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(54) A CUTTING UNIT FOR A LABELLING MACHINE

SCHNEIDEINHEIT FÜR EINE ETIKETTIERMASCHINE

UNITÉ DE COUPE POUR UNE MACHINE D'ÉTIQUETAGE

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Description

TECHNICAL FIELD

[0001] The present invention relates to a cutting unit for labelling machines, particularly for the type of labelling machines comprising a reel from which a web of labelling material is cut into lengths (labels) of a predetermined size and applied on articles, namely on containers filled with a pourable product.

BACKGROUND ART

[0002] Known labelling machines of the above-mentioned type basically comprise a carousel for advancing the articles along an article path towards a labelling station, and a labelling unit fed with a web of labelling material, progressively advancing such web along a label path towards the labelling station as well as cutting the web itself into a plurality of labels to be applied onto the articles moving along the article path.

[0003] In detail, the labelling unit comprises:

- one or more motorized feeding rolls for moving the web of labelling material from a label reel towards the carousel;
- a cutting unit for cutting one label at any one time from the web; and
- a vacuum drum receiving the cut labels and transferring them to the articles in the carousel.

[0004] As each label is transferred from the cutting unit toward the labelling station, a layer of adhesive is typically applied on its surface for subsequently securing it to the surface of one respective article being fed to the labelling station.

[0005] As an alternative, in a sleeve-type labelling machine, the labels are transferred from the cutting unit in order to be wound about rotating mandrels carried by a carousel for forming tubular lengths of labelling material which shall subsequently be applied on the articles.

[0006] Known cutting units typically comprise:

- a stationary blade mounted on a stationary support structure;
- a rotary drum rotating, in use, about a vertical axis and having a lateral surface facing the stationary blade and receiving the web of labelling material; and
- a rotary blade borne by the lateral surface of the rotary drum and cyclically passing, in use, by the stationary blade to define a cutting position, wherein the stationary blade and the rotary blade cooperate, in use, with opposite sides of the web of labelling material so as to separate one label at any one time from the web itself.

[0007] Both the stationary and rotary blades are arranged adjacent to the vacuum drum.

[0008] In use, the web of labelling material is advanced between the stationary and the rotary blades of the cutting unit, the leading edge of the web being picked, by suction, by the vacuum drum.

[0009] In greater details, the vacuum drum is typically driven to rotate at a speed higher than the speed at which the web of labelling material is advanced along the label path, whereby the vacuum drum applies a pulling force on the leading edge of the web. When, upon rotation, the rotary blade becomes opposed to the stationary blade, the web is cut.

[0010] Known from EP0319894A2 and DE19933497A1 is a cutting unit as defined in the preamble of claim 1.

[0011] The applicant has observed that, in order to achieve a proper cut of the web of labelling material as well as to safeguard the life of the blades, it is preferable to maintain the stationary blade very close to the rotary blade at the cutting position without any interference between them; in other words, the minimum gap compatible with the performance of a proper cutting action on the web of labelling material should be established and maintained between the stationary blade and the rotary blade at the cutting position.

[0012] In practice, in use, the web of labelling material (generally a thin, polymeric film) is weakened along the cutting line and the label is "torn" off the rest of the web by means of the pulling force applied by the vacuum drum.

[0013] In the known solutions, the condition of non-interference cannot be ensured during the initial transitory time following the start-up of the cutting unit; as a matter of fact, during that time, the temperatures of the blades are lower than the target ones and this typically generates interference between the blades, with a consequent undesired wear thereof.

[0014] In addition, possible problems of non-uniform wear or degradation of the stationary blade may occur when webs of different heights are subsequently used on the same cutting unit. In particular, a working cycle with a first type of web only engaging a portion of the height of the stationary blade may produce different levels of wear on different zones of the blade itself (the working zone may be subjected to a higher wear than the non-working zone); in a subsequent working cycle with a higher web engaging the whole height of the stationary blade, the cutting action may be negatively affected by the non-uniform wear of the stationary blade itself.

[0015] Furthermore, the gap between the stationary blade and the rotary blade can change during the operation, due to the inevitable wear of the blades. An increase or decrease in such gap of one or two micrometres may result in a big difference in the quality of the cutting.

DISCLOSURE OF INVENTION

[0016] It is therefore an object of the present invention to provide a cutting unit for cutting labels from a web of

labelling material, which allows to overcome, in a straightforward and low-cost manner, the drawbacks associated with the cutting units of known type.

[0017] According to the present invention, there is provided a cutting unit as claimed in claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Two preferred embodiments are hereinafter disclosed for a better understanding of the present invention.

[0019] The cutting unit claimed in claim 1 has piezoelectric elements used as sensors and as actuator means as illustrated in figures 12 and 13, while the embodiment of figures 1 to 11 shows an example of a different type of cutting unit.

[0020] With reference to the accompanying drawings:

Figure 1 shows a side view of a cutting unit not according to the present invention, with parts removed for clarity;

Figure 2 shows a smaller-scale section along line II-II in Figure 1, in a different configuration of the cutting unit and with the additional representation of a web of labelling material cut by the cutting unit into a plurality of labels;

Figure 3 shows a schematic smaller-scale side view of the cutting unit of Figure 1 with additional diagrammatic details of a control system of the cutting unit itself;

Figures 4 to 6 diagrammatically show different possible operating conditions of the cutting unit of Figures 1 to 3;

Figures 7 shows an enlarged section view of a detail of the cutting unit of Figure 2 in one possible operating condition and without the web of labelling material, the proportions of the parts being overemphasized for illustrative purposes and clarity reasons;

Figure 8 is analogous to Figure 7 and shows the cutting unit cooperating with the web of labelling material;

Figure 9 is analogous to Figure 7 and shows the same detail of the Figure 7 itself in a different condition and without the web of labelling material;

Figure 10 is analogous to Figure 9 and shows the cutting unit cooperating with the web of labelling material;

Figure 11 is analogous to Figures 7 and 9 and shows the same detail of these latter Figures in a further different condition and without the web of labelling material;

Figure 12 is analogous to Figure 2 and shows a cutting unit according to the present invention, with parts removed for clarity; and

Figure 13 is analogous to Figure 3 and shows the cutting unit of Figure 12 with additional diagrammatic details of a control system of the cutting unit itself.

BEST MODE FOR CARRYING OUT THE INVENTION

[0021] Number 1 in Figures 1 to 3 indicates as a whole a cutting unit not according to the present invention for cutting material from a web, in particular labels 2 from a web 3 of labelling material.

[0022] Cutting unit 1 is adapted to be incorporated into a labelling machine (known per se and not shown), especially into a roll-fed labelling machine for applying labels 2 to relative articles, in particular containers (known per se and not shown) filled with a pourable product.

[0023] In detail, the roll-fed labelling machine substantially comprises:

- a label reel from which web 3 is unwound along a path A from a motorized roll;
- a carousel for advancing the articles to be labelled along an additional curved path; and
- a labelling unit for applying labels 2 onto respective articles which are advanced by the carousel.

[0024] In a known manner, the labelling unit comprises:

- a web feeding device C including one or more motorized feeding rolls (known per se and not shown) for moving web 3 from the label reel towards the carousel;
- cutting unit 1 for cutting one label 2 at any one time from web 3; and
- a vacuum drum D (only partially shown in Figure 2) receiving the cut labels 2 and transferring them to the articles in the carousel.

[0025] Cutting unit 1 cuts labels 2 from web 3 and conveys them towards the carousel.

[0026] With reference to Figures 1 to 3, cutting unit 1 substantially comprises:

- a stationary blade 4 mounted on a stationary support structure 5;
- a rotary drum 6 rotating, in use, about a vertical axis B and having a lateral surface 7 facing stationary blade 4 and receiving web 3; and
- at least one rotary blade 8 borne by lateral surface 7 of rotary drum 6 and cyclically passing, in use, by stationary blade 4 to define a cutting position, wherein the stationary blade 4 and the rotary blade 8 cooperate, in use, with opposite sides of the web 3 so as to separate a label 2 from the web 3 itself.

[0027] Axis B of rotary drum 6 is parallel to the axis of vacuum drum D; rotary drum 6 and vacuum drum D are substantially arranged tangential to one another to allow transfer of the cut labels 2 from the rotary drum 6 to the vacuum drum D.

[0028] In detail, rotary drum 6 comprises a central shaft 9 supported in a rotating manner about its axis B by a fixed frame 10 through a pair of bearings 11, in particular

rolling bearings, and a cylindrical annular main body 12, coaxially coupled onto shaft 9 and delimited by lateral surface 7.

[0029] As clearly shown in Figure 2, rotary blade 8 outwardly protrudes slightly from lateral surface 7 of rotary drum 6 and is provided with a cutting edge 15 (Figures 7 to 11) extending parallel to axis B.

[0030] As a possible alternative not shown, rotary drum 6 may also comprise two or more rotary blades 8 equally spaced angularly about axis B.

[0031] In the particular example shown in Figure 2, axis of rotary drum 6 extends orthogonally to path A followed by web 3 at the cutting position.

[0032] With reference to Figures 1 and 2, support structure 5 comprises a vertical prismatic block 16 arranged in a position facing lateral surface 7 of rotary drum 6 and carrying stationary blade 4 on one of its sides.

[0033] In particular, stationary blade 4 is defined by a plate having two opposite and parallel flat lateral faces 17, 18, one of which rests, in use, on a relative side of block 16; stationary blade 4 also includes a front wedge-shaped cutting portion 19, protruding from block 16 towards rotary drum 6, and a flat back surface 20 opposite the cutting edge 19. In the particular example shown, back surface 20 abuts against a flange 21 outwardly protruding from the side of block 16 on which stationary blade 4 is arranged.

[0034] Cutting portion 19 of stationary blade 4 has a linear and vertical cutting edge 22 (see in particular Figures 7 to 11) extending parallel to axis B of rotary drum 6 and to cutting edge 15 of rotary blade 8.

[0035] As visible in the specific embodiment shown in Figure 2, which has no limiting effect, block 16 has an internal cavity 23, which opens at a side of the block 16 itself, opposite the rotary drum 6, and is closed by a cover plate 24 secured to said block 16. This specific arrangement permits to amplify, in use, the vibrations generated on stationary blade 4 by rotation of the rotary drum 6; the aim of this amplification will be clarified later on.

[0036] Stationary blade 4 and lateral surface 7 of rotary drum 6 define a passage 25 for web 3; at cutting position, i.e. where rotary blade 8 faces stationary blade 4, the passage 25 reaches a minimum value set to allow a cutting action on the web 3.

[0037] With reference to Figures 1 to 3, cutting unit 1 further comprises:

- sensor means 26 detecting, in use, a quantity R correlated to the distance or interference between stationary blade 4 and rotary blade 6 at the cutting position; and
- actuator means 27 configured to adjust the position of stationary blade 4 towards or away from rotary drum 6 as a function of the quantity R detected by sensor means 26.

[0038] In particular, actuator means 27 are configured to produce micrometric displacements of stationary blade 4 towards or away from rotary drum 6.

[0039] Cutting unit also comprises (Figure 3) a control unit 28 connected to sensor means 26 and to actuator means 27 and configured to control activation of the actuator means 27 so as to maintain the detected quantity R within a given threshold range R_0 corresponding to a given air gap range between cutting edge 22 of stationary blade 4 and cutting edge 15 of rotary blade 8 at the cutting position (see in particular Figures 7 and 8).

[0040] Cutting unit 1 also comprises a temperature sensor 29 arranged on stationary blade 4 and connected to control unit 28.

[0041] According to the unit shown in Figures 1 to 3, sensor means 26 comprise two sensors 30 detecting the quantity R at distinct zones 22a, 22b of cutting edge 22 of stationary blade 4 to give distinct measures of the distances between cutting edge 15 of rotary blade 8 and the zones 22a, 22b of the cutting edge 22 itself.

[0042] In particular, zones 22a, 22b are defined by the opposite end portions of cutting edge 22 stationary blade 4.

[0043] As a possible alternative not shown, sensor means 26 may even comprise more than two sensors 30.

[0044] In the example shown, quantity R is the acceleration of the vibrations transmitted by stationary blade 4 to block 16 during rotation of rotary drum 4. Hence, sensors 30 are accelerometers mounted on portions 31 of block 16 adjacent to zones 22a, 22b of cutting edge 22 of stationary blade 4. In particular, in this case, each sensor 30 detects the acceleration of the vibrations transmitted by the corresponding zone 22a, 22b of cutting edge 22 of stationary blade 4 to block 16 during rotation of rotary drum 6; such accelerations reach respective peaks at cutting position (see for example the diagrams of Figures 4 to 6).

[0045] The applicant has noted that when the peaks detected by each sensor 30 are comprised within the threshold range R_0, corresponding to a given threshold air gap between cutting edge 15 of rotary blade 8 and the respective zone 22a, 22b of cutting edge 22 of stationary blade 4, the cutting operation is performed in the desired or optimal conditions.

[0046] The diagram of Figure 4 shows the desired condition, wherein the peaks of acceleration are contained within the prescribed threshold range R_0.

[0047] The diagram of Figure 5 shows a condition, wherein, at a certain point, the peaks of acceleration start to be out of the prescribed threshold range Ro, i.e. they start to exceed the upper limit of such range. Activation of actuator means 27 by control unit 28 permits to restore the correct condition.

[0048] The diagram of Figure 6 shows a further condition, wherein some of the peaks are within the threshold range R_0 and others are out of such range; there is no repeatability of the values detected. The applicant has noted that this condition corresponds to a failure of bearings 11, which should be replaced. In this specific case, control unit 28 generates a warning signal and the cutting

unit 1 has to be stopped to permit replacement of bearings 11.

[0049] In practice, control unit 28 is configured to generate a warning signal as the quantity R detected by one of the sensors 30 shows no repeatability in a given time interval corresponding to a given plurality of turns of rotary drum 6.

[0050] Figures 7 and 8 show an example of correct air gap between cutting edge 15 of rotary blade 8 and cutting edge 22 of stationary blade 4 at cutting position; the applicant has observed that such gap has to be comprised between 0 and 2 micrometers.

[0051] Figures 9 and 10 show an example wherein there is interference of some micrometers between cutting edge 15 of rotary blade 8 and cutting edge 22 of stationary blade 4 at cutting position; this situation should be corrected to avoid excessive wear of stationary blade 4 and subsequently a non-correct cutting action on the web 3 of labelling material.

[0052] Figure 11 shows a typical situation of failure of bearings 11; the air gap between cutting edge 15 of rotary blade 8 and cutting edge 22 of stationary blade 4 at cutting position continuously varies.

[0053] With reference to Figures 1 to 3, actuator means 27 preferably comprise a plurality of independent actuator members 31 configured to produce independent micrometric displacements of respective areas 22c of cutting edge 22 of stationary blade 4.

[0054] It is pointed out that areas 22c may be distinct from zones 22a, 22b and/or even coincide with the latter.

[0055] Actuator members 31 are configured to adjust the position of the respective areas 22c of cutting edge 22 of stationary blade 4 by direct deformation of the stationary blade 4 itself and/or by deformation of corresponding portions of flange 21 of block 16 directly contacting the stationary blade 4.

[0056] In the specific example shown in Figures 1 to 3, actuator members 31 are linear actuators, in particular screw actuators, externally supported by block 16 and each having an output element 32 directly cooperating with a side of flange 21 opposite the one contacting back surface 20 of stationary blade 4. In this case, the micrometric displacements of each area 22c of stationary blade 4 are obtained as a result of corresponding deformations produced by the respective actuator member 31 on the portion of flange 21 adjacent to said area 22c.

[0057] The operation of cutting unit 1 is described starting from a configuration, in which cutting edge 15 of rotary blade 8 is in the cutting area.

[0058] Web 3 is unwound from label reel and advanced along path A by the motorized roll.

[0059] Web 3 is taken up at its end by suction by vacuum drum D, and advanced within passage 25 which is defined, on its opposite sides, by cutting edge 22 of stationary blade 4 and lateral surface 7 of rotary drum 6.

[0060] Due to the rotation of rotary drum 6 about axis B, at a certain time, rotary blade 8 faces cutting edge 22 of stationary blade 4 reaching the cutting position (Figures 2, 7 and 8), in which rotary blade 4 closes passage 25 so as to leave a minimum air gap.

[0061] In the cutting position, one label 2 is cut from the remaining part of web 3 by the actions of cutting edges 15, 22 of rotary and stationary blades 8, 4.

[0062] Sensors 30 continuously detect quantity R, in the example shown the acceleration of the vibrations produced on block 16 by stationary blade 4 during rotation of rotary drum 6; when the peaks of the detected quantity R by one of sensors 30 exceeds the threshold range R_0 (as for instance in the conditions of Figures 5, 9 and 10), control unit 28 activates one or more actuator members 31 to produce given displacements of stationary blade 4 at the areas 22c of cutting edge 22 involved in such detection.

[0063] During the initial transitory time following the start-up of cutting unit 1, as a result of the temperature detected by temperature sensor 29 along with the quantity R detected by sensors 30, control unit 28 activates the actuator members 31 to maintain the air gap between cutting edge 15 of rotary blade 8 and cutting edge 22 of stationary blade 4 within the desired threshold range.

[0064] If the detected quantity R results in a plurality of peaks having different and not repeatable values, such as shown in the diagram of Figure 6, control unit 28 generates a warning signal indicating a possible failure of bearings 11, which have to be replaced.

[0065] Each cut label 2 is conveyed by the suction action of vacuum drum D towards the carrousel where it is applied onto a relative article by the labelling group.

[0066] With reference to Figures 12 and 13, number 1' indicates as a whole an embodiment of a cutting unit according to the present invention; as cutting unit 1' is similar to cutting unit 1, the following description is limited to the differences between them, by using the same references, where possible, for identical or corresponding parts.

[0067] In particular, cutting unit 1' basically differs from cutting unit 1 by using piezoelectric actuator members 31' instead of linear actuator member 31.

[0068] In this case, piezoelectric actuator members 31' directly act on back surface 20 - which preferably has an arcuate profile - of stationary blade 4. As a possible alternative not shown, piezoelectric actuator members 31' may also act on a portion of support structure 5 directly contacting the stationary blade 4.

[0069] Each piezoelectric actuator member 31' can be selectively deformed under a control voltage signal CVS generated by control unit 28 and selectively transmits its deformations to stationary blade 4 so as to produce corresponding displacements of the respective area 22c of cutting edge 22 of the stationary blade 4 itself towards or away from rotary drum 6.

[0070] Each piezoelectric actuator member 31' is advantageously used as "sensor means" since it selectively transforms impacts of stationary and rotary blades 4, 8 on web 3 into corresponding detected-voltage values DVV correlated to the distance or interference between

the stationary and rotary blades 4, 8 themselves at both the cutting position and the respective area 22c of cutting edge 22 on which said piezoelectric actuator member 31' operates.

[0071] The detected-voltage values DVV are transmitted from each piezoelectric actuator member 31' to control unit 28 as a detected-voltage signal DVS; control unit 28 generates a respective control voltage signal CVS for each piezoelectric actuator member 31' as a function of the detected-voltage signal DVS generated in use by the same piezoelectric actuator member 31'.

[0072] This permits to detect the distance or interference between the stationary and rotary blades 4, 8 at any area 22c of cutting edge 22, without using corresponding sensors, which may complicate the general structure.

[0073] Analogously to cutting unit 1, control unit 28 of cutting unit 1' is configured to generate a warning signal as the detected-voltage values DVV associated to one or more specific piezoelectric actuator members 31' show no repeatability in a given time interval corresponding to a given plurality of turns of rotary drum 6.

[0074] Finally, it should be noted that, in this specific embodiment, support structure 5 has no internal cavity to amplify vibrations generated on stationary blade 4 by rotation of the rotary drum 6, as piezoelectric actuator members 31' do not detect accelerations of vibrations.

[0075] The advantages of cutting units 1, 1' according to the present invention will be clear from the foregoing description.

[0076] In particular, thanks to the continuous detection of the distance between cutting edge 15 of rotary blade 8 and cutting edge 22 of stationary blade 4 at the cutting position as well as the consequent adjustment of the position of the stationary blade 4, it is possible to avoid any possible interference between such cutting edges 15, 22 during operation, so increasing the lives of the blades themselves. At the same time, it is possible to ensure a high quality of the cutting during the entire operation of the cutting unit 1.

[0077] This kind of control also applies during the initial transitory time following the start-up of the cutting unit 1, wherein the temperatures of the stationary and rotary blades 4, 8 are lower than the target ones; in this way, any interference between the blades 4, 8 and any consequent undesired wear thereof during this step are avoided.

[0078] The proposed solution also permits to avoid possible problems of non-uniform wear or degradation of the stationary blade 4 due to the use of webs 3 of different heights. As a matter of fact, by monitoring the behaviour of the stationary blade 4 at different zones of its cutting edge 22 permits the control unit 28 to detect whether a web 3 extending along only part of the entire height of the cutting edge 22 is used and to control the actuator members 31, 31' in such a way to take into account of this.

[0079] Furthermore, as previously explained, the proposed solution permits to detect possible failures of bearings 11.

[0080] Finally, the solution of Figures 12 and 13 permits to avoid to install additional sensors on the stationary blade 4 or on support structure 5, since piezoelectric actuator members 31' can be also used as "sensor means".

[0081] Clearly, changes may be made to cutting units 1, 1' as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

[0082] In particular, each cutting unit 1, 1' may also comprise one single actuator member 31, 31' acting on stationary blade 4.

Claims

1. A cutting unit (1, 1') for cutting material (2) from a web (3), said cutting unit (1, 1') comprising:

- a stationary blade (4) mounted on a stationary support structure (5);
- a rotary drum (6) rotating, in use, about an axis (B) and having a lateral surface (7) facing the stationary blade (4) and receiving the web (3); and
- at least one rotary blade (8) borne by the lateral surface (7) of the rotary drum (6) and cyclically passing, in use, by the stationary blade (4) to define a cutting position, wherein the stationary blade (4) and the rotary blade (8) cooperate, in use, with opposite sides of the web (3) so as to separate material (2) from said web (3);

actuator means (27) configured to adjust the position of the stationary blade (4) towards or away from the rotary drum (6) as a function of the detected distance or interference between said stationary blade (4) and said rotary blade (8) at the cutting position,

said stationary blade (4) and said rotary blade (8) have respective cutting edges (22, 15) cooperating in use with opposite sides of the web (3), and in that said actuator means (27) comprise at least one actuator member (31, 31') configured to adjust the position of the cutting edge (22) of the stationary blade (4) towards or away from the rotary drum (6) by deformation of the stationary blade (4) itself and/or by deformation of a portion (21) of the support structure (5) directly contacting the stationary blade (4), and further comprising a control unit (28) connected to said actuator member (31, 31') and configured to control activation of said actuator member (31, 31') so as to maintain a given air gap range between the cutting edge (22) of the stationary blade (4) and the cutting edge (15) of the rotary blade (8) at the cutting position,

characterized in that said actuator member is a piezoelectric actuator member (31') selectively de-

formed under a control voltage signal (CVS) generated by said control unit (28) and selectively transmitting its deformations to the stationary blade (4) so as to produce corresponding displacements of the cutting edge (22) of the stationary blade (4) itself towards or away from the rotary drum (6), and wherein said piezoelectric actuator member (31') selectively transforms impacts of the stationary and rotary blades (4, 8) on the web (3) into corresponding detected-voltage values (DVV) correlated to the distance or interference between the stationary and rotary blades (4, 8) themselves at the cutting position.

2. The cutting unit as claimed in claim 1, wherein said detected-voltage values (DVV) are transmitted from said piezoelectric actuator member (31') to said control unit (28) as a detected-voltage signal (DVS), and wherein said control unit (28) generates said control voltage signal (CVS) for said piezoelectric actuator member (31') as a function of said detected-voltage signal (DVS).

3. The cutting unit as claimed in claim 1 or 2, wherein said control unit (28) is configured to generate a warning signal as the detected-voltage values (DVV) show no repeatability in a given time interval corresponding to a given plurality of turns of said rotary drum (6).

4. The cutting unit as claimed in claim 1, wherein said actuator means (27) comprise a plurality of said actuator members (31, 31') configured to produce independent micrometric displacements of respective areas (22c) of the cutting edge (22) of the stationary blade (4) .

5. The cutting unit as claimed in claim 1, further comprising a temperature sensor (29) arranged on the stationary blade (4) and connected to the control unit (28) .

6. The cutting unit as claimed in claim 1, wherein said actuator means (27) are configured to produce micrometric displacements of the stationary blade (4) towards or away from the rotary drum (6).

7. The cutting unit as claimed in claim 6, wherein said actuator member is a piezoelectric actuator member (31') selectively deformed under a control voltage signal (CVS) generated by said control unit (28) and selectively transmitting its deformations to the stationary blade (4) so as to produce corresponding displacements of the cutting edge (22) of the stationary blade (4) itself towards or away from the rotary drum (6).

Patentansprüche

1. Schneideinheit (1, 1') zum Schneiden von Material (2) aus einer Bahn (3), wobei die Schneideinheit (1, 1') Folgendes umfasst:

- eine feststehende Klinge (4), die auf einer feststehenden Trägerstruktur (5) montiert ist;
- eine Drehtrommel (6), die sich bei der Verwendung um eine Achse (B) dreht und eine laterale Fläche (7) aufweist, die von der feststehenden Klinge (4) abgewandt ist und die Bahn (3) aufnimmt; und
- mindestens eine sich drehende Klinge (8), die von der lateralen Fläche (7) der Drehtrommel (6) gelagert wird und bei der Verwendung zyklisch an der feststehenden Klinge (4) vorbeiläuft, um eine Schneidposition zu definieren, wobei die feststehende Klinge (4) und die sich drehende Klinge (8) bei der Verwendung mit entgegengesetzten Seiten der Bahn (3) zusammenwirken, um Material (2) von der Bahn (3) zu trennen;

eine Aktoreinrichtung (27), die dazu ausgelegt ist, als Funktion des erfassten Abstands oder der Interferenz zwischen der feststehenden Klinge (4) und der sich drehenden Klinge (8) in der Schneidposition die Position der feststehenden Klinge (4) zur Drehtrommel (6) hin oder davon weg einzustellen, wobei die feststehende Klinge (4) und die sich drehende Klinge (8) entsprechende Schneidkanten (22, 15) aufweisen, die bei der Verwendung mit entgegengesetzten Seiten der Bahn (3) zusammenwirken, und wobei
die Aktoreinrichtung (27) mindestens ein Aktorelement (31, 31') umfasst, das dazu ausgelegt ist, die Position der Schneidkante (22) der feststehenden Klinge (4) durch Verformen der feststehenden Klinge (4) selbst und/oder durch Verformen eines Teils (21) der Trägerstruktur (5), der die feststehende Klinge (4) direkt berührt, zur Drehtrommel (6) hin oder davon weg einzustellen, und ferner eine Steuereinheit (28) umfasst, die mit dem Aktorelement (31, 31') verbunden ist und dazu ausgelegt ist, die Aktivierung des Aktorelements (31, 31') zu steuern, um einen gegebenen Luftspaltbereich zwischen der Schneidkante (22) der feststehenden Klinge (4) und der Schneidkante (15) der sich drehenden Klinge (8) in der Schneidposition zu erhalten,
dadurch gekennzeichnet, dass das Aktorelement ein piezoelektrisches Aktorelement (31') ist, das unter einem von der Steuereinheit (28) erzeugten Steuerspannungssignal (control voltage signal, CVS) selektiv verform wird und seine Verformungen selektiv an die feststehende Klinge (4) überträgt, um zugehörige Verschiebungen der Schneidkante (22) der feststehenden Klinge (4) selbst zur Drehtrommel (6)

hin oder davon weg zu bewirken, und
wobei das piezoelektrische Aktorelement (31') Einwirkungen der feststehenden und sich drehenden Klinge (4, 8) auf die Bahn (3) selektiv in zugehörige erfasste Spannungswerte (detected-voltage values, DVV) umwandelt, die dem Abstand oder der Interferenz zwischen der feststehenden und der sich drehenden Klinge (4, 8) selbst in der Schneidposition entsprechen.

2. Schneideinheit nach Anspruch 1, wobei die erfassten Spannungswerte (DVV) als erfasstes Spannungssignal (detected-voltage signal, DVS) vom piezoelektrischen Aktorelement (31') zur Steuereinheit (28) übertragen werden und wobei die Steuereinheit (28) das Steuerspannungssignal (CVS) als Funktion des erfassten Spannungssignals (DVS) für das piezoelektrische Aktorelement (31') erzeugt.

3. Schneideinheit nach Anspruch 1 oder 2, wobei die Steuereinheit (28) dazu ausgelegt ist, ein Warnsignal zu erzeugen, wenn die erfassten Spannungswerte (DVV) in einem gegebenen Zeitintervall, das gegebenen mehreren Umdrehungen der Drehtrommel (6) entspricht, keine Wiederholbarkeit zeigen.

4. Schneideinheit nach Anspruch 1, wobei die Aktoreinrichtung (27) mehrere der Aktorelemente (31, 31') umfasst, die dazu ausgelegt sind, unabhängige Mikrometerverschiebungen jeweiliger Bereiche (22c) der Schneidkante (22) der feststehenden Klinge (4) zu bewirken.

5. Schneideinheit nach Anspruch 1, ferner einen Temperatursensor (29) umfassend, der auf der feststehenden Klinge (4) angeordnet ist und mit der Steuereinheit (28) verbunden ist.

6. Schneideinheit nach Anspruch 1, wobei die Aktoreinrichtung (27) dazu ausgelegt ist, Mikrometerverschiebungen der feststehenden Klinge (4) zur Drehtrommel (6) hin oder davon weg zu bewirken.

7. Schneideinheit nach Anspruch 6, wobei das Aktorelement ein piezoelektrisches Aktorelement (31') ist, das unter einem von der Steuereinheit (28) erzeugten Steuerspannungssignal (CVS) selektiv verformt wird und seine Verformungen selektiv zur feststehenden Klinge (4) überträgt, um zugehörige Verschiebungen der Schneidkante (22) der feststehenden Klinge (4) selbst zur Drehtrommel (6) hin oder davon weg zu bewirken.

Revendications

1. Unité de coupe (1, 1') destinée à couper un matériau (2) à partir d'une bande (3), ladite unité de coupe (1, 1') comprenant:

- une lame fixe (4) montée sur une structure de support fixe (5);
- un tambour rotatif (6) tournant, en utilisation, autour d'un axe (B) et ayant une surface latérale (7) tournée vers la lame fixe (4) et recevant la bande (3); et
- au moins une lame rotative (8) portée par la surface latérale (7) du tambour rotatif (6) et passant cycliquement, en utilisation, par la lame fixe (4) pour définir une position de coupe, la lame fixe (4) et la lame rotative (8) coopérant, en utilisation, avec des côtés opposés de la bande (3) afin de séparer le matériau (2) de ladite bande (3);

un moyen d'actionnement (27) configuré pour ajuster la position de la lame fixe (4) vers ou depuis le tambour rotatif (6) en fonction de la distance ou de l'interférence détectée entre ladite lame fixe (4) et ladite lame rotative (8) en position de coupe,
ladite lame fixe (4) et ladite lame rotative (8) ayant des arêtes de coupe respectives (22, 15) coopérant en utilisation avec des côtés opposés de la bande (3), et
ledit moyen d'actionnement (27) comprenant au moins un élément d'actionnement (31, 31') configuré pour ajuster la position de l'arête de coupe (22) de la lame fixe (4) vers ou depuis le tambour rotatif (6) par déformation de la lame fixe (4) elle-même et/ou par déformation d'une partie (21) de la structure de support (5) en contact direct avec la lame fixe (4), et comprenant en outre une unité de commande (28) reliée audit élément d'actionnement (31, 31') et configurée pour commander l'activation dudit élément d'actionnement (31, 31') de manière à maintenir une plage d'entrefer donnée entre le bord de coupe (22) de la lame fixe (4) et le bord de coupe (15) de la lame rotative (8) en position de coupe,
caractérisée en ce que ledit élément d'actionnement est un élément d'actionnement piézoélectrique (31') déformé sélectivement sous un signal de tension de commande (CVS) généré par ladite unité de commande (28) et transmettant sélectivement ses déformations à la lame fixe (4) de manière à produire des déplacements correspondants du bord de coupe (22) de la lame fixe (4) elle-même vers ou depuis le tambour rotatif (6), et
dans laquelle ledit élément d'actionnement piézoélectrique (31') transformant sélectivement les impacts des lames fixe et rotative (4, 8) sur la bande (3) en valeurs de tension détectée correspondantes (DVV) corrélées à la distance ou à l'interférence entre les lames fixe et rotative (4, 8) elles-mêmes en position de coupe.

2. Unité de coupe selon la revendication 1, dans la-

quelle lesdites valeurs de tension détectées (DVV) sont transmises dudit élément d'actionnement piézoélectrique (31') à ladite unité de commande (28) en tant que signal de tension détecté (DVS), et dans laquelle ladite unité de commande (28) génère ledit signal de tension de commande (CVS) pour ledit élément d'actionnement piézoélectrique (31') en fonction dudit signal de tension détecté (DVS).

3. Unité de coupe selon la revendication 1 ou 2, dans laquelle ladite unité de commande (28) est configurée pour générer un signal d'avertissement lorsque les valeurs de tension détectées (DVV) ne montrent aucune répétabilité dans un intervalle de temps donné correspondant à une pluralité donnée de tours dudit tambour rotatif (6).

4. Unité de coupe selon la revendication 1, dans laquelle ledit moyen d'actionnement (27) comprend une pluralité desdits éléments d'actionnement (31, 31') configurés pour produire des déplacements micrométriques indépendants de zones respectives (22c) du bord de coupe (22) de la lame fixe (4).

5. Unité de coupe selon la revendication 1, comprenant en outre un capteur de température (29) disposé sur la lame fixe (4) et relié à l'unité de commande (28).

6. Unité de coupe selon la revendication 1, dans laquelle lesdits moyens d'actionnement (27) sont configurés pour produire des déplacements micrométriques de la lame fixe (4) vers ou depuis le tambour rotatif (6).

7. Unité de coupe selon la revendication 6, dans laquelle ledit élément d'actionnement est un élément d'actionnement piézoélectrique (31') déformé sélectivement sous un signal de tension de commande (CVS) généré par ladite unité de commande (28) et transmettant sélectivement ses déformations à la lame fixe (4) de manière à produire des déplacements correspondants du bord de coupe (22) de la lame fixe (4) elle-même vers ou depuis le tambour rotatif (6) .

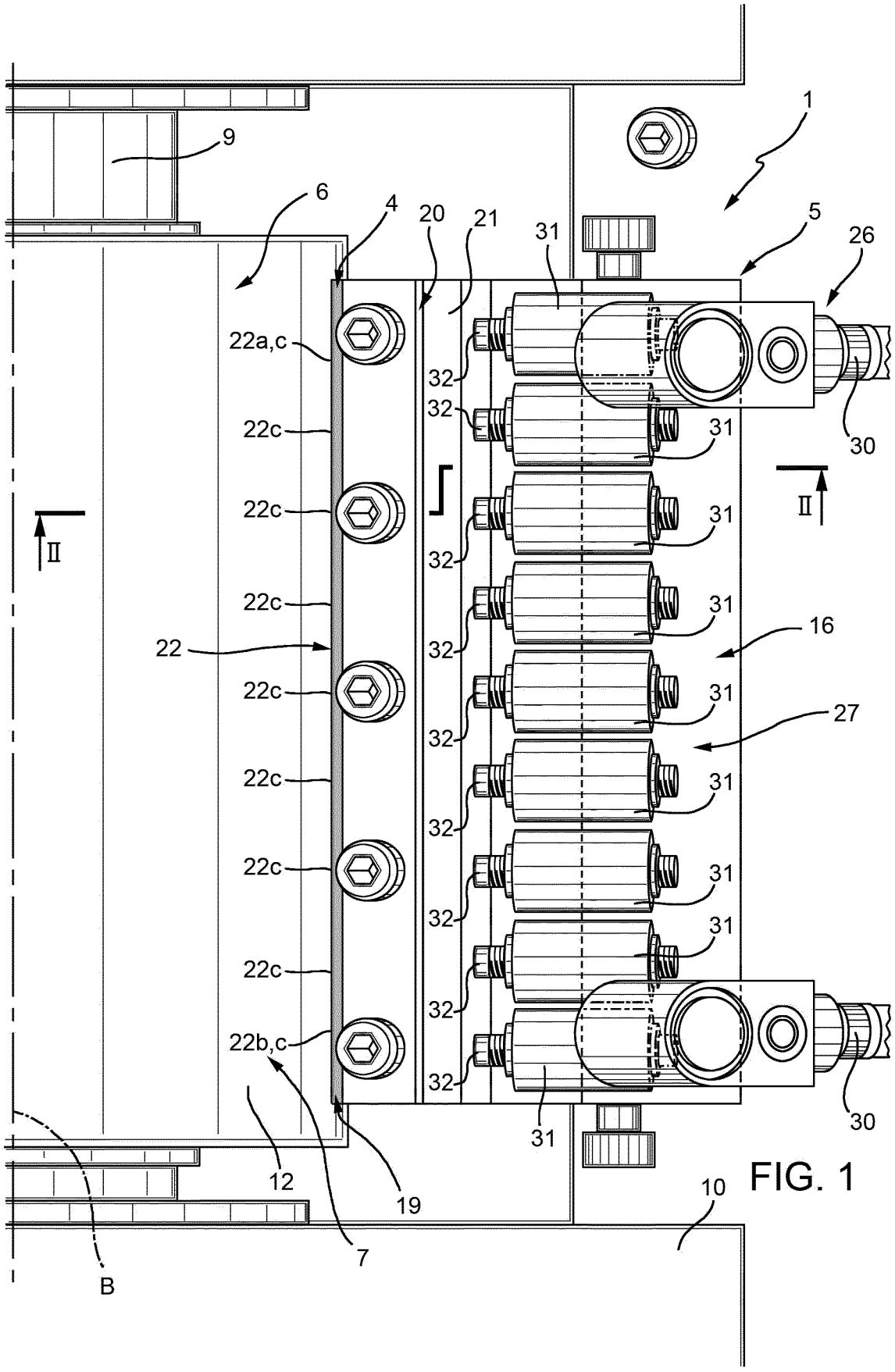


FIG. 1

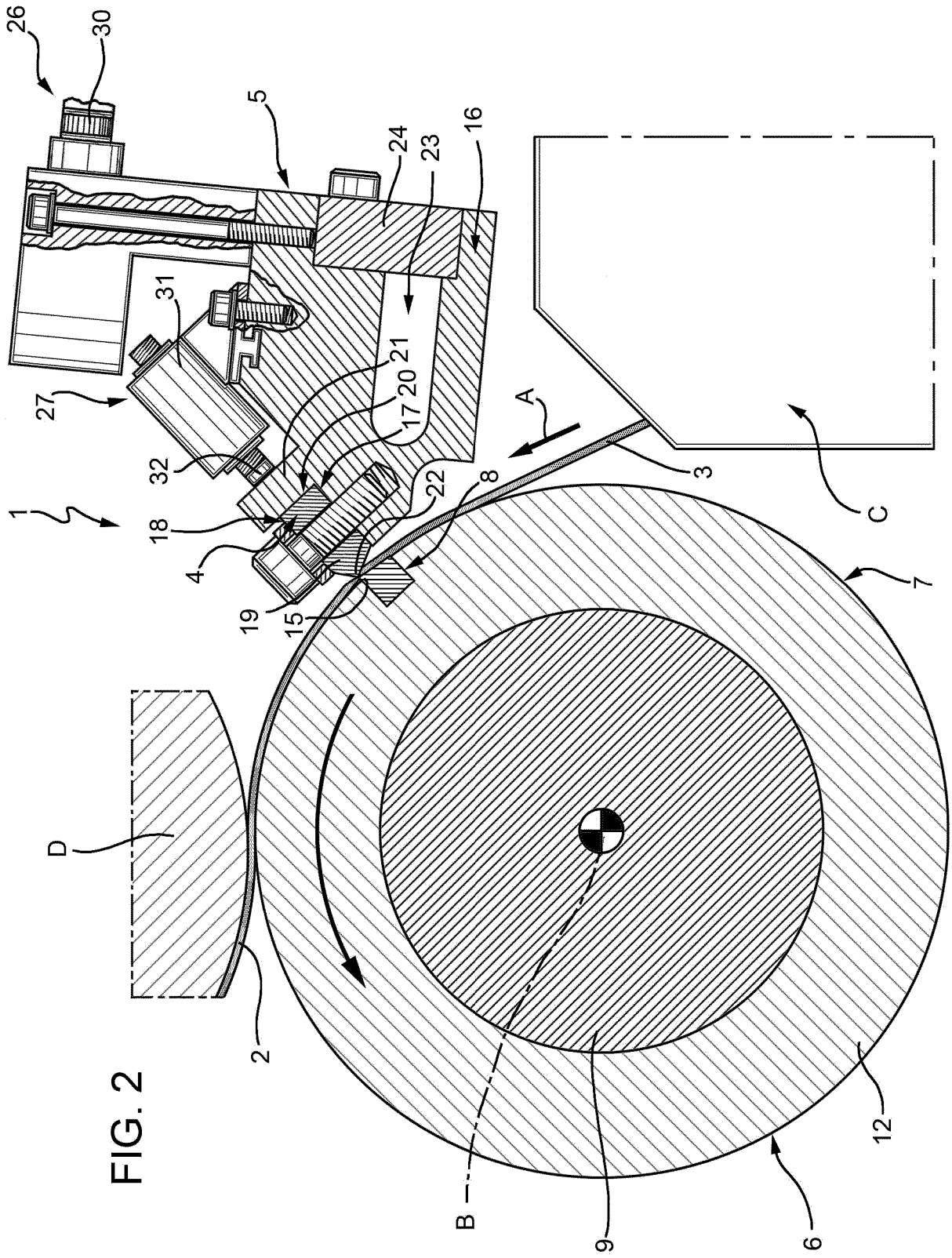


FIG. 2

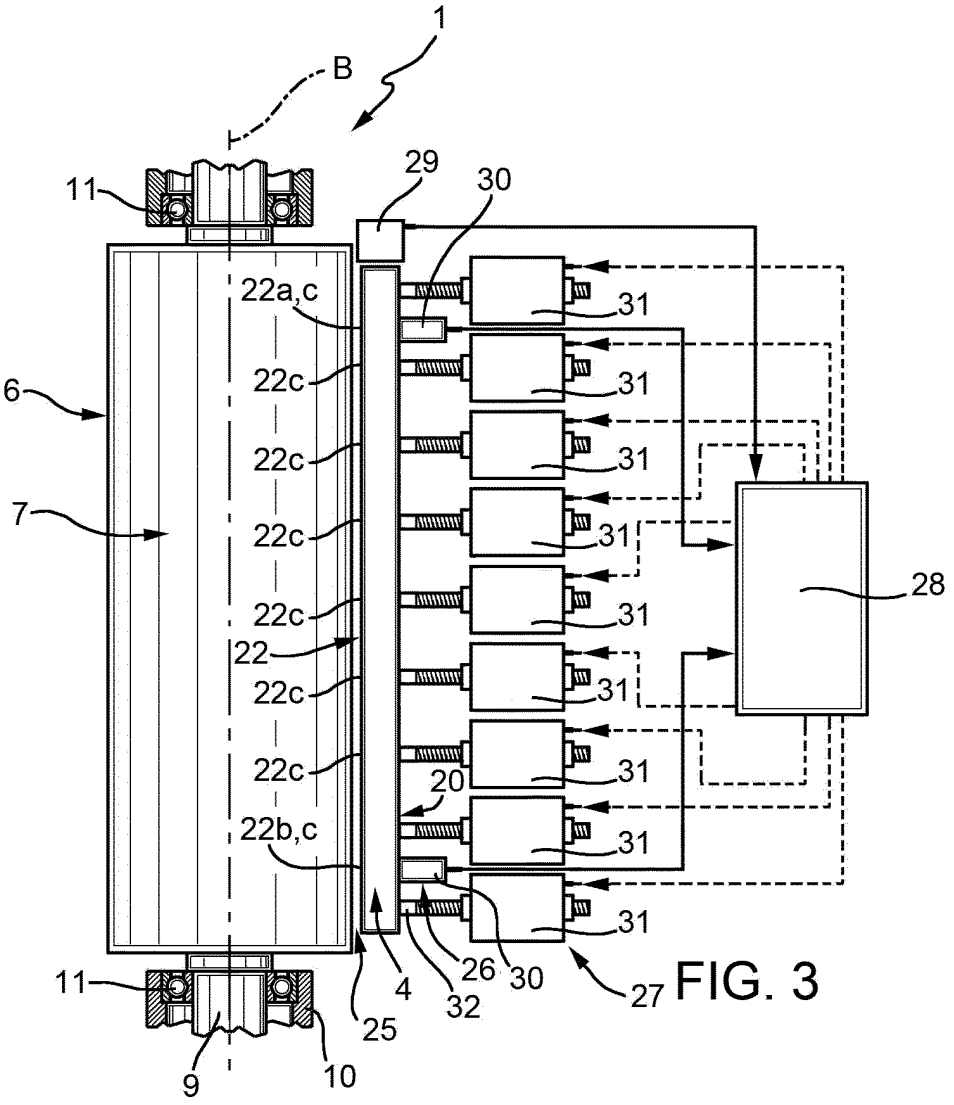

1
B
11
29
30
22a,c
31
22c
6
7
28
22
20
22b,c
4
25
26
32
27
9
10

FIG. 3

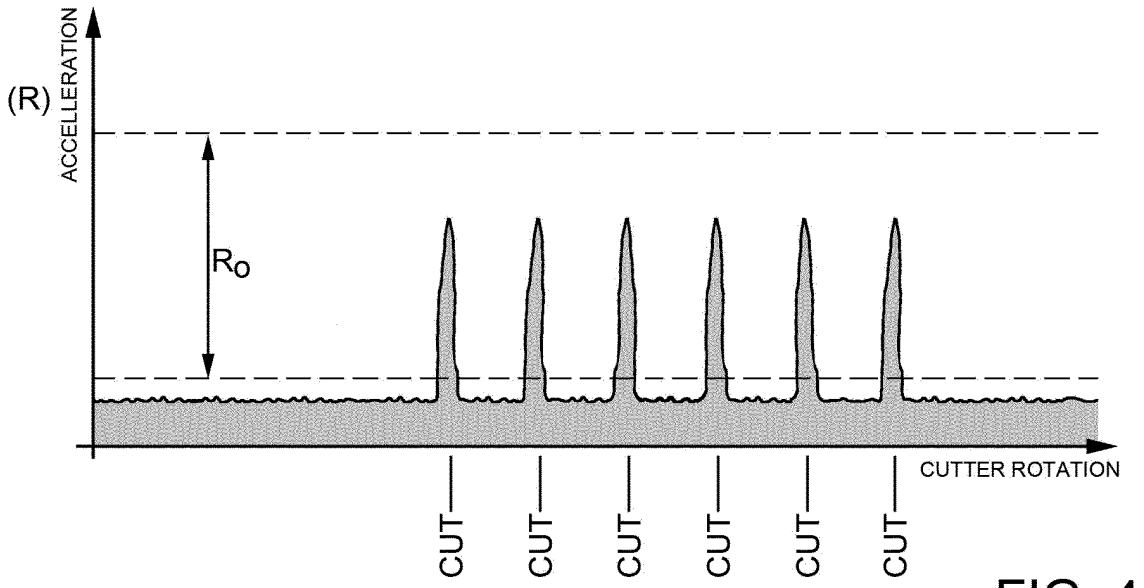
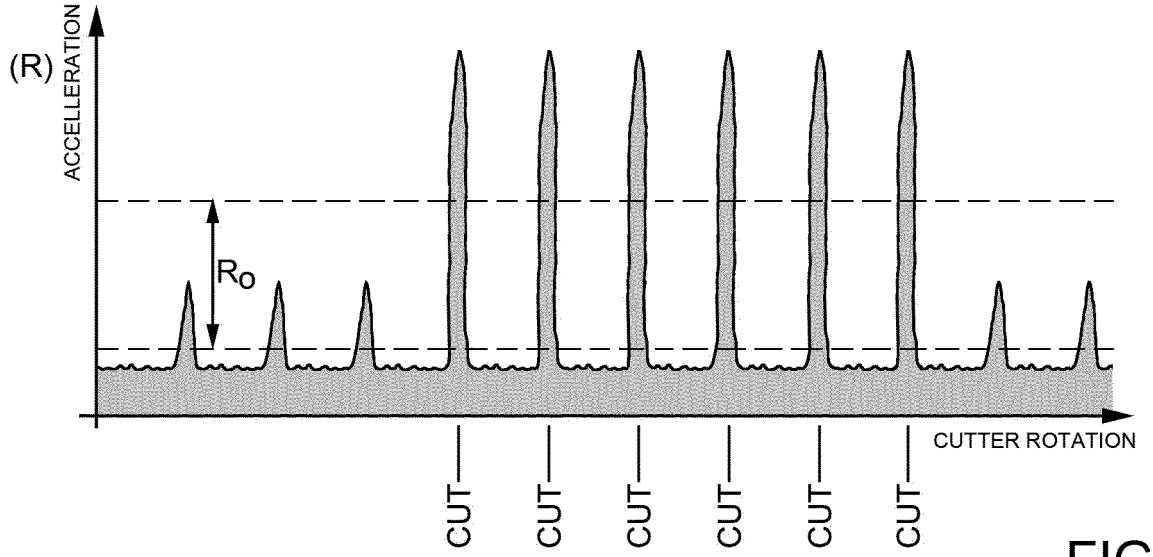

(R)
ACCELLERATION
Ro
CUTTER ROTATION
CUT
CUT
CUT
CUT
CUT
CUT

FIG. 4


(R)
ACCELLERATION
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CUTTER ROTATION
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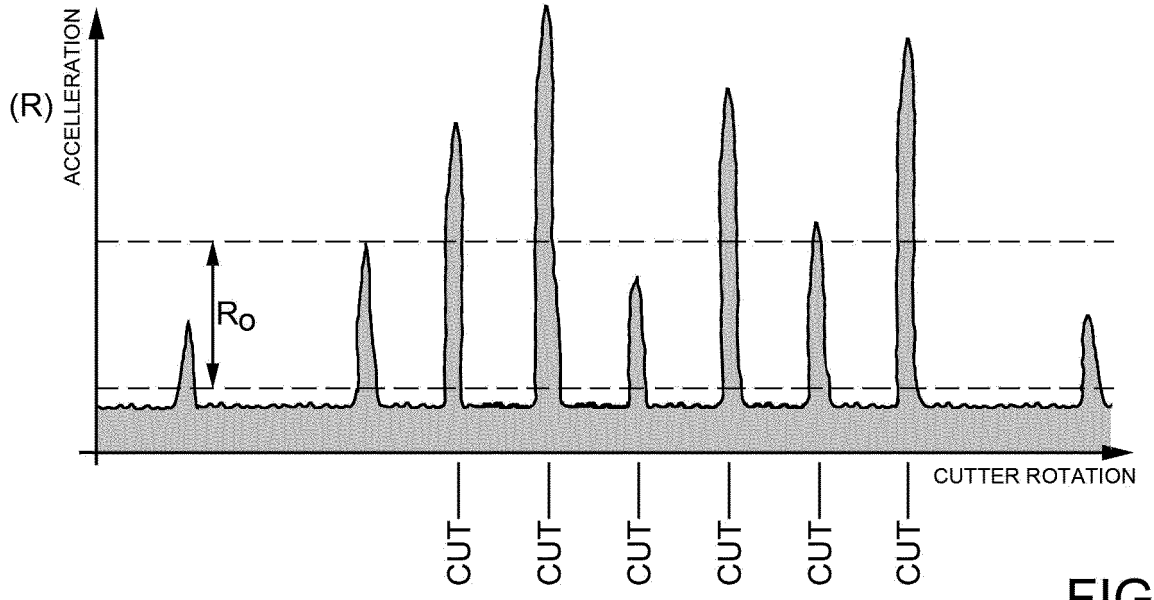
CUT

FIG. 5


(R)
ACCELLERATION
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CUTTER ROTATION
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FIG. 6

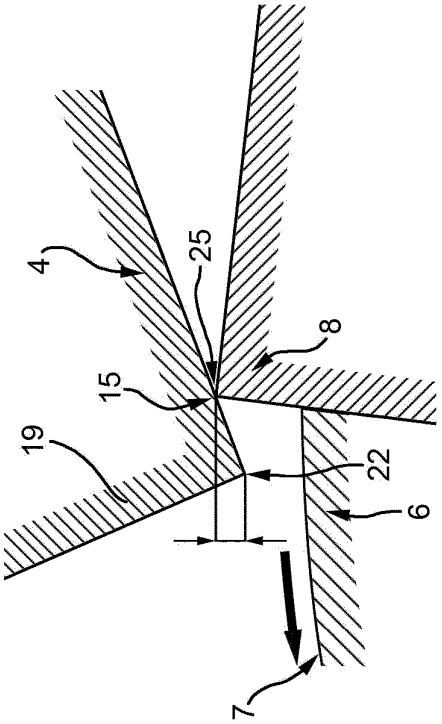


FIG. 9

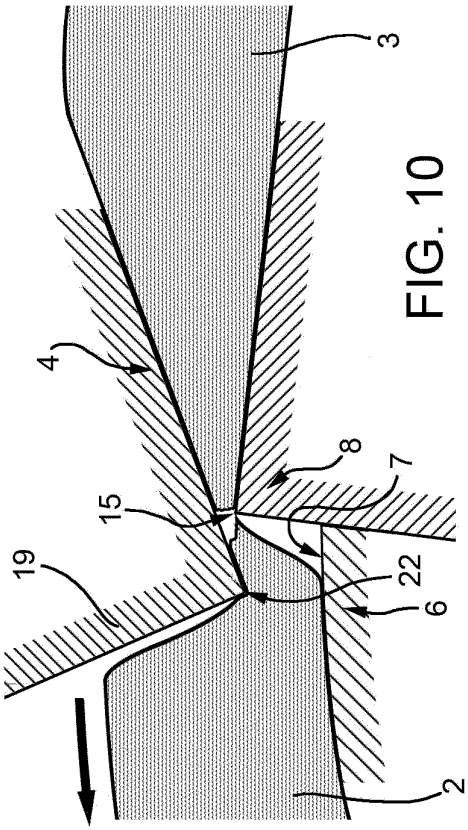


FIG. 10

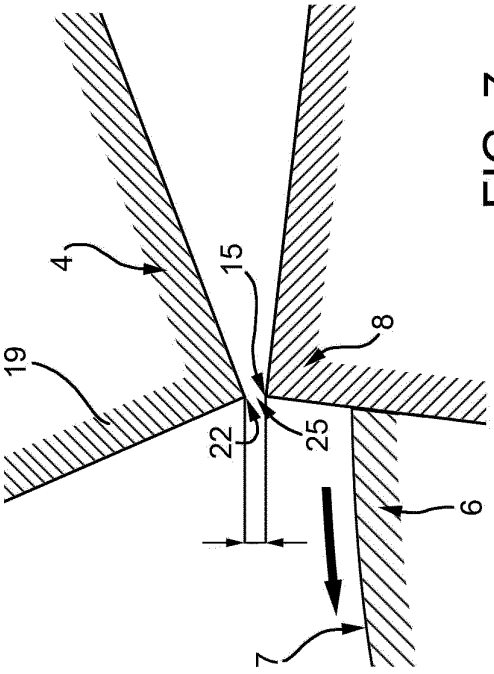


FIG. 7

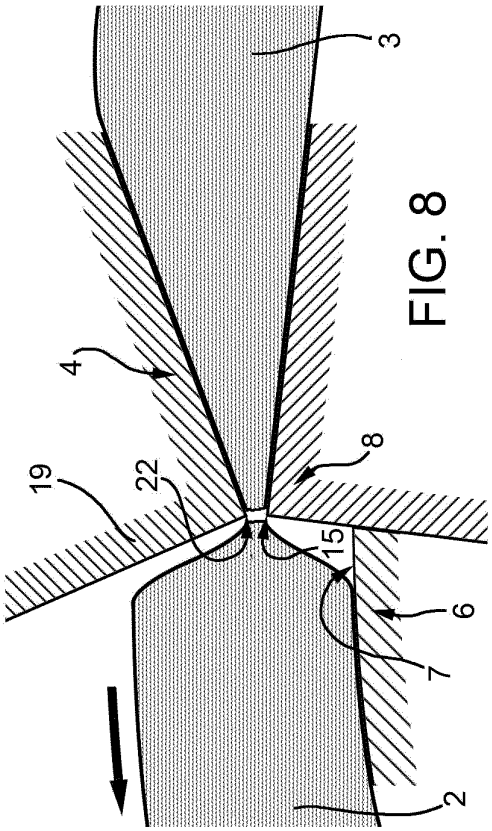
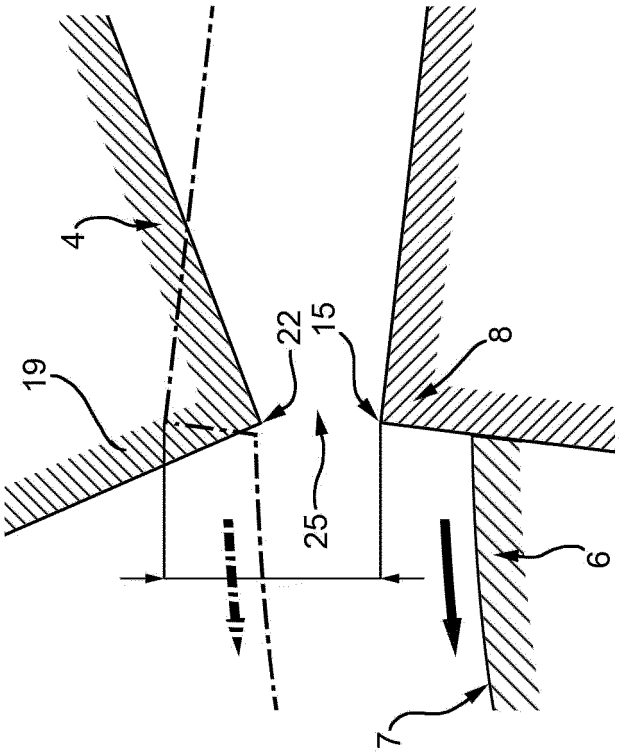


FIG. 8

FIG. 11



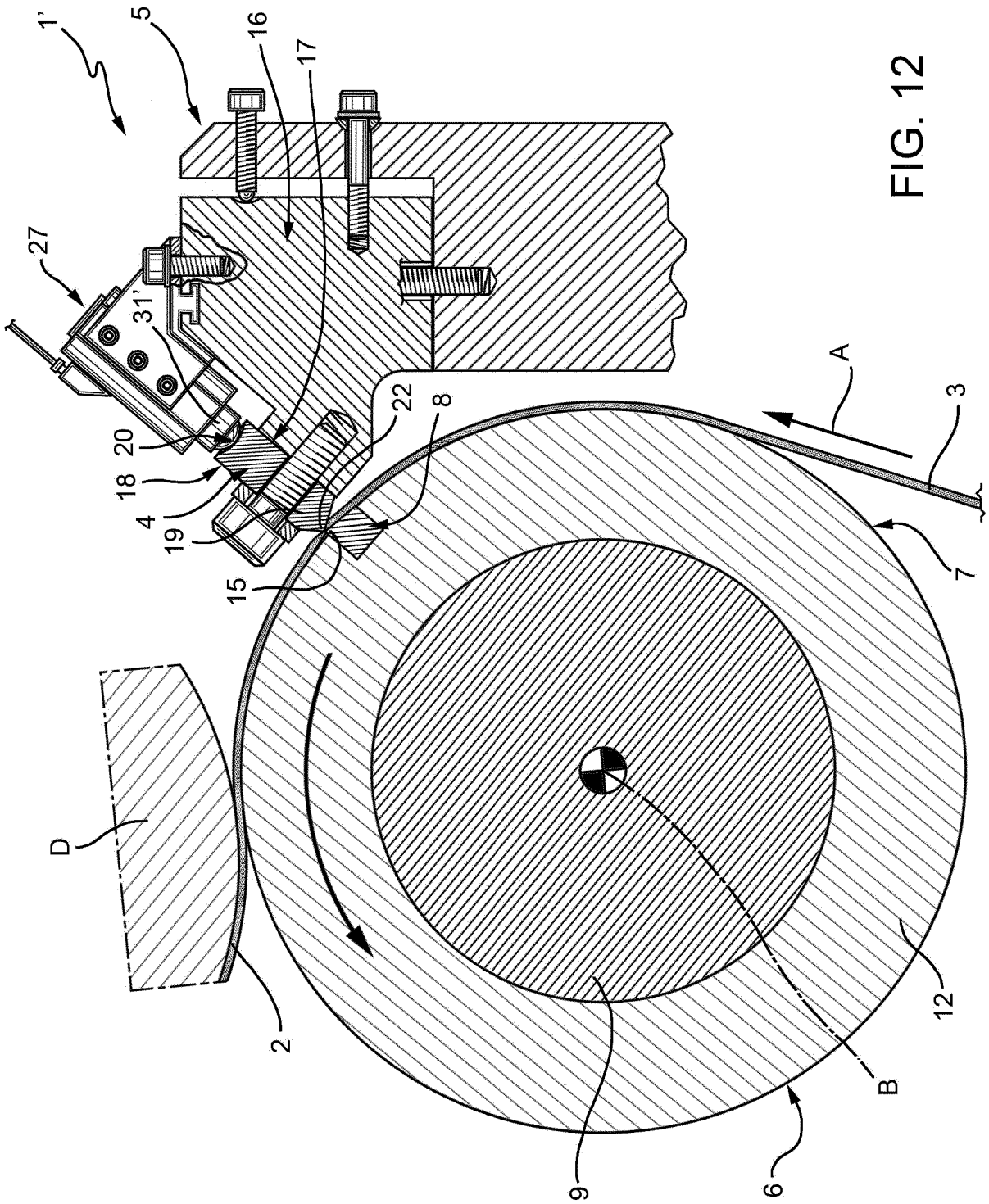


FIG. 12

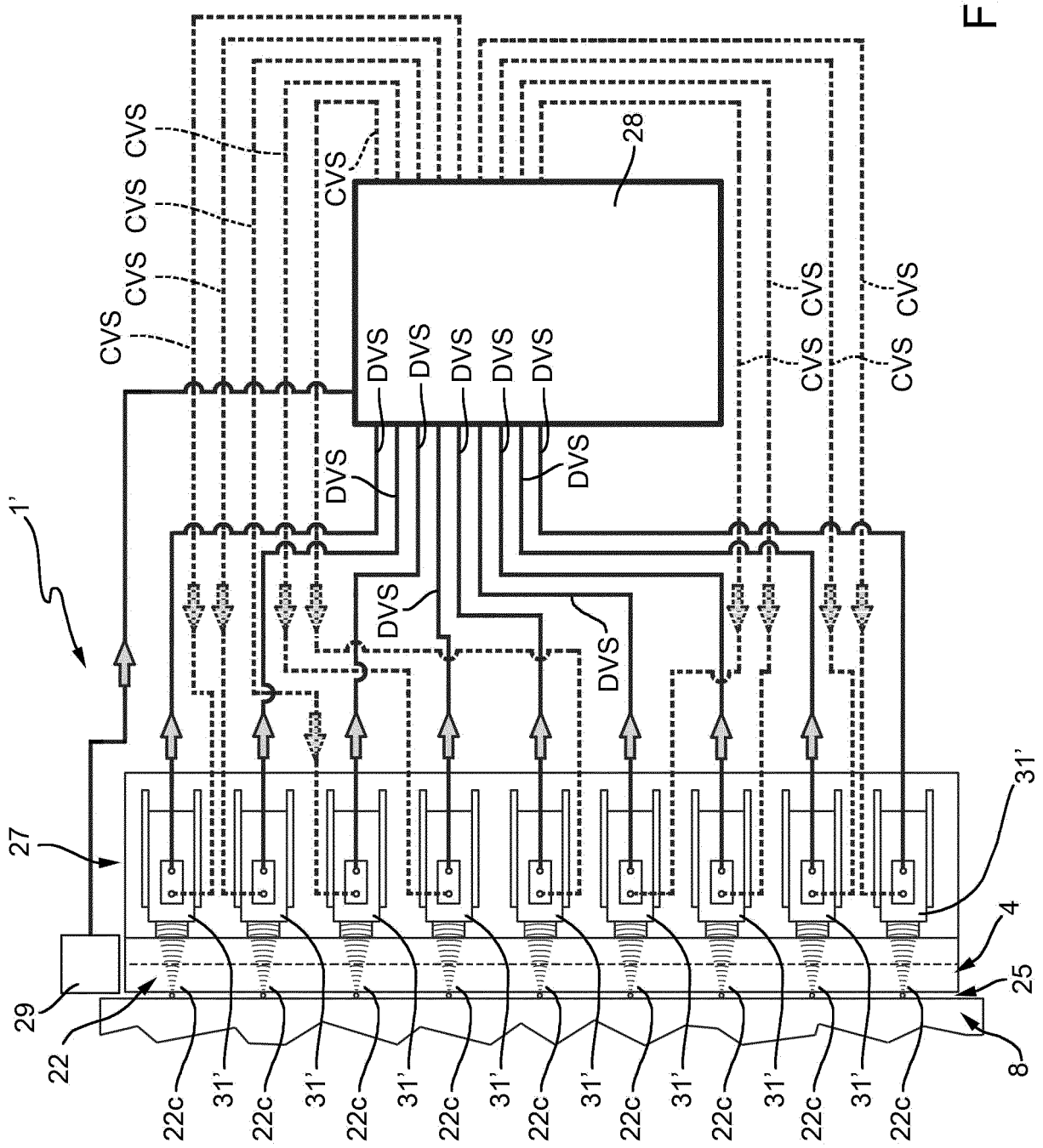


FIG. 13

REFERENCES CITED IN THE DESCRIPTION

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- EP 0319894 A2 **[0010]**
- DE 19933497 A1 **[0010]**