



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.04.2018 Bulletin 2018/17

(51) Int Cl.:
B26D 3/16 (2006.01) B26D 7/08 (2006.01)

(21) Application number: **17195028.0**

(22) Date of filing: **05.10.2017**

(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 MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(72) Inventors:
• **BERTOLI BARSOTTI, Giovanni**
55051 Fornaci di Barga (Lucca) (IT)
• **TAGLIASACCHI, Luca**
55051 Fornaci di Barga (Lucca) (IT)

(74) Representative: **Petruzziello, Aldo et al**
Racheli S.r.l.
Viale San Michele del Carso, 4
20144 Milano (IT)

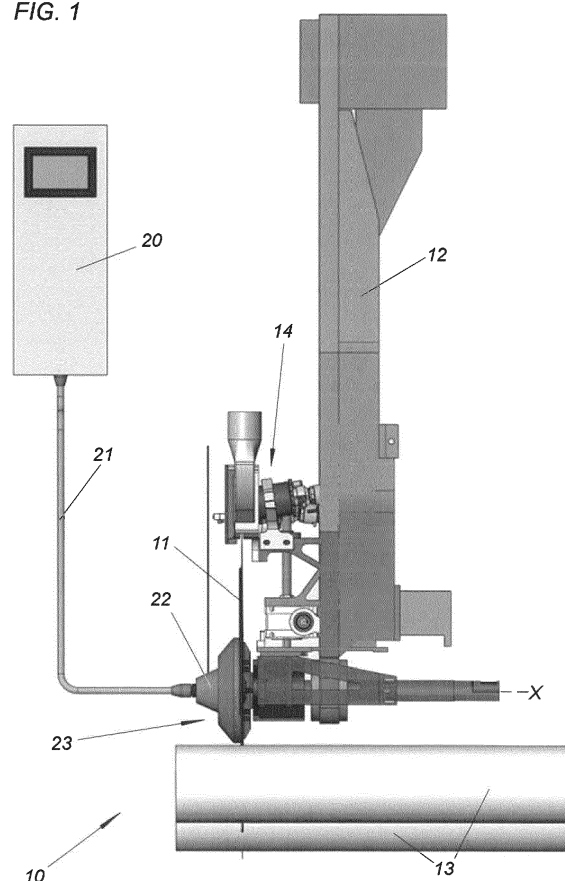
(30) Priority: **18.10.2016 IT 201600104428**

(71) Applicant: **Paper Converting Machine Company
Italia S.p.A.**
55051 Fornaci di Barga (LU) (IT)

(54) **CUTTING-OFF MACHINE FOR THE CUTTING OF LOGS OF SHEET MATERIAL AND RELATIVE CUTTING METHOD**

(57) Cutting-off machine (10) for cutting logs (13) of sheet material, comprising at least one cutting blade (11) placed on a plane perpendicular to the axis of the logs (13), in order to perform transverse cuts over the same and produce rolls (16) of smaller length than the logs, wherein said at least one cutting blade (11) is associated with an ultrasonic device apt to generate a vibrating force on the blade.

FIG. 1



Description

[0001] The present invention relates in general to the production of rolls of sheet material and more particularly to a cutting-off machine and a method for the cutting of logs or sticks of sheet material, in particular paper.

[0002] Traditionally the manufacture of rolls of materials in sheet form, such as toilet paper, tissue paper, kitchen paper and similar products requires a plurality of process stages, comprising the unwinding of the sheet material from a roll of large diameter and rewinding, possibly on a core, to form logs or sticks of smaller diameter, cutting of the logs into rolls of the required length, on the basis of their end use, and packaging of the rolls.

[0003] Cutting of the logs for forming rolls of smaller length is carried out with special cutting-off machines which have one or more metal or ceramic blades, of the disc type, which are made to rotate in an orbit around an axis in a cutting plane transverse to the direction of feeding of the log, or of the belt type, which are cyclically lowered onto the log to be cut.

[0004] The logs are made to move forwards, normally in several parallel channels, towards the cutting blade, pushed by special pushers of a drive chain transferred on transfer wheels.

[0005] Another type of cutting-off machine provides for a series of fixed flat blades against which the logs are driven in a direction perpendicular to their axes, so as to be "sliced".

[0006] A problem which reduces, even drastically, productivity of the cutting-off machines is overheating and the consequent deformation of the cutting blade. Since the cutting blade (in the case of belt disc blades) for performing the cutting of the log has to have a high rotation speed, during cutting, between the surface of the blade and that of the log to be cut, a high friction is generated which causes excessive overheating of the blade. Having reached a limit temperature, variable in accordance with the material and the shape of the disc of the blade, a relaxation and thermal expansion of the material of the disc occur which lead to deformation of the same disc.

[0007] This deformation is due to the residual tensions induced in the disc of the blade in the phase of manufacture to make its surface take on the required planarity.

[0008] Consequently, having achieved a limit deformation of the blade, cutting of the logs has to be interrupted to allow cooling thereof, otherwise the excessively hot blade could deform further, becoming damaged or even broken, without mentioning the poor quality of the cut which is produced.

[0009] Cutting-off machines are therefore equipped with systems aiming to lower the temperature of the blade or to control deformation thereof, as occurs in the patent EP 1609570 B1 of the same Applicant, or to ascertain the quality of the cut.

[0010] US 3 468 203 describes an apparatus for cutting a strip of flexible material by means of a knife which is

pushed elastically against the belt while the latter advances continuously in order to be wound on a spindle. In order to improve the cutting effect means are provided to vibrate the knife in the range of sonic or ultrasonic frequencies.

[0011] There is therefore the need for a cutting-off machine which overcomes the limits of known machines.

The object of the invention is in fact that of providing such a cutting-off machine which eliminates, or at least reduces, the disadvantages of the cutting-off machines of the prior art.

[0012] More particularly an object of the invention is that of providing a cutting-off machine which allows cuts to be made of high quality, avoiding overheating and deformation of the cutting blade.

[0013] Another object of the invention is that of providing such a cutting-off machine wherein the cutting blade does not require frequent sharpening.

[0014] Yet another object of the invention is that of providing a cutting-off machine of any one of the known types, which requires minimum modifications to achieve the abovementioned results.

[0015] These and other objects of the invention are achieved by the cutting-off machine according to the invention which has the features of the appended independent claim 1.

[0016] Advantageous embodiments of the invention are disclosed by the dependent claims.

[0017] Substantially the cutting-off machine for the cutting of logs of sheet material according to the invention comprises at least one cutting blade placed on a plane perpendicular to the axis of the logs, in order to perform transverse cuts over the same and produce rolls of smaller length with respect to the logs, said at least one cutting blade being associated with an ultrasonic device apt to generate a vibrating force on the blade.

[0018] Further features of the invention will be made clearer by the following detailed description, referred to its embodiments purely by way of a non-limiting example and illustrated in the accompanying drawings, in which:

Figures 1 and 2 are respectively a front view and a side view of a cutting-off machine with rotating disc blade mounted on orbiting arm, provided with a system of ultrasounds according to the invention applied at the centre of the blade;

Figures 3 and 4 are respectively a perspective view and front view of a cutting-off machine similar to that of the preceding drawings, with the ultrasounds applied on the edge of the blade;

Figure 5 is a schematic perspective view of a cutting-off machine with two flat blades mounted on a rotating support, with ultrasounds applied at the bases of the blades;

Figs. 6, 7 and 8 are, respectively, a schematic perspective view, a front view and a side view of a cutting-off machine with multiple flat blades for "passing" cutting of the logs, with ultrasounds applied at

the bases of the blades.

[0019] Referring to the accompanying drawings, and for the time being to Figures 1 and 2, a cutting-off machine for logs in sheet material, in particular paper, is shown schematically, denoted overall by reference numeral 10.

[0020] The cutting-off machine 10 is of the standard type, with rotating disc blade 11, mounted on an orbiting arm 12 so that the blade performs an orbit in a cutting plane perpendicular to the axis of the logs, denoted by reference numeral 13.

[0021] According to the embodiment of Figures 1 and 2, the logs 13 are made to move forwards in the direction of their axes in order to be taken under the cutting blade 11. Obviously, several cutting blades can be provided.

[0022] The drawings also show schematically a sharpening assembly 14 apt to sharpen periodically, and on indication of special sensors, the blade 11 as the latter wears out, if manufactured for example in metal. However, for what is stated here below, with the systems adopted by the invention, the wear of the blade is considerably reduced. Moreover, if special blades are used, for example in titanium, the sharpening assembly 14 can be absent.

[0023] According to the invention the cutting-off machine 10 is equipped with an ultrasonic device for causing the blade 11 to vibrate and improve the cut, eliminating the disadvantages illustrated previously.

[0024] The ultrasonic device, in the schematic form shown, comprises a generator of ultrasounds 20, connected by means of a cable 21, to an ultrasonic converter 22, coupled to a sonotrode 23.

[0025] The ultrasonic converter 22 converts the electrical energy with frequency coming from the generator 20 into mechanical vibrations with high frequency, which are transferred to the sonotrode 23, which transmits the vibratory energy to the blade 11.

[0026] In the embodiment of Figures 1 and 2 the sonotrode 23 is mounted on the axis X of the blade 11, so that the ultrasounds are applied at the centre of the blade.

[0027] The provision of the ultrasounds, which make the blade vibrate, allows a very precise cut of the logs 13 to be made, avoiding overheating of the blade thanks to the reduced cutting force required by the vibration of the blade. The logs are not therefore deformed by the compression.

[0028] Figures 3 and 4, in which the same reference numerals introduced previously are used, illustrate an embodiment of the cutting-off machine wholly similar to that of Figures 1 and 2.

[0029] The only difference is that in this case the ultrasonic converter 22 and the sonotrode 23 are applied in proximity of the edge of the blade. Therefore, the vibratory force of the ultrasounds acts directly on the edge of the blade.

[0030] According to the embodiment of Figure 5, the cutting-off machine comprises two rectilinear flat blades 11 placed in diametrically opposed positions on a rotating

support 12.

[0031] In this case the sonotrodes 23 are placed at the base of the blades 11.

[0032] According to the embodiment of Figures 6, 7 and 8 a plurality of fixed flat blades 11 are provided, against which the logs 13 are made to move forwards in a direction perpendicular to their axes, for a so-called "passing" cut.

[0033] For the transport of the logs a plurality of lower drive belts 30 are provided, and a corresponding plurality of opposite upper drive belts 31, placed between the plurality of blades 11.

[0034] In Figures 6 and 8, two logs moving forwards towards the cutting blades 11 are shown between the opposite series of belts 30, 31, one log at the cutting stage and one log already cut into rolls 15, with side trims 16.

[0035] In this case a plurality of ultrasounds generators 20 are provided, connected by means of respective cables 21 to corresponding ultrasonic converters 22 and sonotrodes 23 placed at the bases of the respective blades 11.

[0036] From what has been disclosed the advantages appear clear of the invention which, combining an ultrasonic device with a cutting-off machine of logs of sheet material of any known type, allows an extremely precise cut to be obtained, eliminating the disadvantages of the prior art linked to the overheating and deformation of the cutting blade.

[0037] Naturally the invention is not limited to the particular embodiments previously described and illustrated in the accompanying drawings, but numerous detailed changes may be made thereto, within the reach of the person skilled in the art, without thereby departing from the scope of the invention itself as defined by the appended claims.

Claims

1. Cutting-off machine (10) for cutting logs (13) of sheet material, comprising at least one cutting blade (11) placed on a plane perpendicular to the axis of the logs (13), in order to perform transverse cuts over the same and produce rolls (15) of smaller length than the logs, **characterised in that** said at least one cutting blade (11) is a rotating blade, with which is associated a sonotrode (23) of an ultrasonic device apt to generate a vibrating force on the blade.
2. Cutting-off machine according to claim 1, wherein said rotating blade (11) is a disc carried by an orbiting arm, and said sonotrode (23) is placed on the axis (X) of the disc blade (11).
3. Cutting-off machine according to claim 1, wherein said rotating blade (11) is a disc carried by an orbiting arm (12), and said sonotrode (23) is placed in prox-

imity to the edge of said disc blade (13).

4. Cutting-off machine according to claim 1, wherein said rotating blade (11) is constituted by rectilinear flat blades (11) diametrically opposed, carried by a rotating support (12), and said sonotrode (23) is placed in correspondence to the base of the corresponding blade. 5
5. Cutting-off machine according to claim 1, **characterised in that** said ultrasonic device comprises an ultrasonic generator (20) linked by means of a cable (21) to an ultrasonic converter (22) and to said sonotrode (23) placed on the blade (11). 10 15
6. Cutting-off machine (10) for cutting logs (13) of sheet material, comprising a plurality of cutting blades (11) placed on planes perpendicular to the axis of the logs (13), in order to perform transverse cuts over the same and produce rolls (15) of smaller length with respect to the logs, 20
wherein said blades are rectilinear fixed flat blades (11) at whose bases are placed respective sonotrodes (23) of an ultrasonic device apt to generate a vibrating force on the blades, apt to perform a "passing" cut of the logs. 25
7. Method for cutting logs (13) of sheet material by means of a cutting-off machine having at least one cutting blade (11) placed on a plane perpendicular to the axis of the logs, consisting in carrying said at least one blade into contact with said logs, or vice versa said logs into contact with said at least one blade to perform transverse cuts over the logs and to produce rolls (15) of smaller length than the logs, **characterised in that** said at least one cutting blade (11) is a rotating blade and ultrasounds are applied thereon during the cutting operation. 30 35
8. Method according to claim 7, wherein said rotating blade (11) is a disc carried by an orbiting arm (12) and said ultrasounds are applied on the axis (X) of the disc or in proximity of its edge. 40
9. Method according to claim 7, wherein said at least one rotating cutting blade (11) is constituted by rectilinear flat blades diametrically opposed and said ultrasounds are applied at the base of the respective blade. 45 50
10. Method for cutting logs (13) of sheet material by means of a cutting-off machine having a plurality of fixed cutting blades (11) placed on planes perpendicular to the axis of the logs, consisting in carrying said logs into contact with said blades to perform transverse cuts over the logs and to produce rolls (15) of smaller length with respect to the logs, wherein the logs are made to move forwards against said 55

fixed blades in a perpendicular direction to their axes for a "passing" cut of the logs and ultrasounds are applied to the blades during the cutting.

FIG. 1

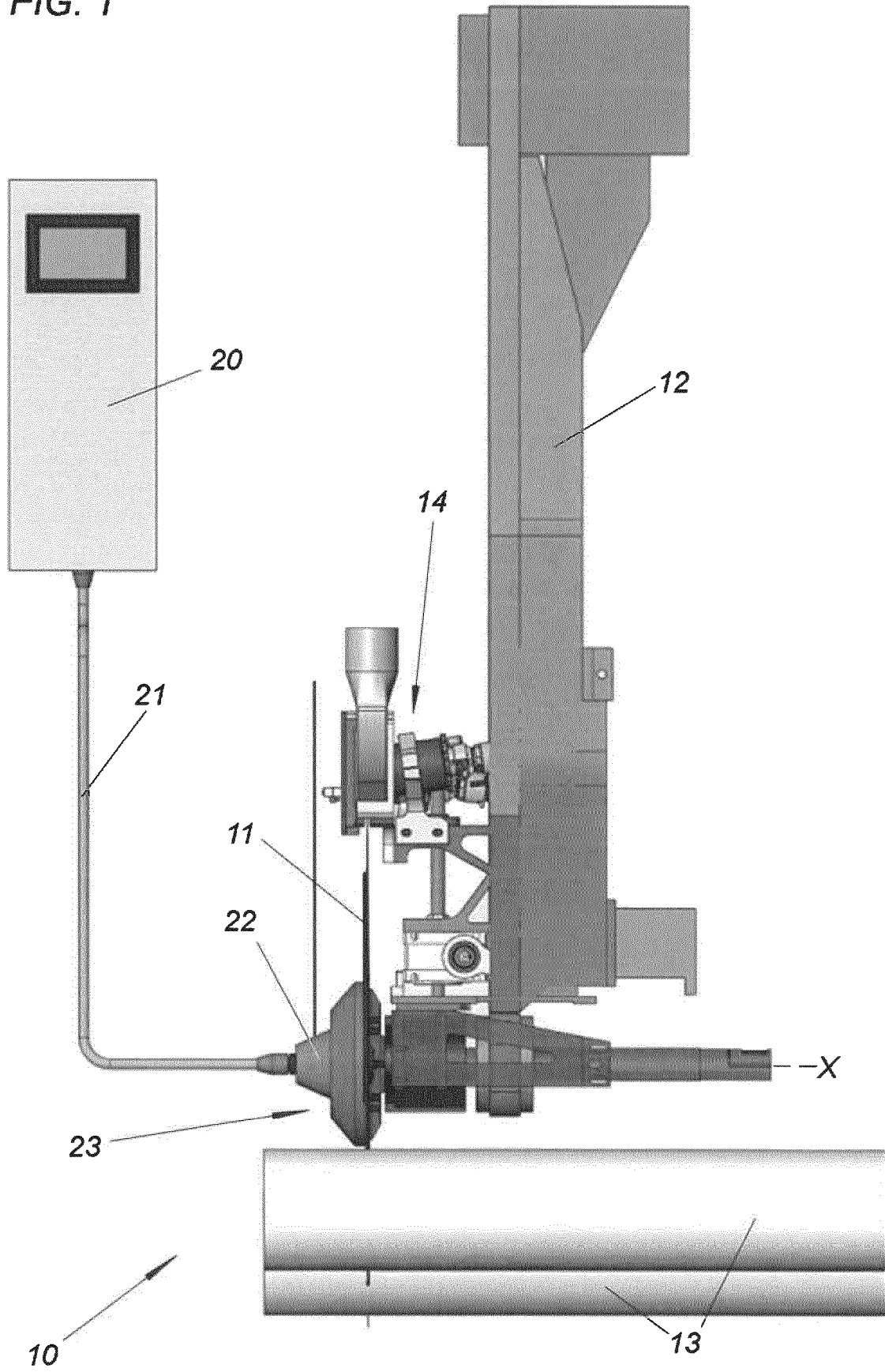
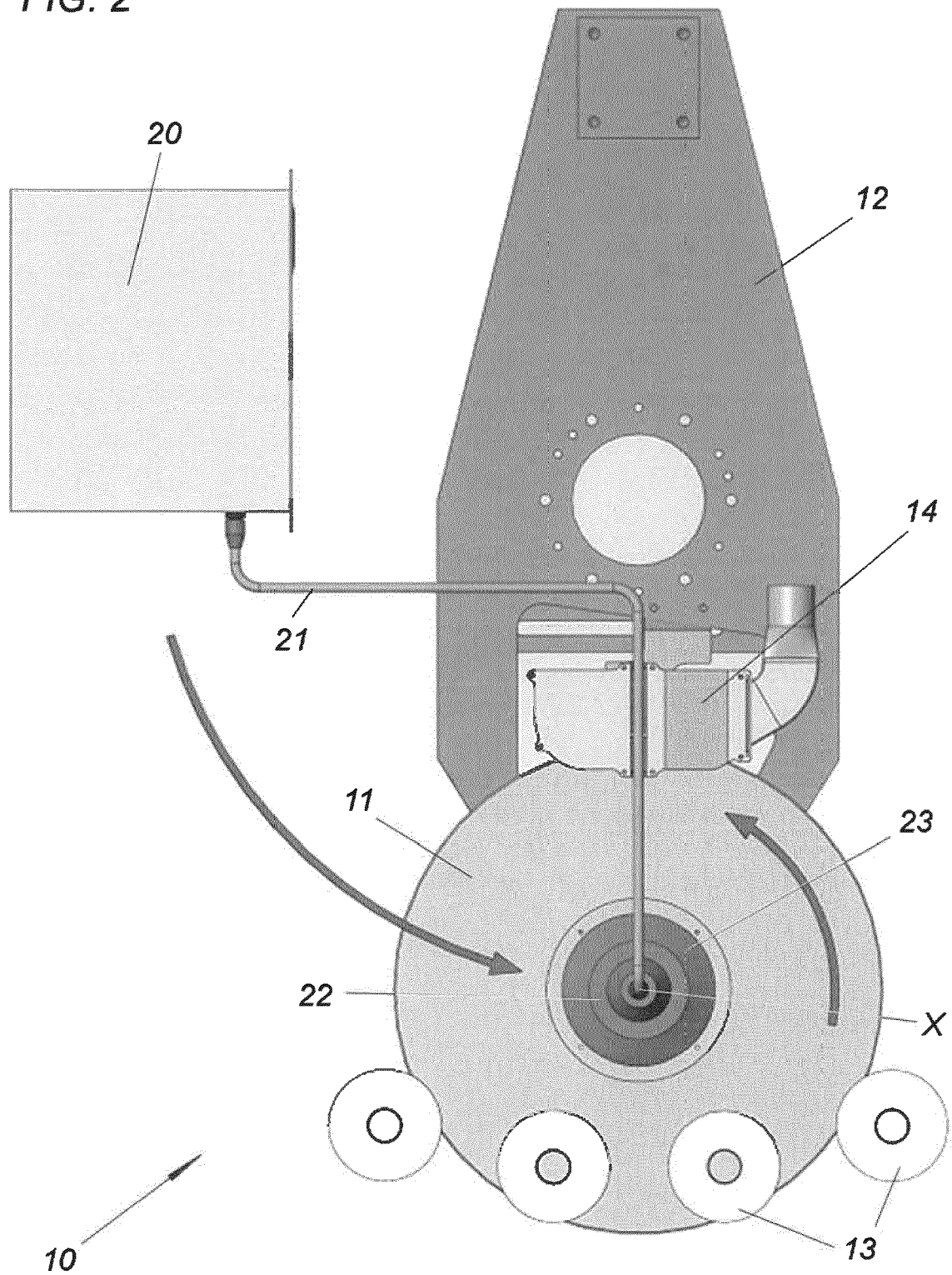


FIG. 2



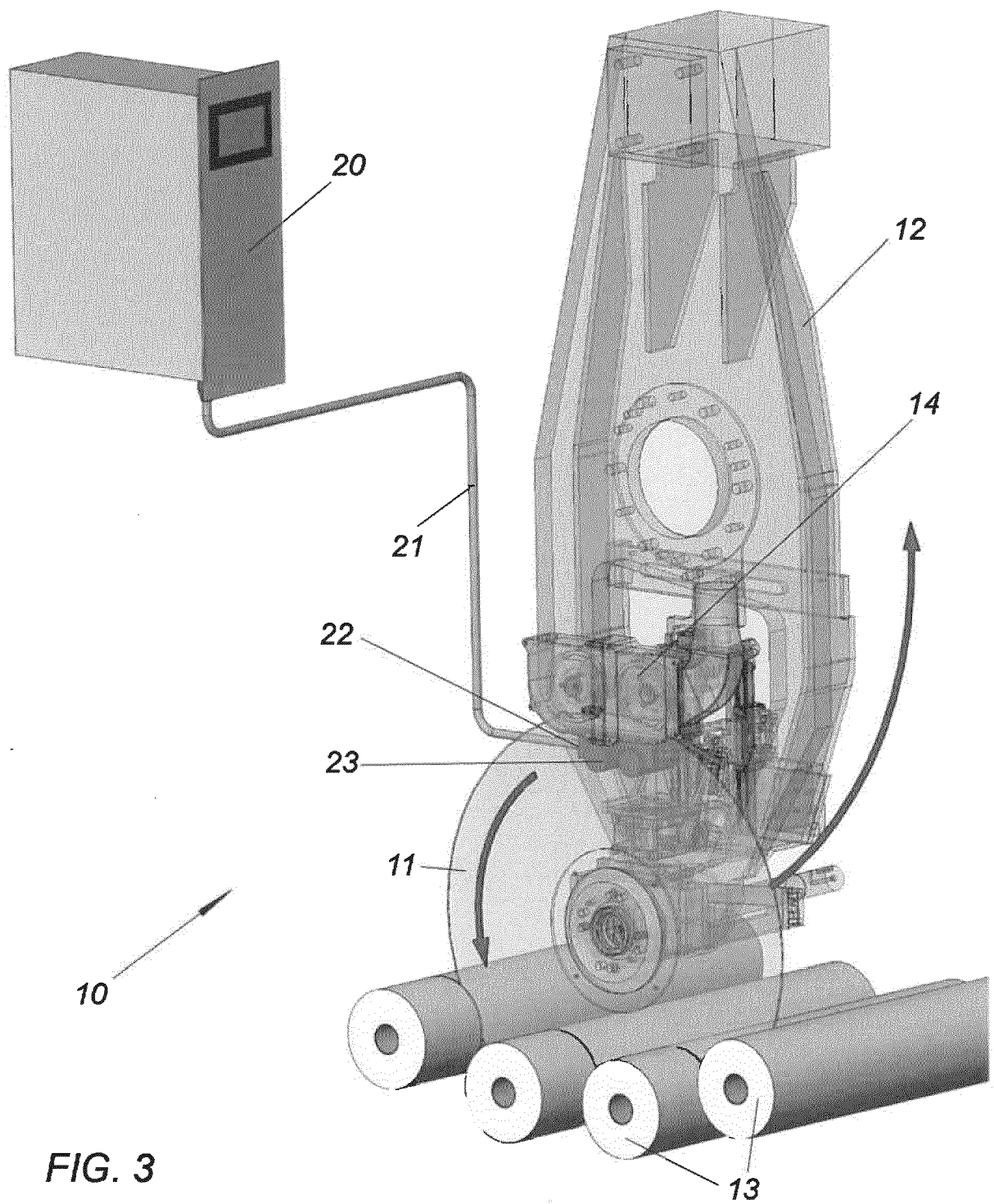


FIG. 3

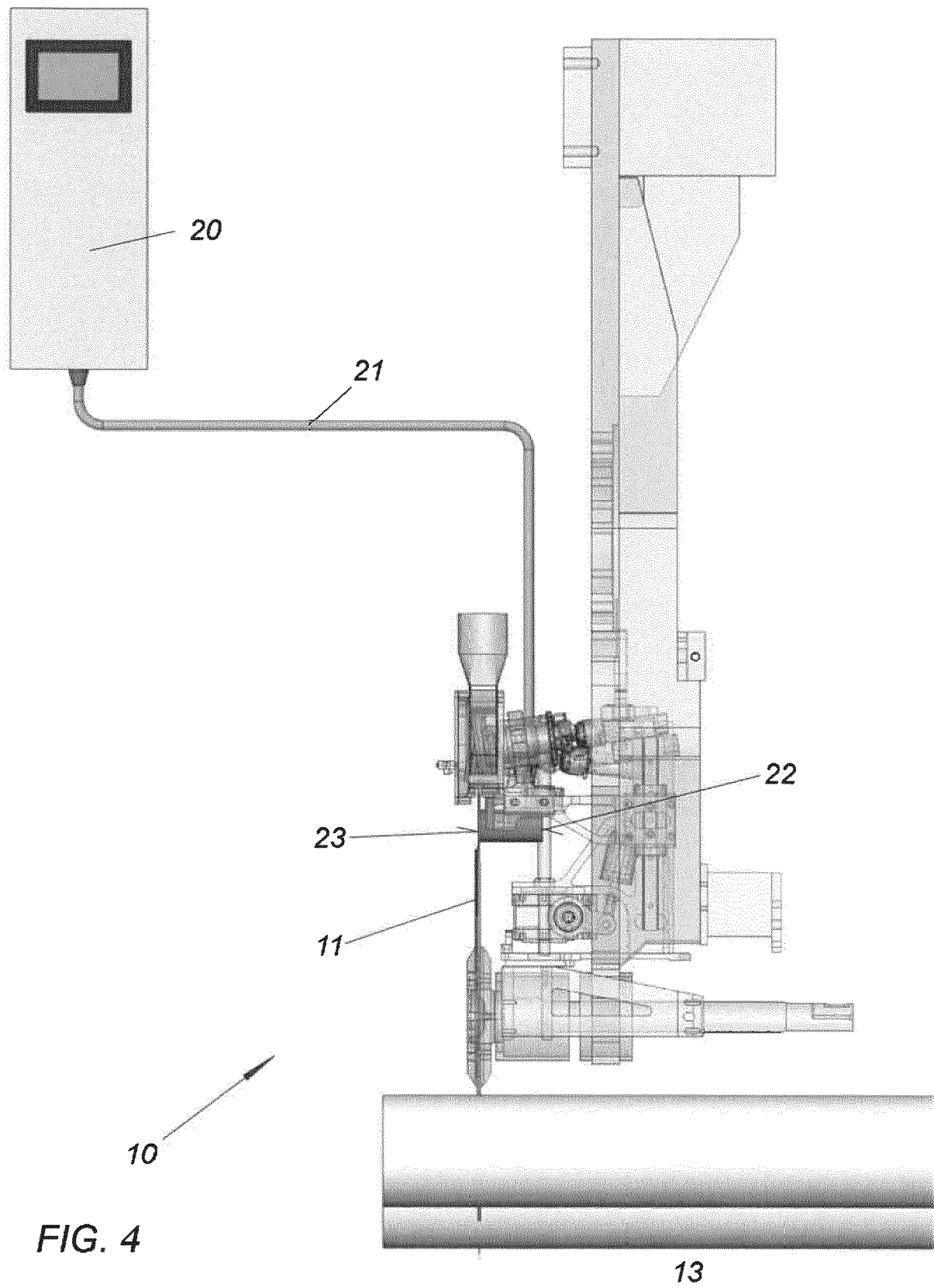


FIG. 5

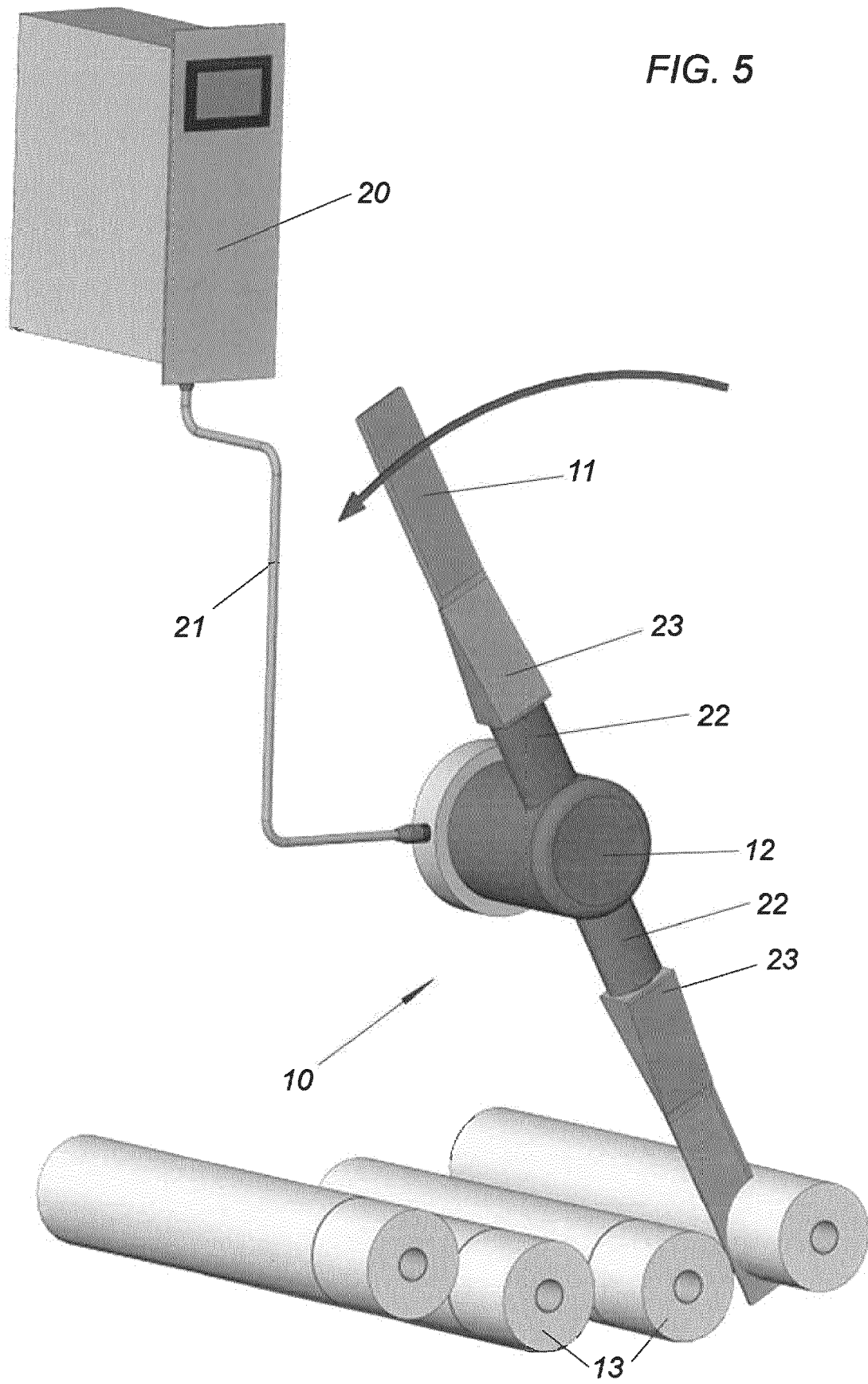
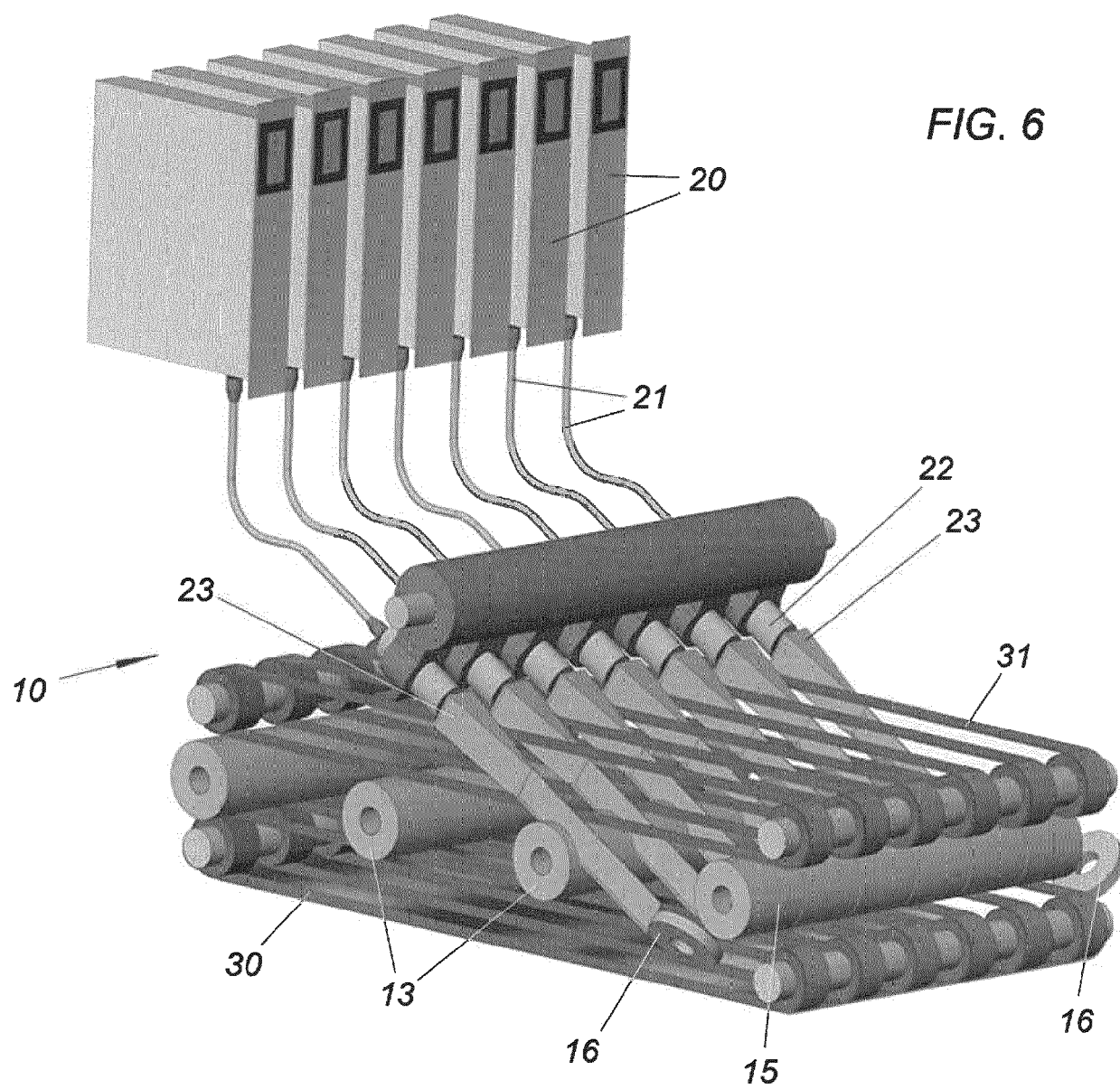
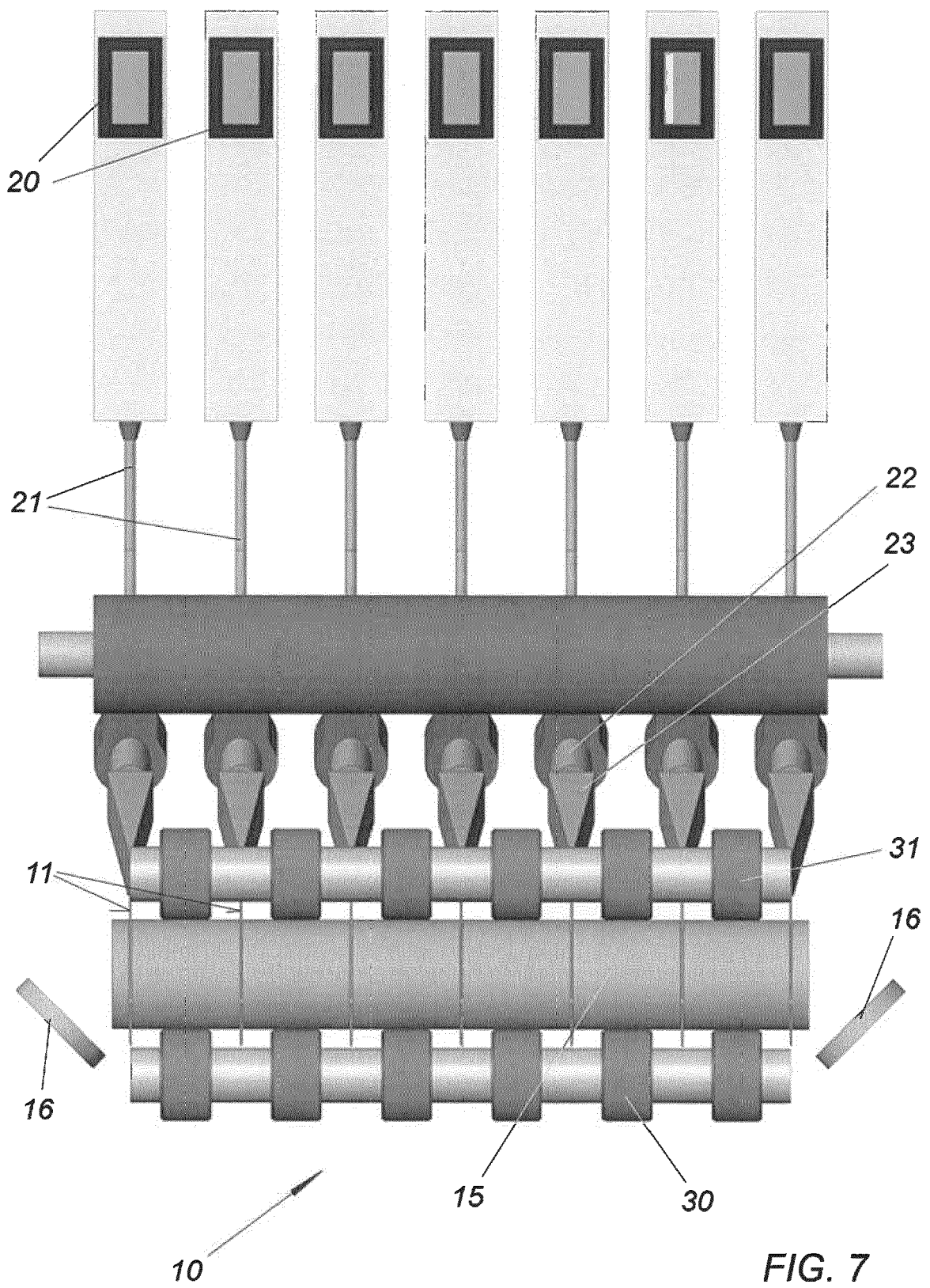
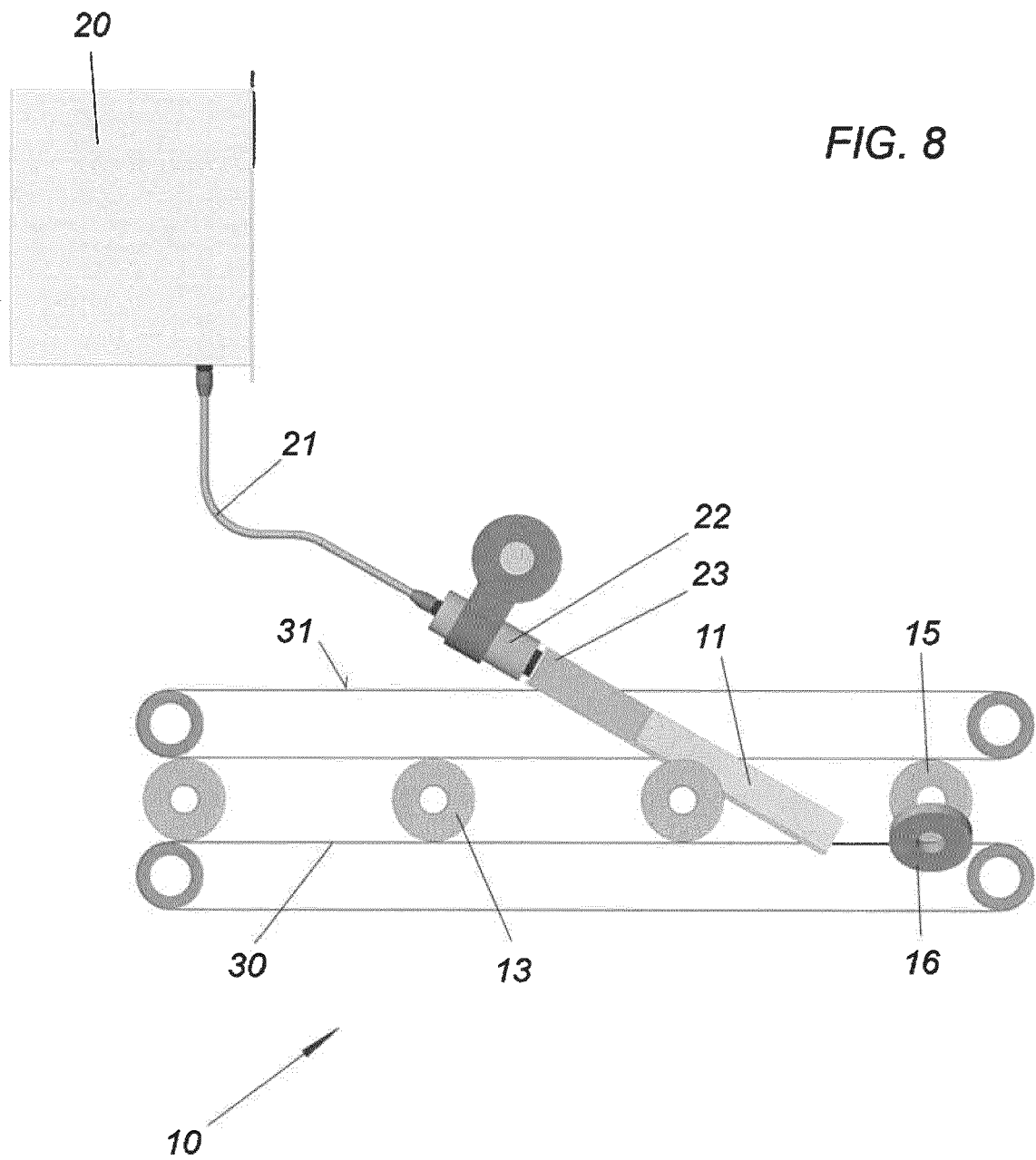


FIG. 6









EUROPEAN SEARCH REPORT

 Application Number
 EP 17 19 5028

5

10

15

20

25

30

35

40

45

50

55

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	US 2016/114494 A1 (CARRASCO CÉSAR [CH]) 28 April 2016 (2016-04-28)	6,10	INV. B26D3/16 B26D7/08
A	* abstract; figure 2 * -----	1-5,7-9	
A	EP 1 075 910 A1 (FORT JAMES FRANCE [FR]) 14 February 2001 (2001-02-14) * abstract; figure 1 *	1-10	
A	US 3 468 203 A (ARMELIN EDOUARD ROGER ET AL) 23 September 1969 (1969-09-23) * column 2, line 1; figures 1,2 * -----	1-10	
			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 16 October 2017	Examiner Müller, Andreas
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			

 1
 EPO FORM 1503 03.02 (P04C01)

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

EP 17 19 5028

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.

16-10-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2016114494 A1	28-04-2016	AU 2014267443 A1	19-11-2015
		CA 2911385 A1	20-11-2014
		CN 105228800 A	06-01-2016
		EP 2803455 A1	19-11-2014
		EP 2996847 A1	23-03-2016
		JP 2016532538 A	20-10-2016
		US 2016114494 A1	28-04-2016
		WO 2014184150 A1	20-11-2014

EP 1075910 A1	14-02-2001	NONE	

US 3468203 A	23-09-1969	BE 696420 A	01-09-1967
		DE 1561733 A1	12-03-1970
		GB 1177064 A	07-01-1970
		US 3468203 A	23-09-1969

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 1609570 B1 [0009]
- US 3468203 A [0010]