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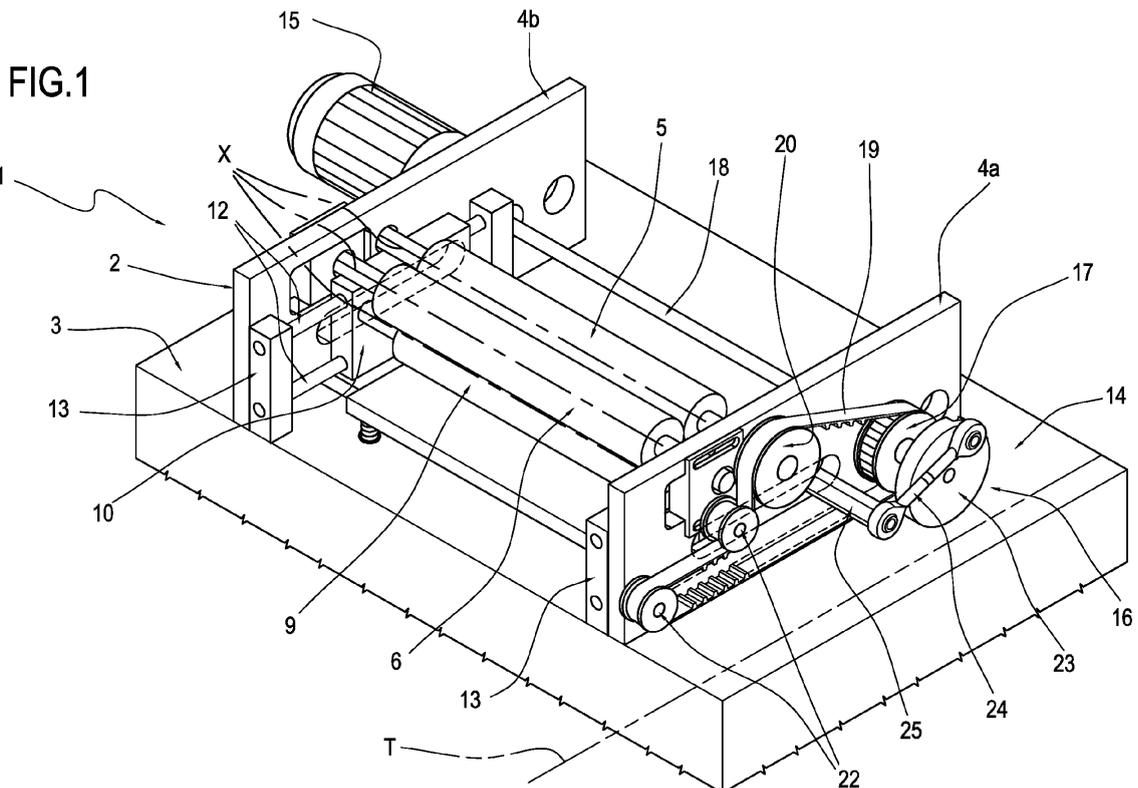
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(54) **Device for folding sheets**

(57) A device for folding sheets in superposed layers comprises a frame (2), a pair of first rollers (5, 6) for feeding a sheet to be folded and mounted on the frame (2), a contact surface (11), a pair of second, folding rollers

(8, 9) interposed between the pair of first rollers (5, 6) and the contact surface (11), the pair of second rollers (8, 9) being movable with reciprocating motion to form in the sheet a succession of superposed layers.



Description

[0001] This invention relates to a machine and a method for folding sheets.

[0002] In particular, this invention relates to a machine for folding information sheets intended for insertion in packets of medicines and the like.

[0003] In a prior art system for folding information sheets a web of paper is passed between two rollers which are shaped to match each other in such a way as to impart to the web lines for folding in alternating directions.

[0004] This is done using a plurality of teeth alternating with corresponding grooves made in the two rollers, so that during rotation the tooth of the first roller engages with a corresponding groove in the second roller and immediately afterwards a tooth of the second roller engages with a corresponding groove in the first roller. During the movement of the rollers, the meshing of the teeth causes the paper web running between the rollers to receive a succession of folds which are only rough.

[0005] Complete folding with superposing of the layers is left to further devices located downstream, for example two large-diameter screws which rotate, their respective threads engaging, the screws having axes which are parallel with each other and perpendicular to those of the rollers described above.

[0006] The prior art folding system just described has many disadvantages, one of which is the fact that it is impossible to vary the size of the layer, since it is uniquely linked to the diameter of the rollers and the distance between the teeth/grooves made in them.

[0007] This circumstance means that the system is not very versatile.

[0008] Another disadvantage of the prior art folding system is the limited life of the rollers which, in practice, are exposed to rapid wear of the teeth with consequent worsening of the folding quality and the need for frequent substitutions.

[0009] Therefore, the aim of this invention is to overcome these disadvantages by providing a device for folding sheets in superposed layers which is at the same time simple and economical to make and practical and effective to use.

[0010] The technical features of this invention, according to the aforementioned aim, may be easily inferred from the contents of the appended claims, especially claim 1, and preferably any of the claims that depend, either directly or indirectly, on claim 1.

[0011] Further, the advantages of the invention are more apparent from the detailed description which follows, with reference to the accompanying drawings, which illustrate a preferred, nonlimiting example embodiment of it and in which:

- Figure 1 is a schematic perspective top view of a preferred embodiment of the device for folding sheets made in accordance with this invention;

- Figures 2 to 8 are respective schematic side elevation views, with some parts cut away to better illustrate others, illustrate, of the device of Figure 1 in a succession of operating steps;
- 5 - Figure 9 is a schematic perspective top view of a second embodiment of the device of the previous figures.

[0012] With reference to the accompanying drawings, the numeral 1 denotes in its entirety a device for folding sheets in superposed layers made in accordance with this invention.

[0013] As shown in Figure 1, the device 1 comprises a supporting frame 2 which, by way of example, comprises a base 3 and two lateral walls 4a, 4b extending vertically from the base 3.

[0014] The device 1 comprises a pair of first rollers for feeding a sheet 7, advantageously of paper, which is visible in Figures 2 to 8.

[0015] The pair of first rollers, hereinafter also referred to without distinction as the first pair, comprises, as indicated, the two rollers 5, 6 one of which, labelled 5 in the drawings, is motor-driven, and the other of which, labelled 6, is idle.

[0016] The two rollers 5, 6 are parallel with each other and are rotatably mounted on the vertical walls 4a, 4b of the frame 2 by means of rolling bearings of the known type and not illustrated.

[0017] The device 1 comprises a pair of second, folding rollers 8, 9, also referred to as the second pair, which is located below the first pair.

[0018] In detail, as shown in the accompanying drawings, the second pair comprises two rollers 8, 9 which are parallel with each other and spaced with a predetermined centre-to-centre distance.

[0019] The first rollers 5, 6 and the second rollers 8, 9 have respective axes of rotation X which are all parallel with each other.

[0020] The two second rollers 8, 9 are free-rotatably mounted, by means of rolling bearings of the known type and not illustrated, on two sliders 10, only one of which is visible in Figure 1, which are located at respective opposite longitudinal ends of the second rollers 8, 9 themselves.

[0021] Below the second pair of rollers 8, 9, the device 1 comprises a contact surface 11 elastically mounted on the frame 2 by means of a plurality of elastic elements 12 of the known type, for varying its distance from the above-mentioned pair of second rollers 8, 9.

[0022] As shown in the accompanying drawings, each slider 10 slidably engages on two respective cylindrical tracks 12 which extend longitudinally in directions transversal to those identified by the axes of the rollers 5, 6, 8, 9.

[0023] The cylindrical tracks 12 are mounted at the respective longitudinal ends on vertical members 13 which are rigidly connected to the frame 2 and, in particular, are against the vertical walls 4a, 4b. The sliders 10 are

slidably movable relative to the frame 2, to produce a straight line reciprocating motion of the pair of second rollers 8, 9 along a direction T which is substantially perpendicular to the axes of rotation X of the rollers 5, 6, 8, 9. In detail, the device 1 comprises actuating means 14 designed both to make the first roller 5 rotate, thus producing a sheet 7 feeding motion, and to move the pair of second rollers 8, 9 with reciprocating motion.

[0024] In the preferred embodiment illustrated in the accompanying drawings from Figures 1 to 8, the actuating means 14 comprise a single electric motor 15 and means 16 for transmitting the motion both to the first roller 5 and to the sliders 10.

[0025] As illustrated in Figure 1, the motion transmission means 16 comprise at least one gear wheel 17 keyed to a driving shaft 18 connected to the motor 15. The gear wheel 17 engages with a toothed belt 19 which transmits the rotary motion to a pulley 20 keyed to a shaft 21 integral with the first roller 5. The belt 19 also engages with a plurality of return rollers 22.

[0026] The motion transmission means 16 also comprise a crank and link mechanism in turn comprising a crank 23 keyed to the driving shaft 18 and a link 24 connected to an arm 25 fixed cantilever-style to one of the sliders 10.

[0027] In the vertical wall 4a there is a slot 26 designed to allow the straight line movement of the arm 25 producing the reciprocating motion of the sliders 10.

[0028] According to alternative embodiments of this invention, not illustrated, the actuating means 14 have two separate motors for respectively moving the first roller 5 and the crank 23.

[0029] According to such alternative embodiments, not illustrated, there are therefore separate motor means for feeding the paper and for moving the sliders, for easily varying the dimensions of the layers without having to substitute the rollers.

[0030] In practice, as illustrated in succession in the accompanying drawings from 2 to 8, a sheet 7, preferably of paper, is fed to the first rollers 5, 6.

[0031] The first rollers 5, 6 rotate in opposite directions, since the rotation of the first roller 5 is driven by the actuating means 14, through the belt 19 and the related pulley 20, while the roller 6 is idle, that is to say, it rotates freely.

[0032] Therefore, the sheet 7, interposed between the two first rollers 5, 6 which rotate in opposite directions is pushed by said rollers towards the pair of second rollers 8, 9.

[0033] Starting from the configuration shown in Figure 2 in which a first end 7a of the sheet lies on the contact surface 11 and is retained against it, the movement of the sliders 10 in the direction indicated by the arrow S causes, simultaneously with continuous sheet 7 feed in the direction indicated by the arrow A by the first rollers 5, 6, positioning of a predetermined stretch of the sheet 7 on the contact surface 11.

[0034] As Figure 3 shows, when the sliders 10 invert

their motion, according to the direction of the arrow D, when the crank and link mechanism reaches a dead centre, the second roller 9 makes a fold in the sheet 7, with the simultaneous formation of a second layer intended to be superposed on a first layer in contact with the contact surface 11. Figures 4 to 6 show successive moments of the creation of the second layer of the sheet 7, corresponding to respective successive positions of the sliders 10 as they advance along the direction indicated by the arrow D.

[0035] In other words, Figures 3 to 6 show, in successive moments, the movement of the second rollers 8, 9 and the action of the second roller 9 on the sheet 7. In particular, they show how the second roller 9 lays out the sheet 7 so that it is lying on the layer below, until a superposing layer is created. The superposing layer is formed, in its entirety, at the moment when the pair of second rollers 8, 9 and the related sliders 10 invert their motion, as illustrated substantially in Figure 7.

[0036] Said figure shows the formation of a further fold in the sheet 7, said fold confirming the start of the formation of a further layer superposed on the previous layers.

[0037] From the configuration shown in Figure 7, the sliders 10 and with them the second rollers 8, 9 advance along the direction shown by the arrow S. Figure 8 shows the device 1 at a moment after the configuration of Figure 7, a moment when the sheet 7 fed by the first rollers 5, 6 and pushed by the second roller 8 on the right, rests on the second roller 9 on the left.

[0038] According to the alternative embodiment illustrated in Figure 9, the device 1 comprises an oscillating element 27 for guiding the sheet to be folded, the guide element 27 being interposed between the second rollers 8, 9. The presence of the oscillating element 27 advantageously allows more rapid feeding of the sheet to be folded, preventing the "natural" formation of loops in the sheet from resulting in any hindrance between the second rollers 8, 9.

[0039] The oscillating element 27 advantageously comprises two superposed plates which are spaced by a gap big enough to allow the passage of a sheet between them.

[0040] The means for driving the oscillation, not illustrated, advantageously derive their motion from the crank and link mechanism which drives the reciprocating movement of the sliders 10.

[0041] The invention described above is susceptible of industrial application and may be modified and adapted in several ways without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent elements.

55 Claims

1. A device for folding sheets in superposed layers, comprising

- a frame (2),
 - a pair of first rollers (5, 6) for feeding a sheet (7) to be folded, said first rollers (5, 6) being mounted on the frame (2),
 - a contact surface (11),
 - a pair of second, folding rollers (8, 9) interposed between the pair of first rollers (5, 6) and the contact surface (11), the pair of second rollers (8, 9) being movable with reciprocating motion and acting in conjunction with the contact surface (11) to form in the sheet (7) a succession of superposed layers.
2. The device according to claim 1, **characterized in that** the second rollers (8, 9) are free-rotatably mounted on two sliders (10) located at respective opposite longitudinal ends of the second rollers (8, 9) themselves.
3. The device according to claim 2, **characterized in that** the sliders (10) are slidably movable relative to the frame (2) to produce the reciprocating motion of the pair of second rollers (8, 9).
4. The device according to claim 3, **characterized in that** the sliders (10) are movable with reciprocating motion in a straight line along a direction (T) perpendicular to the axis of rotation (X) of each of the second rollers (8, 9).
5. The device according to any of the claims from 1 to 4, **characterized in that** the contact surface (11) is elastically mounted to vary its distance from the pair of second rollers (8, 9) following the formation of the layers.
6. The device according to any of the claims from 1 to 5, **characterized in that** it comprises actuating means (14) to make at least one of the first rollers (5, 6) rotate and to move the pair of second rollers (8, 9) with reciprocating motion.
7. The device according to claim 6, **characterized in that** the actuating means (14) comprise a crank and link mechanism to impart the reciprocating motion to the pair of second rollers (8, 9).
8. The device according to claim 6 or 7, **characterized in that** the actuating means (14) comprise a single motor (15) and related motion transmission means (16) to move the at least one of the first rollers (5, 6) rotationally and the second rollers (8, 9) with reciprocating motion.
9. The device according to claim 6 or 7, **characterized in that** the actuating means (14) comprise two separate motors to move respectively the at least one of the first rollers (5, 6) rotationally and the second rollers (8, 9) with reciprocating motion.
10. The device according to any of the claims from 1 to 9, **characterized in that** it comprises an oscillating element (27) for guiding the sheet (7) to be folded, the guide element (27) being interposed between the second rollers (8, 9).

FIG.2

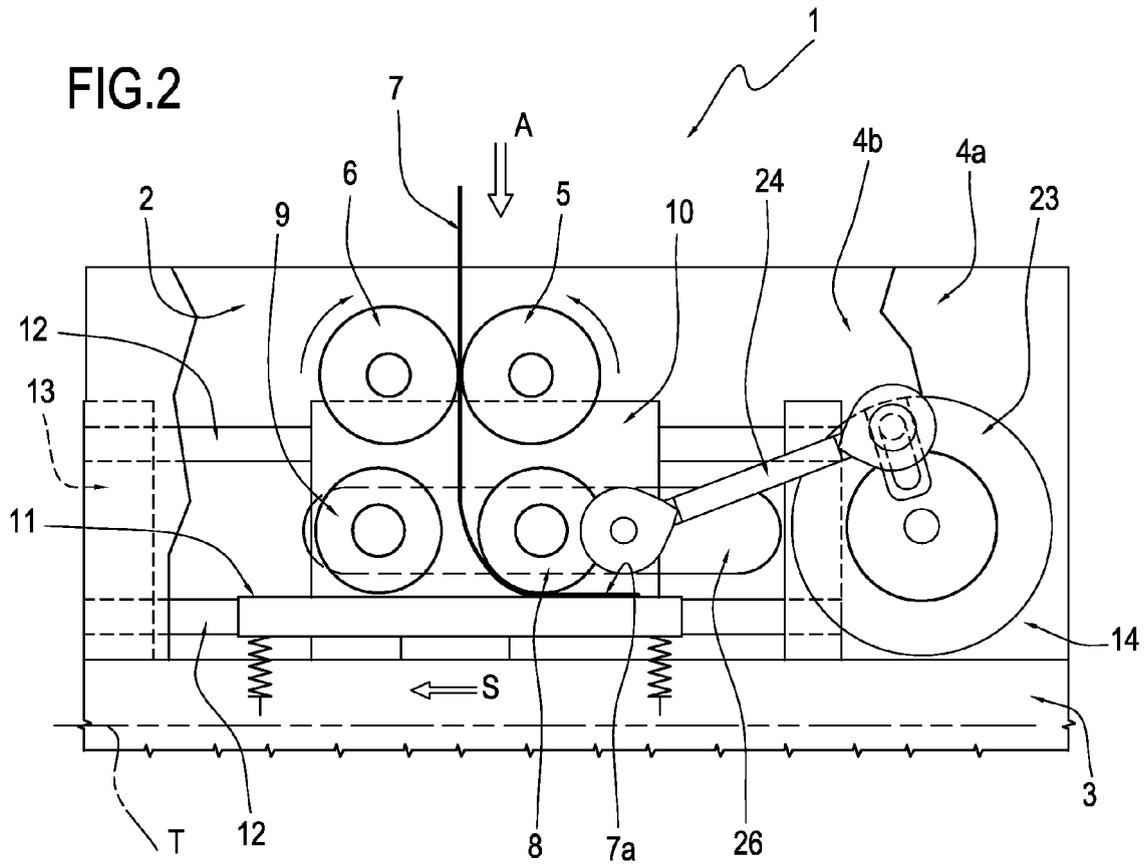
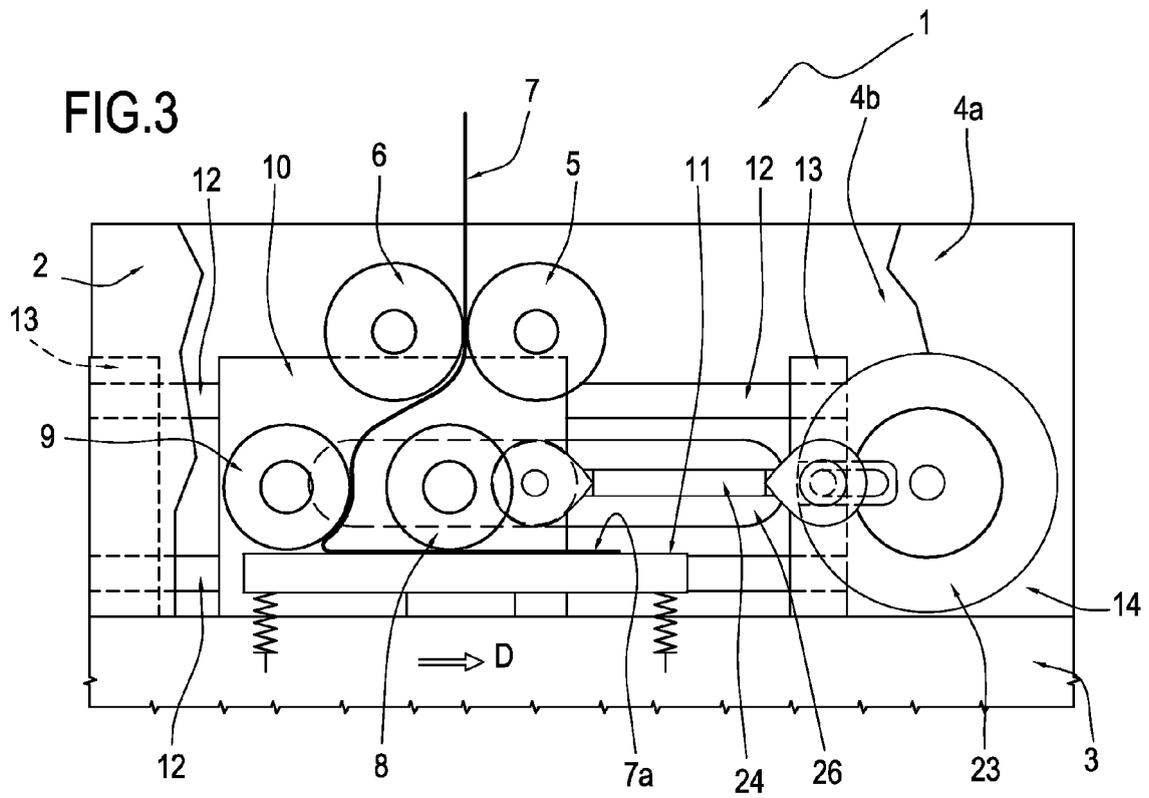
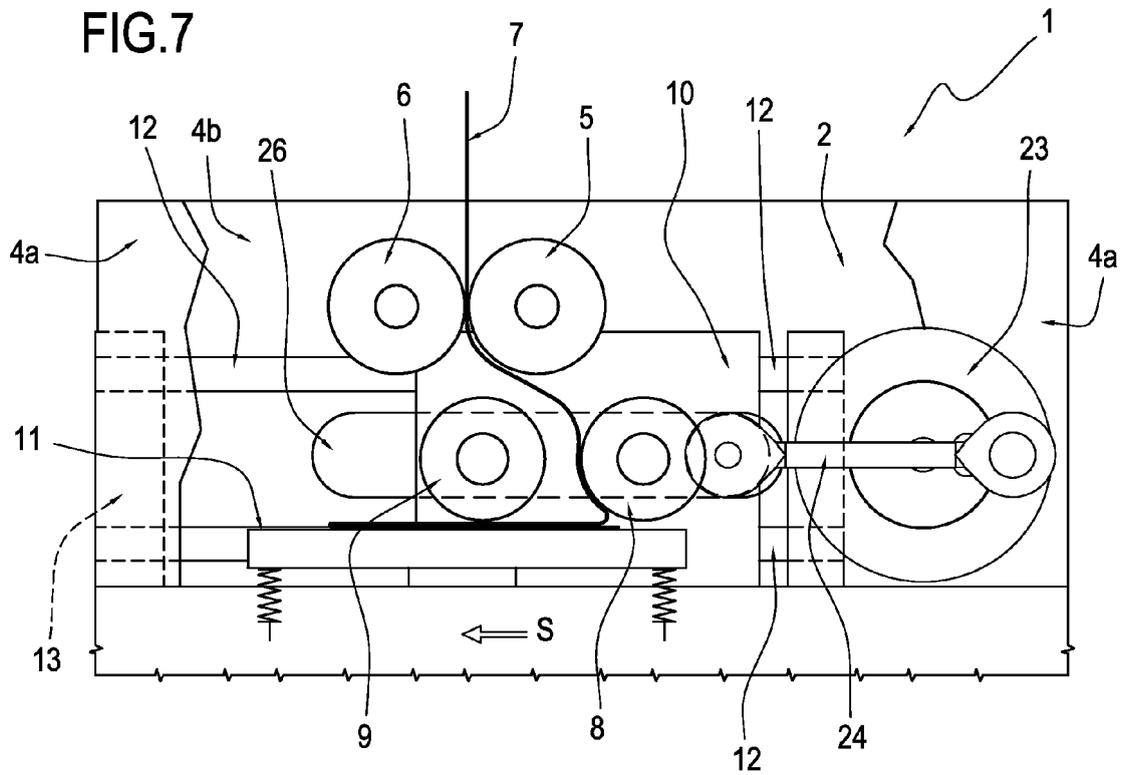
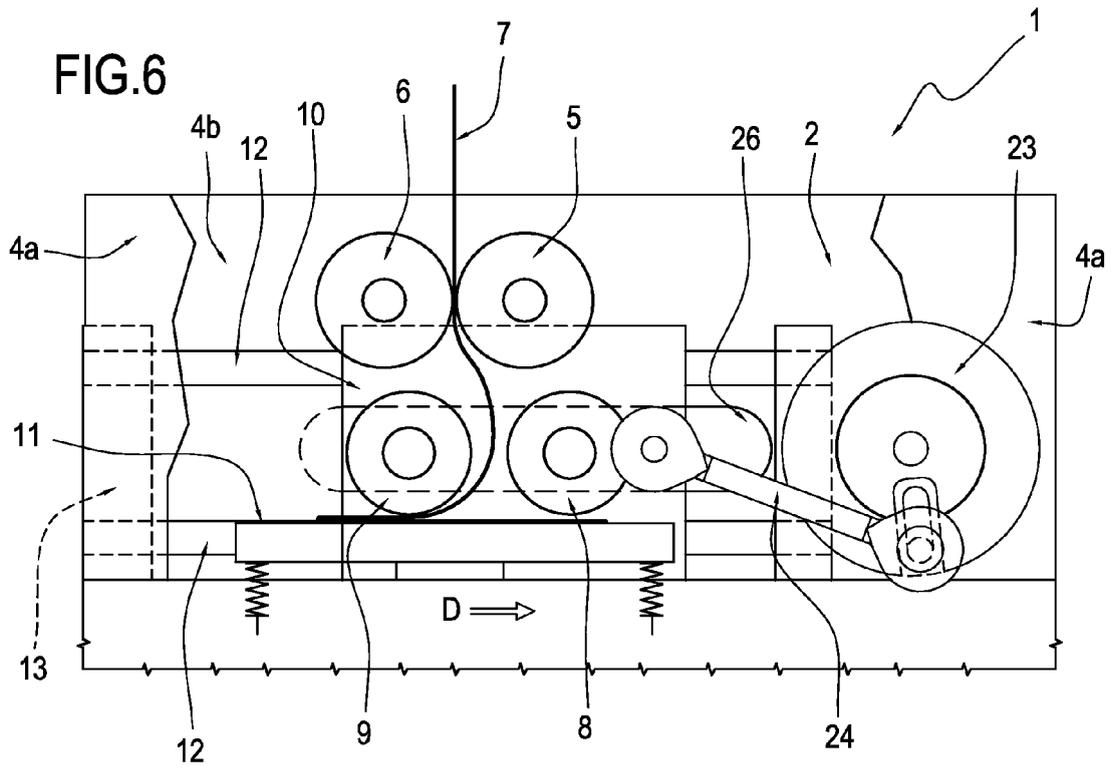
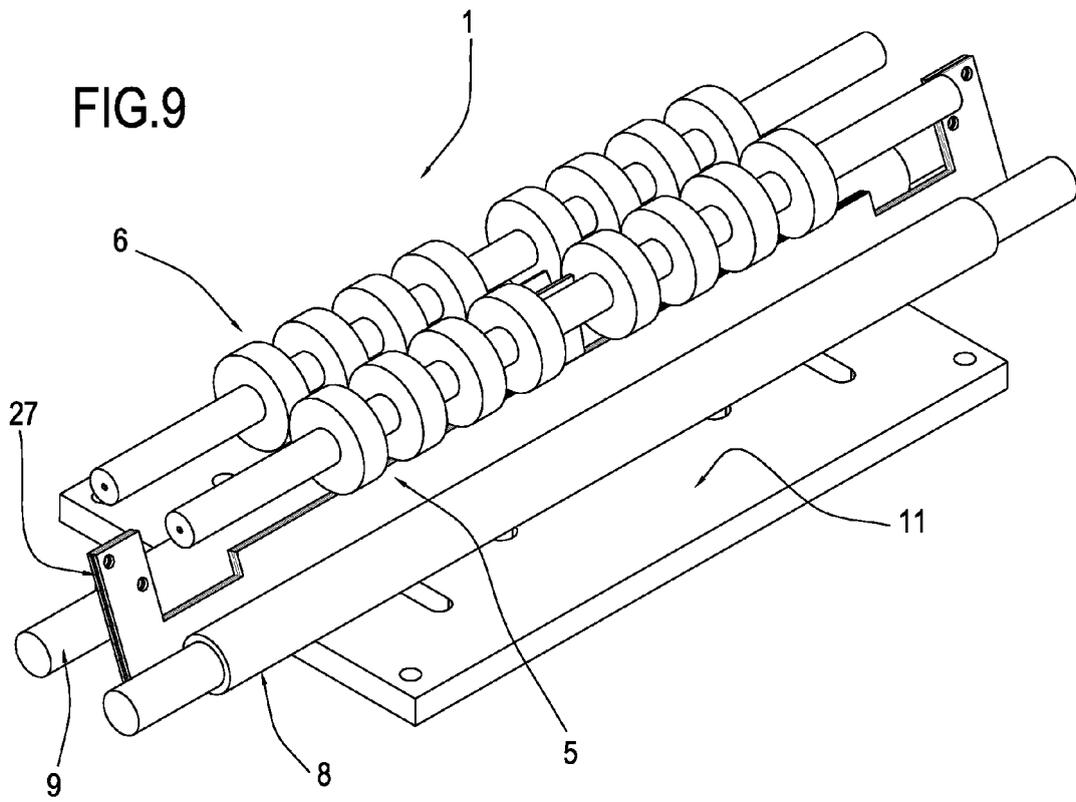
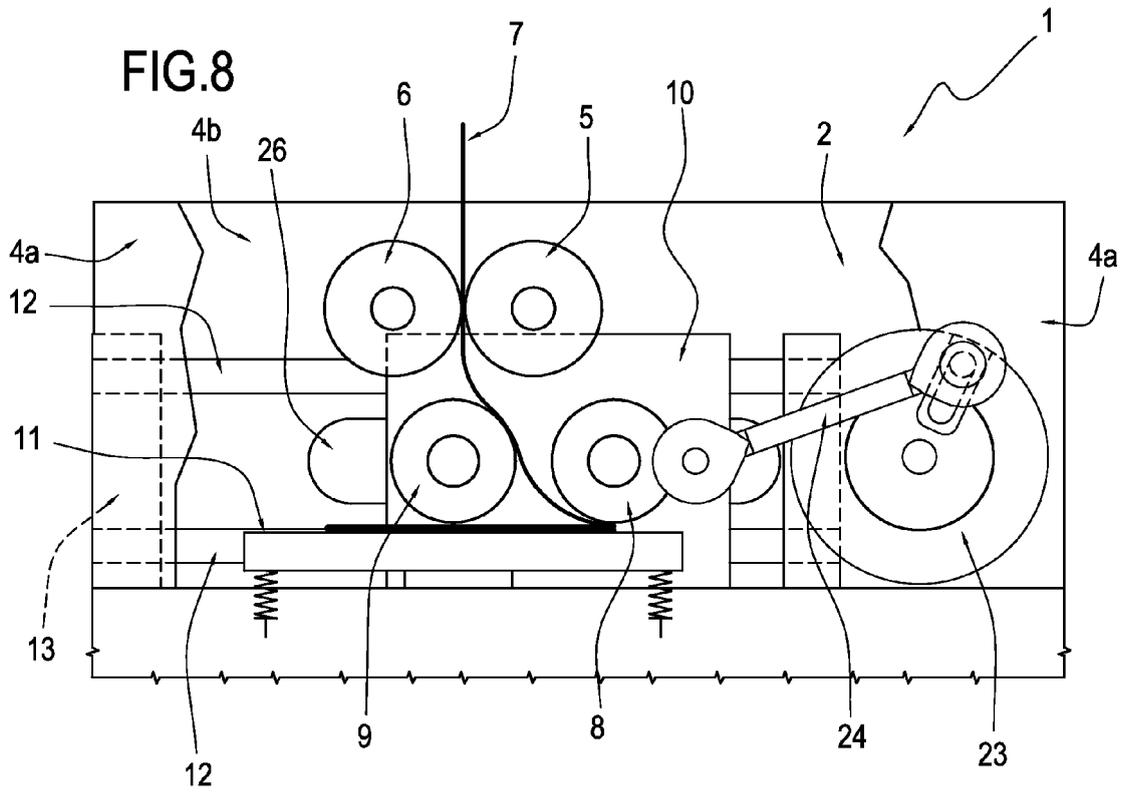


FIG.3









EUROPEAN SEARCH REPORT

Application Number
EP 11 15 6349

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	US 4 573 958 A (BIESINGER PETER J [DE]) 4 March 1986 (1986-03-04) * column 2, lines 53-68 * * column 4, line 6 - column 5, line 36; figures * -----	1-10	INV. B65H45/101 B65H45/20
A	WO 99/16693 A1 (STAC PAC TECH INC [BB]; OCONNOR LAWRENCE [CA]; SCHEPS RICHARD [CA]; SM) 8 April 1999 (1999-04-08) * page 6, paragraph 3 - page 10, paragraph 4; figures * -----	1-10	
A	US 4 573 670 A (FELIX WILLI [CH]) 4 March 1986 (1986-03-04) * the whole document * -----	1-10	
A	JP 58 100065 A (HATAHARA HIROSHI) 14 June 1983 (1983-06-14) * the whole document * -----	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		10 June 2011	Raven, Peter
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	

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EPO FORM 1503 03/82 (P04C01)

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

EP 11 15 6349

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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10-06-2011

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 4573958	A	04-03-1986	NONE		

WO 9916693	A1	08-04-1999	AU	9333998 A	23-04-1999

US 4573670	A	04-03-1986	CA	1257303 A1	11-07-1989
			DE	3344260 A1	20-06-1985
			EP	0144861 A2	19-06-1985
			ES	8507415 A1	16-12-1985
			JP	1001382 B	11-01-1989
			JP	1523278 C	12-10-1989
			JP	60132867 A	15-07-1985

JP 58100065	A	14-06-1983	JP	1259961 C	12-04-1985
			JP	59035811 B	30-08-1984
