



EUROPEAN PATENT APPLICATION

(43) Date of publication:
24.01.2024 Bulletin 2024/04

(21) Application number: **23185485.2**

(22) Date of filing: **14.07.2023**

(51) International Patent Classification (IPC):
B26D 1/08 (2006.01) **B26D 1/56** (2006.01)
B26D 7/08 (2006.01) **B26D 3/16** (2006.01)

(52) Cooperative Patent Classification (CPC):
B26D 1/08; B26D 1/56; B26D 3/16; B26D 5/20;
B26D 7/08; B26D 7/088; B65B 11/008;
B65B 61/06; B26D 2007/013

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **20.07.2022 IT 202200015222**

(71) Applicant: **Area S.r.l.**
20017 Rho (IT)

(72) Inventor: **CORBERI, Davide**
20017 Rho Mi (IT)

(74) Representative: **Faggioni, Carlo Maria et al**
Fumero S.r.l.
Pettenkoferstrasse 20/22
80336 München (DE)

(54) **PAPER CUTTING UNIT COMPRISING WETTING ASSEMBLY AND RELATIVE CONTINUOUS PACKAGING SYSTEM**

(57) A continuous wrapping system and a respective cutting unit are disclosed, for cutting a paper-based wrapping web continuously wound onto a plurality of wrapped products (8) spaced apart one another by a separation gap (D) and running along a sliding axis (Y-Y), comprising a ground support frame (T) supporting a translation assembly (S),
a carriage (C) slidably mounted on said translation assembly (S), equipped with at least one roller conveyor assembly (R) for supporting said wrapped products (B),
and
a support frame (CT), integral in translation with said carriage (C), which defines a cutting plane,
further comprising
a wetting assembly (U) provided with nozzles (16) apt to spray a work liquid crosswise to said sliding axis (Y-Y), so as to define wetted areas at least on a perimeter annular band crosswise to said sliding axis (Y-Y) and in correspondence of said cutting plane.

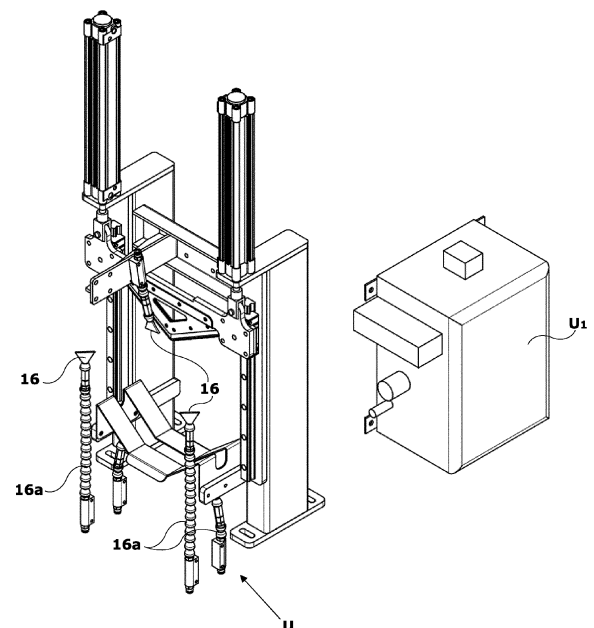


Fig. 4

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a paper-cutting unit to be used on continuous wrapping systems.

BACKGROUND ART

[0002] In the wrapping industry, banding machines are commonly used which wrap the packages to be wrapped with plastic or paper webs, for consolidation and protection purposes. The wrapping can be automatic or semi-automatic, by applying coils of web according to a vertical axis (normally by translating the wrapping reel along the wrapping axis) or according to a horizontal axis (usually by translating the package to be wrapped along the wrapping axis).

[0003] In the second case, each package to be wrapped is fed to the wrapping station along a conveyor belt or a roller conveyor, which horizontally cross a ring-shaped guide along which a carriage moves carrying the wrapping web reel.

[0004] The spiral pattern of the wrapping web (either made of paper or plastic film) is therefore obtained by combining the reel circular rotation about a horizontal axis with a translational movement of the package to be wrapped along the same horizontal axis.

[0005] Exemplary wrapping machines are disclosed in EP197574 and US4050220.

[0006] In some particular industrial applications, for example when wrapping metal bars, the package is wrapped with a paper-based web, such as poly-coated paper. Hereinafter, reference will be made by way of example to metal bar wrapping, but this is not the only product which could be usefully wrapped by means of the inventive solution here disclosed.

[0007] To simplify and speed up the process, the paper web-wrapping is typically conducted continuously on the bundles of metal bars as they enter the wrapping station, in sequence, spaced apart one another by small gaps.

[0008] According to the prior art, in order to be able to separate the wrapped packages from each other again, at the exit of the wrapping station the movement of the outgoing bundle of bars is made to accelerate along the conveyor belt, so as to increase the relative spacing with respect to the previous bundle of bars: the sudden spacing causes the spirally wound paper web to tear, resulting in the desired interruption of the wrapping between one package and another.

[0009] This separation method is economical, but yields an unpredictable tearing of the web, which therefore occurs at different positions, resulting in an aesthetically deplorable result and in the chance that the wrapping web unties and opens.

[0010] It would be desirable, instead, to have a system which yields a precise and repeatable tearing of the wrapping, so as not to give rise to any drawback.

[0011] It has been suggested the use of cutting blades that intervene between one package and another to separate the wrapping continuity. An example of such technology applied to plastic film wrapping is illustrated in WO2017/137360, wherein a cutting and sealing unit is provided, mounted movable along the transport line of bundles of bottles.

[0012] These systems, however, despite the complexity of their configuration - the cutting blade unit is mounted longitudinally movable to follow the wrapped product movement - are not particularly satisfactory for paper cutting, because the action of the guillotine blade fails to produce a clear-cut separation of the paper web, especially in the case of poly-coated paper.

[0013] Consequently, there is a need to provide a paper-cutting unit which overcomes the drawbacks of the prior art, which can therefore be applied to a continuous wrapping system with effective and repeatable operation, to achieve a clean and aesthetically acceptable cut.

SUMMARY OF THE INVENTION

[0014] The object of the invention is achieved by means of a unit and respective wrapping system having the main features described in the appended, independent claims.

[0015] Particular and advantageous features are described in the dependent claims.

[0016] In particular, according to a first aspect of the invention, a cutting unit is provided for cutting a paper-based wrapping web continuously wound onto a plurality of wrapped products, spaced apart one another by a separation gap and translating along a sliding axis, comprising

a ground support frame supporting a translation assembly,
a carriage slidably mounted on said translation assembly, equipped with at least one roller conveyor unit for supporting said wrapped products, and
a support framework, integral in translation with said carriage, which defines a cutting plane,
further comprising
a wetting assembly provided with nozzles apt to spray a work liquid crosswise to said sliding axis, so as to define wetted areas at least on a perimeter annular band crosswise said sliding axis and in correspondence with said cutting plane.

[0017] According to another aspect, the cutting unit further comprises a cutting assembly mounted on said framework, equipped with at least one movable guillotine blade in correspondence with said cutting plane.

[0018] Preferably, a presser assembly is furthermore provided, equipped with at least one series of rotating wheels apt to be pressure-pushed towards said sliding axis by means of a respective actuator.

[0019] According to a further aspect, said translation

assembly has first drive means apt to synchronize the direction and module of a first translation speed of said carriage with the direction and module of a second translation speed of said wrapped products along said sliding axis.

[0020] Preferably, said plurality of nozzles is adjustable in its orientation.

[0021] The plurality of nozzles is fed with work liquid by means of respective feeding lines which are in communication with a feeding box wherein at least a suitable tank of said work liquid and a corresponding supply pump are provided.

[0022] The work liquid can be water or, preferably, oil.

[0023] According to a different aspect, the invention provides a continuous wrapping system comprising

a horizontal axis wrapping machine, provided with ring-shaped driving means which drive in rotation a reel of a paper-based wrapping web, and a transport line, parallel to a sliding axis, which crosses said ring-shaped driving means, and further comprising a cutting unit as described above, arranged downstream of said ring-shaped driving means.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] Further features and advantages of the system according to the present invention will anyhow become more evident from the following detailed description of a preferred embodiment of the same, given by mere way of non-limiting example and illustrated in the attached drawings, wherein:

Fig. 1 is a perspective view of a cutting unit according to the invention;

Fig. 2 is a view similar to that of Fig. 1, wherein several components have been removed;

Fig. 3 is a perspective view of the roller conveyor assembly only used on the unit of Fig. 1;

Fig. 4 is a perspective view of the cutting assembly and the wetting assembly according to the invention;

Fig. 5 is a perspective view of the presser assembly only used on the unit of Fig. 1;

Figs. 6A, 6B are perspective views of the cutting assembly only used on the unit of Fig. 1, in the home position and in the lower end-stroke position, respectively;

Fig. 7A is a side elevation, partially sectional view of the unit of Fig. 1, in an operational phase with the cutting assembly in a rest phase; and

Fig. 7B is a detail, perspective, partly broken away view of the unit of Fig. 7A, with the cutting assembly in a lower end-stroke phase.

DESCRIPTION OF A PREFERRED EMBODIMENT

[0025] Fig. 1 shows a cutting unit arranged along a

horizontal sliding axis Y-Y of a transport line which transfers wrapped products coming from a continuous horizontal wrapping machine (not shown). The cutting unit is located downstream of the wrapping machine.

[0026] The processed products - for example bundles of metal bars B (schematically illustrated only in Figs. 7A and 7B) - are continuously wrapped with a paper web, spirally wound according to a horizontal axis, and proceed in sequence according to the axis Y-Y, along a longitudinal conveyor, spaced apart one another by a small gap D.

[0027] The cutting unit has a ground support frame T supporting a translation assembly S on which a sliding carriage C equipped in turn with a frame CT and a roller conveyor assembly R is slidably mounted.

[0028] On the frame CT, slidably mounted along the axis Y-Y by means of the sliding carriage C, a cutting assembly L and, optionally, a presser assembly P are installed.

[0029] According to the invention, a wetting assembly U is furthermore provided in the proximity of the cutting assembly, the function of which will be explained below.

[0030] Fig. 2 shows in detail an exemplary translation assembly S, mounted above the support frame T.

[0031] In the illustrated case, the assembly S has a pair of parallel guides 1 arranged to support respective drive belts 2, closed in a loop around terminal guide rollers 3a and 3b. The drive belts 2 are synchronized and driven in reciprocating motion by means of a suitable first drive M₁. Dragging plates 4 are fixed to the drive belts 2, plates to which the sliding carriage C is constrained.

[0032] A roller conveyor assembly R is installed on the sliding carriage C, comprising at least one pair of sliding rollers 5a and 5b, driven in rotation by a respective second drive M₂ and synchronized with each other, for example, by means of a synchronization belt 6. The sliding rollers 5a, 5b are arranged to receive the wrapped products, such as the bundles of metal bars B, and to guide them longitudinally along an axis parallel to the sliding axis Y-Y.

[0033] The frame CT supporting the cutting assembly L is also mounted on the sliding carriage C.

[0034] Figs. 6A and 6B show in detail the cutting assembly L in two respective operating phases. The frame CT has a pair of uprights 7a and 7b arranged opposite each other on the two sides of the sliding axis Y-Y, so as not to interfere with the wrapped products arriving on the roller conveyor assembly R. A stiffening crosspiece 8 is optionally provided in the upper part of the frame CT, rigidly connecting the two uprights 7a and 7b.

[0035] The cutting assembly L essentially consists of one movable guillotine blade 9 mounted sliding along a vertical axis, and controlled in its movement by one, preferably two, actuators 10. To better guide the vertical movement of the blade 9, two rectilinear vertical guides 11a and 11b, fixed to the respective two uprights 7a, 7b of the frame CT, are provided, with which slide elements 12a and 12b integral with the blade 9 engage. Two ac-

tuators 10 are acting in correspondence of the two slide elements 12a and 12b, respectively.

[0036] In the lower part of the frame CT a jig 13 is preferably provided, equipped with a transversal slit 13a in which the blade 9 engages in the final phase of its cutting stroke. The jig 13 is arranged below a sliding plane of the roller conveyor assembly R whereon the wrapped products are running.

[0037] During operation of the cutting assembly L, the cutting blade 9 goes from a raised home position (Fig. 6A) to a lower end-stroke position (Fig. 6B), by the intervention of the actuators 10, sliding along a substantially vertical cutting plane which intercepts the wrapped products lying on the roller conveyor assembly R. In correspondence of its lower end-stroke (Fig. 6B), the blade 9 engages with the jig 13, to optimize the cutting effect on the material it interacts with, i.e., typically, the paper-based wrapping web to be cut.

[0038] It should be noted that the cutting assembly L, mounted on the frame CT, can also be longitudinally translated along the sliding axis Y-Y, as it is integral with the plates 4 of the translation assembly S.

[0039] Preferably, a presser assembly P arranged above the blade 9 is also provided on the frame CT. The presser assembly P, illustrated in detail in Fig. 5, is equipped with at least one series of pressure wheels 14 mounted at the bottom end of an actuator 15. The wheels 14 are mounted free to rotate about respective rotational axes 14a orthogonal to the sliding axis Y-Y. The pressure wheels 14 can be lowered and raised by means of the actuator 15, so as to be brought into contact with, or lifted off, the wrapped product arriving under the frame CT, for the function which will be illustrated below.

[0040] Preferably, at least two series of wheels 14 are provided, one placed in front, and the other behind, the cutting plane where the cutting assembly L is installed (as clearly depicted in Figs. 7A and 7B).

[0041] According to a peculiar feature of the invention, a wetting assembly U (Fig. 4) is arranged in the proximity of the cutting plane of the cutting assembly L, consisting of a plurality of nozzles 16, preferably adjustable in their orientation, supplied with a work liquid.

[0042] The nozzles 16 can be of various types, apt to spray a work liquid jet, but they are preferably flat nozzles (as shown in the Figure) for delivering a flat liquid jet which opens like a fan. The nozzles 16 can be more or less numerous, but ideally there are provided at least one upper and two lower nozzles, and preferably two additional lateral ones, at a certain height from the sliding plane.

[0043] The nozzles 16 are fed with work liquid by means of respective feeding pipes 16a which are in communication with a feeding box Ui, wherein at least one suitable work liquid tank and a respective supply pump are provided (not shown).

[0044] The work liquid can be any liquid suitable for wetting the material of which the wrapping web is made. For example, in the case of a poly-coated paper web, the

liquid can be water or, preferably, oil (more convenient if the wrapped product is bundles of metal bars, which would undergo oxidation if they were wetted with water).

[0045] The nozzles 16 of the wetting assembly U are arranged and designed to define a series of work liquid jets which wet the wrapping material on a narrow perimeter annular band, in correspondence of the cutting plane. In other words, the nozzles 16 spray the work liquid crosswise to the sliding axis Y-Y, so as to define wetted areas on a perimeter annular band around said sliding axis Y-Y.

[0046] The wetted areas can cover the entire cross perimeter of the wrapping material or only some significant parts, depending on the number and nature of the nozzles 16.

[0047] The Applicant has in fact found that a narrow, wetted band of paper-based wrapping material drastically reduces the toughness of the material even in the case of poly-coated paper; the material can thus be cut by the blade 9 in correspondence of such band, with precision and no uncertainty.

[0048] At this point, all the component elements of the system according to the invention having been described, its operation can be understood.

[0049] The wrapped products, for example bundles of metal bars B (Fig. 7A) wrapped in a poly-coated paper web, approaches the cutting unit, downstream of the wrapping machine. The wrapped products are spaced apart one another by a small separation gap D. The continuously aligned products move along the sliding axis Y-Y and lay on the roller conveyor unit R, and on additional rollers Ra located in fixed positions.

[0050] When the separation gap D area between the products comes close to the cutting plane, the translation assembly S is activated to move the carriage C - on which the frame CT with the roller conveyor assembly R and the presser assembly P are integral in translation - in the same forward direction as the products B. Meanwhile, the presser assembly P, if provided, is lowered until bringing the wheels 14 into contact with the wrapped product, thus exerting a certain pressure to tighten and stabilize the product between the upper wheels 14 of the presser assembly P and the lower wheels 5a, 5b.

[0051] To synchronize the speed of products B with that of carriage C, a series of proximity sensors is provided which identifies the position of bar B, while an encoder is arranged on the translation assembly S, which allows to keep the correct position control. As can be understood by a person skilled in the art, this is not the only way to synchronize the two movements.

[0052] Once the forward speed of carriage C is synchronized with that of products B, the cutting plane of the cutting unit is static with respect to the separation gap D. The wrapping material is then wetted by the wetting assembly U, followed by the descent of the blade 9 of the cutting assembly L, in this sequence.

[0053] With the intervention of the nozzles 16 of the wetting assembly U, a narrow annular band of wetted

wrapping paper is created, in correspondence of the cutting plane, which can be cut precisely and without irregular tearing by the cutting blade 9 moving from the upper position (Fig. 7A) of its stroke to the lower one (Fig. 7B).

[0054] When the cut is complete, the blade 9 is brought back to the upper, home position of its stroke, then the carriage C is stopped and brought back to the beginning of its longitudinal stroke (in Fig. 7A, from right to left), in order to be able to start a new cutting cycle.

[0055] As can be understood from the above description, the cutting unit of the invention within its respective wrapping system perfectly achieves the objects set out in the introduction.

[0056] In fact, adding the wetting assembly it is possible to produce a narrow, less tough band of wrapping material, which can thus be easily cut by the cutting assembly without inconvenience. Besides, it is not excluded that the wrapping tearing may take place with the necessary precision and reliability, along a virtual cutting plane, even without the use of a cutting blade, but simply causing a mutual distancing of the wrapped products along the transport line (i.e. mechanical widening of the separation gap D), which results in a clear separation of the wrapping on the cutting plane: it depends on the thickness and nature of the wrapping web.

[0057] However, it is understood that the invention should not be considered as limited to the here described and illustrated specific embodiment, but that various variants are possible all within the reach of a person skilled in the art, without thereby departing from the scope of protection of the invention itself, which is only defined by the appended claims.

[0058] For example, although the nozzles 16 are shown mounted at the end of fixed, albeit adjustable, ducts, it is not excluded that they may be mounted on a carriage movable along a limited stroke, for example according to an arc of a circle, on a plane crosswise to the sliding axis Y-Y, so as to create a wetted narrow annular band with a mutual displacement between nozzles and paper web.

[0059] Finally, it is understood that the cutting guillotine blade 9 can also be moved according to other directions crosswise to the axis Y-Y, such as the horizontal direction.

Claims

1. Cutting unit for cutting a wrapping web continuously wound onto a plurality of wrapped products (B), arranged spaced apart one another by a separation gap (D) and running along a sliding axis (Y-Y), comprising

a ground support frame (T) supporting a translation assembly (S),
a carriage (C) slidably mounted on said translation assembly (S), equipped with at least one

roller conveyor assembly (R) for supporting said wrapped products (B), and

a support frame (CT), integral in translation with said carriage (C), which defines a cutting plane, **characterized in that** it furthermore comprises a wetting assembly (U) provided with nozzles (16) apt to spray a work liquid crosswise to said sliding axis (Y-Y), so as to define wetted areas at least on a perimeter annular band crosswise to said sliding axis (Y-Y) and in correspondence of said cutting plane.

2. Cutting unit as in claim 1, wherein a cutting assembly (L) mounted on said support frame (CT) is furthermore provided, equipped with at least one movable guillotine blade (9) in correspondence of said cutting plane.
3. Cutting unit as in claim 1 or 2, wherein a presser assembly (P) is furthermore provided, equipped with at least one series of rotating wheels (14) apt to be pressure-pushed towards said sliding axis (Y-Y) by means of a respective actuator (15).
4. Cutting unit as in claim 1, 2 or 3, wherein said translation assembly (S) has first drive means (M_1) apt to synchronize the direction and module of a first translation speed of said carriage (C) with the direction and module of a second translation speed of said wrapped products (B) along said sliding axis (Y-Y).
5. Cutting unit as in any one of the preceding claims, wherein said plurality of nozzles (16) is adjustable in their orientation.
6. Cutting unit as in any one of the preceding claims, wherein said plurality of nozzles (16) is fed with work liquid by means of respective feeding pipes (16a) which are in communication with a feeding box (U1) wherein at least one suitable tank of said work liquid and a corresponding supply pump are provided.
7. Cutting unit as in any one of the preceding claims, wherein said work liquid is water or, preferably, oil.
8. Continuous wrapping system comprising

a horizontal axis wrapping machine, provided with ring-shaped driving means which drive in rotation a reel of a paper-based wrapping web, and

a transport line, parallel to a sliding axis (Y-Y), which crosses said ring-shaped driving means, **characterized in that** it furthermore comprises a cutting unit as in any one of the preceding claims arranged downstream of said ring-shaped driving means.

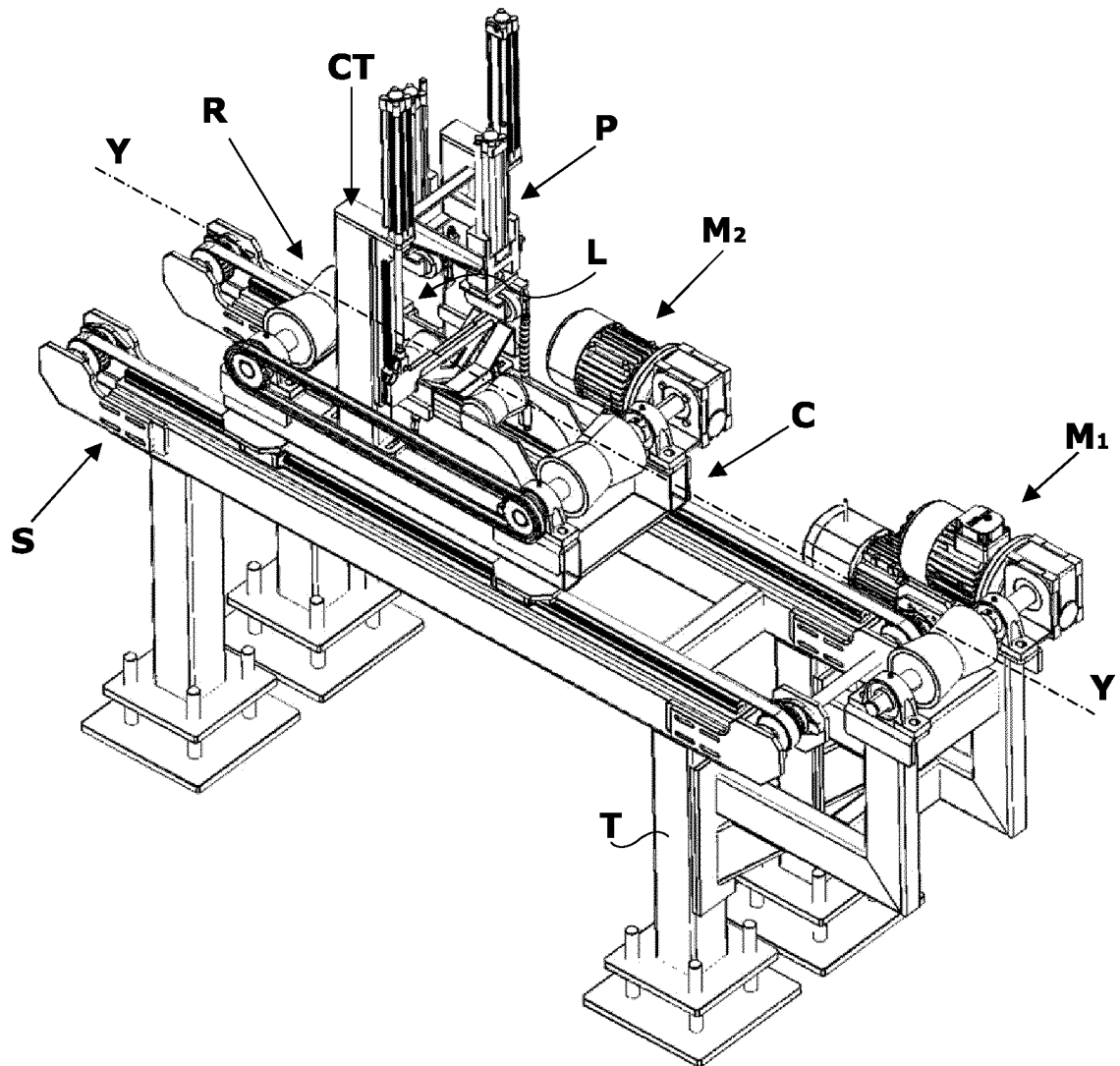


Fig. 1

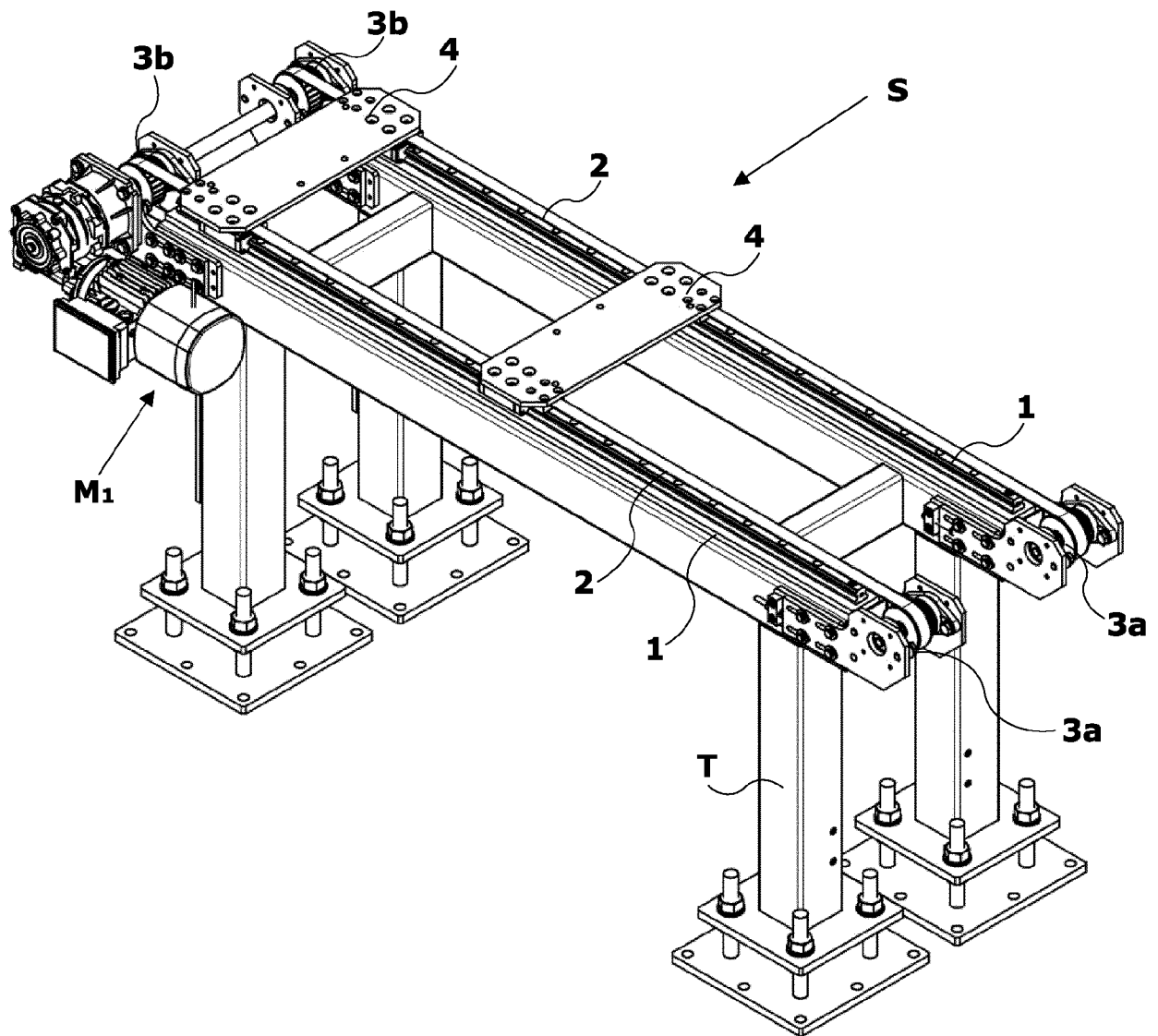


Fig. 2

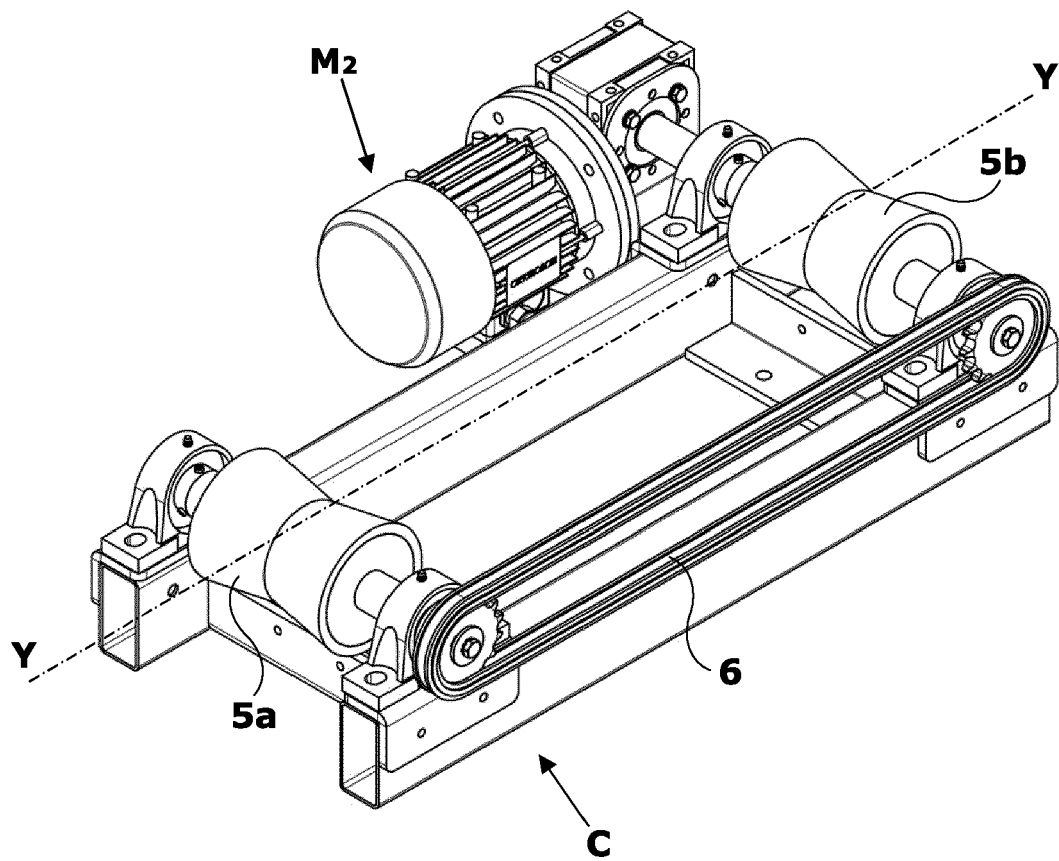


Fig. 3

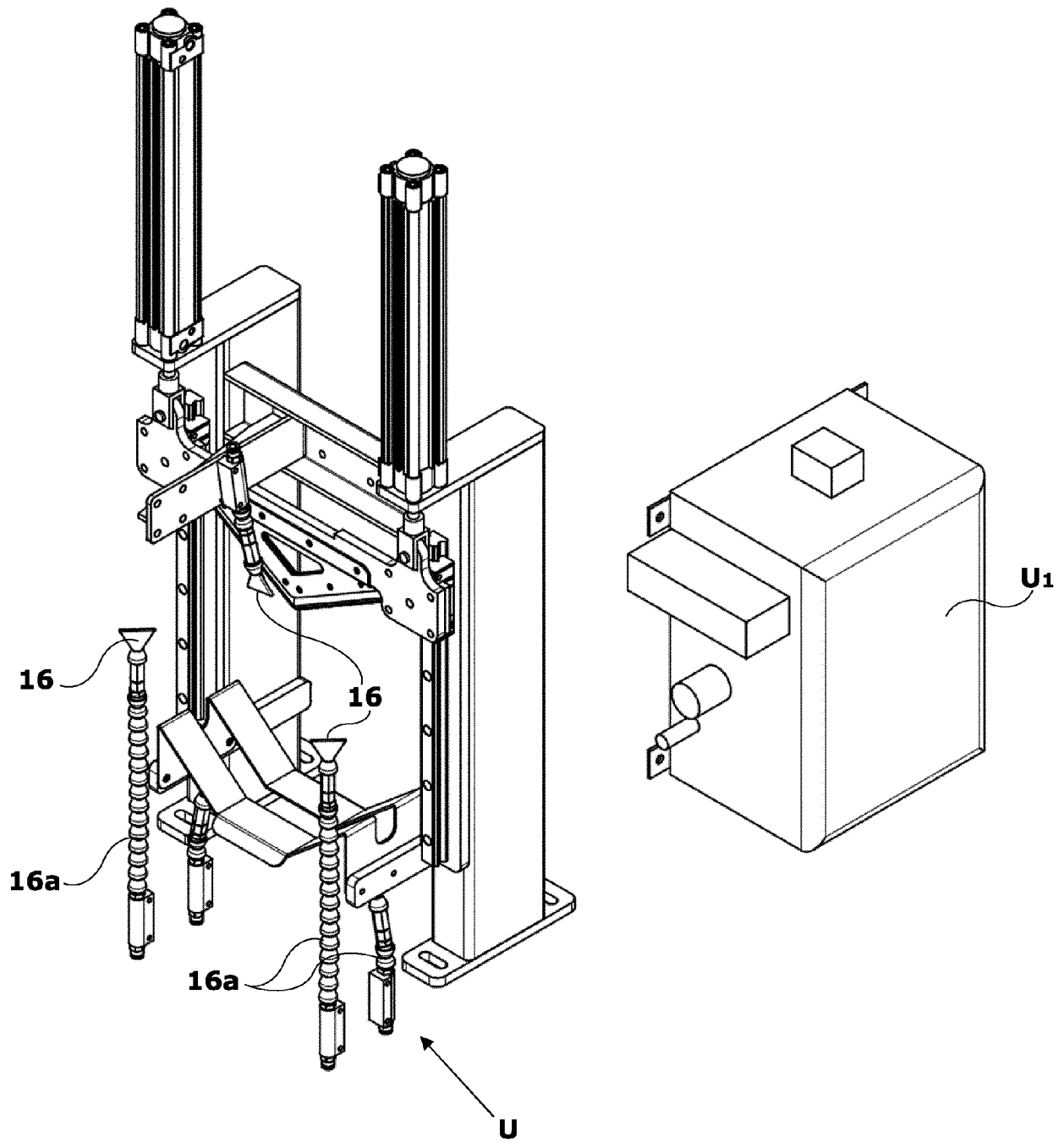


Fig. 4

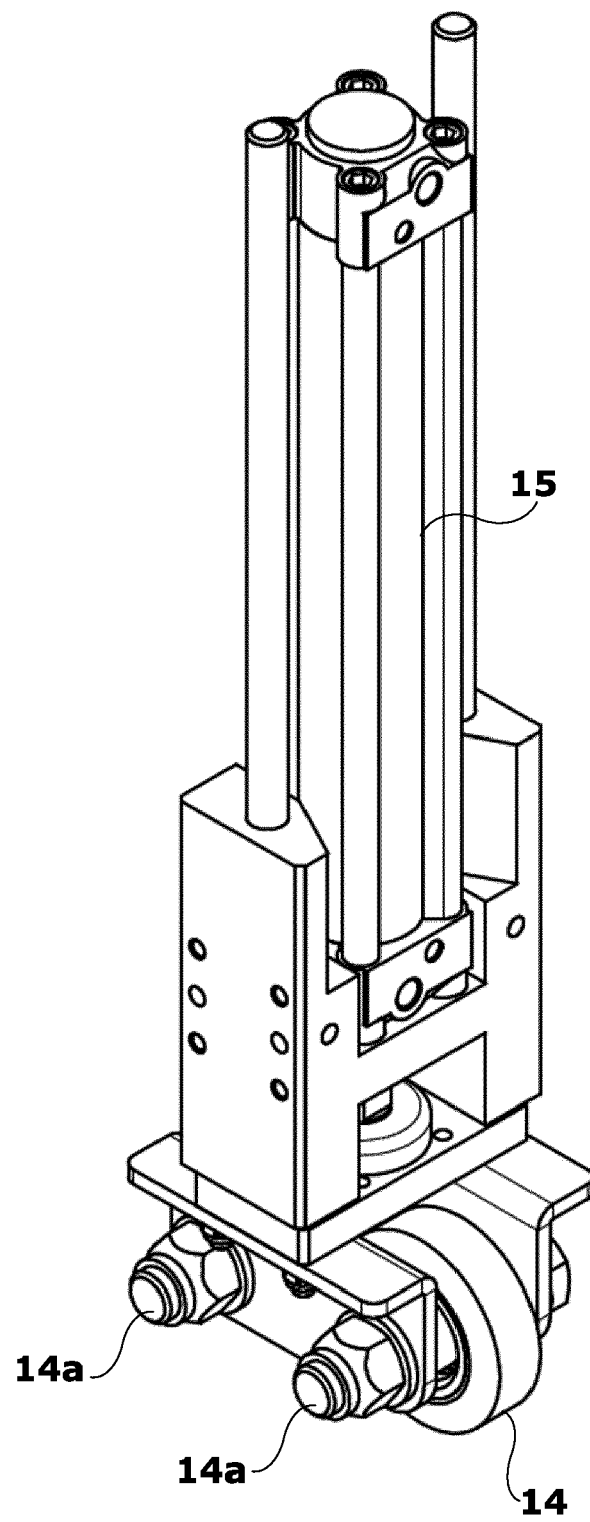


Fig. 5

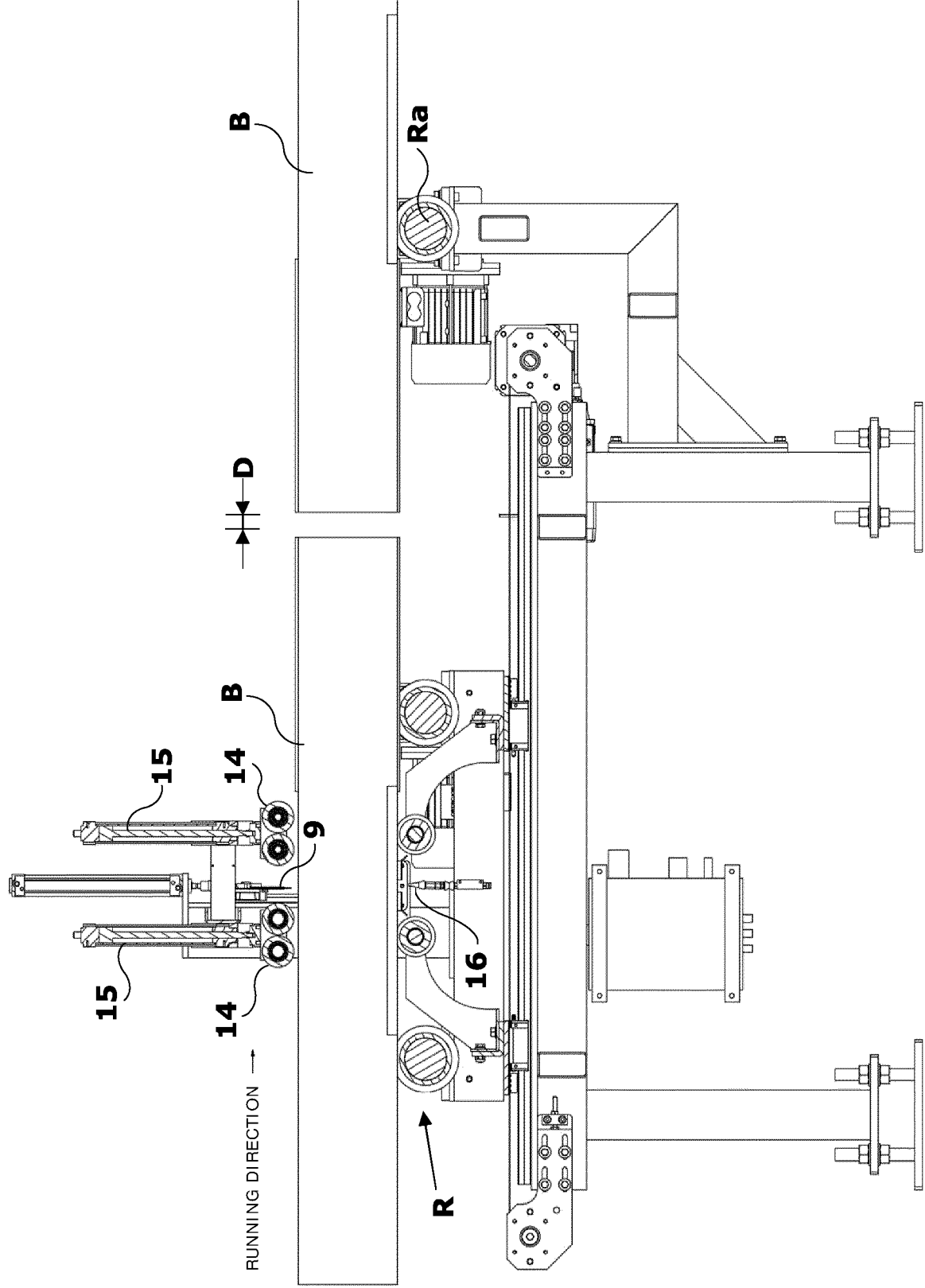


Fig. 7A

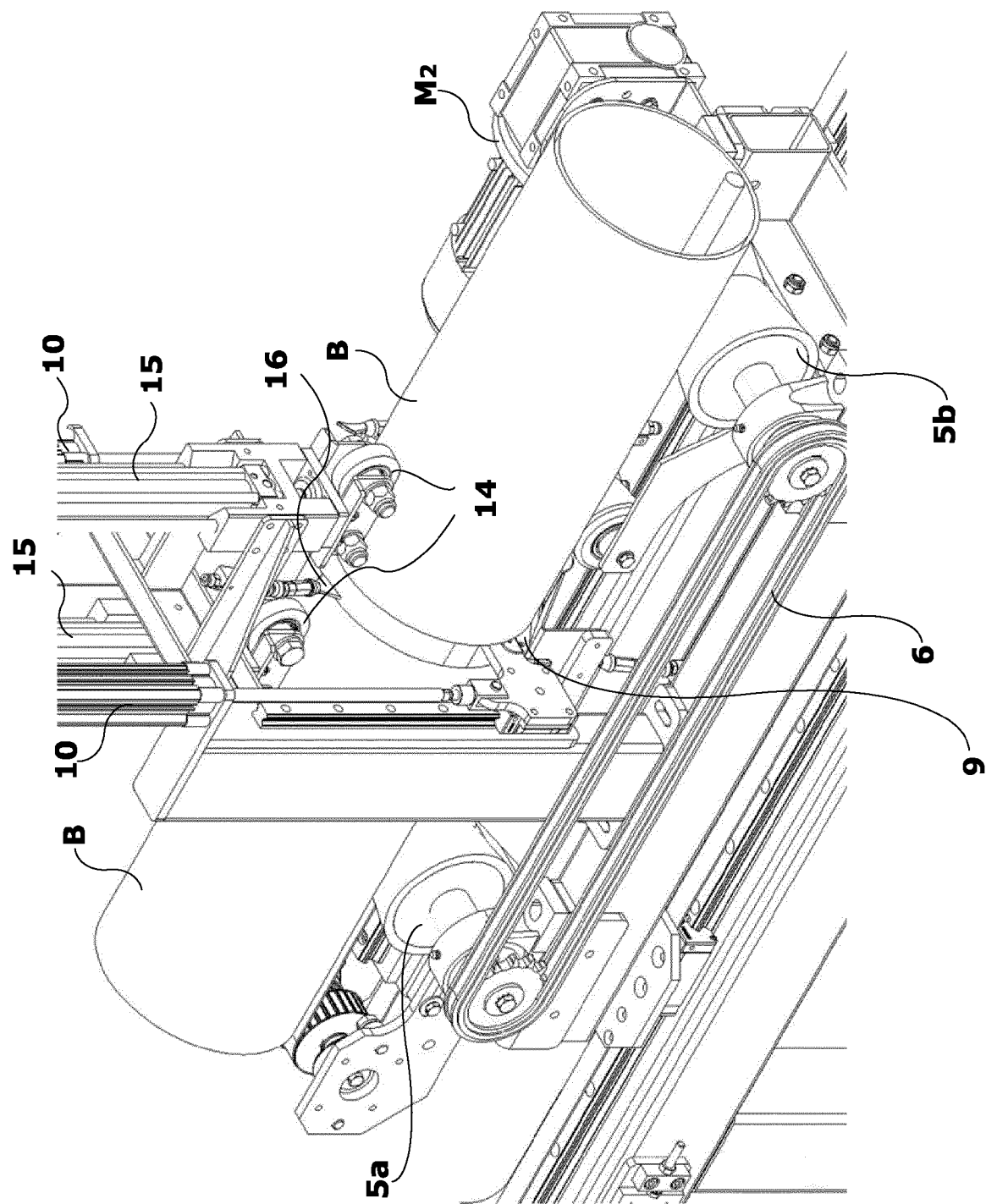


Fig. 7B



EUROPEAN SEARCH REPORT

Application Number

EP 23 18 5485

5

10

15

20

25

30

35

40

45

50

55

1

EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2017/137360 A1 (COLINES SPA [IT]) 17 August 2017 (2017-08-17) * page 14, line 24 - page 17, line 5; figures 10-12 *	1-8	INV. B26D1/08 B26D1/56 B26D7/08 B26D3/16
A	----- CN 108 748 329 A (ANHUI TIANYI PAPER TECH CO LTD) 6 November 2018 (2018-11-06) * abstract; figures *	1	
A	----- KR 2021 0045240 A (OH JUNG MIN [KR]) 26 April 2021 (2021-04-26) * paragraph [0052] - paragraph [0053]; figures *	1	
A,D	----- EP 0 197 574 A1 (VAL MEC S R L [IT]) 15 October 1986 (1986-10-15) * abstract; figures *	1-8	
A,D	----- US 4 050 220 A (LANCASTER WILLIAM G ET AL) 27 September 1977 (1977-09-27) * abstract; figures *	1-8	
	-----		TECHNICAL FIELDS SEARCHED (IPC)
			B26D B65B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 3 November 2023	Examiner Canelas, Rui
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 23 18 5485

5

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-11-2023

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2017137360 A1	17-08-2017	BR 112018015171 A2	26-12-2018
		CA 3011646 A1	17-08-2017
		CN 108698718 A	23-10-2018
		EP 3414167 A1	19-12-2018
		ES 2800208 T3	28-12-2020
		JP 2019504806 A	21-02-2019
		PL 3414167 T3	02-11-2020
		RU 2018128944 A	10-02-2020
		SI 3414167 T1	31-08-2020
		US 2019016488 A1	17-01-2019
		WO 2017137360 A1	17-08-2017

CN 108748329 A	06-11-2018	NONE	

KR 20210045240 A	26-04-2021	NONE	

EP 0197574 A1	15-10-1986	EP 0197574 A1	15-10-1986
		IT 1184905 B	28-10-1987
		US 4730436 A	15-03-1988

US 4050220 A	27-09-1977	NONE	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 197574 A [0005]
- US 4050220 A [0005]
- WO 2017137360 A [0011]