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(54) **A method and apparatus for feeding semifinished roll products of tissue paper to a roll cutting station.**

(57) In a method of feeding semifinished roll products (6) of tissue paper in the form of a web wound around a core (5), the semifinished products (6) are sent to a cutting station (11) equipped with a circular blade (13) which cuts the semifinished products (6) into roll lengths (7r); the semifinished products (6) are fed in such a way as to form stacks (14) of at least two layers (12) of semifinished roll products (6) positioned side by side, where the layers (12) are placed over one another in a suitable di-

rection (13a) relative to the blade (13); each layer (12) in the stack (14) contains a number of semifinished products (6) that differs from that in the previous layer (12). The semifinished products (6) in a stack (14) can be enclosed within an envelope boundary (20) of a geometric shape contained in a circular segment (F, G, H) of the blade (13) whose largest chord corresponds to the layer with the highest number of semifinished products (6) in the stack (14).

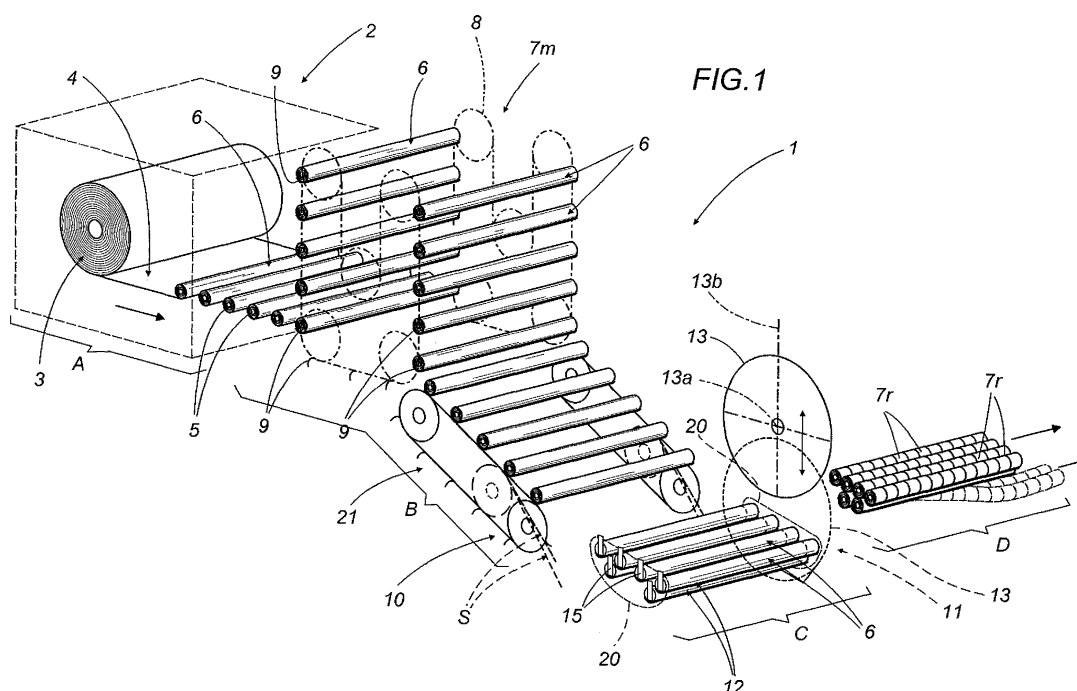


FIG. 1

Description

[0001] This invention relates to an improved apparatus for producing rolls of tissue paper for bathroom and/or household or general use.

[0002] Rolls of tissue paper are made in standard commercial sizes in specific installations where long, semi-finished rolls are fed into cutting stations which cut them at regular intervals to make finished rolls which are ready for end use.

[0003] These semifinished rolls are equal in diameter to the standard commercial size rolls and are made by rewinding onto a cardboard core a continuous web of tissue paper unwound from a larger parent roll which may be, for example around 2500 mm in diameter and 2700 mm in length.

[0004] These very long semifinished roll products or tubes - commonly known as "logs" in the jargon of the trade - are made in machines known as rewinders precisely because they rewind the web of tissue paper from one large parent roll onto the smaller logs of tissue paper.

[0005] Between the rewinder and the cutting station, the production installation comprises a mobile magazine equipped with chain and tray conveyors.

[0006] As the semifinished roll products or logs leave the rewinder, each log is loaded onto a respective tray in the magazine which transfers it to a preparation station which feeds it directly to the cutting station.

[0007] In the preparation station, the magazine successively dumps the logs by tipping the trays in a systematic and ordered manner as they strike an overturning element suitably mounted on the path of the chain conveyors.

[0008] In the preparation station of the cutting station, the logs are fed transversally in parallel and divided into groups of several logs each where the logs are placed side by side to form a horizontal layer consisting, for example, of four logs.

[0009] The logs are then advanced in steps, and this time longitudinally of their axes, in such a way that they all simultaneously reach a vertically reciprocating circular blade that intersects the layer of logs in such a way as to cut a predetermined length from each log, thus cutting off as many lengths as there are logs in the layer at each cutting stroke.

[0010] The lengths cut off correspond in size and diameter to a standard commercial roll size and are thus ready to be sent to packaging machines located further downstream of the cutting station in the production process.

[0011] Experience in designing these cutting stations has led to the formulation of criteria of good design practice according to which, bearing in mind all the variables involved, these installations meet optimum economic and functional requirements when the circular blades used do not exceed 1000/1200 mm in diameter and when no more than four or five rolls are cut off from the log layers at each cutting stroke.

[0012] These design criteria condense in just a few basic rules a number of much more complex concepts intended to achieve, through practical experience, an optimum compromise between numerous variables often in contrast with each other.

[0013] These include, for example, the diameter of the commercial rolls, the economic cutting speed, the length of active and passive strokes of the circular blade, the length of time it takes to sharpen a blade, cutter down time due to blade sharpening, the gradual reductions in blade diameter due to sharpening, the properties of the materials the blades are made of, and so on.

[0014] Taking for granted that these installations serve as feed lines for machinery that packages and wraps the rolls in groups suitable for commercial package sizes (from single roll to bulk packages), it has been found, in view of the above mentioned economic criteria, that the output capacities of the log cutting lines are relatively low compared to the output potential of the modern packaging machines downstream.

[0015] On the other hand, it is also true that modifications to traditional installations involving an increased number of logs placed side by side and composing a single layer would necessitate an increase in blade diameter and, hence, a proportional increase in the cost of the blades.

[0016] Increasing the diameter of a blade would also, inevitably, mean increasing the length of the blade stroke and, consequently, the duration of each cutting cycle, resulting in a loss of economic efficiency linked directly to the longer passive strokes of the reciprocating motion of the blade.

[0017] Thus, an attempt to increase the roll output by increasing the number of rolls per layer might paradoxically lead to longer cycle times, thus reducing line speed.

[0018] This invention therefore has for an object to meet the ever increasing productions speed demands of roll packaging machinery with a roll production apparatus designed in such a way that it can continue to operate according to consolidated economic criteria.

[0019] According to this object, the basic idea of this invention is to feed the cutting station in such a way as to form stacks of at least two layers of semifinished roll products, superposed in a direction radial to the circular blade and where each layer comprises a number of rolls which always differs from that of the preceding layer and such that the boundary of the geometric envelope of all the rolls in the stack does not exceed the boundary of the circular segment of the blade with the largest chord corresponding to the stack layer with the highest number of logs.

[0020] Compared to prior art, under equal conditions of circular blade diameter and cutting stroke length, the invention increases production volumes significantly and to such an extent as to not only meet the maximum operating speeds of packaging machines but also be able to feed more than one machine in parallel. This makes it possible to configure packaging installations even ac-

cording to different and variable commercial pack size combinations.

[0021] The technical characteristics of the invention may be easily inferred from the contents of the appended claims, especially claim 1 or 8 or 13, and also any of the claims that depend, either directly or indirectly, thereon.

[0022] The advantages of the invention are apparent from the detailed description which follows, with reference to the accompanying drawings which illustrate preferred, non-limiting embodiments of it provided merely by way of example and in which:

- Figure 1 schematically represents a first part of a roll production apparatus;
- Figure 2 is a highly schematic representation of a second part of the apparatus of Figure 1;
- Figures 3a, 3b and 3c are schematic front views illustrating three possible configurations of the semifinished roll products in the cutting station of the apparatus;
- Figure 4 is a simplified, example representation of one of the numerous possible embodiments of the means for feeding the semifinished roll products to the cutting station.

[0023] The numeral 1 in Figure 1 denotes in its entirety an apparatus for making rolls 7r of tissue paper for bathroom or household use.

[0024] As also shown in Figure 2, the apparatus 1 essentially comprises a production line schematically divided for greater clarity of description into five basic sections located one after the other and labelled A, B, C, D and E.

[0025] A first section A of the line 1 comprises a rewinding machine 2 fed by a large parent roll 3 of tissue paper in the form of a web 4 of tissue paper which the machine 2 unwinds from the parent roll 3 and repeatedly rewinds onto a tubular core 5 obtaining a semifinished roll product 6 identical in length to the parent roll 3 but smaller in diameter, that is to say, equal in diameter to the tissue paper rolls 7r in the currently available commercial sizes.

[0026] The semifinished roll products 6 referred to above are usually known in the trade by the English jargon term "logs".

[0027] Downstream of the rewinding machine 2, the apparatus 1 comprises a second section, labelled B in its entirety, where the semifinished roll products 6 advance transversally in parallel with each other and are fed to a mobile magazine, labelled 7m as a whole.

[0028] The magazine 7m, which is represented in a very schematic form since, in this embodiment, it is of well known, conventional type, comprises a power-driven chain conveyor 8 equipped with a succession of cradles 9 designed and structured to individually accommodate the semifinished roll products 6 feeding out of the first section A of the apparatus 1.

[0029] Downstream of the chain conveyor 8, the second section B of the apparatus 1 comprises feed means

10 designed to feed the semifinished roll products 6 in suitable manner to a cutting station 11 located in the next station C of the apparatus 1.

[0030] The feed means 10 are designed to feed the semifinished products 6 to the cutting station 11, to divide them into groups in the form of horizontal layers 12 with a predetermined number of semifinished roll products 6 placed side by side and to arrange the layers 12 in stacks 14 with a vertical axis 13b.

[0031] In other words, as will become clearer as this description continues, the stacks 14 are defined in such a way that the entire stack 14 formed can be cut by a blade 13 in a single cutting stroke.

[0032] The cutting station 11 comprises a cutting blade 13 in the form of a large circular saw blade that revolves about its axis of symmetry 13a and reciprocates in a vertical direction 13b in a plane parallel to the axis of the stacks 14 of semifinished layered products 6.

[0033] The cutting station 11 also comprises a system of pushers 15 which act synchronously on the cores 5 of the stack 14 in such way as to make all the semifinished products 6 in the stack 14 advance simultaneously horizontally across the plane in which the circular blade 13 moves.

[0034] The semifinished products 6 are advanced in steps equal in length to the axial lengths of the commercial size rolls 7r.

[0035] Since this step-by-step movement is synchronized with the up and down movement of the blade 13, each time the blade 13 moves down, it cuts off from the semifinished products 6 in the stack 14 as many commercial size rolls 7r of paper as there are semifinished products 6 in the stack 14 itself.

[0036] The letter D, downstream of the cutting section 11, denotes another section of the apparatus 1 through which the rolls 7r travel to reach a switching station, labelled 16 (shown in Figure 2), from where one or more streams 17 of rolls 7r branch out to feed an equal number of packaging machines 18 located further downstream and schematically represented as blocks.

[0037] Figures 3a, 3b, 3c show how the semifinished products 6 in the cutting station 11 may be layered in stacks 14 according to different grouping patterns.

[0038] Figure 3a shows a grouping with two layers 12 of semifinished roll products 6, with four semifinished products 6 at the top of the stack 14 and two semifinished products 6 at the bottom.

[0039] All the semifinished products 6 are accommodated in individual housings 19 designed in such a way as to enable the semifinished roll products 6 to be advanced towards the plane in which the blade 13 moves and so that the blade 13 itself can go through the housings 19 when the semifinished products 6 are cut into lengths to form the commercial size rolls 7r of tissue paper.

[0040] Figures 3b and 3c show two further non-limiting examples of possible groupings of semifinished roll products 6, alternative to the one shown in Figure 3a.

[0041] As in the case shown in Figure 3a, the cores 5

of the semifinished products 6 in one layer 12 are offset from those in another layer in the same stack 14.

[0042] The grouping patterns shown in Figures 3a, 3b and 3c are non-limiting, non-exhaustive examples of possible groupings of semifinished roll products 6. All the grouping patterns, however, have in common the fact of comprising a number of semifinished products 6 that varies from one layer 12 to another, decreasing substantially in a radial, centrifugal direction 13b relative to the blade 13. Further, as clearly shown in Figures 3a, 3b, 3c, another feature shared by all the grouping patterns is that the boundary 20 of the geometric envelope circumscribing all the semifinished products 6 in one stack 14 never cuts the boundary of the circular segment FGH of the blade 13 whose longest chord corresponds to the layer with the highest number of semifinished products 6 in the stack 14.

[0043] As to the offsetting of the centres of the semifinished products 6 in the superposed layers 12, it should be stressed that this makes it possible to minimize the length of the working stroke of the circular blade 13.

[0044] Thanks to the specific features just mentioned, it is evident that at each working stroke of the blade 13, where all other conditions are the same as in prior art, the invention makes it possible to cut off as many rolls 7r of tissue paper as there are semifinished products 6 overall in a given stack 14.

[0045] In an apparatus 1 configured according to the invention, therefore, the roll 7r feed rate not only matches the output capacity of the fastest packaging machines 18 but also enables the apparatus to simultaneously serve more than one machine 18, as shown in Figure 2.

[0046] Moreover, looking again at the grouping patterns of Figures 3a, 3b, 3c, it may also be easily inferred that the machine 18 setup may be such as to provide different commercial pack sizes: thus, the rolls 7r of one layer in the stack 14 might be sent to one of the machines 18 to be packaged collectively for example in twos or multiples of two, while the rolls 7r in the other layer 12 might be sent to a machine 18 that packages the rolls in fours or multiples of four.

[0047] It is also quite evident that there are many more roll 7r combinations than those shown in the examples, since there may be multiples of the rolls 7r in each of the two layers 12 or a combination of different numbers between the rolls 7r of one layer 12 and those of another.

[0048] Therefore, irrespective of the size of the packages, it is clear that the roll 7r layering feature confers on the apparatus 1 a degree of versatility much higher than any available in prior art.

[0049] Figure 4 shows the numerous possible embodiments of the means 10 for feeding the semifinished products 6 to the cutting station 11.

[0050] The feed means 10 may comprise a conveyor 21 with an endless belt 28 trained around a pair of pulleys 22 and 23, one power-driven, structured to include means 24 for varying the working length of the conveying section of the belt 28 and to vary it selectively according

not only to which layer 12 of the stack 14 is being formed but also to the position of the semifinished product 6 within that layer 12.

[0051] For maximum configuration versatility, the conveyor 21 might also be equipped with an adjustable head 25 controlled by suitable actuating means (not illustrated).

[0052] As to the means 24 for varying the working length of the conveying section, Figure 4 shows that these means may be embodied by the controlled sliding of one of the pulleys 22 and simultaneously taking up the excess length of the belt 28 using a third pulley 30 actuated by a linear actuator 31.

[0053] The drawings show by way of example two different configurations that may be adopted by the belt 28: one illustrated as a continuous line and the other as a dashed line.

[0054] The conveyor 21 thus makes it possible to form stacks 14 at the cutting station 11 by filling the housings 19 with the semifinished roll products 6 starting, for example, from the top layer 12 of the stack 14 and proceeding to the bottom layer 12 underneath.

[0055] The variability of the belt 28 configuration obviously enables the conveyor to be easily adapted to the different height of each layer of the stack 14 being formed.

[0056] As regards the method of loading and unloading the conveyor 21, the invention contemplates providing the latter with tipping cradles 26 that may be overturned by suitable means located on the path of the belt 28 in such a way that the semifinished product 6 carried by each is unloaded directly into the cutting station 11.

[0057] The above is obviously not the only possible embodiment of the feed means 10.

[0058] The layering of the semifinished products 6 in the stacks 14 may be accomplished by numerous different variant embodiments.

[0059] These variants include the possibility of interposing between the belt 28 and the stack layers 12 a plain chute S that can be selectively and variably directed and inclined in such a way as to unload the semifinished products 6 into the housings 19 of the top layer 12 of the stack 14 or, vice versa, into the housings 19 of the bottom layer 12 (as schematically illustrated by the dashed line in Figure 1).

[0060] Another possible solution, not illustrated in detail, might be that of providing a fixed chute and selectively moving the groups of cradles 19 in both directions (see arrow F19 in Figure 4) in such a way as to form the layers 12 and, hence, the stacks 14.

[0061] The method and apparatus as described above fully achieve the aforementioned aims thanks to the possibility of increasing roll production output capacity under equal conditions of circular blade diameter and cutting stroke length.

[0062] The significant increase of production volumes not only meets the maximum operating speeds of packaging machines but also makes it possible to feed more than one machine in parallel.

[0063] Thus, packaging installations can be configured even according to different and variable commercial pack size combinations.

[0064] The invention described above is susceptible of industrial application and may be modified and adapted in many ways without thereby departing from the scope of the inventive concept. Moreover, all details of the invention may be substituted by technically equivalent elements.

Claims

1. A method of feeding semifinished roll products (6) of tissue paper in the form of a web wound around a core (5), where the semifinished products (6) are sent to a cutting station (11) equipped with a circular blade (13) which cuts the semifinished products (6) into successive roll lengths (7r); the method being **characterized in that** it comprises at least the steps of feeding the semifinished products (6) in such a way as to form stacks (14) of at least two layers (12) of semifinished roll products (6) positioned side by side, where the layers (12) are placed over one another in a suitable direction (13a) relative to the blade (13) and in such a way that the blade (13) cuts the entire stack (14) in one stroke during a single cutting step.
2. The method according to claim 1, **characterized in that** the step of feeding the semifinished products (6) comprises forming a stack (14) that can be enclosed within an envelope boundary (20) of a geometric shape contained in a circular segment (F, G, H) of the circular blade (13) whose largest chord corresponds to the layer with the highest number of semifinished products (6) in the stack (14).
3. The method according to claim 1, **characterized in that** the step of feeding the semifinished products (6) forms stacks (14) where each layer (12) contains a number of semifinished products (6) that differs from that in the previous layer (12).
4. The method according to claim 1, **characterized in that** the stack (14) is formed by placing the layers (12) one over the other increasing in a centrifugal direction (13b) relative to the centre (13a) of the circular blade (13).
5. The method according to claim 1 or 4, **characterized in that** the stack (14) extends in a vertical direction (13b).
6. The method according to claim 5, **characterized in that** the stack (14) is formed by placing the layers (12) of semifinished roll products (6) one under the other.
7. The method according to any of the foregoing claims, **characterized in that** the layer (12) with the highest number of semifinished roll products (6) is composed of at least four of said semifinished products (6) positioned side by side.
8. The method according to any of the foregoing claims, **characterized in that** it comprises two layers (12) of semifinished roll products (6) placed one under the other, where one of the layers (12) is composed of four of the semifinished roll products (6) positioned side by side, and the other layer (12) is composed of at least one semifinished roll product (6).
9. The method according to any of the foregoing claims, **characterized in that** the semifinished roll products (6) positioned side by side in one of the layers (12) of the stack (14) are offset relative to the semifinished roll products (6) in the adjacent layer (12).
10. An apparatus for feeding a station (11) that cuts semifinished roll products (6) into lengths (7), where said station (11) is equipped with a circular blade (13) and where the semifinished roll products (6) are fed in such a way as to form layers (12) of semifinished roll products (6) placed side by side, the layers (12) being subsequently made to advance longitudinally of themselves towards the blade (13) to be cut into lengths (7r), the apparatus being **characterized in that** it comprises feed means (10) for receiving the semifinished roll products (6) one after the other and to position them selectively in a stack (14) in the cutting station (11) and upstream of the blade (13).
11. The apparatus according to claim 10, **characterized in that** the feed means (10) comprise layers (12) of housings (19) for individually accommodating the semifinished roll products (6) positioned side by side.
12. The apparatus according to claim 10 or 11, **characterized in that** the feed means (10) comprise a variable configuration conveyor (21) operatively interposed between a magazine (7m) for feeding the semifinished roll products (6) transversally, parallel to one another, and the cutting station (11).
13. The apparatus according to claim 12, **characterized in that** the feed means (10) comprise a conveyor (21) with an endless belt (28) equipped with cradles (26) for individually accommodating the semifinished roll products (6) to be sent to the cutting station (11) of the apparatus.
14. The apparatus according to any of the foregoing claims from 10 to 13, **characterized in that** the feed means (10) comprise chutes designed to receive the semifinished roll products (6) and to convey them to the cutting station (11) under a layer (12) of semifin-

ished roll products (6) arranged in the stack (14).

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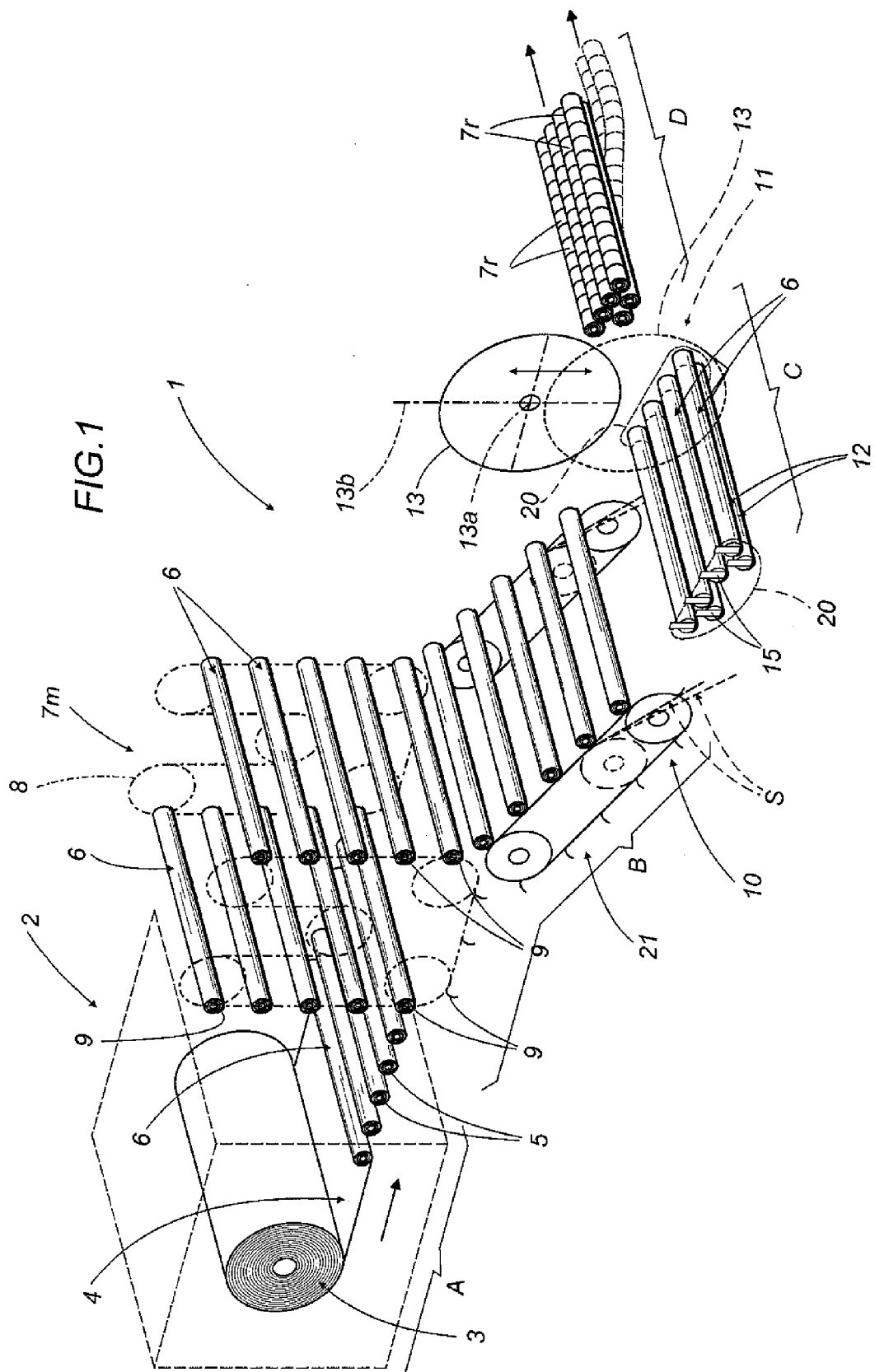


FIG.2

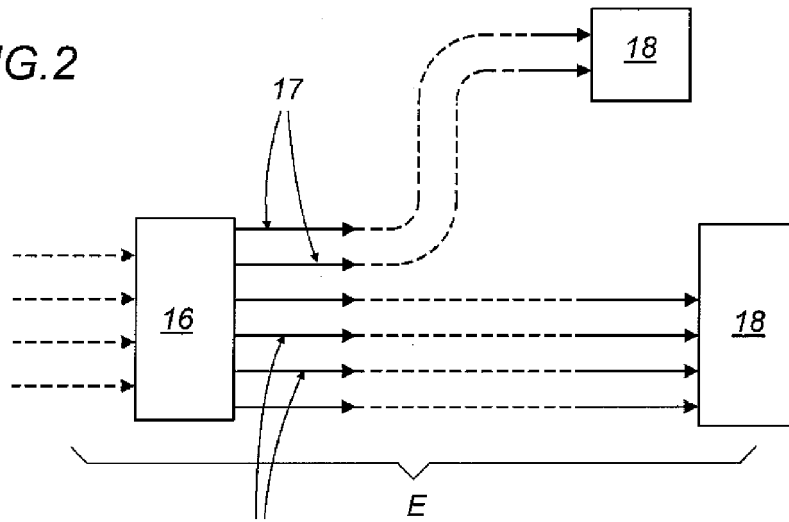


FIG.3a

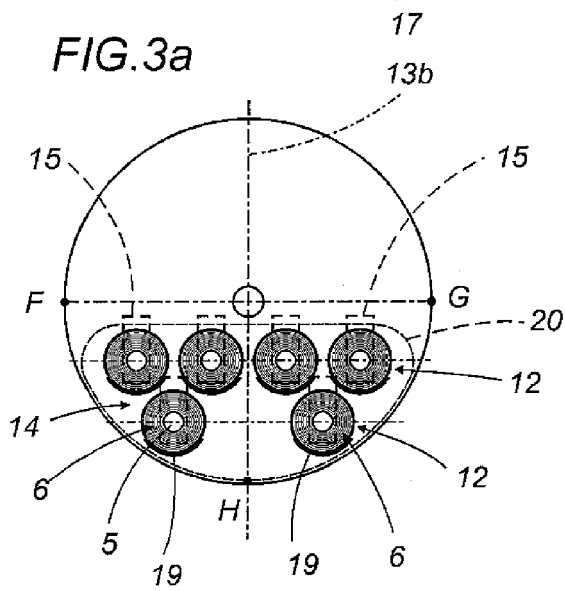


FIG.3b

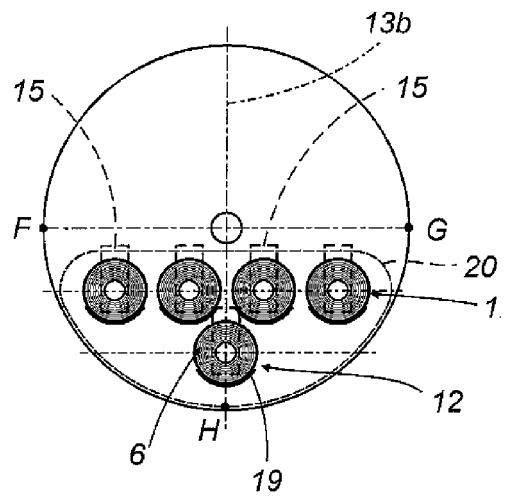
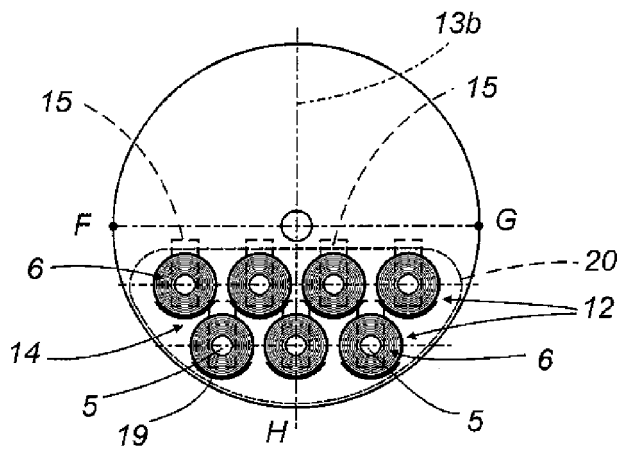
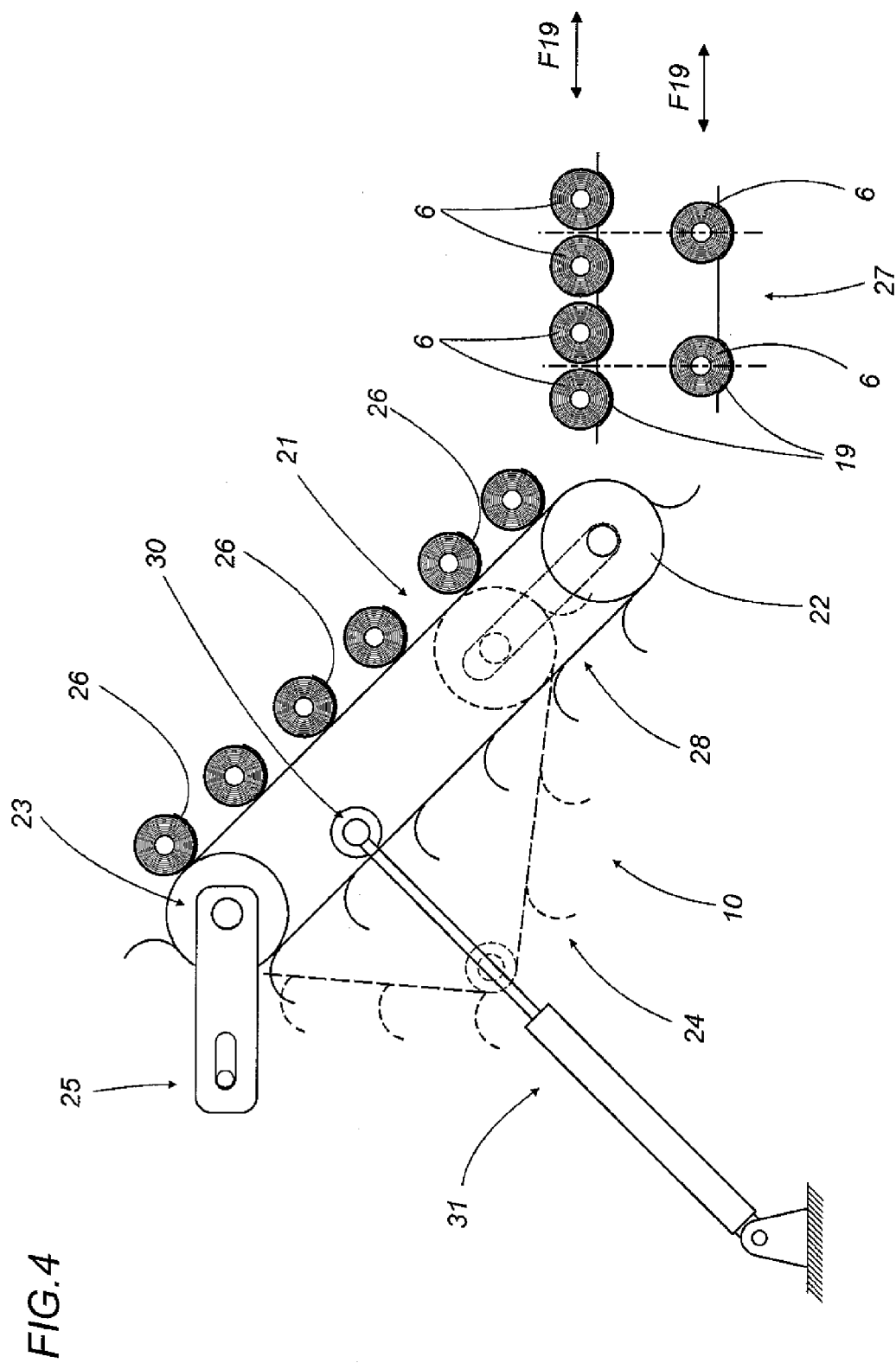


FIG.3c







EUROPEAN SEARCH REPORT

Application Number
EP 08 16 0961

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X	US 3 905 260 A (NYSTRAND ERNST D) 16 September 1975 (1975-09-16)	1,3-11, 13,14	INV. B26D3/16 B26D7/06
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		24 October 2008	Vaglianti, Giovanni
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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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 08 16 0961

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