented transversely to the advancement direction of the soap bar along said surface. The oscillation of the arm allows the blade to follow the soap bar during cutting and to move backward with respect to the bar in order to reposition itself before performing a subsequent cut. In other machines, the blade is mounted on an articulated quadrilateral or other kinematic mechanism which allows it likewise to follow the soap bar during cutting and to move backward between one cut and the next. Generally, the motion of the blade along the direction of advancement of the soap bar is achieved by means of the direct traction performed by the soap bar when the blade begins to interfere with the soap bar, while the motion of the blade in the opposite direction, after the blade has ended its cutting action and has been disengaged from the soap bar, is obtained by means of elastic elements which are loaded by the advancement of the blade together with the soap bar.

[0012] Electronically-driven machines are generally provided with means for sensing the advancement speed of the soap bar, and the actuation of the blade at right angles to the support and advancement surface is adjusted as a function of the preset cutting length.

[0013] In practice, the operating cycle of such machines comprises a cutting step, during which the blade cuts the soap bar, advancing together with the soap bar, and a repositioning step, in which the blade is disengaged from the soap bar and moves in the opposite direction with respect to the soap bar in order to be returned to the initial position to perform a new cut. To meet the requirement of being able to produce different cutting lengths and of working with relatively high soap bar advancement speeds, the second step must be very short. This entails high accelerations and decelerations in the reciprocating motion of the blade at right angles to the support and advancement surface, which cause excessive stresses in the machine.

[0014] The aim of the present invention is to solve the problems described above by providing a machine for cutting soap bars into portions of preset length which is highly flexible in operation and is capable of meeting the most disparate requirements as regards the cutting length without generating excessive stresses of the elements that compose it.

[0015] Within this aim, an object of the invention is to provide a machine which can be fitted without problems on modem production lines with high extrusion rates.

[0016] Another object of the invention is to provide a machine which allows to vary the cutting length in an extremely short time and optionally even during its operation.

[0017] Another object of the invention is to provide a structurally simple machine which can be produced at competitive costs and requires limited maintenance interventions.

[0018] Another object of the invention is to provide a machine which has high cutting precision.

[0019] This aim and these and other objects, which will become better apparent hereinafter, are achieved by a machine for cutting soap bars into portions of preset length, which comprises:

- a supporting structure, which forms a surface for the support and advancement of the soap bar along a longitudinal advancement direction;
- means for detecting the advancement speed of said bar along said advancement direction;
- cutting means, which comprise at least one blade which can move toward and away with respect to said support and advancement surface in order to interfere with the soap bar, a control and actuation element of the electronic type which is functionally connected to said means for sensing the advancement speed of the soap bar along said advancement direction and to said cutting means in order to actuate said cutting means as a function of the advancement speed of the soap bar and of a preset length for the portions of bar to be cut;

characterized in that said cutting means comprise:

- at least one arm which can rotate about a rotation axis which is substantially parallel to said support and advancement surface and is oriented transversely to said advancement direction;
- a motor for actuating said at least one arm with a rotary motion about said rotation axis and with a variable rotation rate, actuated by said actuation and control element; and
- at least one blade which is mounted on said at least one arm in a region which is spaced from said rotation axis;

said blade being movable, as a consequence of the rotation of said arm about said rotation axis, along a path which is substantially tangent to said support and advancement surface; means for orienting the blade being provided in order to keep said blade on a plane which is substantially perpendicular to said support and advancement surface and to said advancement direction at least within an interval of distance of said blade from said support surface which is equal to the thickness of said soap bar meant to be crossed by said blade and synchronization means being provided in order to keep the component of the speed of said blade along said advancement direction substantially equal to the advancement speed of the bar at least within said distance interval.

[0020] Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the machine according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a front elevation view of the machine according to the invention at the beginning of the cutting step;
Figure 2 is a front elevation view of the machine according to the invention during the cutting step;
Figure 3 is a front elevation view of the machine according to the invention at the end of the cutting step;
Figure 4 is an enlarged-scale view of a detail of Figure 2, with the soap bar removed for the sake of greater clarity;
Figure 5 is a sectional view of Figure 4, taken along the line V-V;
Figure 6 is a top plan view of the machine according to the invention.

[0021] With reference to the figures, the machine according to the invention, generally designated by the reference numeral 1, comprises a supporting structure 2, which forms a surface 3 for the support and advancement of a soap bar 4 to be cut, which advances along a longitudinal direction indicated by the arrow 5.

[0022] The machine is provided with means 6 for sensing the advancement speed of the soap bar 4 along the advancement direction 5 and with cutting means 7 which can be actuated so as to interfere cyclically with the soap bar 4 during its advancement along the direction 5 so as to cut it into portions of preset length.

[0023] The support and advancement surface 3 is preferably arranged horizontally, and along such surface there are guiding means for the soap bar 4. The guiding means comprise for example two pairs of rollers 8a, 8b, 9a, 9b, the axes of which are oriented substantially at right angles to the support and advancement surface 3. These rollers 8a, 8b, 9a, 9b are supported so that they can rotate about their respective axes by the supporting structure 2 and are arranged upstream of the cutting means 7 along the advancement direction 5.

[0024] Moreover, the guiding means comprise two side walls 10a, 10b, which are arranged along planes which are substantially perpendicular to the support and advancement surface 3 downstream of the cutting means 7 along the advancement direction 5. The rollers 8a, 8b, 9a, 9b, as well as the walls 10a, 10b, are designed to limit the possibility of movement of the soap bar 4 on the support and advancement surface 3 at right angles to the advancement direction 5.

[0025] The advancement of the soap bar 4 on the support and advancement surface 3 can be achieved by simple sliding of the soap bar 4 as a consequence of the thrust produced by the extrusion process which occurs upstream of the machine according to the invention or, as an alternative or in combination, can be obtained by providing the support and advancement surface 3 as a

belt 40 which is supported by a pair of pulleys 41 a, 41b, which are arranged so that their axes lie at right angles to the advancement direction 5.

[0026] The cutting means comprise at least one blade 11, 12, which can move toward and away from the support and advancement surface 3 in order to interfere with the soap bar 4. The cutting means 7 are actuated by an actuation and control element 13, of the programmable electronic type, which is functionally connected to the means 6 for sensing the advancement speed of the soap bar 4 along the advancement direction 5 and to the cutting means 7 so as to actuate the cutting means 7 as a function of the advancement speed of the soap bar 4 along the advancement direction 5 and of a preset length, or cutting length, for the portions of bar to be cut.

[0027] According to the invention, the cutting means 7 comprise at least one arm 14, which can rotate about a rotation axis 15 which is substantially parallel to the support and advancement surface 3 and is oriented transversely to the advancement direction 5. The arm 14 is connected to an actuation motor 16 of the variable-speed type, which can be actuated in order to produce the rotation of the arm 14 about the rotation axis 15.

[0028] At least one blade 11, 12 is mounted on the arm 14 in a region which is spaced from the rotation axis 15.

[0029] As a consequence of the rotation of the arm 14 about the rotation axis 15, the blade 11, 12 follows a path which is substantially tangent, in one point, to the support and advancement surface 3, and means for orienting the blade 11, 12 are provided in order to keep said blade 11, 12 on a plane which is substantially perpendicular to the support and advancement surface 3 and to the advancement direction 5 at least within an interval of distance of the blade 11, 12 from the support and advancement surface 3 which is equal to the thickness of the soap bar 4 to be crossed by the blade 11, 12. The machine further comprises synchronization means in order to keep the component of the speed of the blade 11, 12 along the advancement direction 5 substantially equal to the advancement speed of the soap bar 4 at least within said distance interval, i.e., when the blade 11, 12 is engaged with the soap bar 4 during cutting.

[0030] Preferably, the orientation means of the blade 11, 12 are of the kinematic type and link the blade 11, 12 to the rotation of the arm 14 about the rotation axis 15.

[0031] More particularly, the arm 14 is pivoted, at an intermediate region, to the supporting structure 2 about the rotation axis 15. The arm 14 supports, in two mutually opposite regions which are equidistant with respect to the rotation axis 15, two blades 11, 12, which can engage alternately the soap bar 4 as a consequence of the rotation of the arm 14 about the rotation axis 15.

[0032] With particular reference to Figure 5, the arm 14 is fixed, so as to rotate rigidly about the rotation axis 15, to a hollow shaft 18, the axis of which coincides with the rotation axis 15 and is supported by the supporting structure 2 so that it can rotate about said axis by means of a pair of bearings 19a and 19b. A pulley 20 is fixed to the hollow shaft 18 and connects said hollow shaft 18 to the output shaft of the variable-speed motor 16.

[0033] With particular reference to Figures 5 and 6, the orientation means of the blade, or rather of the two blades 11 and 12, comprise a gear system which is composed of a central gear 21, whose axis coincides with the rotation axis 15, and of two planetary gears 22 and 23, which mesh with two diametrically mutually opposite regions of the central gear 21 and are arranged so that their axes are parallel to the rotation axis 15. An end gear 24 and 25 meshes with each of these planetary gears 22 and 23, and its axis likewise is oriented parallel to the rotation axis 15.

[0034] The central gear 21 is fixed to a shaft 26 which passes coaxially through the hollow shaft 18 and is rigidly fixed to the supporting structure 2. A pair of bearings 27a, 27b is arranged between the hollow shaft 18 and the shaft 26.

[0035] The planetary gears 22 and 23 are supported so that they can rotate about their respective axes, by means of pairs of bearings 28a, 28b, 29a, 29b, by the arm 14. Likewise, the end gears 24 and 25 also are supported so that they can rotate about their respective axes by means of pairs of bearings 30a, 30b, 31a, 31b by the arm 14.

[0036] Moreover, the rotation axis 15 and the axes of the planetary gears 22 and 23 and of the end gears 24 and 25 are arranged on a same plane.

[0037] The end gears 24 and 25 have the same number of teeth as the central gear 21.

[0038] The blades 11 and 12 are rigidly fixed to the end gears 24 and 25. In greater detail, the blades 11 and 12 are mounted on respective bows 33 and 34, which are fixed to blocks 35 and 36 which in turn are fixed to the end gears 24 and 25.

[0039] The blades 11 and 12 are arranged on planes which are perpendicular to the support and advancement surface 3 and the kinematic connection provided by means of the central gear 21, the planetary gears 22 and 23 and the end gears 24 and 25 maintains this orientation of the blades 11 and 12 during the rotation of the arm 14 about the rotation axis 15.

[0040] The synchronization means comprise a program which is preset in the actuation and control element 13 and is adapted to obtain, for the arm 14, an actuation with a rotary motion about the rotation axis 15 with a speed which can vary as a function of the advancement speed of the soap bar 4 along the advancement direction 5, so as to maintain the component of the speed of the blade 11 or 12 in engagement with the soap bar 4, along the advancement direction 5, substantially equal to the advancement speed of the soap bar 4, while the blade 11 or 12 is engaged with the soap bar 4, and in a manner adapted to obtain an advancement of the soap bar 4 along the support and advancement surface 3, between the disengagement of one blade 11 or 12 from the soap bar 4 after cutting it and the subsequent engagement of the other blade 12 or 11 with the soap bar 4, which is

equal to the preset length, or cutting length, for the portion of bar to be cut.

[0041] The means 6 for sensing the advancement speed of the bar of soap 4 along the support and advancement surface 3 comprise a contact roller 37, which is arranged so that its axis lies parallel to the support and advancement surface 3 and at right angles to the advancement direction 5.

[0042] The contact roller 37 is spaced from the support and advancement surface 3 so as to make contact with the face of the soap bar 4 that lies opposite the face that rests on the support and advancement surface 3.

[0043] The contact roller 37 is connected to an encoder which detects the rotation rate of the contact roller 37 and therefore the advancement speed of the soap bar 4 along the advancement direction 5 and transmits it to the control and actuation element 13.

[0044] Operation of the machine according to the invention is as follows.

[0045] The intended length for the portions to be cut from the bar of soap 4, i.e., the chosen cutting length, is set in the control and actuation element 13.

[0046] The control and actuation element 13, by knowing the advancement speed of the soap bar 4 along the advancement direction 5 transmitted by the encoder connected to the contact roller 37, actuates, according to the program that is preset in the control and actuation element 13, the actuation motor 16, which in turn produces the rotation of the arm 14 about the rotation axis 15.

[0047] The rotation of the arm 14 about the rotation axis 15 cyclically causes the blades 11 and 12 to interfere with the soap bar 4 during its advancement along the advancement direction 5, cutting the soap bar 4 into portions whose length is preset in the control and actuation element 13.

[0048] More particularly, the control and actuation element 13 turns, by means of the actuation motor 16, the arm 14 about the rotation axis 15 with a rotation rate which is variable during a cutting cycle, so as to adapt the action of the blades 11 and 12 on the soap bar 4 to the advancement speed of the soap bar 4 along the direction 5 and to the preset cutting length.

[0049] More particularly, the rotation rate of the arm 14, while one blade 11 or 12 is cutting the soap bar 4, is such as to obtain a movement of said blade along the advancement direction 5 at a speed which is equal to the advancement speed of the soap bar 4 along the same direction. After such blade has been disengaged from the soap bar 4 and before the other blade engages the soap bar 4, the rotation speed of the arm 14 about the rotation axis 15 is changed so that the next blade engages the soap bar at a distance from the previous cut which is equal to the preset cutting length as a function of the advancement speed of the soap bar 4 along the direction 5.

[0050] It should be noted that during the operation of the machine the cutting length can be changed simply by setting a new cutting length in the control and actuation element 13.

[0051] In practice it has been found that the machine according to the invention fully achieves the intended aim, since it provides a high operating flexibility which is capable of meeting the most disparate requirements as regards the cutting length and, thanks to the particular actuation of the blade or blades, does not cause excessive stresses for the elements that compose it.

[0052] Another advantage of the machine according to the invention is that it allows to vary the cutting length even during the operation of the machine.

[0053] The machine thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0054] In practice, the materials used, as well as the dimensions, may be any according to requirements and to the state of the art.

[0055] The disclosures in Italian Patent Application no. MI2006A000098, from which this application claims priority, are incorporated herein by reference.

[0056] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A machine for cutting soap bars into portions of preset length, comprising:

- a supporting structure, which forms a surface for the support and advancement of the soap bar along a longitudinal advancement direction;
- means for detecting the advancement speed of said bar along said advancement direction;
- cutting means, which comprise at least one blade which can move toward and away with respect to said support and advancement surface in order to interfere with the soap bar, a control and actuation element of the electronic type which is functionally connected to said means for sensing the advancement speed of the soap bar along said advancement direction and to said cutting means in order to actuate said cutting means as a function of the advancement speed of the soap bar and of a preset length for the portions of bar to be cut;

characterized in that said cutting means comprise:

- at least one arm which can rotate about a rotation axis which is substantially parallel to said

support and advancement surface and is oriented transversely to said advancement direction;
- a motor for actuating said at least one arm with a rotary motion about said rotation axis and with a variable rotation rate, actuated by said actuation and control element; and
- at least one blade which is mounted on said at least one arm in a region which is spaced from said rotation axis;

said blade being movable, as a consequence of the rotation of said arm about said rotation axis, along a path which is substantially tangent to said support and advancement surface; means for orienting the blade being provided in order to keep said blade on a plane which is substantially perpendicular to said support and advancement surface and to said advancement direction at least within an interval of distance of said blade from said support surface which is equal to the thickness of said soap bar intended to be crossed by said blade and synchronization means being provided in order to keep the component of the speed of said blade along said advancement direction substantially equal to the advancement speed of the bar at least within said distance interval.

2. The machine according to claim 1, **characterized in that** said means for orienting the blade are of the kinematic type and link said blade to the rotation of said arm about said rotation axis.

3. The machine according to claims 1 and 2, **characterized in that** said arm is pivoted, at an intermediate region thereof, to said supporting structure about said rotation axis, and supports, in mutually opposite regions which are equidistant from said rotation axis, two blades which can engage alternately the soap bar as a consequence of the rotation of said arm about said rotation axis.

4. The machine according to one or more of the preceding claims, **characterized in that** said blade orientation means comprise a gear system composed of a central gear, whose axis coincides with said rotation axis and which is fixed to said supporting structure, two planetary gears which mesh with two diametrically mutually opposite regions of said central gear and are supported by said arm so that they can rotate about the respective axes, which are parallel to said rotation axis; an end gear meshing with each of said planetary gears and being supported so that it can rotate about its own axis by said arm and rigidly supporting one of said two blades.

5. The machine according to one or more of the preceding claims, **characterized in that** said rotation axis, the axis of said planetary gears and the axes of said end gears are mutually coplanar.

6. The machine according to one or more of the preceding claims, **characterized in that** said synchronization means comprise a program which is preset in said actuation and control element and is adapted to obtain, for said arm, an actuation with a rotary motion about said rotation axis with a speed which can vary as a function of the advancement speed of said bar along said advancement direction in order to keep the component of the speed of said blade along said advancement direction substantially equal to the advancement speed of the bar within said distance interval and in order to obtain an advancement of the soap bar along said support and advancement surface, between the disengagement of one blade from the soap bar after cutting it and the subsequent engagement of the other blade with the soap bar, which is equal to the preset length for the bar portion to be cut.

7. The machine according to one or more of the preceding claims, **characterized in that** said means for sensing the advancement speed of the soap bar along said support and advancement surface comprise an encoder which is connected to a contact roller which makes contact with the soap bar, said contact roller being arranged so that its axis lies transversely to said advancement direction.

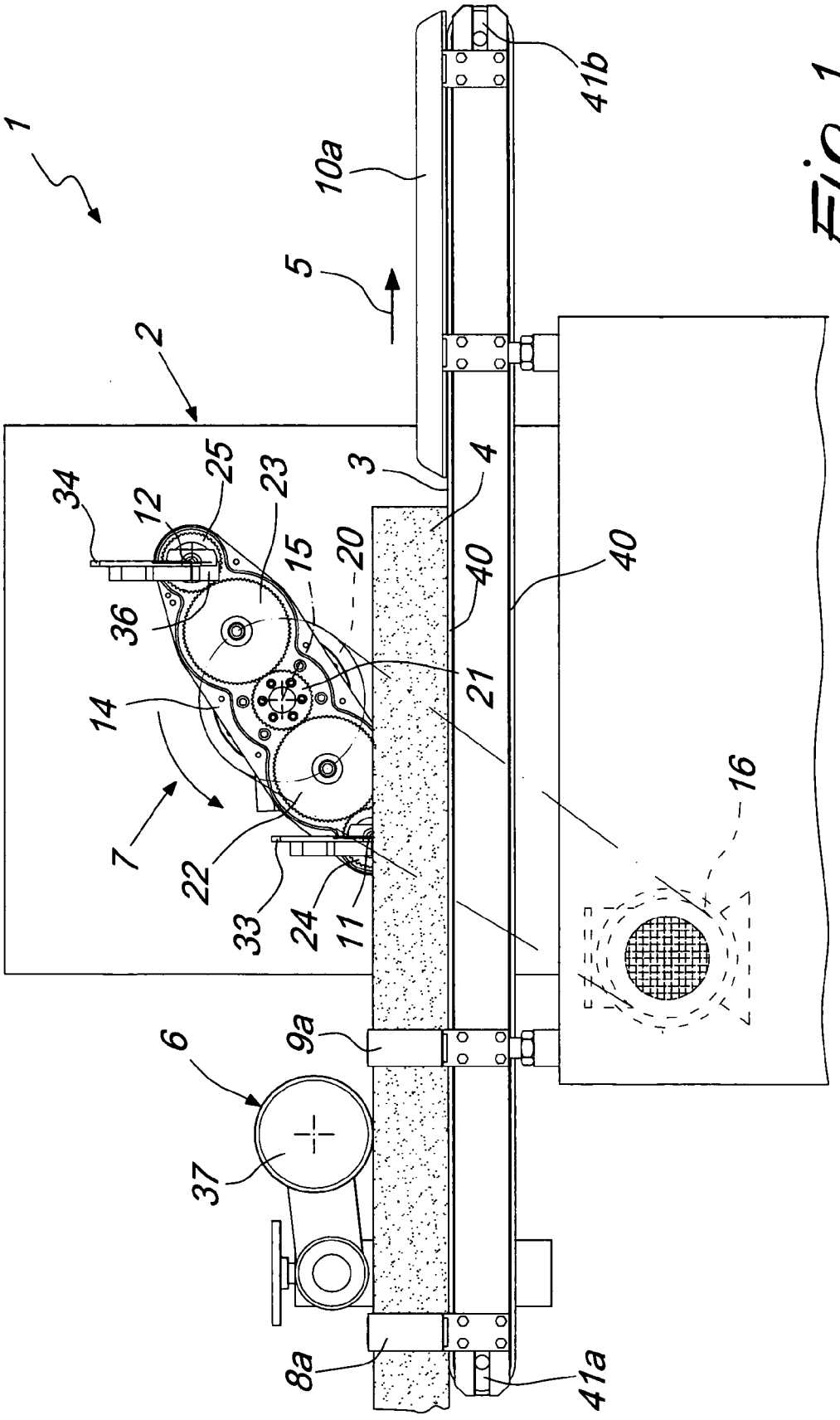
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Fig. 1

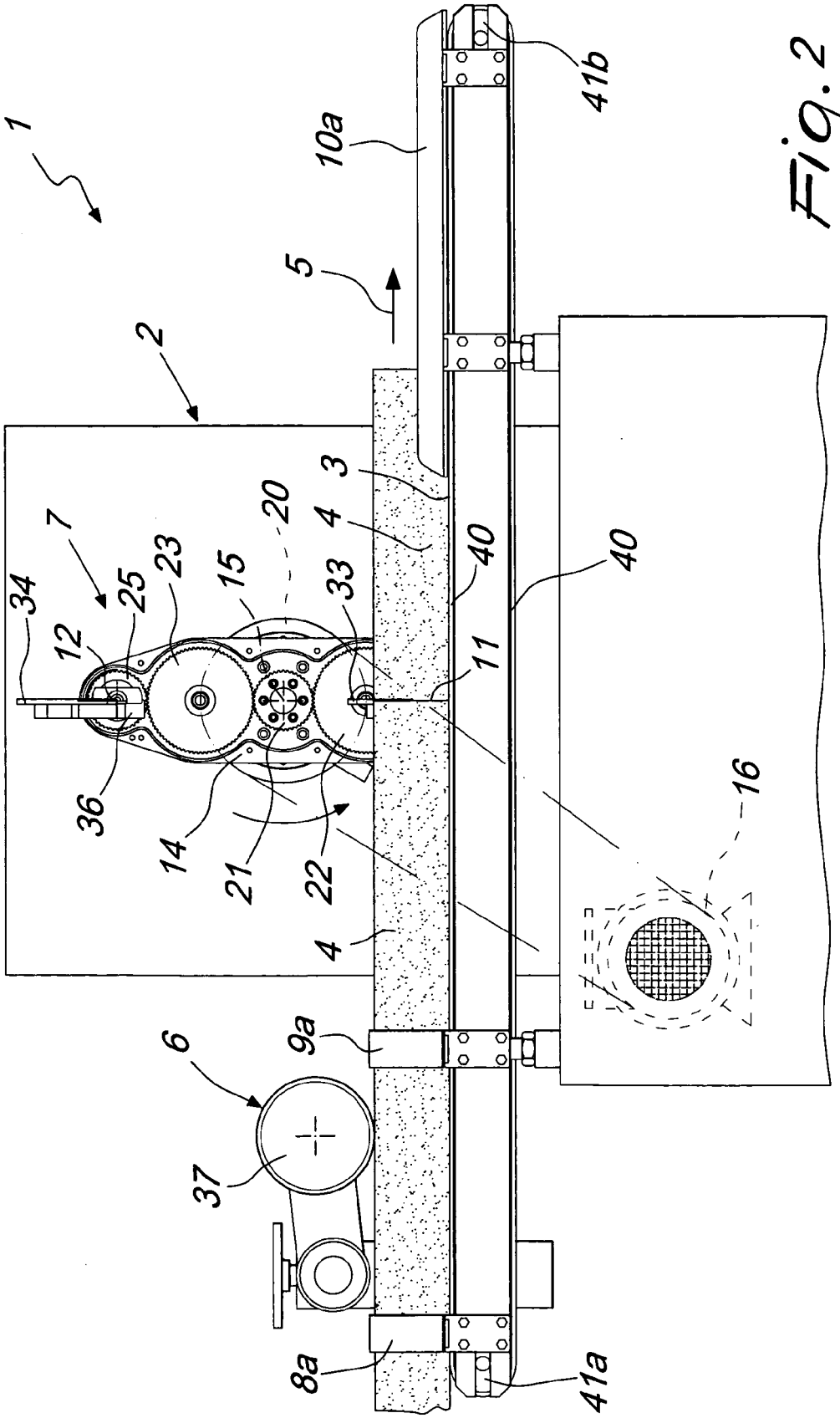
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Fig. 2

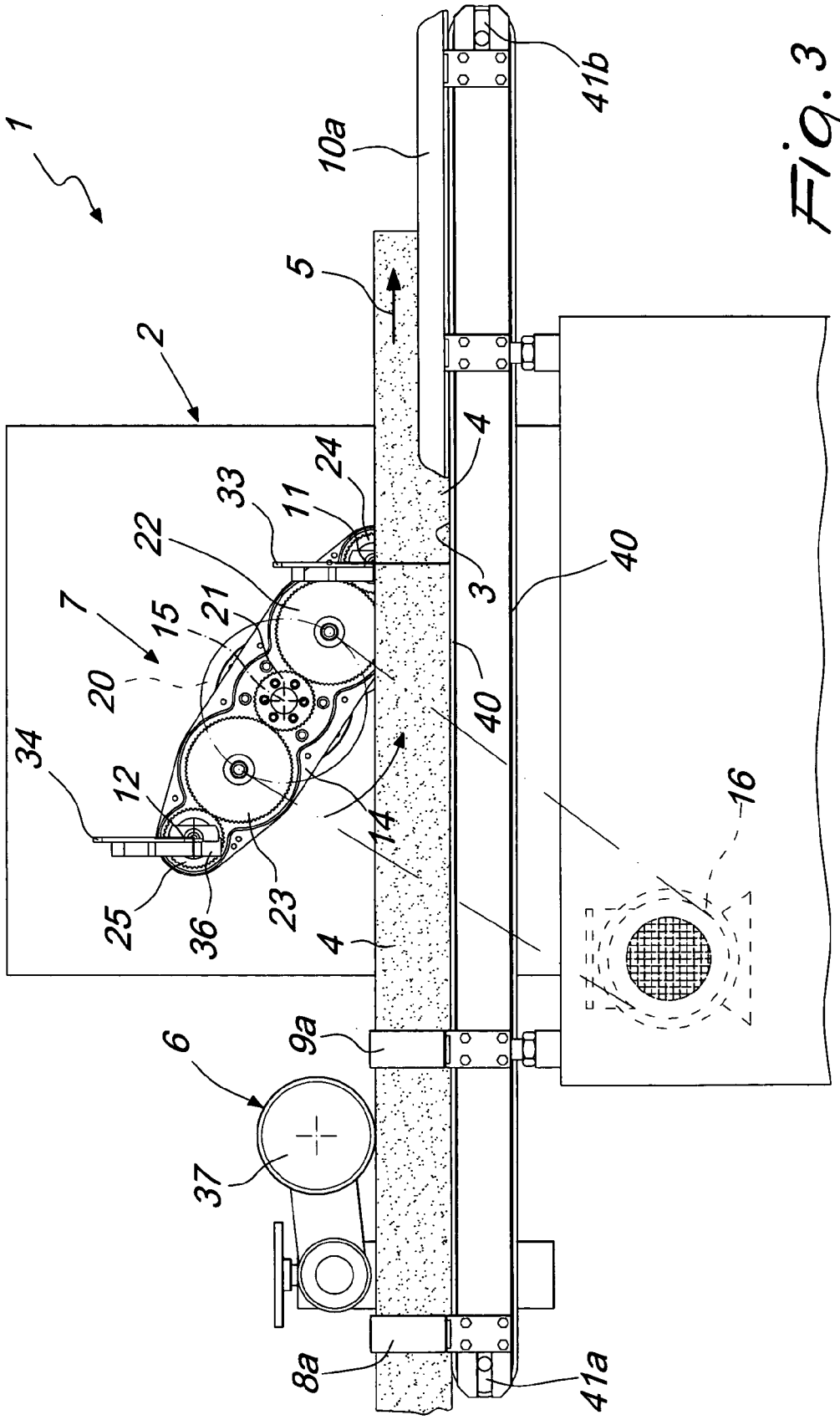
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Fig. 3

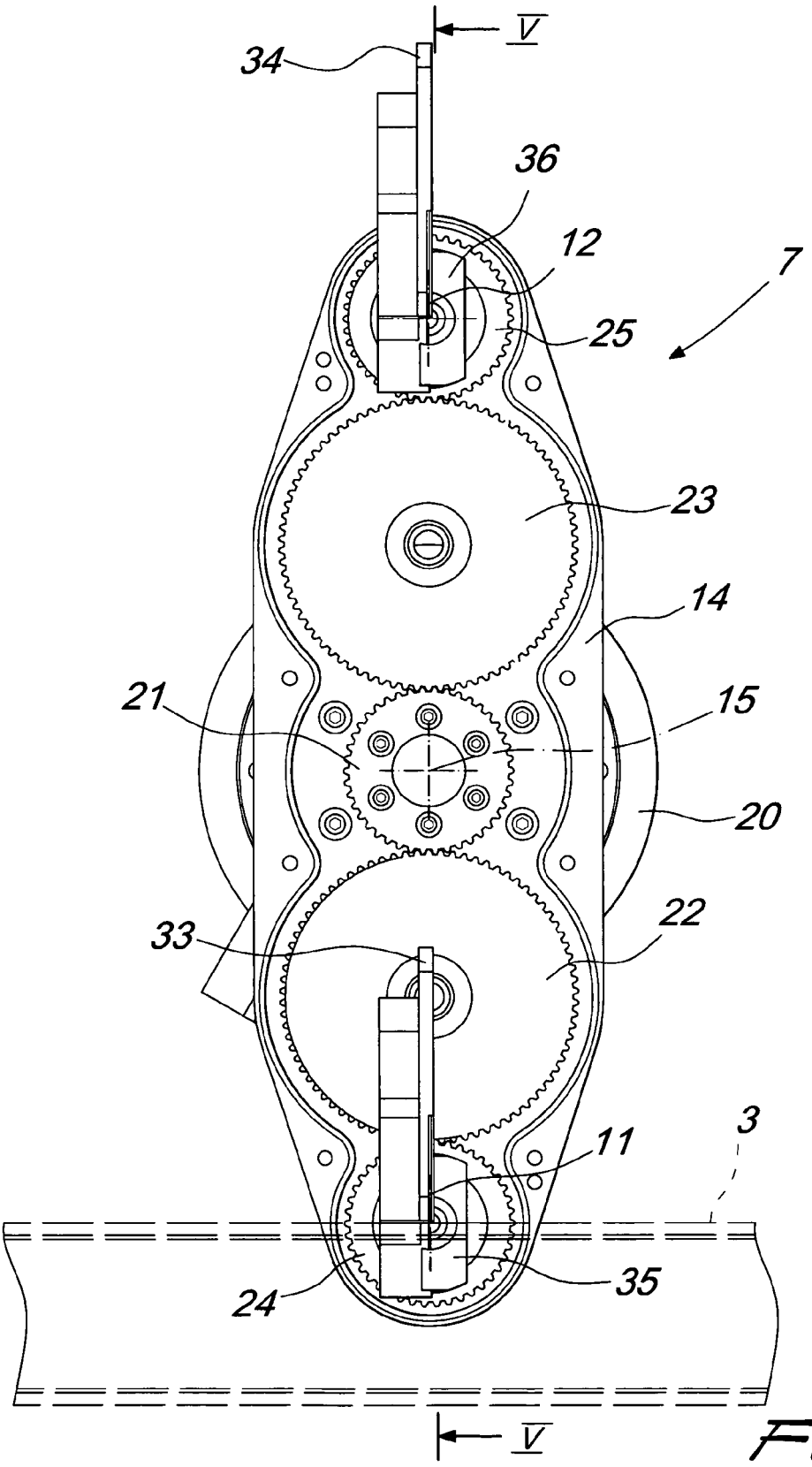

Fig. 4

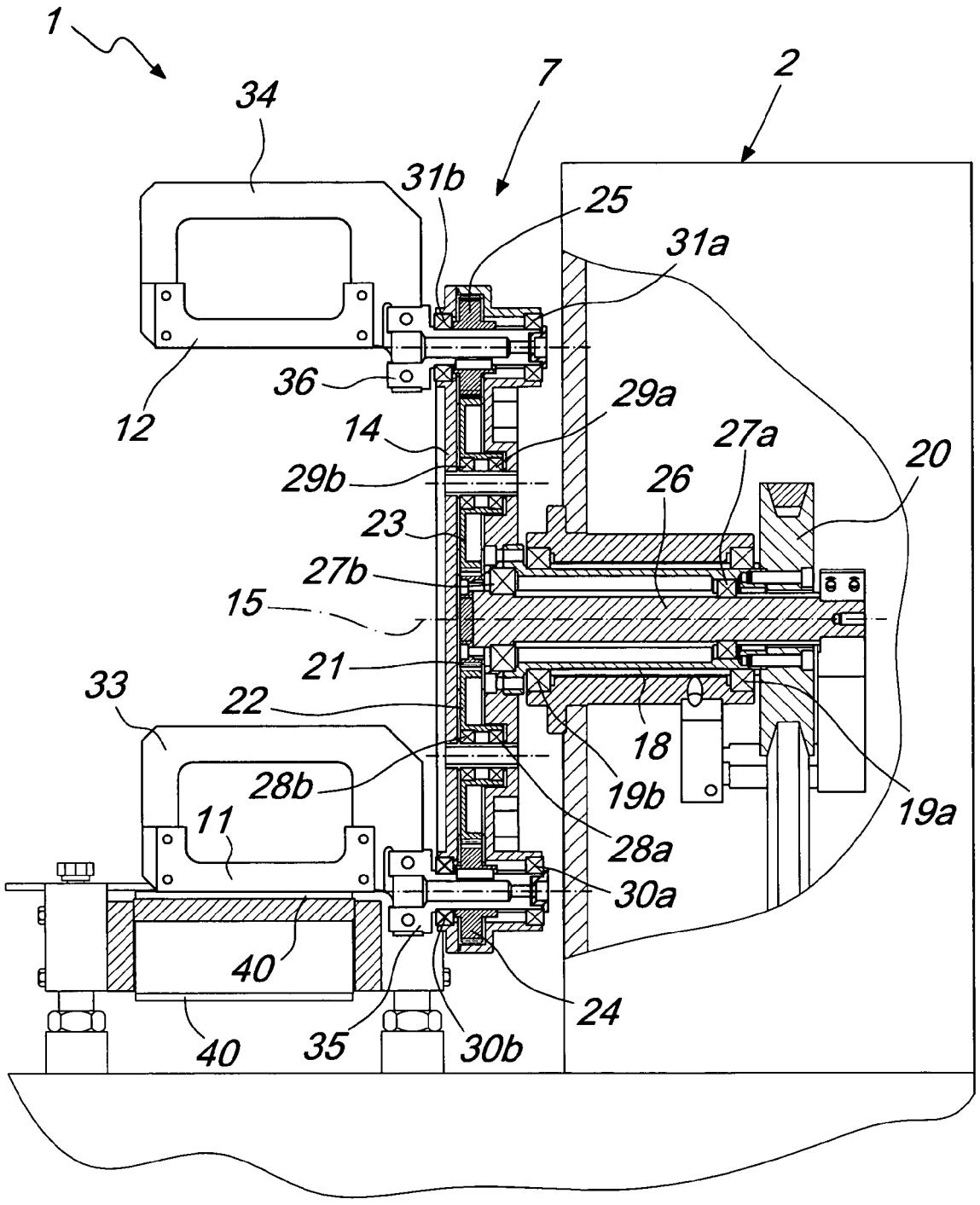
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Fig. 5

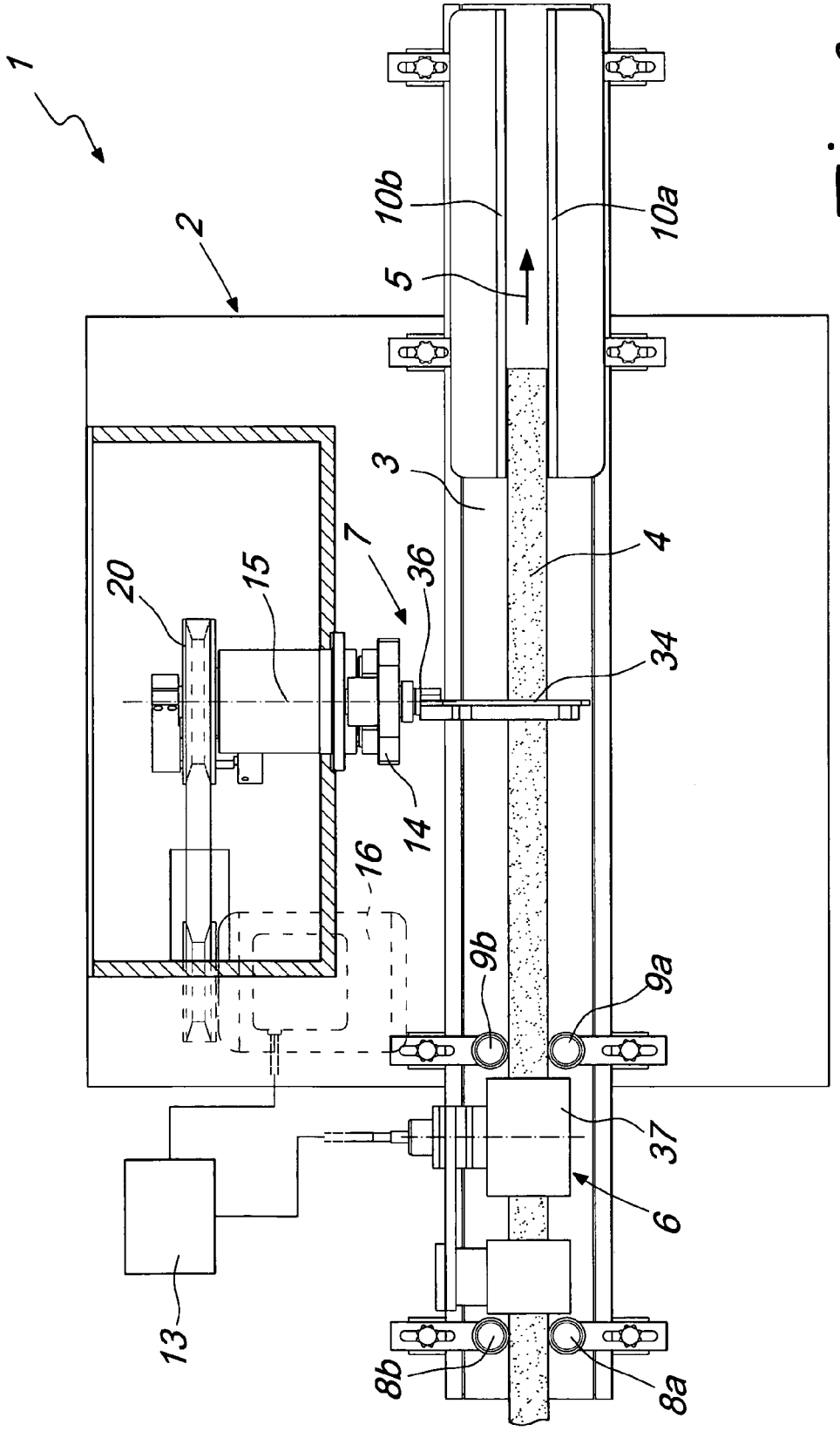

Fig. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 00 0609

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	IT MI 942 643 A1 (BINACCHI & CO [IT] BINACCHI & CO) 24 June 1996 (1996-06-24) * the whole document * -----	1-7	INV. B26D1/58 C11D13/22
A	WO 2004/106017 A (PERINI FABIO SPA [IT]; GELLI MAURO [IT]; CHIOCCHETTI MARIO GIONI [IT]) 9 December 2004 (2004-12-09) * abstract; figures * -----	1	
A	DE 19 56 274 A1 (GUSCHKY & TOENNESMANN KG) 23 December 1971 (1971-12-23) * the whole document * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

B26D
C11D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 April 2007	Canelas, Rui

CATEGORY OF CITED DOCUMENTS

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P : intermediate document

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
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1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 00 0609

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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11-04-2007

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