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(71) Applicant: **Sidel S.p.a. Con Socio Unico**
Parma (IT)

(72) Inventors:
- **Carmichael, James**
  43100 PARMA (IT)
- **Ferri, Marco**
  43100 PARMA (IT)

(74) Representative: **Di Sciuva, Michele et al**
Studio Torta S.p.A.
Via Viotti, 9
10121 Torino (IT)

(54) **Application unit and method for applying adhesive onto labels to be applied onto respective articles**

(57) There is described an application unit (12, 12') for applying an adhesive onto labels (2) to be applied to respective articles (3), comprising: an adhesive roller (20), which is rotatable about a first axis (C) and is adapted to receive an adhesive and to apply adhesive to said labels (2); an adhesive distributor (22), which is adapted to dispense adhesive on a surface (21) of said roller (20); an adhesive scraper (23), which is adapted to be arranged at a radial distance from surface (21), so as to remove an excess of adhesive from said roller (20) and to define the amount of said adhesive to be applied to labels (2); and adjusting means (24, 40) for adjusting the amount of adhesive to be applied to labels (2); adjusting means (24, 40) comprise an actuator (40), which is controllable to exert an adjustable force (F3) on adhesive scraper (23) also on the basis of at least one first operative parameter of said adhesive and/or labels (2) and/or said adhesive roller (20), so as to correspondingly adjust the pressure exerted by adhesive scraper (23) onto adhesive and correspondingly adjust the pressure exerted by said adhesive scraper (23) onto said adhesive and adjust said amount of said adhesive to be applied to said labels (2). (Figure 2)

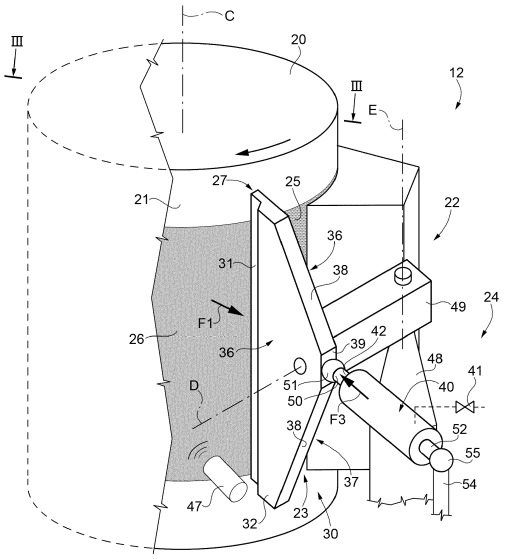

FIG. 2

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Description

[0001] The present invention relates to an application unit and to a method for applying adhesive onto labels to be applied onto respective articles.

[0002] Labelling machines are known, for example from the European patent application no. 12199786 in the name of the same Applicant,which substantially comprise:

- a rotary carousel, which conveys along an arch-shaped trajectory a succession of articles to be labelled from an input station to an application station and conveys labelled articles from the application station to an output station; and
- at least one labelling group, which feeds and applies a plurality of labels on respective articles at the application unit.

[0003] In a particular type of labelling machine known as "roll-feed", the labelling group substantially comprises:

- at least one shaft for rotatably supporting a reel off which a strip of labels is unwound and fed along a feed path;
- a plurality of unwinding rollers for guiding the strip along a rectilinear feed path;
- a cutter for cutting a sequence of single labels from the strip;
- a transfer drum for advancing each label which has been previously cut towards the application station; and
- an application unit, which is adapted to apply an adhesive on each previously cut label, as the latter is advanced by the transfer drum.

[0004] In greater detail, the known application unit comprises, in turn,:

- an adhesive roller, which is rotatable about an axis;
- a stationary adhesive distributor, which is arranged at the periphery of the adhesive roller and distributes a continuous flow of adhesive onto a lateral surface of the adhesive roller; and
- an adhesive scraper, which is arranged at the periphery of the adhesive roller and at a certain radial distance from the lateral surface of the adhesive roller, and removes the excess of adhesive and smoothes the surface of the adhesive layer applied onto the lateral surface of the adhesive roller.

[0005] In particular, the adhesive scraper is arranged downstream of the adhesive distributor with reference to the advancing rotation direction of the adhesive roller about its own axis.

[0006] The final thickness of the adhesive on the outer surface of the adhesive roll substantially corresponds to the radial distance between the adhesive scraper and the lateral surface of the adhesive roller.

[0007] As it is advanced by the transfer drum, each previously cut label contacts, on the opposite side thereof with respect to the transfer drum, the adhesive roller.

[0008] In this way, the adhesive is applied on the side of each previously cut label opposite to the transfer drum.

[0009] In order to vary the thickness of the adhesive that is applied to the labels, i.e. the thickness of the adhesive downstream of the adhesive scraper, it has been proposed to use a mechanical adjustment, which causes a movement in the radial direction of the adhesive scraper towards and away from the adhesive roller.

[0010] In this way, the mechanical adjustment adjusts the radial distance between the adhesive scraper and the lateral surface of the adhesive roller.

[0011] The smaller the distance, the smaller the thickness.

[0012] In other words, the amount of adhesive to be eventually applied on the labels is controlled by simply adjusting the radial distance between the adhesive scraper and the outer surface of the adhesive roller.

[0013] The Applicant has found that even if it is efficient, the above-described known technique leaves for improvement.

[0014] In greater detail, the Applicant has found that, in some operative conditions, the amount of adhesive which passes between the adhesive scraper and the adhesive roller cannot be controlled precisely and in a repeatable way, by simply controlling the radial distance between the adhesive scraper and the lateral surface of the adhesive roller.

[0015] As a matter of fact, in case of hot-melt glues used as adhesive, the viscosity of the adhesive renders the required amount of the adhesive highly variable according to many not-completely predictable factors, e.g. type of the adhesive substance, material of the label, roughness of the lateral surface of the adhesive roller, contamination of the lateral surface of the adhesive roller, profile of the lateral surface of the adhesive roller, the stresses and temperature of the adhesive.

[0016] Furthermore, the rotational speed of the adhesive roller also has a considerable effect on the amount of adhesive, which passes between the adhesive roller and the adhesive scraper.

[0017] As a consequence, it is necessary to frequently adjust the position of the adhesive scraper, by making use of highly skilled operators, when the adhesive roller is operated at high-speed and/or high-viscous adhesive are used and/or the operative conditions are particularly severe.

[0018] A need is felt within the industry to apply with the highest precision and repeatability possible the correct amount of adhesive on the adhesive roller, also when the adhesive roller is operated at high-speed and/or high-viscous adhesive are used and/or the operative conditions are particularly severe.

[0019] Finally, the adhesive scrapers and the adhesive roller are generally made respectively of relatively soft

material like brass and relatively hard material like steel.

[0020] As a result, the adhesive scrapers and the adhesive roller tend to damage and/or wear out the surface of the adhesive roller, thus requiring costly operation to upgrade the surface of the adhesive roller and subsequently costly tests to verify the correct operation of the application unit.

[0021] A need is felt within the industry to reduce the damage of and the wear affecting the adhesive roller.

[0022] It is an object of the present invention to provide an application unit for applying adhesive onto labels to be applied onto respective articles, which allows to meet at least one of the above-identified needs.

[0023] The aforementioned object is achieved by the present invention as it relates to an application unit for applying adhesive onto labels to be applied onto respective articles, as defined in claim 1.

[0024] The present invention also relates to a method for applying adhesive onto labels to be applied onto respective articles, as defined in claim 9.

[0025] The present invention also relates to an application unit for applying adhesive onto labels to be applied onto respective articles, as defined in claim 13.

[0026] The present invention also relates to an adhesive scraper for removing an excess of adhesive from an adhesive roller, as defined in claim 15.

[0027] Two non-limiting embodiment of the present invention will be described in the following by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a top schematic view of a labelling machine, comprising an application unit according to the invention, with parts removed for clarity;

Figure 2 is a perspective view in an enlarged scale of a first embodiment of the application unit of Figure 1, with parts removed for clarity;

Figure 3 is a section along line III-III of Figure 2 of some components of the application unit of Figures 1 and 2, with parts removed for clarity;

Figures 4a, 4b and 4c are schematic views of further components of the labelling machine of Figures 1 to 3, with parts removed for clarity; and

Figure 5 is a top view of a second embodiment of the application unit according to the invention.

[0028] Number 1 in Figure 1 indicates as a whole a labelling machine for applying labels 2 to respective articles 3, containers for pourable food product in the embodiment shown.

[0029] More precisely, labelling machine 1 substantially comprises:

- a carousel 4 which rotates about an axis A, vertical in the embodiment shown;
- a plurality of labelling groups 5, only one shown in Figure 1, which apply, in use, a relative label 2 onto articles 3 conveyed by carousel 4 at respective application stations 6 of path P.

[0030] In detail, carousel 4 receives articles 3 to be labelled at an inlet station 7, conveys articles 3 along an arc-shaped path P having centre on axis A, and outputs labelled articles 3 at an output station 8.

[0031] Being understood that all labelling groups 5 are identical, only one labelling group 5 will be described hereinafter.

[0032] Labelling group 5 comprises:

- a pair of shafts for rotatably supporting respective reels 10a off one of which a backing strip 10b bearing labels 2 is unwound and fed along a feed path towards relative application stations 6;
- a plurality of unwinding rollers 10c for unwinding backing strip 10b along the feed path;
- a cutting device 11 interposed along the feed path downstream from unwinding rollers 10c and adapted to separate such a cut label 2 from strip 10b (Figures 2 to 4); and
- an application unit 12, which is arranged downstream from cutting device 11 along the feed path and applies an adhesive, glue in the embodiment shown, to each cut label 2.

[0033] Furthermore, labelling group 5 comprises a transfer mechanism 13 rotating about an axis B for advancing, one after the other, each cut label 2 from cutting device 11 towards application station 6 (Figure 1) and through application unit 12.

[0034] In particular, transfer mechanism 13 contacts a first side of each label 2.

[0035] In detail, transfer mechanism 13 comprises a drum 14 (shown only in Figure 2), which retains the first side of cut label 2 by means of vacuum applied onto such a cut label 2.

[0036] Axis B is parallel to axis A and vertical in the embodiment shown.

[0037] Application unit 12 comprises, in turn, (Figure 2):

- an adhesive roller 20, which rotates about an axis C parallel to axes A, B and comprises an outer surface 21 arranged on the opposite side of axis C;
- an adhesive distributor 22, which is stationary with respect to axis C, is arranged at an outer periphery of surface 21 of roller 20 and distributes a continuous flow of adhesive onto surface 21;
- an adhesive scraper 23, which is arranged at an outer periphery of surface 21 of roller 20, and removes the excess of the adhesive from surface 23; and
- adjusting means 24 for regulating the amount of adhesive to be applied on labels 2.

[0038] In particular, surface 21 of rollers 20 contacts and apply the adhesive on a second side, opposite to the first side, of each cut label 2.

[0039] Scraper 23 is arranged downstream of distributor 22, with reference to the rotation direction of roller 20 about axis C.

[0040] Furthermore, scraper 23 is angularly fixed with respect to axis C.

[0041] In the embodiment shown, scraper 23 is in made of plastic material, peek or PTFE or inert plastic in the embodiment shown.

[0042] Surface 21 of roller 20 is, in the embodiment shown, knurled.

[0043] With reference to Figure 2, it is possible to define on surface 21:

- an area 25 interposed between distributor 22 and scraper 23 and onto which distributor 22 has deposited the adhesive; and
- an area 26, and onto which the final amount of adhesive to be applied onto each previously cut label 2 is deposited.

[0044] Area 26 is arranged downstream of area 25 and of distributor 22, proceeding according to the advancing rotation direction of roller 20 about axis C.

[0045] The thickness of the adhesive in area 25 is higher than the thickness of the adhesive in area 26.

[0046] As it is advanced by transfer mechanism 13 (Figure 1), the second side of each cut label 2 contacts, on the opposite side with respect to transfer mechanism 13, area 26 of surface 21 of roller 20.

[0047] In the embodiment shown, distributor 22 is shaped as a bar parallel to axis C.

[0048] Scraper 23 comprises, in turn,:

- a support 30; and
- a tool 31 which is shaped as blade and contacts the adhesive travelling on surface 21.

[0049] Tool 31 and surface 21 are separated in a radial direction with respect to axis C by a gap 27.

[0050] Advantageously, adjusting means 24 comprise an actuator 40, which is controllable to exert an adjustable force F3 on scraper 23 also on the basis of at least one first operative parameter of said adhesive and/or said labels and/or adhesive roller, so as to correspondingly adjust the pressure exerted by adhesive scraper 23 onto the adhesive and, therefore, the amount of adhesive to be applied to labels 2.

[0051] In other words, the amount of adhesive that remains on area 26 downstream of scraper 23 is controlled by adjusting the pressure exerted by scraper 23 on the adhesive flowing between scarper 23 and roller 20.

[0052] This is due to the fact that the Applicant has found that the pressure exerted by scraper 23 on adhesive flowing through gap 27 varies the residual load of the adhesive on roller 20 and, therefore, varies the amount of adhesive that flows in area 26.

[0053] In greater detail, the Applicant has found that rheology of the adhesive is such that the adhesion of the adhesive to roller 20 and the stiffness of the adhesive is enough to create a reaction force F1 (opposite to force F3), which tends to separate scraper 23 from roller 20, when the latter rotates about axis C. This means that substantial pressures are created as the adhesive is dragged inside gap 27.

[0054] By suitably adjusting force F3 - i.e. by more or less balancing force F1 -, it is therefore possible to adjust the amount of adhesive which flows through gap 27 towards area 26.

[0055] In particular, the first operative parameters can be the type of the adhesive; and/or the material of labels 2; the roughness of surface 21; and/or the level of contamination of surface 21; and/or the shape, in particular the profile of surface 21; and/or the stresses applied to the adhesive; and/or the application temperature of the adhesive.

[0056] In the following of the present description, three different operative scenarios of labelling group 5 are described.

[0057] In a first operative scenario (Figure 4a), the pressure exerted by actuator 40 is adjusted by the operator through a manual regulator 75, on the basis of the rotational speed of adhesive roller 20 about axis C.

[0058] In a second operative scenario (Figure 4b), the operator inserts one or more first parameters in a human machine interface 45, which is connected, via a control unit 46, to actuator 40.

[0059] Preferably, in the second operative scenario, labelling group 5 comprises:

- human machine interface 45 (only schematically shown in Figure 4), through which an operator can selectively insert one or more first parameters inside labelling machine 1; and
- control unit 46 (only schematically shown in Figure 4), which is programmed for elaborating the first parameters and generating a control signal for actuator 40, so as to adjust force F3 exerted by actuator 40 on scraper 23 on the basis of the first parameters.

[0060] In particular, human machine interface 45 comprises a programmable logic controller 70.

[0061] Furthermore, a plurality of temporal profiles of force F3 are memorized in a store unit 71 of controller 70 and associated with different operative conditions of labelling group 5.

[0062] Actuator 40 is controlled by human machine interface 45, so that force F3 exerted by actuator 40 on scraper 23 is adjusted on the basis of the first parameters set in human machine interface 45.

[0063] In a third operative scenario (Figure 4c), actuator 40 is controlled also by using a sensor 47 (Figure 2), which is connected, via a control unit 46, to actuator 40.

[0064] In this third scenario, labelling group 5 comprises sensor 47 (only schematically shown in Figure 4), which is configured to generate a signal, which is asso-

ciated to at least one second parameter representative of the adhesive in area 26, downstream of scraper 23 proceeding according to the advancing rotation direction of roller 20.

[0065] Furthermore, labelling group 5 comprises a programmable logic controller 70.

[0066] In particular, sensor 47 is configured to generate a signal associated to the weight per unit of surface of adhesive in area 26.

[0067] Control unit 46 is also programmed for elaborating the signal generated by sensor 47 and generating a control signal for actuator 40, so as to adjust force F3 exerted by actuator 40 on scraper 23 on the basis of the first parameters and/or second parameters.

[0068] In this third scenario, sensor 46, control unit 47 and actuator 40 form a continuous closed control loop.

[0069] A software is loaded and executed on control unit 46 and implements and algorithm, which generates, for each set of first parameters and/or second parameters, a control law for actuator 40.

[0070] In greater detail, actuator 40 comprises (as schematically shown in Figure 2):

- a proportional pressure valve 41; and
- a pneumatic cylinder 42, which is controlled by pressure valve 41 and applies force F3 on scraper 23.

[0071] With reference to Figure 2, actuator 40 is configured to exert only force F3 of scraper 23 and is freely movable with respect to scraper 23. In this way, the actuator 40 does not cause any movement of scraper 23 in the radial direction to axis C.

[0072] Still more precisely, cylinder 42 comprises:

- a first end 50, which is arranged on the side of scraper 23, cooperates with and exerts force F3 on scraper 23, and is connected to scraper 23 by a spherical joint 51;
- a second end 52, which is arranged on the opposite side of scraper 23 and end 50, and is connected to a support rod 54 of actuator 40 (only schematically shown in Figure 4) by a spherical joint 55.

[0073] Spherical joints 51, 55 are aligned parallel to direction of force F3, which, coincides, in the embodiment shown, with the radial direction to axis C.

[0074] With reference to Figure 2, support 30 comprises, in turn,:

- a holder 32, to which tool 31 is fitted on the side of axis C with respect to holder 32 itself; and
- a support structure 33, which supports holder 32 and is connected to a fixed part of labelling group 5.

[0075] Holder 32 comprises, in turn,:

- a pair of walls 36 lying on respective planes parallel to each other and perpendicular to axis C; and
- an edge 37 radially outer with respect to axis C and radially opposite with respect to tool 31.

[0076] In the embodiment shown, walls 36 are substantially trapezoidal.

[0077] Edge 37 comprises, in turn, a pair of end segments 38, which are sloped with respect to axis C and define respective oblique sides of corresponding walls 36.

[0078] Edge 37 further comprises a planar portion 39, which is interposed between segments 38, lies on a plane orthogonal to a radial direction to axis C and parallel to axis C, and defines respective minor basis of walls 36.

[0079] Actuator 40 is configured to exert force F3 directly on planar portion 39 of scraper 23.

[0080] In particular, cylinder 42 cooperates with planar portion 39, through the interposition of spherical joint 51.

[0081] Tool 31 is therefore, in use, subjected to:

- force F1, which directed radially to axis C and towards scraper 23, and is generated, for hydrodynamic and viscous effect, by the pressure of adhesive flowing in gap 27 between scraper 23 and surface 21; and
- force F3, which is directed radially to axis C and towards roller 20, is generated by actuator 40, and transmitted by holder 32.

[0082] Advantageously, holder 32 and, therefore, tool 31 is hinged to support 30:

- about an axis D orthogonal to axis C and horizontal in the embodiment shown; and
- about an axis E parallel to axis C, orthogonal to axis D and vertical in the embodiment shown.

[0083] In particular, support 30 comprises:

- a rod 48, which extends parallel to axis C-along a vertical direction in the embodiment shown - and is fixed to the fixed part of the labelling group 5; and
- a rod 49 which extends parallel to axis D - along a horizontal direction in the embodiment shown - and is hinged about axis D to walls 36 of holder 32 and about an axis E to rod 48.

[0084] Axis E is, in the embodiment shown, parallel to and staggered from axis C.

[0085] Rod 48 of support 30 is fixed with respect to axis C, in particular along the radial direction with respect to axis C.

[0086] Furthermore, support 30 and rod 48 are not motorized in the radial direction with respect to axis C.

[0087] Accordingly, the tool 31 is substantially fixed in the radial direction with respect to axis C.

[0088] This is due to the fact that the rotation of tool 31 about axes D and/or E is of the order of one millionth of degree.

[0089] With reference to Figure 3, adhesive roller 20 comprises:

- a shaft 58 rotating parallel to axis C; and
- a pair of bearings 56 (only schematically shown), which support shaft 58 rotationally about axis C with respect to a stator 57 (only schematically shown).

[0090] Due to the inevitable tolerances in the shape/design of bearing 56, as shaft 58 rotates about axis C, the latter is not perfectly fixed but slightly oscillates with respect to a fixed direction, for example vertical.

[0091] Thanks to the fact that holder 32 can oscillate about axes D, E, tool 31 remains aligned and parallel to slightly oscillating axis C, as adhesive roller 20 rotates.

[0092] In use, carousel 4 is fed with articles 3 to be labelled at inlet station 7 and rotates about axis A so as to convey articles 3 to be labelled along path P.

[0093] Labelling groups 5 apply, at respective application stations 6 of path P, respective series of single cut and covered with adhesive labels 2 onto relative articles 3.

[0094] In the following of the present description, reference is made to only one labelling group 5 and to only one label 2.

[0095] During the operation of labelling group 5, strip 10b is unwound off reel 10a and fed along the feed path by unwinding rollers 10c.

[0096] Afterwards, cutting device 11 cuts label 2 to the desired length.

[0097] Transfer mechanism 13 rotates about axis B, so as to transfer, one after the other, cut label 2 from cutting device 11 to application station 6 through application unit 12.

[0098] In particular, drum 14 contacts the first side of label 2.

[0099] Application unit 12 applies a required amount of adhesive substance onto the second side, opposite to drum 14, of label 2.

[0100] In particular, adhesive roller 20 rotates about axis C, and distributor 22 applies adhesive onto area 25 of roller 20.

[0101] Tool 31 of scraper 23 removes the excess of adhesive from area 25 of roller 20, so that only the required amount of adhesive to be applied on label 2 remains on area 26 of roller 20.

[0102] In greater detail, actuator 40 exerts an adjustable force F3 on tool 31. Force F3 is directed radially to axis C and towards the roller 20, and generates a pressure on the adhesive flowing between scraper 23 and roller 20.

[0103] Furthermore, the pressure exerted by scraper 23 on the adhesive flowing through gap 27 varies the residual load of the adhesive on roller 20 and, therefore, varies the amount of adhesive that flow in area 26.

[0104] In greater detail, the Applicant has found that rheology of the adhesive is such that the adhesion of the adhesive to roller 20 and the stiffness of the adhesive is enough to create a reaction force F1 (opposite to force F3), which tends to separate scraper 23 from roller 20, when the latter rotates about axis C.

[0105] By suitably adjusting force F3 - i.e. by more or less balancing force F1 -, it is therefore possible to adjust the amount of adhesive which flows through gap 27 towards area 26.

[0106] It is important to highlight that support 30 is radially stationary with respect to axis C and that actuator 40 applies only force F3 on scraper 23 and substantially does cause any radial displacement of scraper 23, due to the presence of spherical joints 51, 55.

[0107] Accordingly, the amount of adhesive that remains on area 26 is adjusted by scraper 23 without any substantial adjustment of the thickness of gap 27, but adjusting the pressure exerted by scraper 23 on the adhesive which passes through gap 27.

[0108] In the first operative scenario (Figure 4a), force F3 exerted by actuator 40 on scraper 23 - and, therefore, the pressure exerted by scraper 23 on the adhesive flowing between surface 21 and tool 31 - is manually controlled by the operator through regulator 75, on the basis of the rotational speed of roller 20 about axis C

[0109] In this way, also the amount of adhesive that remains on area 26 and is therefore applied on labels 2 is manually controlled by the operator, on the basis of the rotational speed of roller 20 about axis C.

[0110] In the second operative scenario (Figure 4b), the operator inserts the first parameters in the human machine interface 45. Control unit 46 elaborates the first parameters and generates, on the basis of the data stored in store unit 71, a control signal for actuator 40, so as to generate a temporal profile force F3 exerted by actuator 40 on scraper 23 and accordingly a temporal profile of the pressure generated by tool 31 on the adhesive flowing between surface 21 and scraper 23.

[0111] Non-limitative examples of the first parameters are the type of the adhesive; and/or the material of labels 2; the roughness of surface 21; and/or the level of contamination of surface 21; and/or the shape, in particular the profile of surface 21; and/or the stresses applied to the adhesive; and/or the application temperature of the adhesive.

[0112] In the third operative scenario (Figure 4c), sensor 47 generates the signal, which is associated to at least one second parameter representative of the adhesive in area 26, e.g. a parameter representative of the weight per unit of surface of adhesive in area 26.

[0113] In that third operative scenario, control unit 46 elaborates also the second parameters and generates the control signal for actuator 40, on the basis of the first parameters and the second parameters. In this way, force F3 exerted by actuator 40 on scraper 23 and accordingly the pressure generated by tool 31 on the adhesive flowing between surface 21 and scraper 23 is adjusted on the basis also of the second parameters. In that third scenario, sensor 47, control unit 46 and actuator 40 form a closed continuous loop.

[0114] As adhesive roller 20 rotates, axis C slightly oscillates with respect to the fixed direction - for example vertical, due to the inevitable tolerances in the shape/design of bearings 56.

[0115] Thanks to the fact that holder 32 can oscillate about axes D, E with respect to rod 48 of one millionth of degrees, tool 31 substantially remains in the same position with respect to the oscillating surface 21 of roller 20.

[0116] Downstream from sensor 47 proceeding according to the rotation direction of adhesive roller 20, area 26 of surface 21 applies adhesive on the second side of label 2.

[0117] Downstream of application unit 12, cut and covered with adhesive label 2 is transferred to the application station 6 where it is applied to a relative article 3.

[0118] Finally, carousel 4 outputs labelled articles 3 at output station 8.

[0119] Number 1' in Figure 5 indicates a second embodiment of an application unit 12' in accordance with the present invention; application unit 12, 12' similar to each other, the following description is limited to the differences between them, and using the same references, where possible, for identical or corresponding parts.

[0120] In particular, application unit 12' differs from application unit 12 in that:

- it comprises a bar 60' to which scraper 23 is fitted; and in that:
- actuator 40 exerts a force F3' directed parallel to a direction G' which is staggered from axis C of adhesive roller 20.

[0121] In particular, direction G' is orthogonal to axes D and C.

[0122] Furthermore, force F3' and force F1' are staggered with respect to one another.

[0123] The operation of application unit 12' differs from that of application unit 12 in that force F3' is staggered from and parallel to force F1' acting on scraper 23 and deriving from the action of flow of adhesive inside gap 27.

[0124] From an analysis of the features of application unit 12, 12' made according to the present invention, the advantages it allows to obtain are apparent.

[0125] In particular, actuator 40 is controllable on the basis of at least one first operative parameter to exert an adjustable force F3, F3' on scraper 23. That adjustable force F3, F3' adjusts the pressure exerted by scraper 23 on the adhesive flowing between surface 21 and tool 31 of scraper 23, thus correspondingly adjusting the amount of adhesive to be applied to labels 2.

[0126] In other words, actuator 40 adjusts the amount the of adhesive that remains on area 26 and that, therefore, is applied to labels 2 by adjusting force F3, F3' exerted on scraper 23, instead of adjusting the thickness of gap 27 between surface 21 and scraper 23, as in the known solution discussed in the introductory part of the present description.

[0127] As a matter of fact, the Applicant has found that it possible to control the amount of adhesive to be applied on labels 2 in a high precise and repeatable way, also in some particularly severe operative conditions, especially in case of high-viscous adhesive and/or in case of high rotational speed of roller 20 about axis C.

[0128] In greater detail, the Applicant has found that the pressure exerted by scraper 23 on adhesive flowing through gap 27 varies the residual load of the adhesive on roller 20 and, therefore, varies the amount of adhesive that flows in area 26.

[0129] The Applicant has also found that rheology of the adhesive is such that the adhesion of the adhesive to roller 20 and the stiffness of the adhesive is enough to create reaction force F1, F1' (opposite to force F3, F3'), which tends to separate scraper 23 from roller 20, when the latter rotates about axis C.

[0130] By suitably adjusting force F3, F3' - i.e. by more or less balancing force F1, F1' -, it is, therefore, possible to adjust the amount of adhesive which flows through gap 27 towards area 26.

[0131] This effect is particularly enhanced in case of high-viscous adhesive and/or the hydrodynamic actions generated by high rotational speed of roller 20.

[0132] It is important to stress that:

- support 30 is not motorized; and
- actuator 40 is connected to scraper 23 and support 54 by respective spherical joints 51, 55.

[0133] In this way, tool 31 of scraper 30 is not displaced along a radial direction with respect to axis C, but simply undergoes force F3, F3' directed parallel to that radial direction.

[0134] With reference to the second operative scenario (Figure 4b), control unit 46 is programmed for associating to the different first parameters inserted by the user inside human interface 45 respective control laws for actuator 40 and, therefore, respective temporary profiles of force F3 applied on scraper 23.

[0135] In this way, the temporary profile of pressure acting on the adhesive can be adjusted automatically on the basis of the first parameters, in particular, on the basis of the format of labels 2 and/or roller 20 and of the material of adhesive.

[0136] As a result, the amount of adhesive applied on area 26 and, therefore, on labels 2 can be precisely and with high repeatability controlled, without requiring highly skilled operators.

[0137] With reference to third operative scenario (Figure 4c), control unit 46 controls force F3, F3' also on the basis of the second parameters detected by sensor 47, thus creating a continuous closed loop and further enhancing the repeatability and the precision of the application of adhesive onto labels 2.

[0138] Holder 32 of scraper 23 can rotate about axes D, E with respect to rod 48.

[0139] In this way, tool 31 remains aligned and parallel

to axis C, as roller 20 rotates and axis C slightly oscillates about a fixed direction, due to the inevitable tolerances in the shape/design of bearings 56.

[0140] Scraper 23 is made of plastic material. In this way, scraper 23 can be made of a material, which is soft, and wear resistant with low friction as for example PTFE or in a more stable material as for example Peek.

[0141] Furthermore, scraper 23 can be made of an inert plastic. In this way, the risk of complex mechanical friction mechanism against the metal of roller 20 is dramatically reduced.

[0142] Thanks to these features, the scraper 23 allows to overcome the drawbacks of the known scrapers discussed in the introductory part of the present description.

[0143] Finally, it is apparent that modifications and variants not departing from the scope of protection of the claims may be made to application unit 12, 12'.

[0144] In particular, spherical joints 51, 55 could be replaced by respective hinges, which are configured in such way to ensure that actuator 40 exerts force F3, F3' on scraper 23 directed parallel to the radial direction to axis C, without substantially causing any displacement of scraper 23 parallel to axis C.

[0145] Actuator 40 could not comprise cylinder 42, but could be electro-mechanical, hydraulic or comprising a screw.

Claims

1. An application unit (12, 12') for applying an adhesive onto labels (2) to be applied to respective articles (3), comprising:

   - an adhesive roller (20), which is rotatable about a first axis (C) and is adapted to receive an adhesive and to apply said adhesive to said labels (2);
   - an adhesive distributor (22), which is adapted to dispense said adhesive on a surface (21) of said roller (20) ;
   - an adhesive scraper (23), which is adapted to be arranged at a radial distance from said surface (21), so as to remove an excess of said adhesive from said roller (20) and to define the amount of said adhesive to be applied to said labels (2); and
   - adjusting means (24, 40) for adjusting the amount of adhesive to be applied to said labels (2);

   characterized in that said adjusting means (24, 40) comprise an actuator (40), which is controllable to exert an adjustable force (F3, F3') on said adhesive scraper (23) also on the basis of at least one first operative parameter of said adhesive and/or said labels (2) and/or said adhesive roller (20), so as to correspondingly adjust the pressure exerted by said adhesive scraper (23) onto said adhesive and adjust said amount of said adhesive to be applied to said labels (2).

2. The application unit of claim 1, **characterized by** comprising a first support element (30, 48) for supporting said adhesive scraper (23), and which is stationary at least in a radial direction with respect to said first axis (C).

3. The application unit of claim 2, **characterized in that** said adhesive scraper (23) is hinged to said first support element (30, 48) about at least one second axis (D, E) distinct from said first axis (C);
said adhesive roller (20) being rotatably supported by a pair of bearings (56) about said first axis (C).

4. The application unit of claim 3, **characterized in that** said second axis (D) is transversal to a radial direction with respect to said first axis (C);
said adhesive scraper (23) being also hinged to said support element (30, 48) about a third axis (E), which is parallel to said first axis (C).

5. The application unit of any one of the foregoing claims, **characterized by** comprising:

   - a second support element (54) for supporting said actuator (40);
   - a first spherical joint (51), which is interposed between said adhesive scraper (23) and said actuator (40); and
   - a second spherical joint (55), which is interposed between said adhesive scraper (23) and said second support element (54).

6. The application unit of any one of the foregoing claims, **characterized in that** said actuator (40) comprises, in turn,:

   - a proportional pressure valve (41), which is controllable to adjust said pressure exerted by said actuator (40) on said adhesive scraper (23); and
   - a pneumatic cylinder (42), which is controlled by said proportional pressure valve (41).

7. A labelling group (5) for applying labels (2) on relative articles (3), comprising:

   - a human machine interface (45) through which said at least one first operative parameter may be selectively set by an user; and
   - an application unit (12, 12') according to any one of the foregoing claims and which is adapted to apply, in use, said adhesive onto said cut labels (2).

8. A labelling group (5) for applying labels (2) on relative articles (3) according to claim 7, **characterized by** comprising:

- a sensor (47), which is adapted to generate a signal associated to at least one second operative parameter of said adhesive detected, in use, downstream of said adhesive scraper (23), proceeding according to an advancing direction of said adhesive roller (20);

said actuator (40) being controllable to adjust said pressure exerted on said adhesive scraper (23) also on the basis of said at least one second operative parameter.

9. A method for applying an adhesive on labels (2) to be applied on respective articles (3), comprising the steps of:

i) rotating an adhesive roller (20) about a first axis (C);
ii) distributing said adhesive on a surface (21) of said adhesive roller (20);
iii) removing the excess of said adhesive from said adhesive roller (20), by using an adhesive scraper (23) arranged at a radial distance from said first axis (C);
iv) applying said adhesive onto said labels (2) by using said roller (20); and
v) adjusting the amount of said adhesive to be applied onto said labels (2);

characterized in that said step v) comprises a step vi) of exerting an adjustable force (F3, F3') on said adhesive scraper (23) also on the basis of at least one first parameter of said adhesive and/or said labels (2) and/or said adhesive roller (20), so as to correspondingly adjust the pressure exerted by said adhesive scraper (23) onto said adhesive and adjust said amount of said adhesive to be applied to said labels (2).

10. The method of claim 9, **characterized by** comprising the step vii) of selectively inserting said at least one first operative parameter by using a human machine interface (45).

11. The method of claim 9 or 10, **characterized by** comprising the step ix) of generating a signal associated to at least one second operative parameter of said adhesive arranged downstream of said adhesive scraper (23), proceeding according to the advancing direction of said adhesive roller (20);
said step v) comprising the step x) of adjusting said force (F3, F3') also on the basis of said second operative parameter.

12. The method of any one of claims 9 to 11, **characterized by** comprising the step xi) of supporting said adhesive scraper (23) by using a support element (30, 48), which is stationary at least in a radial direction with respect to said first axis (C).

13. An application unit (12, 12') for applying an adhesive onto labels (2) to be applied to respective articles (3), comprising:

- an adhesive roller (20), which is rotatable about a first axis (C) and is adapted to receive an adhesive and to apply said adhesive to said labels (2);
- an adhesive distributor (22), which is adapted to dispense said adhesive on a surface (21) of said roller (20); and
- an adhesive scraper (23), which is adapted to be arranged at a radial distance from said surface (21), so as to remove an excess of said adhesive from said adhesive roller (20) and to define the amount of said adhesive to be applied to said labels (2);

said adhesive roller (20) being rotatably supported by a pair of bearings (56) about said first axis (C);
said application unit (12, 12') comprising, in turn, a support element (30, 48) for said adhesive scarper (23);
said support element (30, 48) being stationary in a radial direction with respect to said first axis (C);
characterized in that said adhesive scraper (23) is hinged to said support element (30, 48) about at least one second axis (D, E) distinct from said first axis (C) ;
said adhesive roller (20) being rotatably supported by a pair of bearings (56) about said first axis (C).

14. The application unit of claim 13, **characterized in that** said second axis (D) is transversal to a radial direction with respect to said first axis (C);
said adhesive scraper (23) being also hinged to said support element (30, 48) about a third axis (E), which is parallel to said first axis (C).

15. An adhesive scraper (23) for removing an excess of adhesive from a an adhesive roller (20), which is adapted to apply an adhesive onto labels (2) to be applied to respective articles (3), **characterized in that** it is made of plastic material.

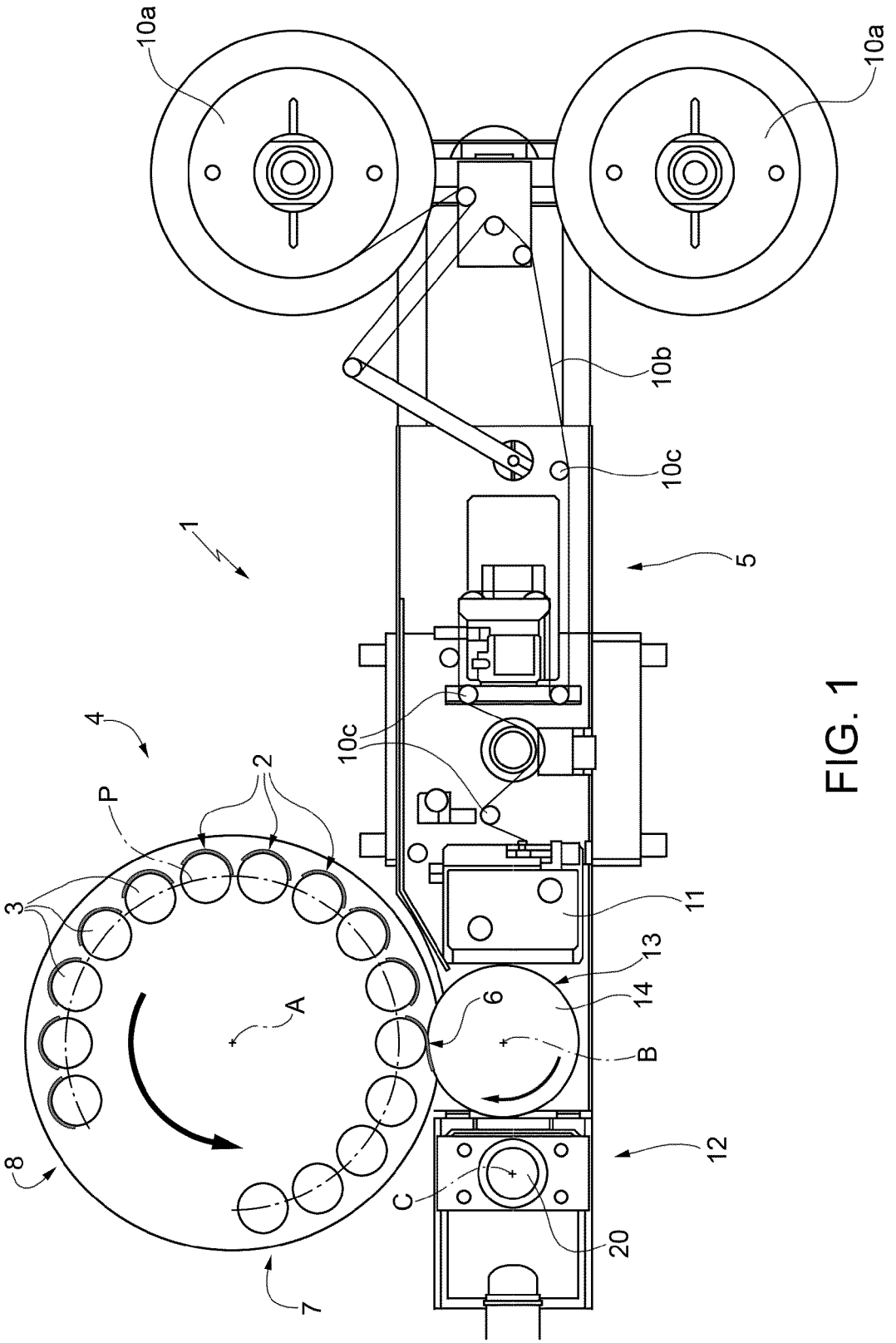

FIG. 1

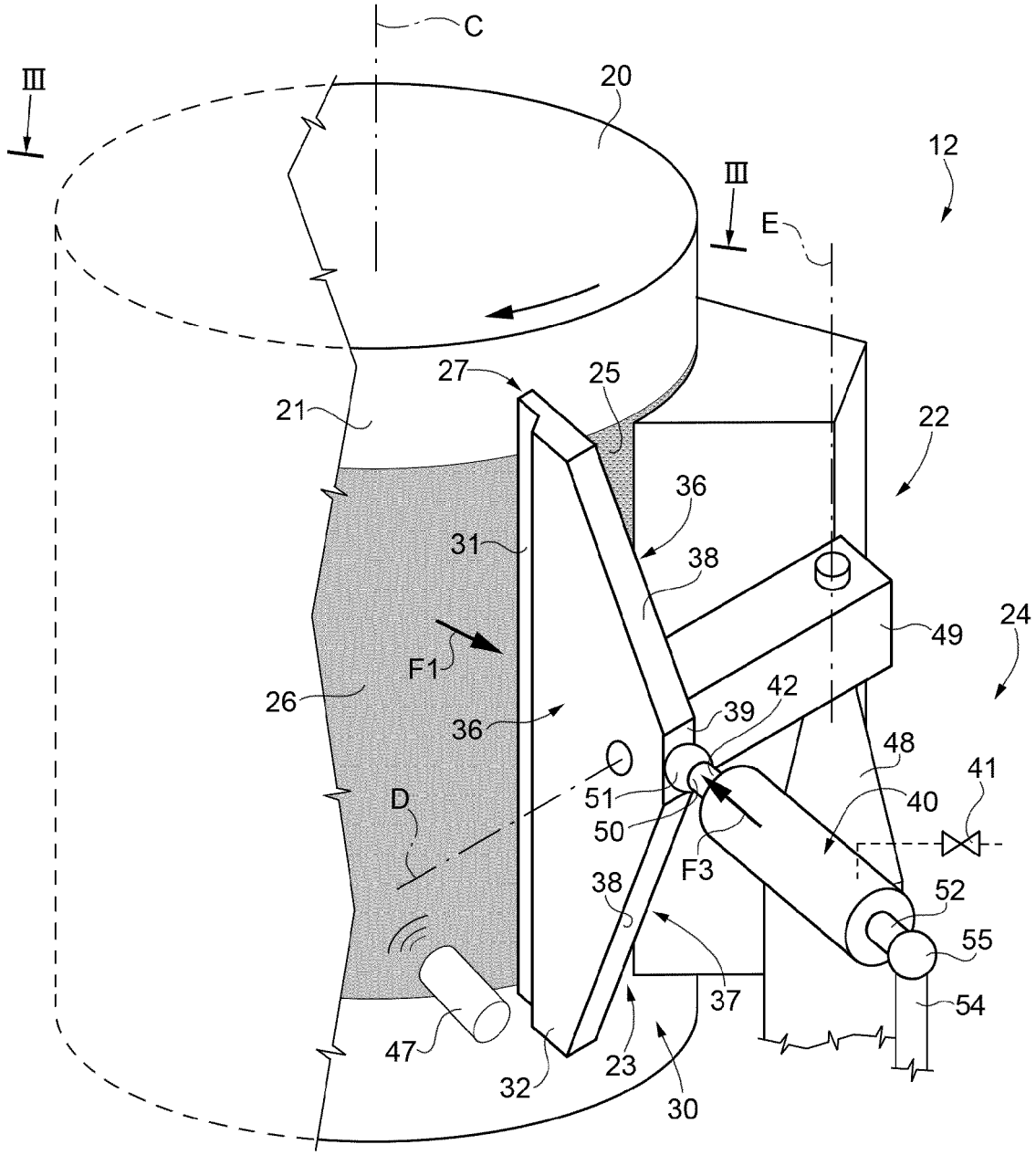
C
III
20
12
III
E
27
25
21
22
36
31
38
49
24
F1
26
36
39
42
48
41
D
51
40
50
F3
38
52
55
37
54
47
32
23
30

FIG. 2

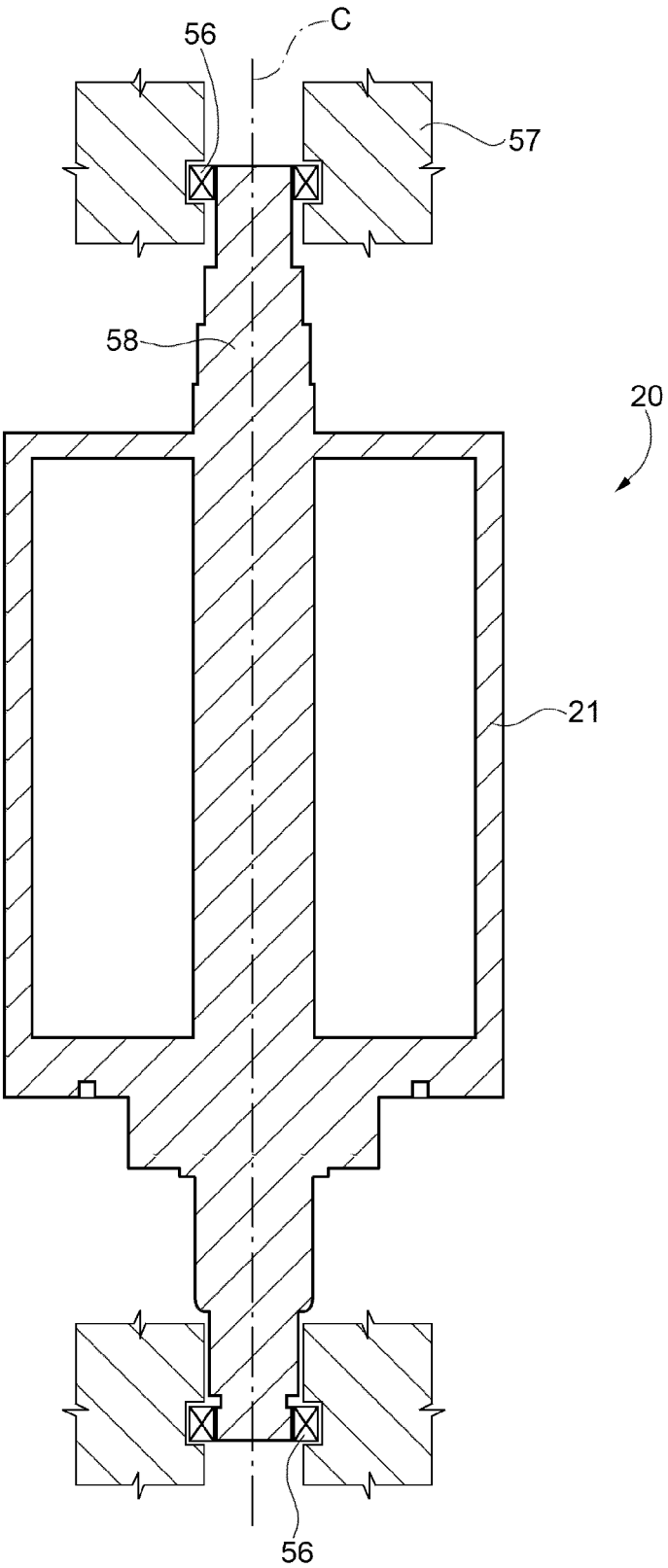

FIG. 3

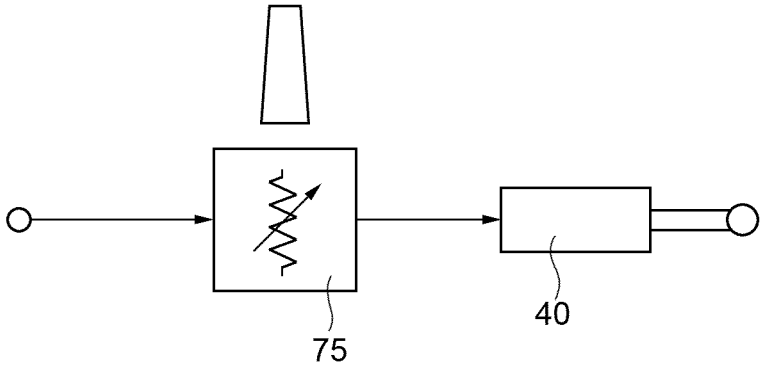

FIG. 4A

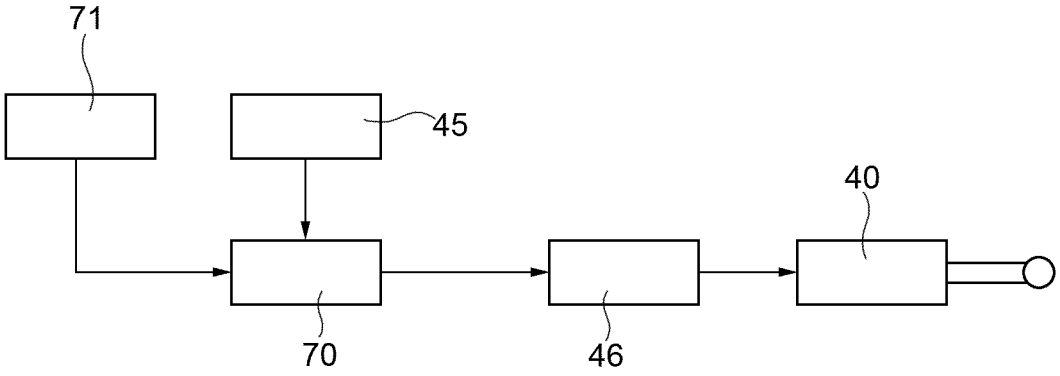

FIG. 4B

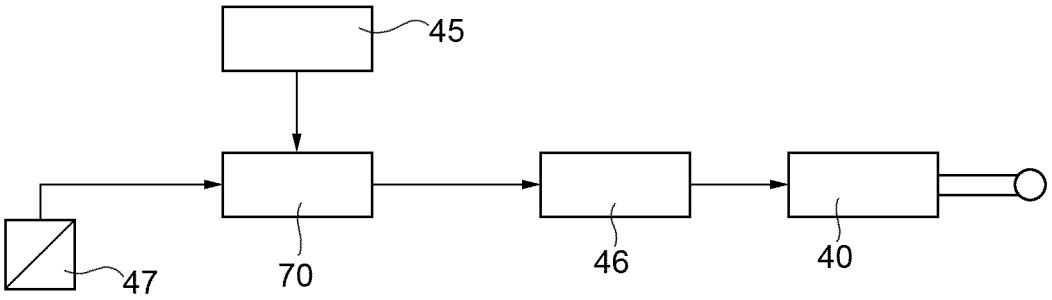

FIG. 4C

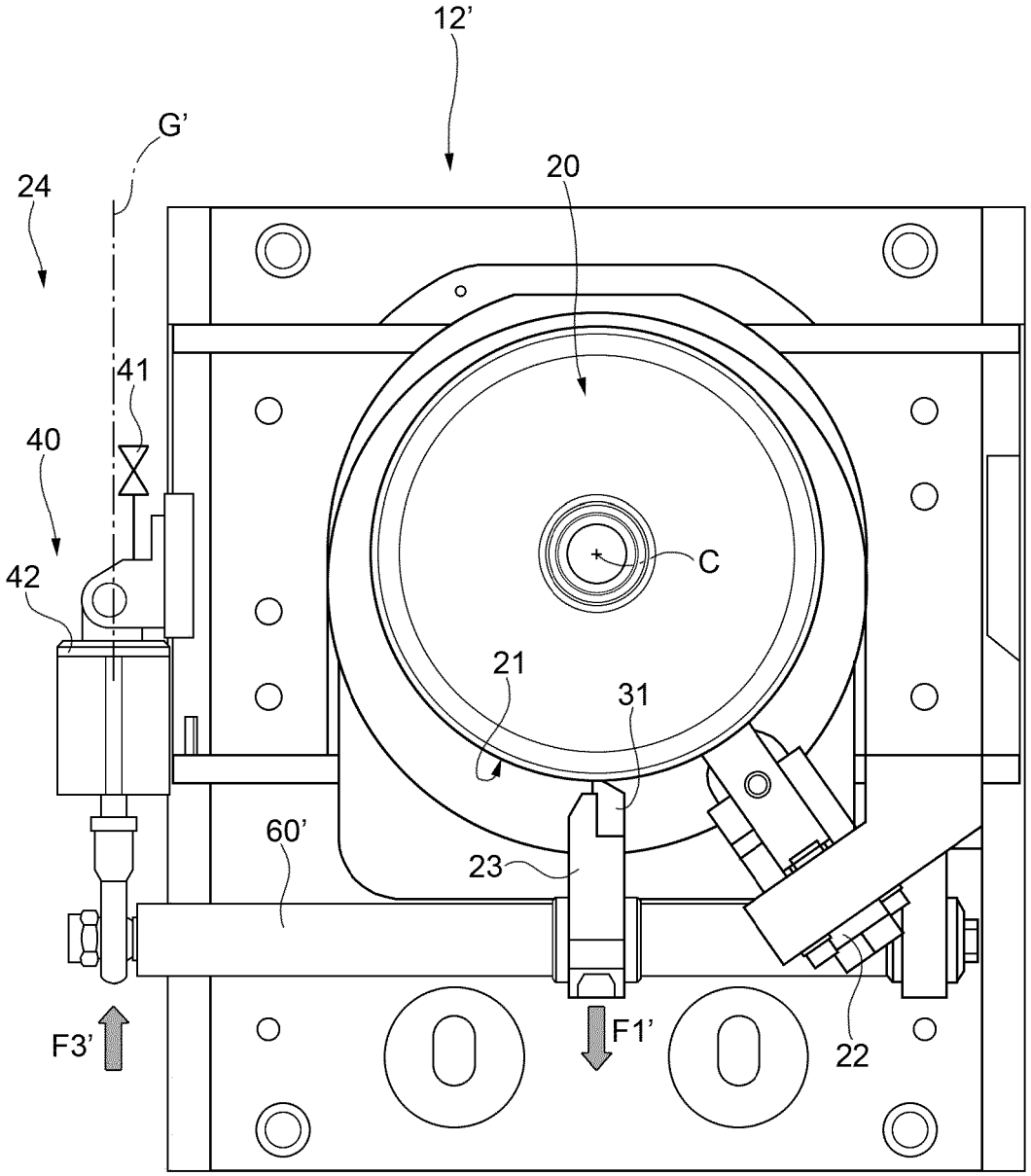

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 14 18 0227

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X	WO 2008/049592 A1 (KHS AG [DE]; KRAEMER KLAUS [DE]; DECKERT LUTZ [DE]; KRESS OLIVER [DE]) 2 May 2008 (2008-05-02) * page 4, paragraph 3 * * page 5, paragraph 3 - paragraph 4 * * page 6, paragraph 2 * * figures 1-4 *	1-5,9, 12-14	INV. B65C9/22
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 February 2015	Luepke, Erik

CATEGORY OF CITED DOCUMENTS

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