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(54) EMBOSSING AND LAMINATION METHOD IN AN EMBOSSING AND LAMINATION ASSEMBLY WITH HEATED ROLLS

(57) An embossing and lamination method actuated on an embossing and lamination assembly with heated rolls comprising two pairs of steel/rubber rolls between which, respectively, a first paper ply (11A) and a second paper ply (11B) are fed, in which an upper steel embossing roll (21) is coupled with an upper rubber embossing counter roll (22) and a lower steel embossing roll (31) is coupled with a lower rubber embossing counter roll (32), as well as comprising a glue-distributor assembly (40), equipped with an anilox roll (42) and a glue applicator roll (41), placed in contact on one side of said upper steel embossing roll (21), and a coupling roll (13), placed in contact on the opposite side of said upper steel embossing roll (21), comprising heating means (50) associated with at least one of said upper steel embossing roll (21) and said lower steel embossing roll (31), in which the upper (22) and/or lower (32) rubber embossing counter roll is provided with an auxiliary motorization (15), selectively activable and deactivable, provides that when the embossing and lamination assembly proceeds in pulse driving mode, the auxiliary motorization (15) of the upper and/or lower rubber embossing counter roll (22, 32), which is placed in rotation and detached from the upper and/or lower steel embossing roll (21, 31), is activated.

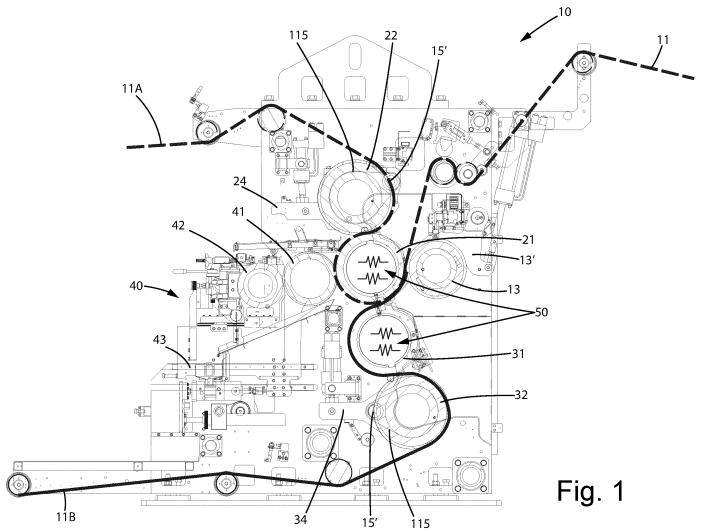

Fig. 1

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Description

[0001] The present invention relates to an embossing and lamination method in an embossing and lamination assembly with heated rolls.

[0002] It is known from EP3747644A1 to equip in an embossing and lamination assembly one or both steel embossing rolls with heating means adapted to heat the surface thereof to perform embossing on the related paper ply during the heating thereof.

[0003] This process, despite offering a number of advantages with respect to the traditional embossing, particularly regarding the final effect generated on the plies, introduces some critical issues compared to a traditional cold embossing and lamination process.

[0004] A drawback introduced by heating one or more steel embossing rolls in an embossing and lamination assembly relates to the risk of damaging the upper and/or lower rubber embossing counter rolls, as well as all the rolls facing the heated steel embossing rolls, such as the coupling roll, or marriage roll, and the glue applicator roll of the glue assembly which are directly exposed to heat during machine operation, but especially during a machine stop. Indeed, during machine operation, the paper transferred through the embossing and lamination assembly at speed is capable of taking part of the heat, while during a machine stop, the rolls statically facing the heated steel embossing rolls risk rapid deterioration of their surface and even deformation thereof.

[0005] In particular, the opening of the upper and/or lower rubber embossing counter rolls poses difficulties at jog mode due to the risk of breaking the paper plies in contact with such rubber embossing counter rolls.

[0006] An object of the present invention is to make an embossing and lamination method in an embossing and lamination assembly with heated rolls that overcomes the above-mentioned drawbacks of the prior art.

[0007] Another object of the present invention is to make an embossing and lamination method in an embossing and lamination assembly with heated rolls that is particularly simple and functional, with low costs.

[0008] These objects according to the present invention are achieved by making an embossing and lamination method in an embossing and lamination assembly with heated rolls as set forth in claim 1.

[0009] Further features are provided in the dependent claims.

[0010] The features and advantages of an embossing and lamination method in an embossing and lamination assembly with heated rolls according to the present invention will be more apparent from the following exemplary and non-limiting description, referred to the attached schematic drawings in which:

Figure 1 is a schematic view of an embossing and lamination assembly with heated rolls in which the paper is fed along a path wrapping the rubber embossing counter rolls;

Figure 2A schematically shows the embossing and lamination assembly of Figure 1 in which the rubber embossing counter rolls, provided with an auxiliary motorization, are moved away from the steel embossing rolls;

Figure 2B shows the auxiliary motorization of Figure 2A viewed from the transmission side;

Figure 3 schematically shows the embossing and lamination assembly in which the glue-distributing assembly is moved away from the steel embossing roll;

Figure 4 schematically shows the embossing and lamination assembly of Figure 1 in which the coupling roll is moved away from the steel embossing roll;

Figure 5 schematically shows the independent motorizations for the steel embossing rolls, for the coupling roll, for the glue applicator roll, for the anilox roll, and for the outgoing draw station of the embossing and lamination assembly with heated rolls.

[0011] With reference to the figures, an embossing and lamination assembly with heated rolls overall indicated by 10 is shown, depicted and described according to the exemplary and non-limiting embodiment that processes two paper plies 11A, 11B to form multi-ply laminated tissue paper 11.

[0012] According to the invention, the embossing and lamination assembly can treat a single upper ply and a single lower ply or even multiple plies together, for example, two upper plies and one lower ply, one upper ply and two lower plies, two upper plies, and two lower plies.

[0013] In the following description, reference will be made for simplicity to the "first upper paper ply 11A" and the "second lower paper ply 11B" even if multiple plies are treated together on the upper and/or lower side.

[0014] The embossing and lamination assembly 10 comprises two pairs consisting of steel/rubber rolls, respectively comprising an upper steel embossing roll 21 and an upper rubber embossing counter roll 22, a lower steel embossing roll 31, and a lower rubber embossing counter roll 32, between which, respectively, the first paper ply 11A and the second paper ply 11B are fed with the aid of related return rolls 12, motorized and/or non-motorized.

[0015] The upper 21 or lower 31 steel embossing rolls can be provided with any type of protrusions defining micro-embossing, macro-embossing, or double-height or multi-height embossing, i.e., arranged according to two or more different heights, as known.

[0016] "Protrusions defining micro-embossing" means protrusions of equal height possibly defining a decorative pattern, for example, obtained with a steel embossing roll with a tip density per cm^2 greater than 40 (up to 100) and with a tip size smaller than 0.7 mm.

[0017] "Protrusions defining macro-embossing" means protrusions of equal height possibly defining a decorative pattern, for example, obtained with a steel

embossing roll with a tip density per cm^2 smaller than 40 (down to 15) and with a tip size greater than 0.7 mm (up to 1 mm) .

[0018] "Protrusions defining double-height embossing" generally means different-height protrusions, in which glue is delivered to the greater-height protrusions, and the smaller-height protrusions generally define a micro-embossed pattern.

[0019] After the passage of the first paper ply 11A between the upper pair consisting of the steel embossing roll 21 and the rubber embossing counter roll 22, the protrusions of the upper steel roll 21 imprint on the first paper ply 11A related protuberances, having the same height or different heights.

[0020] In the embossing and lamination assembly 10, the upper steel embossing roll 21 abuts a glue-distributing assembly 40 on one side and abuts a coupling roll 13, referred to as marriage roll, on the opposite side. In particular, the upper steel embossing roll 21 abuts a glue applicator roll 41, referred to as cliché roll, which distributes glue on the embossed paper ply that has been transferred thereto from the anilox roll 42, which is in turn also paired with a glue reservoir 43. In particular, the clich6 roll 41 distributes the glue on the protuberances imprinted by embossing on the first paper ply 11A.

[0021] The marriage roll 13, approached to the upper embossing roll 21, exerts a coupling pressure to perform the final coupling between the first ply 11A and said second ply 11B at the glue deposits, thus forming multi-ply laminated tissue paper 11.

[0022] In the case where the upper steel roll 21 is double-height, following the passage of the first paper ply 11A between the pair of steel/rubber rolls, the greater-height protrusions of the upper steel roll 21 imprint on the first paper ply 11A protuberances defining a decorative pattern having a first height, and the smaller-height protrusions imprint on the same first paper ply 11A smaller-height protuberances defining a dotted background pattern, referred to as micro-embossing. In this particular case, the glue is applied by the clich6 roll 41 to the greater-height protuberances of the first embossed paper ply 11A. On the opposite side, the marriage roll 13 presses the two paper plies 11A and 11B against each other to ensure their gluing to form the multi-ply laminated tissue paper 11.

[0023] The lower steel embossing roll 31 is generally provided with protrusions all of equal height. Following the passage of the second paper ply 11B between the lower pair consisting of the steel embossing roll 31 and the rubber embossing counter roll 32, the protrusions of the lower embossing roll 31 imprint on the second paper ply 11B constant-height protuberances defining a dotted background pattern, referred to as micro-embossing.

[0024] The steel embossing rolls 21, 31 of the embossing and lamination assembly 10 are not in contact with each other. Indeed, the plies are individually embossed between the pairs of steel/rubber rolls and then pressed together by the coupling roll 13 which acts against the upper steel embossing rolls 21.

[0025] In an equivalent alternative embodiment, the glue-distributing assembly 40 and the coupling roll 13 could be associated with the lower steel embossing roll.

[0026] Furthermore, the embossing on the steel rolls could be different from what has been described.

[0027] The embossing and lamination assembly 10 comprises heating means 50 associated with the upper steel embossing roll 21 and/or the lower steel embossing roll 31.

[0028] The heating means 50 of the steel rolls 21, 31 are configured to bring the surface of the steel roll wrapped by the paper plies 11A and 11B at a temperature between about 90°C and 200°C.

[0029] The heating means 50 can be selected from those known, both housed inside the steel roll to heat the side surface of the steel roll by conduction from the inside and housed outside the roll and facing the side surface of the steel roll to be heated by radiation and/or convection.

[0030] For example, the heating means 50 can comprise an electric resistance suitably embedded in the steel roll, or an oil, water, or steam heating circuit, also at least partially formed inside the steel roll itself, as well as an induction heating assembly facing externally to the steel roll.

[0031] For exemplary purposes only, the heating means 50 have been schematically shown in the figures by way of example through the symbol of a resistance placed on the upper 21 and lower 31 steel embossing rolls.

[0032] According to a first simplified embodiment of the embossing and lamination assembly with heated rolls, it is sufficient to place the heating means 50 only associated with the lower steel embossing roll 31. This solution is advantageously constructively simpler, as the lower steel roll 31 is generally only coupled with the related lower rubber roll 32 and is therefore easier to equip with the heating means 50 in terms of both dimensions and thermal interaction with other components of the machine.

[0033] A further solution, shown in the figures, provides that both steel embossing rolls are equipped with heating means 50 or possibly that the heating means 50 are associated only with the upper steel embossing roll 21.

[0034] In the embossing and lamination assembly 10, the upper and/or lower rubber embossing counter rolls 22, 32, are mounted on a mobile arm 24, 34 when the related steel roll 21, 31, coupled with them, is equipped with heating means 50. In case of a machine stop, it is advantageous to move the rubber embossing counter roll 22, 32 away from the heated steel embossing roll 21, 31, to avoid damaging the rubber surface due to the high temperature (as schematically shown in Figure 2A).

[0035] Furthermore, the glue-distributing assembly 40 is preferably mounted on a slide 43 provided with a linear excursion of at least 50-100 mm, to allow the glue-distributing assembly 40 to move away from the hot upper steel embossing roll 21 in case of a machine stop, by a

greater extent than generally occurs in known embossing and lamination assemblies, equal to about 10 mm (as schematically shown in Figure 3).

[0036] The coupling roll 13, which in known embossing and lamination assemblies is generally mounted on a mobile arm 13' and provided with an excursion away from the upper steel embossing roll 21 of about 10 mm, can also advantageously be provided with a greater excursion away, equal to at least 100 mm (as schematically shown in Figure 4).

[0037] According to the invention, the upper 22 and/or lower 32 rubber embossing counter rolls are each provided with an auxiliary motorization 15, selectively activable and deactivable, so as to place the upper 22 and/or lower 32 rubber embossing counter rolls in rotation when the embossing and lamination assembly proceeds in pulse driving mode.

[0038] Figures 2A and 2B show the example of an auxiliary motorization 15 for the upper rubber embossing counter roll 22 acting through belt transmission 115 when the upper rubber embossing counter roll 22 is detached from the upper steel embossing roll 21. Similarly, the lower rubber embossing counter roll 32, when facing the heated lower steel embossing roll 31, is also provided with the independent auxiliary motorization 15, acting through belt transmission 115.

[0039] The belt transmission 115 provides the interposition of a motorized axis 15' between the auxiliary motorization 15 and the rubber embossing counter roll 22, 32.

[0040] Arranging an auxiliary motorization 15 for the upper 22 and/or lower 32 rubber embossing counter rolls, when facing the upper 21 and/or lower 31 heated steel embossing roll, advantageously allows for a paper passage wrapping the rubber embossing counter roll 22, 32 even at an angle also greater than 90°, as shown in Figure 1B. This path of the paper plies 11A and 11B advantageously makes the presence of additional return rolls to convey the paper ply tangentially through the contact zone of the pair of steel/rubber embossing rolls, the so-called nip, unnecessary.

[0041] Indeed, in the case where the embossing and lamination assembly proceeds at jog mode, the so-called "jog mode,", that is a low-speed driving mode (generally 5 m/min) used for example for paper passage or operator intervention in case of process problems (generally at an even lower speed, such as 1 m/min), according to the invention, the upper 22 and/or lower 32 rubber embossing counter roll is opened and simultaneously put in rotation together with the machine by the auxiliary motorization 15, which serves only in the case of jog mode and is disengageable with the machine at driving mode. Once the machine is placed at driving mode, the upper 22 and/or lower 32 rubber embossing counter roll closes and idly rotates dragged by the upper 21 and/or lower 31 steel embossing roll.

[0042] In the condition of the upper 22 and/or lower 32 rubber embossing counter roll being detached from the upper 21 and/or lower 31 steel embossing roll, if it was idle and wrapped by the paper at an angle greater than 90°, jog mode would not be possible because it would tend to break the paper ply.

[0043] Jog mode is typically used in a converting line to carry out the paper passage by means of the appropriate belt, or in the case where the paper is already present on the machine for control purposes, removal of defective paper portions, or other by the operator.

[0044] Jog mode is commanded by the operator exclusively from inside the machine crankcase, particularly from the control panel near the access, according to specific safety protocols, which also provide a warning siren.

[0045] According to the safety regulations of converting machinery, the jog mode carries out the movement of all motorized rolls of the line at a speed of 5 m/min; particularly dangerous points require a jog mode driving speed reduced to 1 m/min.

[0046] The embossing and lamination assembly 10 preferably further comprises independent motorizations also for the upper 21 and/or lower 31 steel embossing roll, or for the pair consisting of the upper 21 and lower 31 steel embossing rolls, and/or for the glue applicator roll 41, and/or for the anilox roll 42 and/or for the coupling roll 13.

[0047] Figure 5 shows independent motorizations 16 respectively for the upper 21 and lower 31 steel embossing roll acting through respective belts 116; an independent motorization 17 for the glue applicator roll 41 and an independent motorization 18 for the anilox roll 42, both in direct drive, as well as an independent motorization 19 for the coupling roll 13, schematized through a motorized axis preferably driven by belt transmission, not shown.

[0048] The independent motorization 17 for the glue applicator roll 41 and the independent motorization 18 for the anilox roll 42 advantageously allow the rolls to be placed in rotation when the machine is stopped, alternatively or additionally to spacing them from the upper 21 and/or lower 31 steel embossing roll.

[0049] The embossing and lamination method according to the invention, actuated on an embossing and lamination assembly with heated rolls 10, described above, preferably provides that when the embossing and lamination assembly is stopped:

- the upper 22 and/or lower 32 rubber embossing counter rolls are detached from the upper 21 and/or lower 31 steel embossing roll and are stopped;
- the anilox roll 42 and the glue applicator roll 41 are detached from the upper steel embossing roll 21, preferably by at least 50-100 mm, and detached from each other;
- the coupling roll 13 is detached from the upper steel embossing roll 21, preferably by at least 100 mm.

[0050] When the embossing and lamination assembly is stopped, it is also optionally possible, through the

related independent motorizations 18, 17, to place the anilox roll 42 in rotation to remain wet by the glue and to place the glue applicator roll 41 in slow rotation, for example equal to 1 m/min, through its own independent motorization 19.

[0051] According to the invention, the operation of the embossing and lamination assembly with heated rolls preferably provides that when the embossing and lamination assembly proceeds at jog mode:

- the upper 22 and/or lower 32 rubber embossing counter rolls are detached from the upper 21 and/or lower 31 steel embossing roll and are placed in rotation at jog mode driving speed, for example, equal to 1 m/min or 5 m/min, through their own independent motorizations 15;
- the anilox roll 42 and the glue applicator roll 41 are detached from the upper steel embossing roll 21 and from each other;
- the coupling roll 13 is detached from the upper steel embossing roll 21.

[0052] Advantageously, when the embossing and lamination assembly proceeds at jog mode, the anilox roll 42 is placed in rotation to remain wet by the glue, and the glue applicator roll 41 is placed in slow rotation, for example equal to 1 m/min, in which the anilox roll 42 and the glue applicator roll 41 are each placed in rotation through their own independent motorizations 18, 17.

[0053] Furthermore, advantageously, the coupling roll 13 is placed in slow rotation, for example equal to 1 m/min, through its own independent motorization 19.

[0054] When the embossing and lamination assembly proceeds at driving e mode:

- the upper 22 and/or lower 32 rubber embossing counter rolls are placed under pressure on the upper 21 and/or lower 31 steel embossing roll and dragged in idle rotation by it;
- the anilox roll 42 is placed in contact with the glue applicator roll 41, the glue applicator roll 41 is placed in contact with the upper steel embossing roll 21, the anilox roll 42 and the glue applicator roll 41 are placed in rotation at the operating speed through their own independent motorizations 18, 17;
- the coupling roll 13 is placed under pressure on the upper steel embossing roll 21 and placed in rotation at the operating speed through its own independent motorization 19.

[0055] The embossing and lamination method in an embossing and lamination assembly with heated rolls object of the present invention has the advantage of being capable of advancing the paper plies during the jog mode with the embossing counter rolls open without causing the paper ply to break.

[0056] The embossing and lamination method in an embossing and lamination assembly with heated rolls object of the present invention further has the advantage of protecting against heat during a machine stop and a pulse driving, in particular the rubber embossing counter rolls, as well as the remaining components cooperating with the upper and/or lower heated steel embossing rolls.

Claims

1. Embossing and lamination method actuated on an embossing and lamination assembly with heated rolls comprising two pairs of steel/rubber rolls between which, respectively, a first paper ply (11A) and a second paper ply (11B) are fed, in which an upper steel embossing roll (21) is coupled with an upper rubber embossing counter roll (22) and a lower steel embossing roll (31) is coupled with a lower rubber embossing counter roll (32), as well as comprising a glue-distributing assembly (40), equipped with an anilox roll (42) and a glue applicator roll (41), placed in contact on one side of said upper steel embossing roll (21), and a coupling roll (13), placed in contact on the opposite side of said upper steel embossing roll (21), comprising heating means (50) associated with at least one of said upper steel embossing roll (21) and said lower steel embossing roll (31), in which the upper (22) and/or lower (32) rubber embossing counter roll is provided with an auxiliary motorization (15), selectively activable and deactivable, **characterized in that** when the embossing and lamination assembly proceeds in jog mode, the auxiliary motorization (15) of the upper and/or lower rubber embossing counter roll (22, 32), which is placed in rotation and detached from the upper and/or lower steel embossing roll (21, 31), is activated.

2. Method according to claim 1, **characterized in that** when the embossing and lamination assembly proceeds at jog mode:

   - the upper (22) and/or lower (32) rubber embossing counter roll is detached from the upper (21) and/or lower (31) steel embossing roll and is placed in rotation at pulse driving speed;
   - the anilox roll (42) and the glue applicator roll (41) are detached from the upper steel embossing roll (21) and from each other;
   - the coupling roll (13) is detached from the upper steel embossing roll (21).

3. Method according to claim 2, **characterized in that** when the embossing and lamination assembly proceeds at jog mode:

   - the anilox roll (42) is placed in rotation to remain wet by the glue and the glue applicator roll (41) is placed in slow rotation.

4. Method according to any one of claims 2 or 3, **characterized in that** when the embossing and lamination assembly proceeds at jog mode:

    - the coupling roll (13) is placed in slow rotation.

5. Embossing and lamination method actuated on an embossing and lamination assembly with heated rolls comprising two pairs of steel/rubber rolls between which, respectively, a first paper ply (11A) and a second paper ply (11B) are fed, in which an upper steel embossing roll (21) is coupled with an upper rubber embossing counter roll (22) and a lower steel embossing roll (31) is coupled with a lower rubber embossing counter roll (32), as well as comprising a glue-distributing assembly (40), equipped with an anilox roll (42) and a glue applicator roll (41), placed in contact on one side of said upper steel embossing roll (21), and a coupling roll (13), placed in contact on the opposite side of said upper steel embossing roll (21), comprising heating means (50) associated with at least one of said upper steel embossing roll (21) and said lower steel embossing roll (31), in which the upper (22) and/or lower (32) rubber embossing counter roll is provided with an auxiliary motorization (15), selectively activable and deactivable, **characterized in that** when the embossing and lamination assembly is stopped:

    - the upper (22) and/or lower (32) rubber embossing counter roll is detached from the upper (21) and/or lower (31) steel embossing roll and is stopped;
    - the anilox roll (42) and the glue applicator roll (41) are detached from the upper steel embossing roll (21), preferably by at least 50-100 mm, and detached from each other;
    - the coupling roll (13) is detached from the upper steel embossing roll (21), preferably by at least 100 mm.

6. Method according to claim 5, **characterized in that** when the embossing and lamination assembly is stopped, the anilox roll (42) is placed in rotation to remain wet by the glue and the glue applicator roll (41) is placed in slow rotation.

7. Method according to any one of claims 5 or 6, **characterized in that** when the embossing and lamination assembly is stopped, the coupling roll (13) is placed in slow rotation.

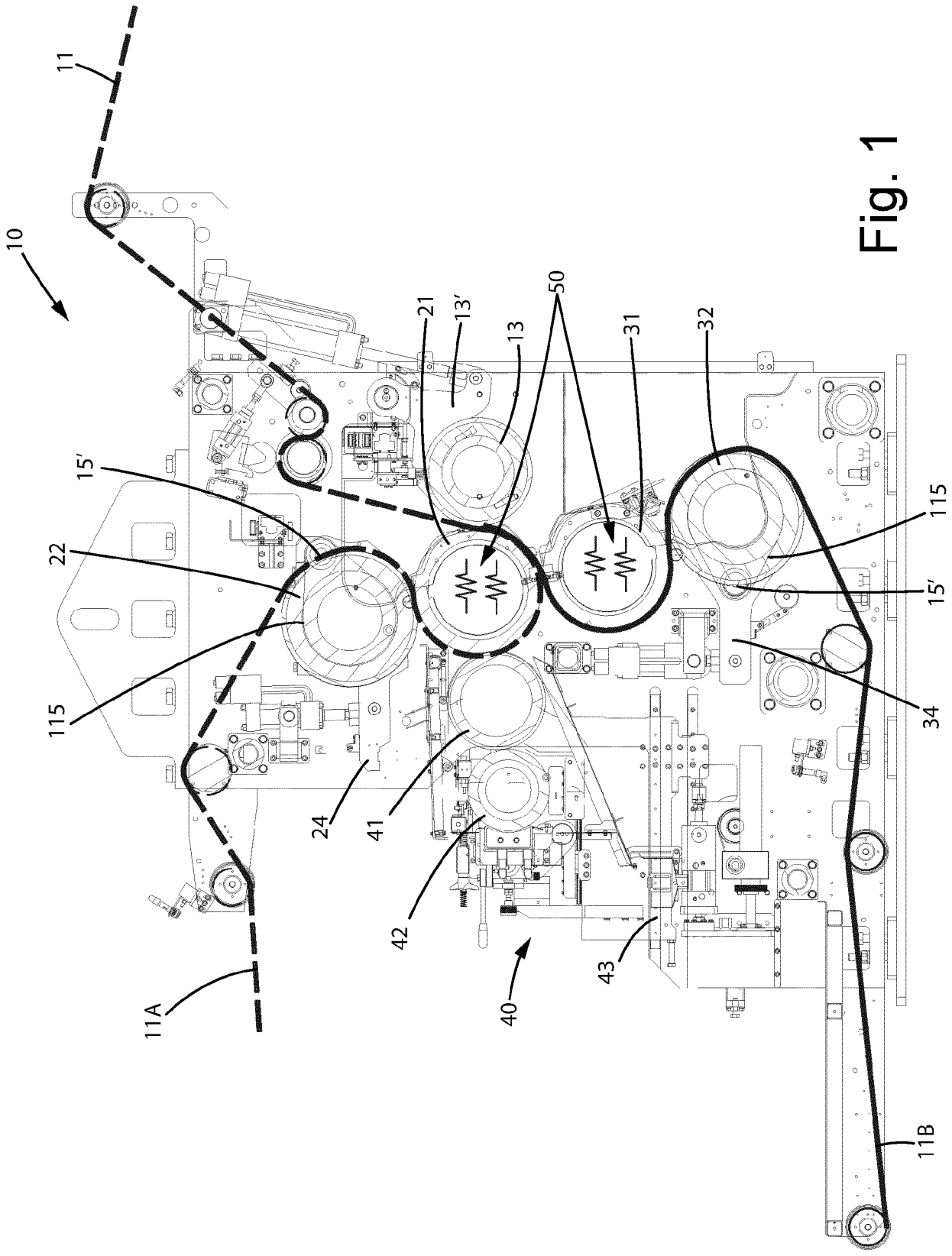

Fig. 1

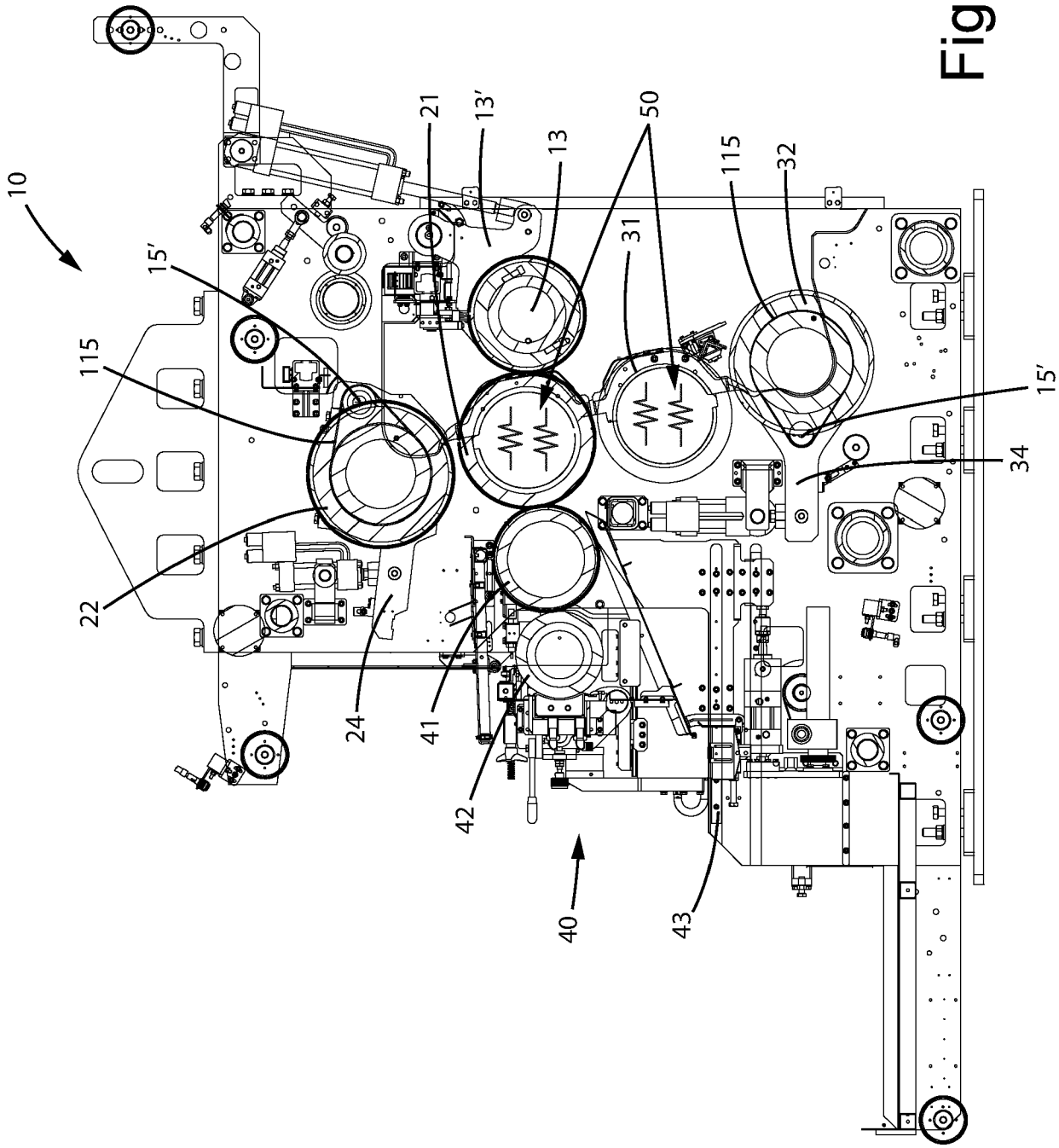

Fig. 2A

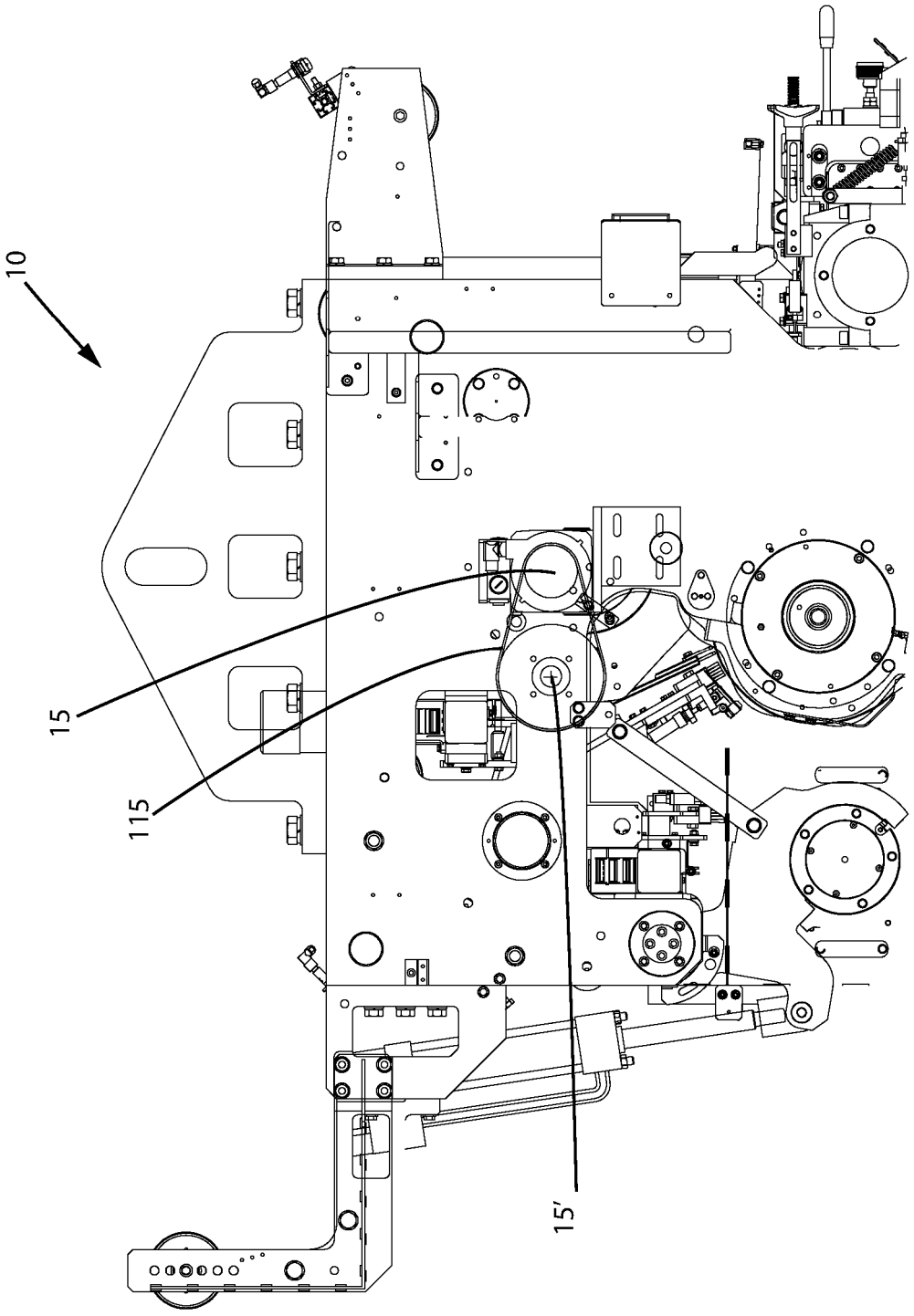

Fig. 2B

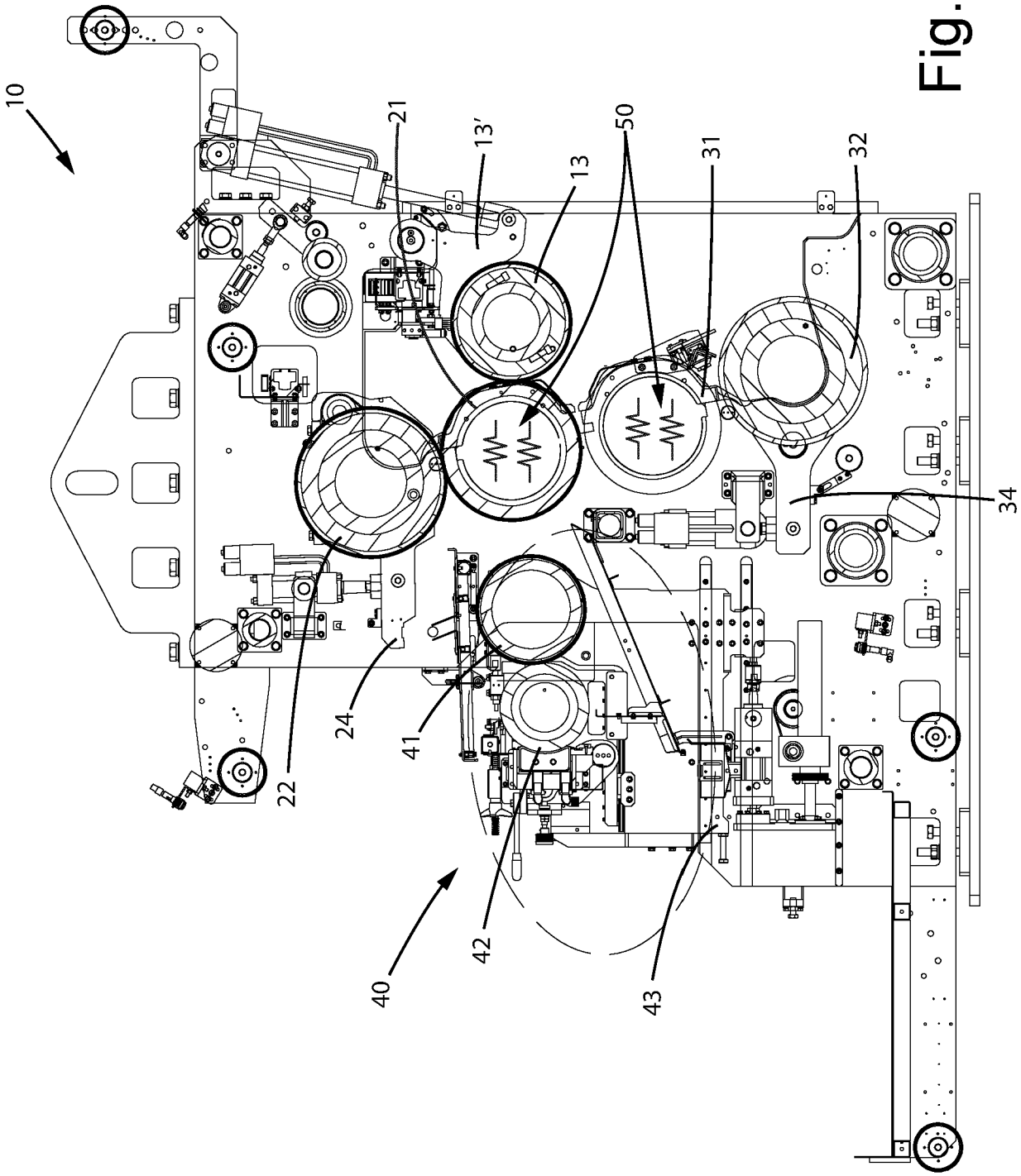

Fig. 3

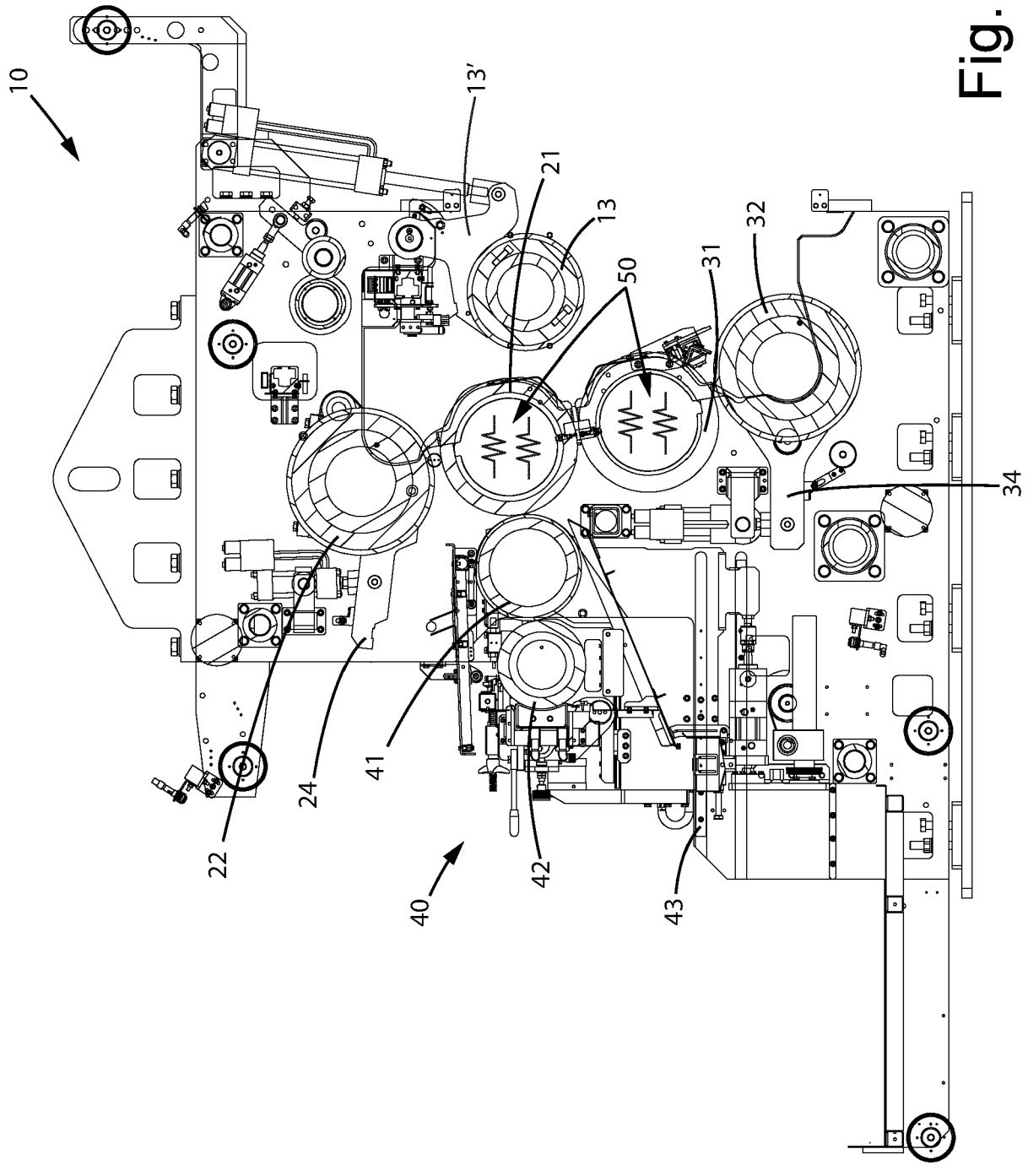

Fig. 4

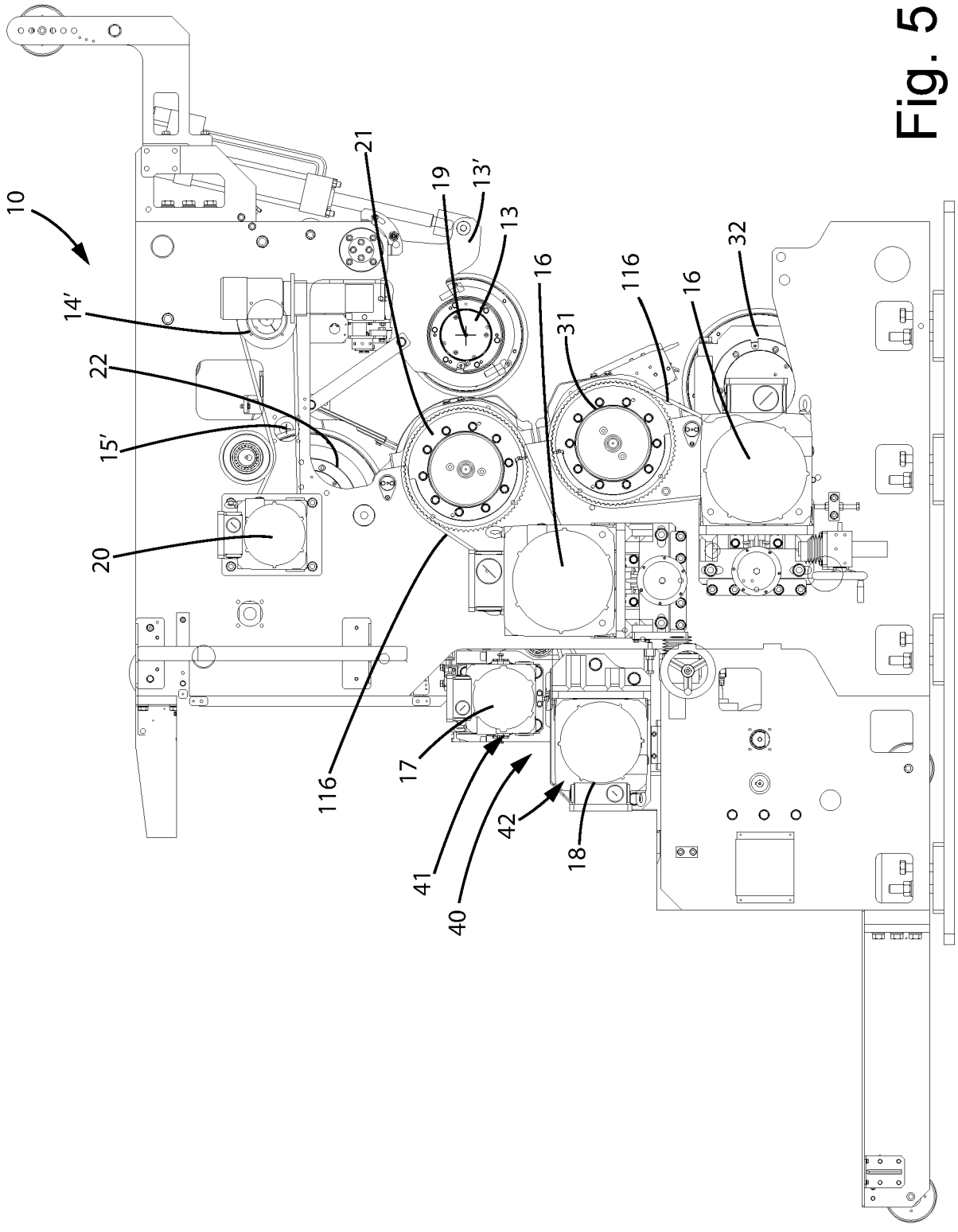

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 24 19 1690

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2023/280722 A1 (KOERBER TISSUE S P A [IT]) 12 January 2023 (2023-01-12) * paragraphs [0001], [0010], [0030], [0042] - [0047], [0055] - [0058], [0068], [0098] - [0105], [0112], [0118] - [0119] * * paragraphs [0125] - [0130], [0138] - [1456159] * * figures 1, 2 *	1-7	INV. B31F1/07 B31F1/36
A	WO 2009/010999 A1 (FUTURA SPA [IT]; PERINI FABIO [IT]) 22 January 2009 (2009-01-22) * page 9, line 28 - page 10, line 20 * * figure 3 *	1-7	
A	WO 2023/001852 A1 (KOERBER TISSUE S P A [IT]) 26 January 2023 (2023-01-26) * paragraphs [0042] - [0043] * * figures 1-4 *	1-7	
A	US 2010/000687 A1 (GELLI MAURO [IT] ET AL) 7 January 2010 (2010-01-07) * figures 2-4 *	1-7	TECHNICAL FIELDS SEARCHED (IPC) B31F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 January 2025	Zeiler, Johannes

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 19 1690

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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08-01-2025

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