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(54) **Assembly for subdividing an advancing continuous tubular element into a plurality of tubular elements**

(57) Assembly (10) for subdividing an advancing continuous tubular element (11) into a plurality of tubular elements (11'), said assembly (10) being of the type comprising a cutting device (12) integrally borne by a movable arm (13), said arm (13) being movable in such a manner that cyclically the cutting end of said cutting device (12) defines a circular cutting path (T) which intersects at least

partially said tubular element (11) in order to subdivide it into said tubular elements (11'), in which said movable arm (13) integrally bearing said cutting device (12) is roto-translating in such a manner that said cutting device (12) along the entire circular cutting path (T) is always parallel to itself and orthogonal to the axis (A) of said tubular element (11).

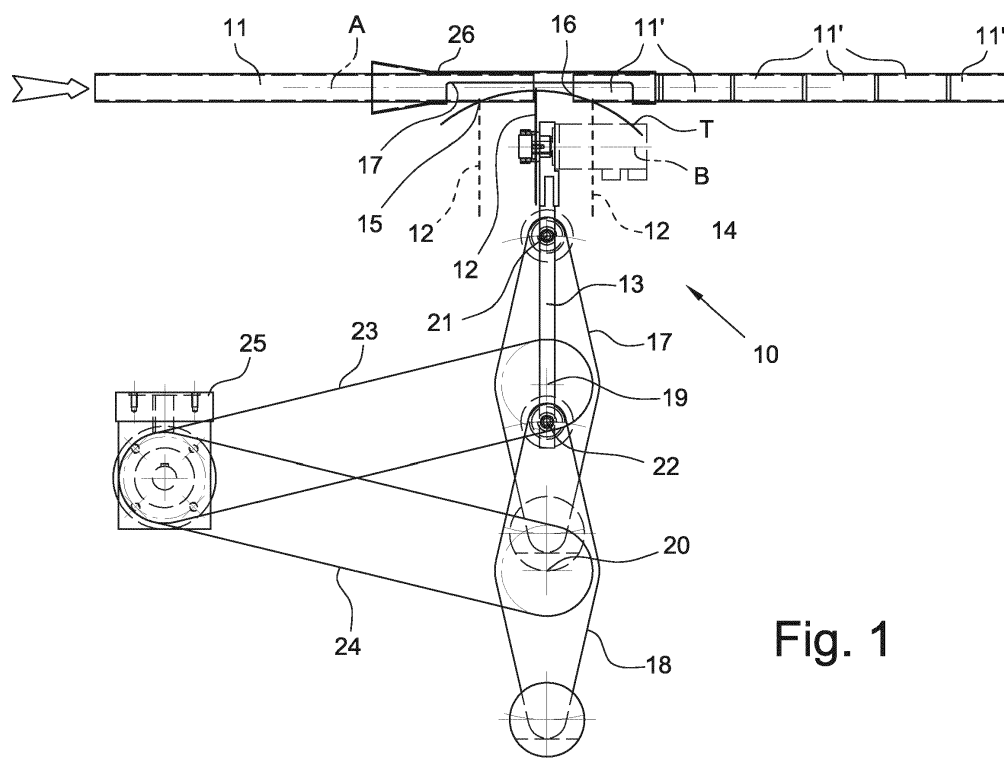


Fig. 1

Description

[0001] The present invention refers to an assembly for subdividing an advancing continuous tubular element into a plurality of independent tubular elements.

[0002] In particular the continuous tubular element is obtained with a helical winding of strips of ribbon-shaped material, usually paper or cardboard, which are glued to one another.

[0003] Indeed due to the fact that the tubular element is generated through the winding of the aforementioned strips, when advancing the tubular element also provides for rotating around its longitudinal axis.

[0004] In general tubular elements in paper or cardboard obtained by cutting a common continuous tubular element are nowadays incorporated in various different products present on the market.

[0005] For example these tubular elements act as an internal core for rolls of toilet paper, rolls of kitchen paper, rolls of adhesive tape or more.

[0006] Nowadays different machines are known for subdividing continuous tubular elements as described above into a plurality of independent tubular elements.

[0007] In general, all these machines comprise one or more mobile cutting elements that are capable of intercepting the advancing tubular element and obtaining a separation line along the tubular element through cutting, again while it is advancing.

[0008] By cyclically making these discontinuities or cutting lines, the continuous tubular element, while it advances, is thus subdivided into a plurality of independent tubular elements.

[0009] According to what is described above it is therefore necessary to provide for cyclically bringing back the cutting members into a position such as to again intercept the tubular element advancing at a precise distance from the cut previously made.

[0010] Nowadays, different solutions are known that are proposed with respect to this requirement.

[0011] A first known solution, described for example in US5873806, discloses the use of a slide structure for supporting the cutting members. This slide is mobile with an alternating forward and backward translational movement parallel to the tubular element to be subdivided.

[0012] This solution however is now considered outdated in view of the continuous growth in hourly production. Indeed as the speed increased, on the translating slide there were high inertia forces and consequent vibrations that were not optimal for controlling the cutting.

[0013] In order to avoid such drawbacks, nowadays, rotating supports are known at the end of which the cutting member is mounted. One example of such a solution is described in AU3021067, in which there is no forward and backward movement, but rather a continuous circular movement of the support of the cutting members.

[0014] However, such a solution has the drawback that the cutting members, in particular knives, are not always in a position that is orthogonal with respect to the axis of

the continuous tubular element. This angle of incidence of the blade which is not orthogonal with respect to the tubular element makes the cutting poor in terms of precision, leaving cutting residue on the subdivided tubular elements.

[0015] Patent application IT2003FI00155, starting from the same solution as AU3021067 with cutting members that are mounted on a rotating arm, also tackles the problem of making a cyclical rotating structure that at the same time makes it possible to keep the cutting members orthogonal with respect to the tubular element to be subdivided.

[0016] In particular the solutions proposed in IT2003FI00155 consist of incorporating an oscillating actuator on the rotating arm that acts on the cutting member, or in comprising a second rotating arm that is associated with the end of the first one by means of a toothed wheel. Such a toothed wheel is configured so as to keep the cutting members orthogonal with respect to the tubular element during the rotations of the two arms in series.

[0017] It is clear that the two solutions proposed above are difficult to make, as well as being not very reliable. Indeed, in order to achieve the required result, it must be provided for there to be rotating joints both on the first arm, and on the second one, making the process mechanics very complex.

[0018] The purpose of the present invention is that of making an assembly for subdividing an advancing continuous tubular element into a plurality of tubular elements that is an alternative to those known today and that is capable of solving the drawbacks mentioned above in an extremely simple, cost-effective and particularly functional manner.

[0019] Another purpose is that of providing an alternative solution for the problem, on one hand, of having a support for the cutting members that is cyclically moved without oscillating movements and on the other hand that of keeping the cutting members always orthogonal to the axis of the tubular element to be subdivided.

[0020] These purposes according to the present invention are achieved by making an assembly for subdividing an advancing continuous tubular element into a plurality of tubular elements as outlined in claim 1.

[0021] Further characteristics of the invention are highlighted in the dependent claims.

[0022] In general the problems highlighted are overcome by housing the cutting members on a roto-translating arm so that the cutting end describes a circular path T, while remaining however always orthogonal to the axis of the tubular element to be subdivided.

[0023] In particular such a roto-translating movement is generated by a motorized articulated quadrilateral.

[0024] The characteristics and the advantages of an assembly for subdividing an advancing continuous tubular element into a plurality of tubular elements according to the present invention shall become clearer from the following description, given as an example and not for limiting purposes, with reference to the attached sche-

matic drawings, in which:

- figure 1 is a side view of an assembly for subdividing an advancing continuous tubular element into a plurality of tubular elements according to the present invention;
- figure 2 is a front view of the assembly of figure 1; and
- figures 3 and 4 are views of the assembly of figure 1 in different configurations of use.

[0025] With reference to the figures, reference numeral 10 indicates an embodiment of an assembly for subdividing an advancing continuous tubular element into a plurality of tubular elements according to the present invention.

[0026] Such an assembly 10 is of the type comprising a cutting device 12 that is integrally borne by a movable arm 13. In particular this arm 13 is mobile in such a manner that cyclically the cutting device 12 defines a circular cutting path T which intersects at least partially the tubular element 11 in order to subdivide it into the tubular elements 11'.

[0027] The movement along the circular cutting path T always follows the same direction, in accordance with the advancing of the tubular element 11, and it is never reversed.

[0028] In particular, according to the invention, the arm 13 integrally bearing the cutting device 12 is roto-translating in such a manner that the cutting device 12 is always parallel to itself along the entire circular cutting path T and is orthogonal to the axis A of the tubular element 11.

[0029] The cutting device 12 comprises a motorized 14 disc-shaped knife 12 that is rotatable about its own central axis B where, according to what has previously been described, such an axis B remains parallel to the axis A of the tubular element 11 along the entire circular cutting path T.

[0030] Of course, instead of the disc-shaped knife 12 any other equivalent cutting means can be provided.

[0031] As shown, the circular cutting path T intersects the tubular element 11, also including its theoretical extension, in at least two points 15, 16 until substantially reaching the axis A in the centreline of the cutting operations.

[0032] Figure 1 shows the three positions of the knife 12 at the intersection points 15, 16, as well as at the centreline.

[0033] Due to the rotation of the tubular element 11 about the axis A, by even only partially penetrating the knife 12, a cutting line is carried out along the entire circumference of the tubular element 11.

[0034] With respect to other known solutions, the tubular element 11 is not provided with inner spindle and therefore the knife 12 can penetrate inside the tubular element until it reaches the axis A, thus ensuring an optimal cut.

[0035] In particular, the roto-translating arm 13 is part of a mobile articulated quadrilateral structure comprising,

in addition to the arm 13, two connecting rods 17, 18. Such connecting rods 17, 18 are rotatable about fixed pins 19, 20 and are hinged at an end 21, 22 to the roto-translating arm 13.

[0036] The fourth side of the quadrilateral is considered to consist of the fixed reference to which the pins 19, 20 are constrained.

[0037] In such a way, when the connecting rods 17, 18 are driven in rotation about the fixed pins 19, 20, they impress a rototranslation to the arm 13 and, therefore, to the disc-shaped knife 12.

[0038] The rotation of the connecting rods 17, 18 about the fixed pins 19, 20 is controlled by motorized 25 belts 23, 24.

[0039] As known, at least during the cutting steps in the intersection portion the tubular element 11 and the cutting device 12 advance in a synchronised manner. Along the portion T of free path, the rototranslation of the arm 13 can be also carried out at greater speeds.

[0040] In order to ensure that the cut is orthogonal, the fixed pins 19, 20 for rotating the connecting rods 17, 18 are vertically aligned along a direction that is orthogonal to the axis A of the tubular element 11. Also the roto-translating arm 13 is substantially vertical and orthogonal to the axis A of the tubular element 11.

[0041] However, the roto-translating arm 13 could also be inclined, whereas the knife 12 must remain orthogonal with respect to the axis A of the tubular element 11.

[0042] As an accessory device it is provided an abutment and containment support 26 of the tubular element 11 at at least the incident portion of the cutting path T having an opening 27 for permitting the intersection of the disc-shaped knife 12 with the tubular element 11.

[0043] The abutment and containment support 26 indeed acts as a stabiliser of the tubular element 11 that is not provided with internal supports of the spindle type.

[0044] It is easy to understand how the assembly for subdividing an advancing continuous tubular element into a plurality of tubular elements object of the invention operates.

[0045] The cutting device 12, preferably of the disc-shaped knife 12 type, is integral with a roto-translating arm 13 which, together with the connecting rods 17, 18 is part of an articulated quadrilateral that is set in motion by motorized belts.

[0046] Since the movement of the arm 13 is a rototranslation and since the disc-shaped knife 12 rotates about an axis that is parallel to the axis A of the tubular element 11, it is ensured that the blade 12 is orthogonal along the entire cutting path T in a simple but effective manner.

[0047] It has thus been seen that an assembly for subdividing an advancing continuous tubular element into a plurality of tubular elements according to the present invention achieves the previously highlighted purposes. The solution described indeed solves the requirement of carrying out a rotating cut that is orthogonal to the material to be cut, overcoming all the problems related to the rotating movement of the knife assembly. The solution

moreover has the advantage of associating, with the knife, a high-performance electric motor that is capable of ensuring an optimal cut.

[0048] Moreover, another advantageous aspect of the assembly described by the present invention is the fact that there is no guide element inside the tubular element. This leads to an absence of vibration on the tubular element during the cut since the inner guide element is only limited to the initial formation portion of the tubular element.

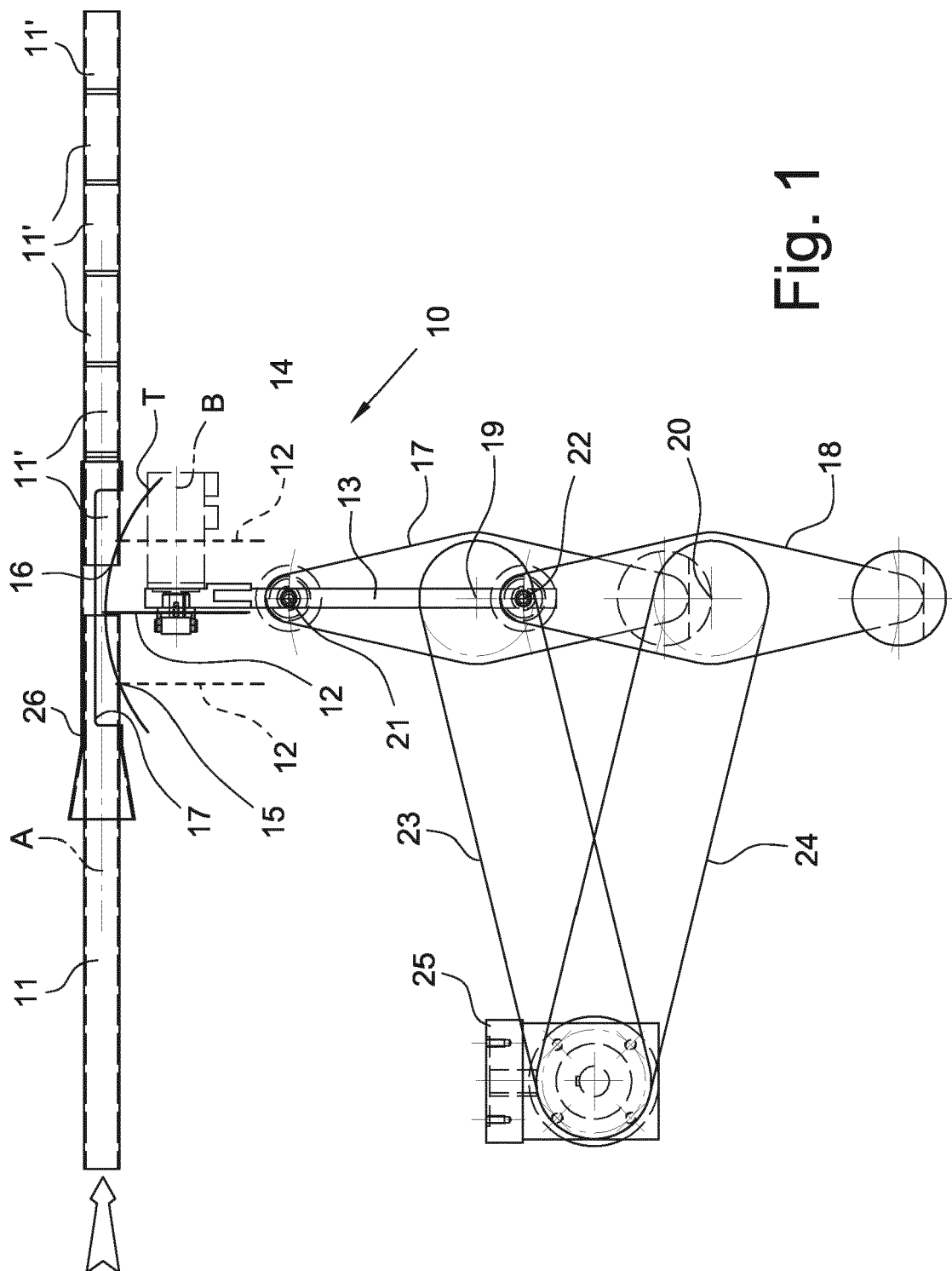
[0049] The assembly for subdividing an advancing continuous tubular element into a plurality of tubular elements of the present invention thus conceived can undergo numerous modifications and variants, all covered by the same inventive core; moreover, all the details can be replaced by technically equivalent elements. In practice, the materials used, as well as their sizes, can be any according to the technical requirements.

Claims

1. Assembly (10) for subdividing an advancing continuous tubular element (11) into a plurality of tubular elements (11'), said assembly (10) being of the type comprising a cutting device (12) integrally borne by a movable arm (13), said arm (13) being movable in such a manner that cyclically the cutting end of said cutting device (12) defines a circular cutting path (T) which intersects at least partially said tubular element (11) in order to subdivide it into said tubular elements (11'), **characterized in that** said movable arm (13) integrally bearing said cutting device (12) is roto-translating in such a manner that said cutting device (12) along the entire circular cutting path (T) is always parallel to itself and orthogonal to the axis (A) of said tubular element (11).
2. Assembly (10) according to claim 1 **characterized in that** said cutting device (12) comprises a disc-shaped knife (12) rotatable about its own central axis (B), said axis (B) being parallel to said axis (A) of said tubular element (11) along the entire circular cutting path (T).
3. Assembly (10) according to claim 2 **characterized in that** said circular cutting path (T) intersects said tubular element (11) in at least two points (15, 16) substantially reaching said axis (A) in the centerline of said intersection points (15, 16).
4. Assembly (10) according to any of the preceding claims **characterized in that** said roto-translating arm (13) is part of an articulated quadrilateral structure comprising in addition two connecting rods (17, 18), said connecting rods (17, 18) being rotatable about fixed pins (19, 20) and hinged at an end (21, 22) to said roto-translating arm (13) so that when

said connecting rods (17, 18) are driven in rotation about said fixed pins (19, 20) they impress a roto-translation to said arm (13) bearing said disc-shaped knife (12).

5. Assembly (10) according to claim 4 **characterized in that** the rotation of said connecting rods (17, 18) about said fixed pins (19, 20) is controlled by motorized (25) belts (23, 24).
6. Assembly (10) according to claim 5 **characterized in that** said fixed pins (19, 20) for rotating said connecting rods (17, 18) are vertically aligned along a direction orthogonal to said axis (A) of said tubular element (11).
7. Assembly (10) according to claim 6 **characterized in that** said roto-translating arm (13) is substantially vertical along a direction orthogonal to said axis (A) of said tubular element (11).
8. Assembly (10) according to any of the preceding claims **characterized in that** it comprises an abutment and containment support (26) of said tubular element (11) at at least said incident portion of said cutting path (T).
9. Assembly (10) according to claim 8 **characterized in that** said abutment and containment support (26) comprises an opening (27) for permitting the intersection of said disc-shaped knife (12) in said tubular element (11), said tubular element (11) being devoid of internal supports.
10. Assembly (10) according to any of the preceding claims **characterized in that** it comprises an electric motor (14) for driving the rotation of said knife (12), said motor (14) being integrally mounted on said roto-translating arm.



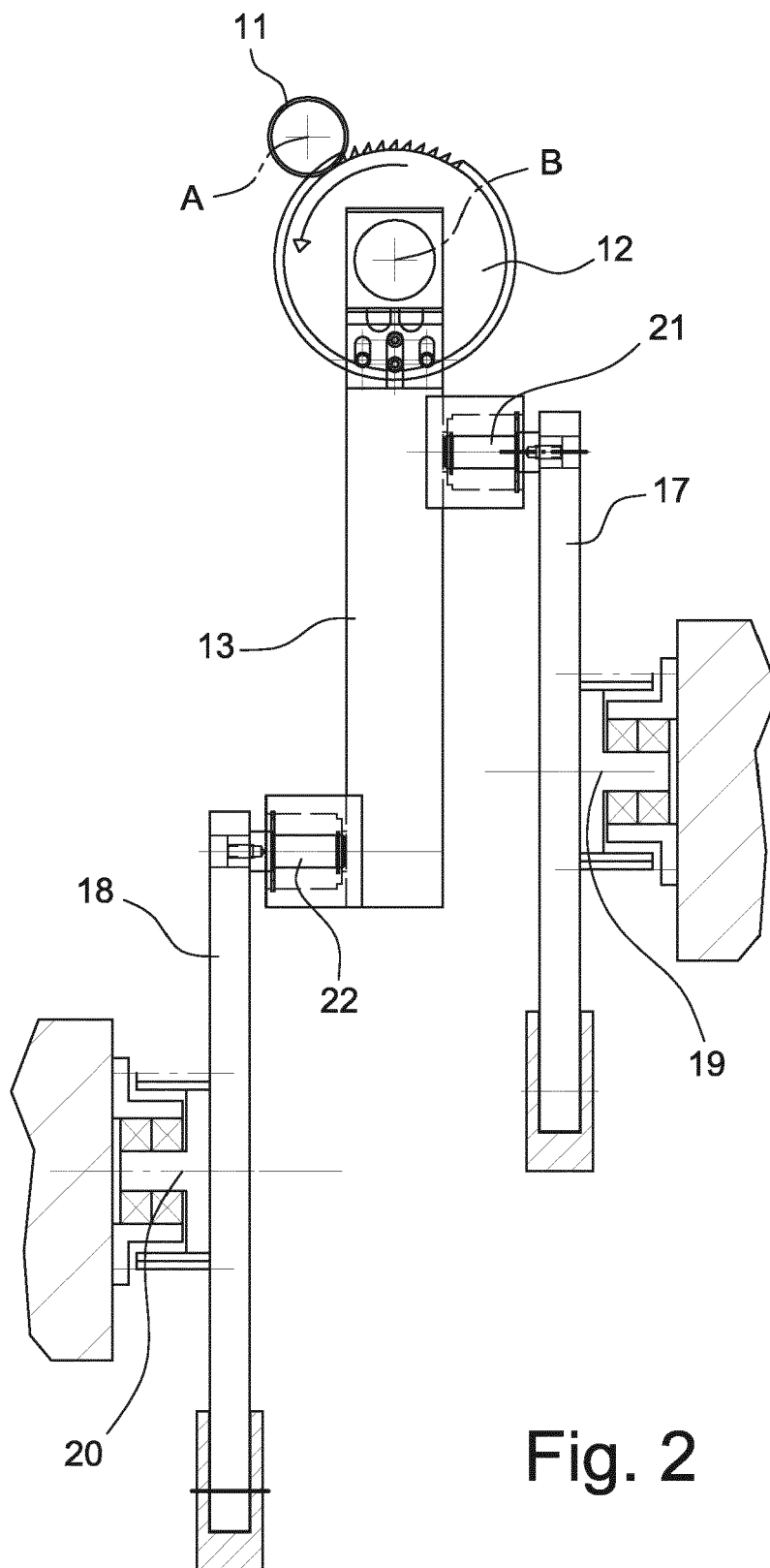


Fig. 2

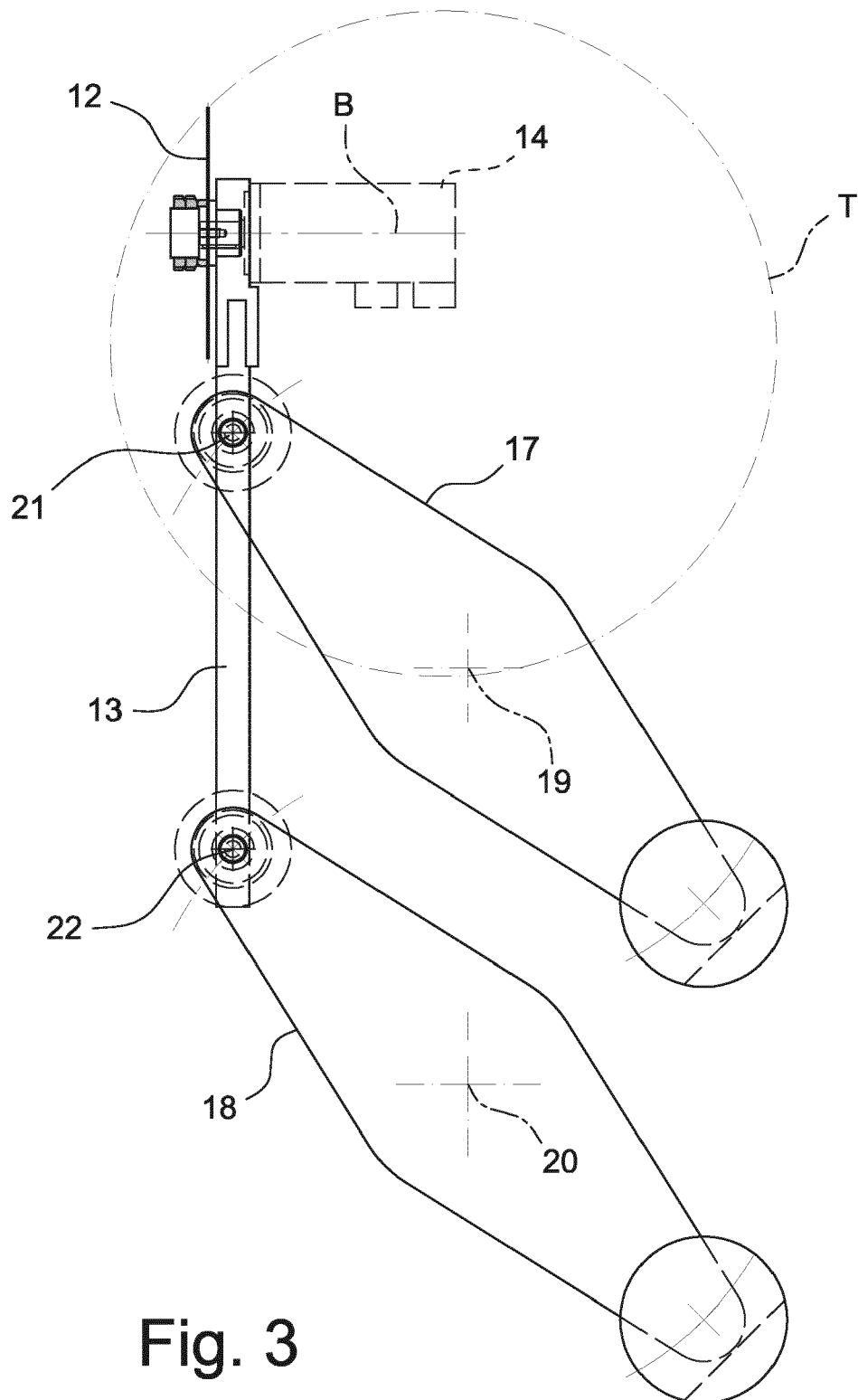


Fig. 3

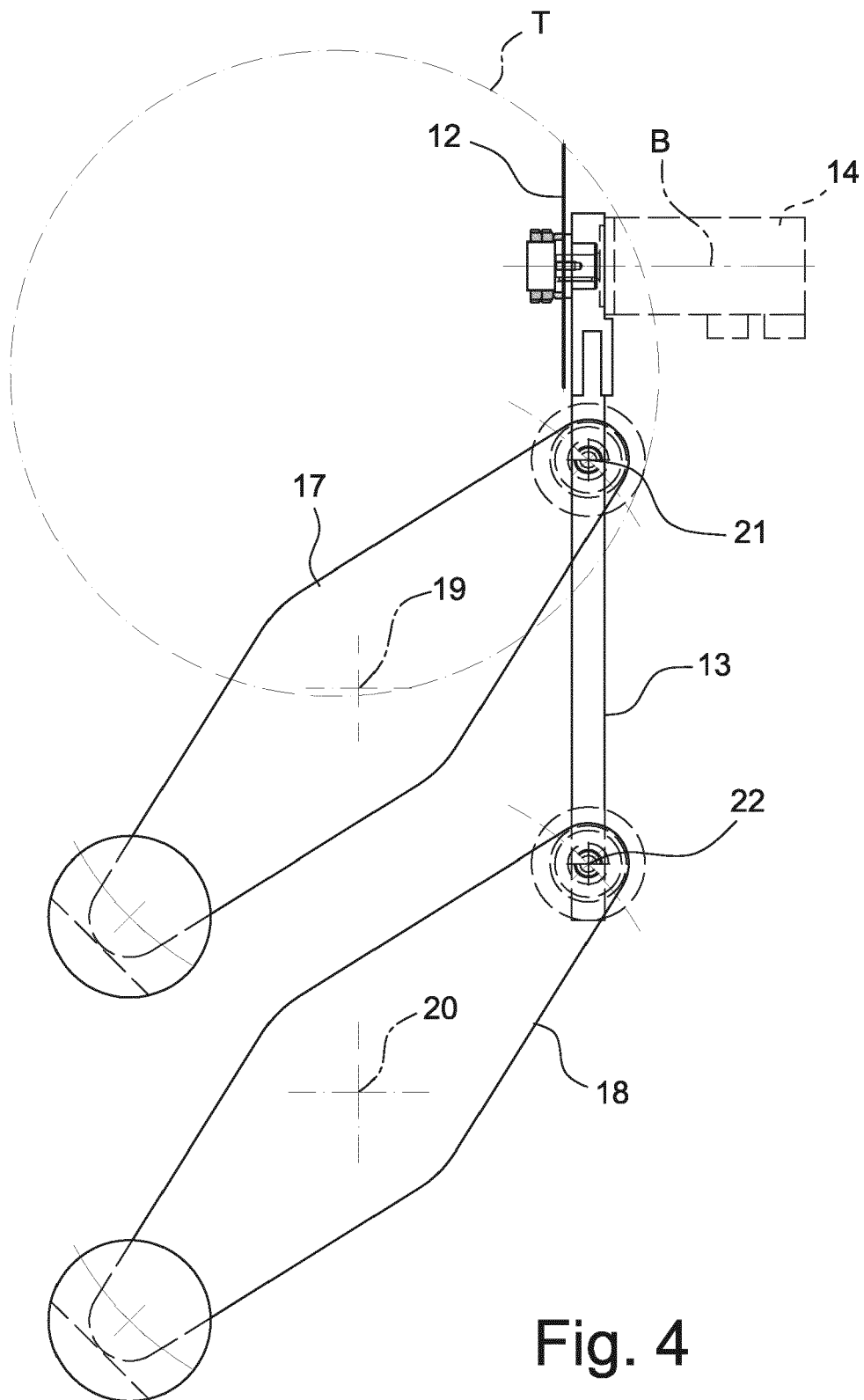


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 14 15 4278

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	EP 1 810 798 A1 (BINACCHI & CO [IT]) 25 July 2007 (2007-07-25)	1-3,8,10	INV. B26D1/58 B26D3/16
A	* the whole document *	4-7,9	
X	WO 2009/040855 A2 (PERINI FABIO SPA [IT]; GELLI MAURO [IT]; CHIOCCHETTI MARIO GIONI [IT];) 2 April 2009 (2009-04-02)	1-3,8-10	
A	* figures *	4-7	
X	US 6 123 002 A (WUNDERLICH GARY R [US] ET AL) 26 September 2000 (2000-09-26)	1,2,10	
	* the whole document *		
			TECHNICAL FIELDS SEARCHED (IPC)
			B26D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 May 2014	Examiner Canelas, Rui
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ON EUROPEAN PATENT APPLICATION NO.**

EP 14 15 4278

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06-05-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1810798 A1	25-07-2007	BR PI0602174 A EP 1810798 A1	06-11-2007 25-07-2007
WO 2009040855 A2	02-04-2009	AT 535368 T CN 101801658 A EP 2185350 A2 ES 2377171 T3 JP 2011519315 A US 2010204031 A1 WO 2009040855 A2	15-12-2011 11-08-2010 19-05-2010 23-03-2012 07-07-2011 12-08-2010 02-04-2009
US 6123002 A	26-09-2000	CA 2138005 A1 DE 1120208 T1 DE 69524278 D1 DE 69524278 T2 DE 69534552 D1 EP 0677360 A1 EP 1120208 A2 EP 1584428 A1 ES 2169090 T3 JP 3497275 B2 JP H0839480 A US 5557997 A US 5924346 A US 6123002 A	07-10-1995 06-03-2003 17-01-2002 13-06-2002 01-12-2005 18-10-1995 01-08-2001 12-10-2005 01-07-2002 16-02-2004 13-02-1996 24-09-1996 20-07-1999 26-09-2000

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5873806 A [0011]
- AU 3021067 [0013] [0015]
- IT 2003 [0015] [0016]
- FI 00155 [0015] [0016]