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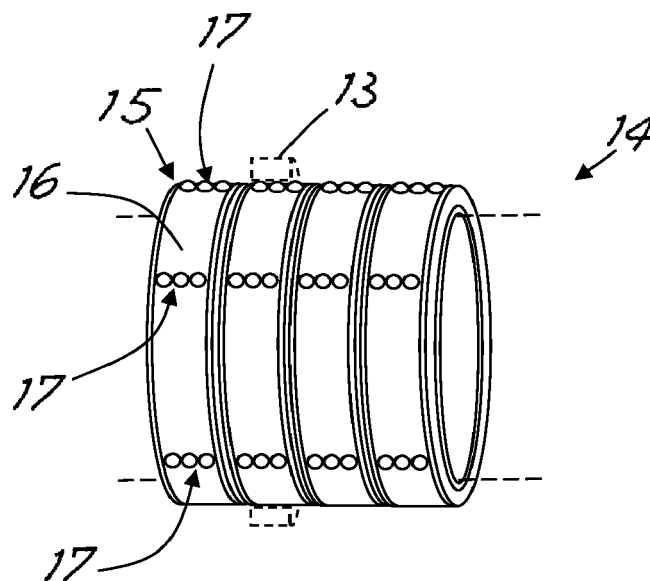
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(54) **ANNULAR DEVICE FOR SHAFTS IN WINDING MACHINES AND SHAFT EQUIPPED THEREWITH**

(57) An annular locking device (15) for winding of reels is intended to be arranged alongside a plurality of same annular devices so as to realize a winding shaft. The device comprises an outer ring (16) and engagement elements (17) protruding from the radial surface of the outer ring. The outer ring being rotatable in the device between a first angular rest position and a second angular locking position, in the first angular rest position the engagement elements (17) being radially retracted or elas-

tically retractable and in the second angular position the engagement elements (17) being elastically retractable less than in the first angular rest position. The device comprises the engagement elements (17) which are distributed along at least three circumferential lines of the radial surface of the outer ring (16). This ensures a high degree of flexibility as regards the widths of cores which can be handled by the device.

**Fig. 2****EP 3 272 690 A1**

Description

[0001] The present invention relates to an annular device of the type used for allowing the locking and winding of reels of strip material in multiple winding machines. The invention also relates to a shaft with a plurality of such devices.

[0002] In the known art of multiple winding machines so-called "friction shafts" are known, these comprising a plurality of annular devices which are arranged alongside each other and onto which the cores of the reels to be wound are fitted.

[0003] The annular devices have an outer ring from which engagement elements (generally balls) project, these being intended to engage the cores which are fitted onto the shaft.

[0004] The outer ring is rotatable through a certain angle relative to the shaft, so as to move between a first angular rest position, in which the engagement elements are retracted or retractable elastically towards the inside of the outer ring, and a second angular locking position, in which the engagement elements are pushed outwards so as to engage against the inside of the core which is fitted on top of the annular device.

[0005] Owing to the annular devices mounted on the shaft, in the angular rest position of the outer rings, the cores of the reels may slide easily along the shaft such that they may be for example mounted or removed, while in the second angular position of the outer rings the cores of the reels are locked by the engagement elements so as to rotate together with the shaft.

[0006] A same shaft may have, mounted on it, even more than one hundred or so such annular devices, each with the outer ring rotatable independently of the other outer rings and a more or less large number of reel cores may be mounted on the friction shaft thus formed.

[0007] When the devices have the outer ring in the rest position, the cores may be inserted and slid along the shaft into their correct position along the shaft.

[0008] Once all the cores have been loaded, a small rotation of the cores (which is performed manually or produced by the start of the winding rotation and therefore the start of pulling of the strip being wound) causes the outer ring of all the devices which are inside the winding cores to be rotated into the locking position.

[0009] Each annular device may rotate in turn with friction relative to the shaft and this allows variations in the pulling force of the single winding reels to be adjusted, even though a same winding shaft is being used.

[0010] Once winding of the reels has been completed, a suitable rotation in the opposite direction of the reels causes the rotation back into the rest position of the outer ring of all the devices on which a reel is mounted, so as to allow the removal of the reels by means of axial sliding thereof along the shaft as far as its free end.

[0011] However, two cores may never be simultaneously present on a same annular device, because this would prevent the independent adjustment of the pulling

force of the two reels. Moreover, each core must always cover engagement elements arranged along at least two circumferences so as to prevent any instable contact. In order to avoid this situation, in the prior art annular devices with a width equal to half the width of the cores are therefore always used. In particular, in the case of cores with a small width, the number of rings on the shaft is therefore very high.

[0012] For example, for a core of 10 mm width, an annular device of 5 mm width is used, such that for a shaft with a working length of 1000 mm as many as 200 adjacent annular devices are required.

[0013] This gives rise, therefore, to a considerable complexity and considerable cost due to the number of annular devices which are required simultaneously, as well as a significant cost due to the need to have a series of annular devices of a particular width for each core width which is to be used. A change in width of the core on a winding machine also results in a significant machine downtime and cost needed to replace on the shaft the entire series of annular devices with another series of annular devices suitable for the new core width. JP2001/106397 and JP2012/111628 describe known rings with one or two rows of balls and with the aforementioned problems.

[0014] GB 2 300 460 describes rings with two, four or six rows of balls. This may improve the stability of the core on the rings, but means that the length of the core with respect to the rings becomes even more critical and does not solve any of the aforementioned problems.

[0015] The general object of the present invention is to provide annular devices and a shaft with such annular devices, which allows the same device to be used for a certain number of core widths, including core widths smaller than then width of the device.

[0016] In view of this object the idea which has occurred is to provide an annular locking device for winding of reels, as claimed in Claim 1.

[0017] An annular locking device for winding of reels, intended to be arranged alongside a plurality of same annular devices so as to realize a winding shaft, comprises an outer ring and engagement elements protruding from the radial surface of the outer ring, the outer ring being rotatable in the device between a first angular rest position and a second angular locking position, in the first angular rest position the engagement elements being radially retracted or elastically retractable, and in the second angular position the engagement elements being elastically retractable less than in the first angular rest position. The engagement elements are distributed along at least three circumferential lines of the radial surface of the outer ring.

[0018] In order to illustrate more clearly the innovative principles of the present invention and its advantages compared to the prior art, examples of embodiment applying these principles will be described below with the aid of the accompanying drawings. In the drawings:

- Figure 1 shows a schematic view of a winding machine with annular devices according to the invention;
- Figure 2 shows a schematic perspective view of a winding shaft with the annular devices according to the invention;
- Figures 3 and 4 show partially sectioned schematic views of a possible embodiment of the device shown in Figure 2;
- Figure 5 shows a schematic view of a possible variant of the device according to the invention;
- Figures 6 and 7 show schematic views of shafts according to the invention and possible core widths which can be accepted by said shafts.

[0019] With reference to the figures, Figure 1 shows in schematic form a winding machine, denoted overall by 10. The machine 10 is fed with a strip 11 (for example of plastic material or the like) which is divided into smaller strips 12 (by known cutting means, not shown) to be wound each onto a respective core 13. The cores 13 are mounted on a pair of motor-driven shafts 14a and 14b which are arranged so as to receive, on one, the odd position strips and, on the other one, the even position strips, as known to the person skilled in the art.

[0020] In order to receive and radially fix the cores, each shaft (indicated more generically by 14) comprises on it a plurality of annular devices 15 arranged axially next to each other. These annular devices are rotatable with friction on the axis of the shaft 14 and comprise an outer ring 16 and engagement elements 17 protruding from the radial surface of the outer ring. The engagement elements 17 are preferably balls.

[0021] The annular devices will be obviously used in a variable number depending on the need to provide shafts which are longer or shorter and perform the winding of a greater or smaller number of reels arranged side-by-side, as will be obvious to the person skilled in the art.

[0022] The outer ring 16 of each annular device 15 is rotatable in the annular device between a first angular rest position and second angular locking position. In the first angular rest position the engagement elements 17 are radially retracted or elastically retractable, while in the second angular position the engagement elements 17 are elastically retractable less than in the first angular rest position. In this way, a suitable rotation of the outer ring allows locking, on the shaft, of the core mounted on the annular device or devices 15.

[0023] Figure 3 shows a possible embodiment of the mechanism which allows the lesser or greater elastic projection of the engagement elements in each annular device.

[0024] In particular, the annular device 15 comprises the outer ring 16 and an inner ring 18 which are coaxially arranged on top of each other. The inner ring 18 is intended to be mounted on the rotational shaft with the arrangement, in between, of known friction elements (indicated generically by 20, for example a layer of felt or

the like) and, if required, with known controlled friction-adjustment means 21 (such as pneumatic chambers or the like) which may be easily imagined by the person skilled in the art and therefore are not further described or shown here. These friction elements allow the annular devices to rotate with friction on the shaft so as to allow the adjustment of the pulling force for winding the strips, as is known to the person skilled in the art.

[0025] The engagement elements 17 project radially at intervals along the periphery through holes on the outer ring 16. Advantageously, the dimensions of the holes are such as to prevent the engagement elements from coming out of the holes entirely.

[0026] Preferably the engagement elements project in an equidistant manner along the circumference of the device. Obviously, it is understood that the number of engagement elements may be different from that shown, depending on the specific requirements, as will also become clear below.

[0027] The rings and the engagement elements are advantageously made of metal.

[0028] The outer ring is rotatable with respect to the inner ring so as to move between the first angular rest position and the second locking position, moving also the engagement means 17 (which from now on will be called more simply "balls", although it is understood that they may be replaced by other rolling elements, for example small cylinders, even though balls have been found to be preferable).

[0029] Figure 3 shows a partially sectioned view of the zone of the annular element where the ball rolls between the rest position (shown in solid lines) and the locking position (shown in broken lines).

[0030] For rolling of the ball, the inner ring has for each ball a seat 19 extending circumferentially between the rest position and the locking position. The bottom of the seat 19 is provided with an elastic element, advantageously in the form of an elastic plate 22 which pushes the ball radially towards the outside of the outer ring. Moreover, the bottom of the seat has a variation in height with respect to the outer ring so that, at one end of the seat, corresponding to the rest position, the plate has a good amount of play so as to allow the ball 17 to retract more than at the opposite end, corresponding to the locking position. This is clear from Figure 3. The smaller elastic retraction of the ball in the locking position may also be reduced to zero and the engagement elements may be pushed outwards in a substantially rigid manner.

[0031] As can be seen in Figure 2 and also in Figure 4, the engagement elements 17 are distributed along at least three circumferential lines (lines 23 in Figure 4) of the radial surface of the outer ring. Preferably, the engagement elements on the at least three circumferential lines are arranged adjacent to each other in groups along generatrices of the outer ring, as can be clearly seen in Figure 4, but they may also be arranged staggered as can be seen in Figure 5.

[0032] It has been found that, by using engagement

elements arranged on at least three circumferential lines of the outer ring, it is possible to use annular devices with a width greater than that of the cores to be mounted on them, while maintaining an independent movement of each core for adjustment of the pulling force.

[0033] Preferably, the distance between the circumferential lines (corresponding to the centre of the ball) on the sides and the side edge of the annular device must be less than the distance between the said lateral lines and the circumferential line in between them. In particular, preferably the lateral circumferential lines may be spaced from the side edges of the device by a distance of between 1/4 and 1/6th of the width of the device.

[0034] Advantageously, the circumferential lines may be spaced from each other by a distance of between 1/3rd and 2/3rds of the distance between the lateral line and the side edge of the device.

[0035] For example, in the case of an annular device with width of 20 mm having three circumferential lines of balls, it has been found to be useful if the distance between lateral circumferential lines and side of the device is between 3.8 and 4.2 mm, while the distance between these lateral circumferential lines and the central line is in the region of 6 mm. The balls preferably have a diameter of 5 mm.

[0036] As a result, with annular devices of 20 mm width, it is possible to mount cores for example of 10 mm width (and also other sizes, also smaller than the width of the annular device). Compared to the devices of the prior art, it is also possible to realize, for example, shafts with a length of 1000 mm using only 50 annular devices, while in the prior art, for correct operation, as many as 200 annular devices with a width of 5 mm are needed.

[0037] Also other sizes of the annular device are obviously possible, depending on the specific needs. For example, an annular device with a width of 30 mm may be used for cores with a width of 15 mm (and other sizes). With three circumferential lines, the lateral lines may be spaced between 5 and 6 mm from the side edge of the device and about 7-11 mm from the central line.

[0038] It is not even necessary for the lateral lines to be equidistant from the central line, which in turn must not be necessarily centred with respect to the side edges of the device.

[0039] For example, with a device of 30 mm width the lateral lines may be spaced 5.5 mm and 6.55 mm from the respective side edges of the device, while they may be spaced 10.10 mm and 7.8 mm, respectively, from the central line.

[0040] An example of an arrangement can be seen in Figure 6 which shows in schematic form a sequence of adjacent annular devices realized according to the invention (for easier understanding the circumferential lines on which the engagement elements lie are shown as dot-dash lines). The odd cores are shown in solid lines, while the even cores (which may be situated on a second shaft, the same as the first shaft) are shown in broken lines (for example the cores may have a width of 15 mm with an-

nular devices having a width of 20 mm).

[0041] As can be clearly seen in Figure 6, in no case are there two cores 13 which cover the same annular device and each core rests in any case on at least two circumferential lines of engagement elements. In this way both the possibility of independent adjustment of the pulling force and the stability and coaxiality of the cores on the rotating shaft are ensured. It should be noted that only four devices are shown because the sequence shown recommences after three devices and therefore any desired shaft length may be realized.

[0042] Figure 7 shows a view similar to that of Figure 6, but for the realization of a shaft having a different width of the devices, suitable for mounting a different core width (for example, an annular device of 30 mm width and core of 27 mm width).

[0043] As can be clearly seen in Figure 7, in this case also there are never two cores 13 which cover the same annular device and each core rests in any case on at least two circumferential lines of engagement elements. In this way both the possibility of independent adjustment of the pulling force and the stability and coaxiality of the cores on the rotating shaft are ensured. It should be noted that only ten devices are shown because the sequence shown recommences after nine devices and therefore any desired shaft length may be realized.

[0044] At this point it is clear how the objects of the invention have been achieved. With the device according to the invention, it is possible to achieve a high degree of flexibility in the widths of cores which can be handled by the said device, unlike the known devices.

[0045] With annular devices according to the invention it is possible, in fact, with a same series of devices to mount on a winding shaft cores of various different lengths and in particular with some widths also smaller than the width of the device itself, thereby reducing the number of devices needed and therefore both the purchase and maintenance cost of the devices and the costs and time needed for adaptation of the machines to the change in width of the winding cores.

[0046] Obviously the description provided above of embodiments applying the innovative principles of the present invention is provided by way of example of these innovative principles and must therefore not be regarded as limiting the scope of the rights claimed herein. For example, dimensions and proportions of the various parts different from those shown in the drawings may be used depending on the specific needs. For example, for particular sizes, the two shafts may also be axially staggered so as to allow correct seating of the odd and even cores without overlapping and with correct supporting.

Claims

1. Annular locking device (15) for winding of reels, intended to be arranged alongside a plurality of same annular devices so as to realize a winding shaft, com-

prising an outer ring (16) and engagement elements (17) protruding from the radial surface of the outer ring, the outer ring being rotatable in the device between a first angular rest position and a second angular locking position, in the first angular rest position the engagement elements (17) being radially retracted or elastically retractable, and in the second angular position the engagement elements (17) being elastically retractable less than in the first angular rest position, **characterized in that** it comprises engagement elements (17) which are distributed along three circumferential lines of the radial surface of the outer ring (16).

2. Annular device according to Claim 1, **characterized in that** the engagement elements (17) along the circumferential lines are adjacent to each other in groups along generatrices of the ring. 15
3. Annular device according to Claim 1, **characterized in that** the engagement elements (17) along the circumferential lines are balls. 20
4. Annular device according to Claim 1, **characterized in that** the lateral circumferential lines are spaced from the side edges of the device by a distance which is between 1/4 and 1/6th of the width of the device. 25
5. Annular device according to Claim 1, **characterized in that** the lateral circumferential lines are spaced from each other by a distance which is between 1/3rd and 2/3rds of the distance between the lateral circumferential line and the side edge of the device. 30
6. Annular device according to Claim 1, **characterized in that** it also comprises an inner ring (18) on which the outer ring (16) coaxially rotates so as to move between the angular rest position and the angular locking position. 35
7. Annular device according to Claim 6, **characterized in that** in the inner ring there are seats (19) which extend circumferentially between the rest position and the locking position and which accommodate the engagement elements (17), on the bottom of each seat (19) there being present an elastic element (22), preferably in the form of an elastic plate, which pushes the corresponding engagement element (17) radially towards the outside of the outer ring, the bottom of the seat (19) having a variation in height with respect to the outer ring so that at one end of the seat, corresponding to the angular rest position, the elastic element allows the greater elastic retraction of the engagement element (17) than at the opposite end, corresponding to the angular locking position. 40 45 50 55
8. Shaft (14) for winding of reels on reel cores (13) in a multiple winding machine (10), comprising a plu-

rality of annular locking devices (15) realized according to any one of the preceding claims, arranged coaxially side-by-side along the shaft so as to accommodate thereon cores of reels to be wound, the devices (15) being axially rotatable with friction on the shaft so as to allow the independent adjustment of the winding pulling force of the reels.

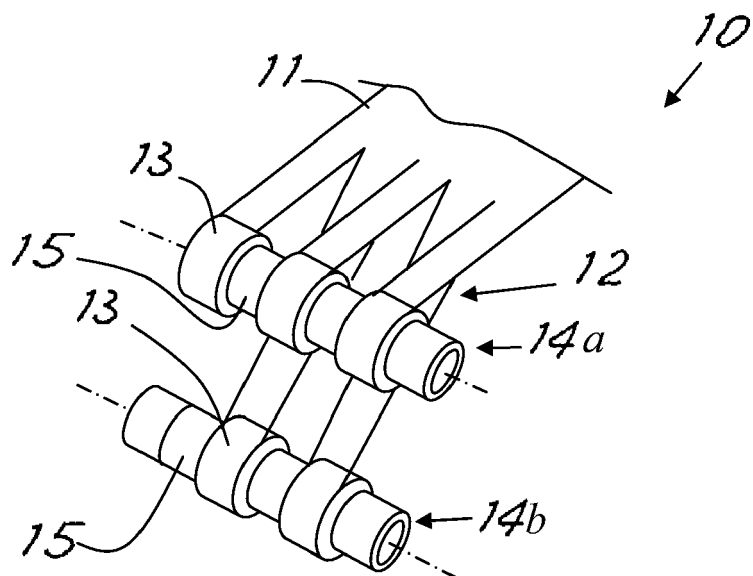


Fig. 1

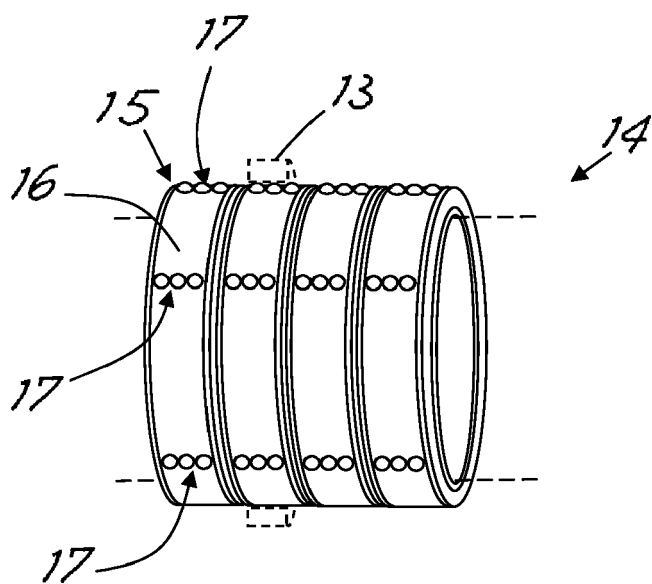


Fig. 2

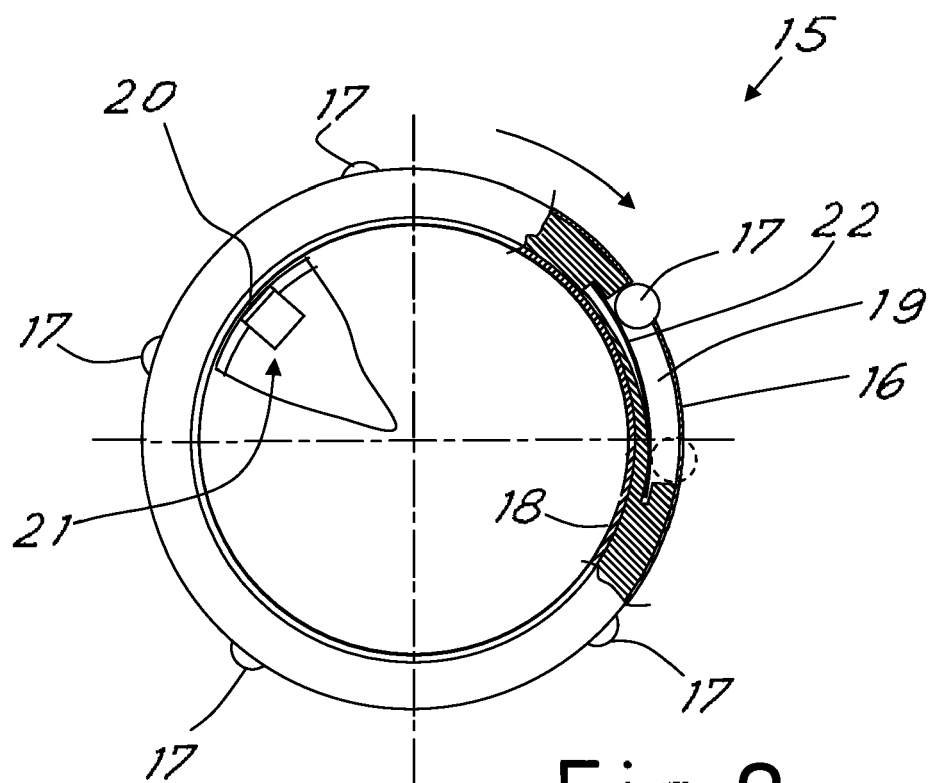


Fig.3

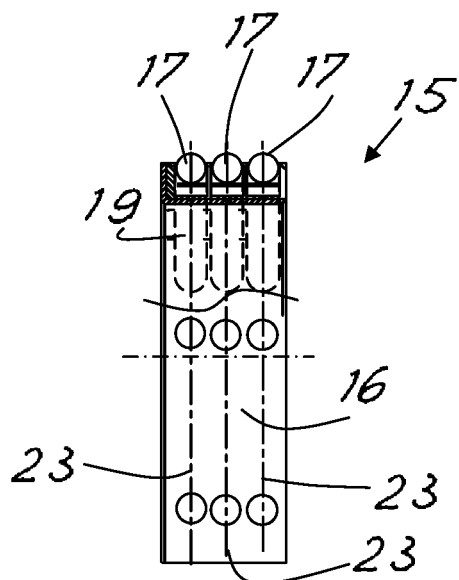


Fig.4

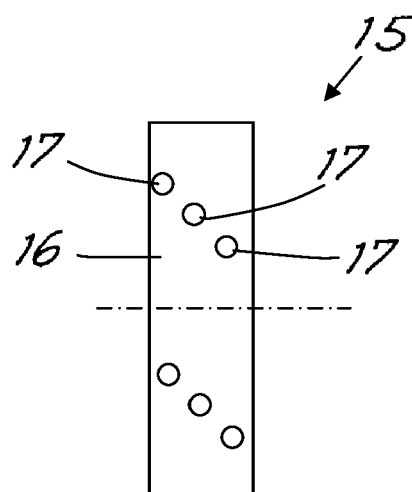


Fig.5

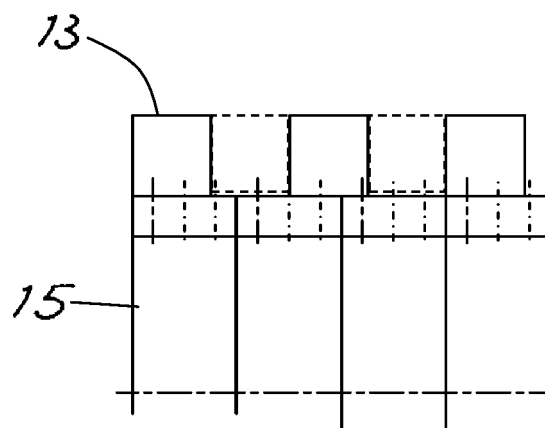


Fig. 6

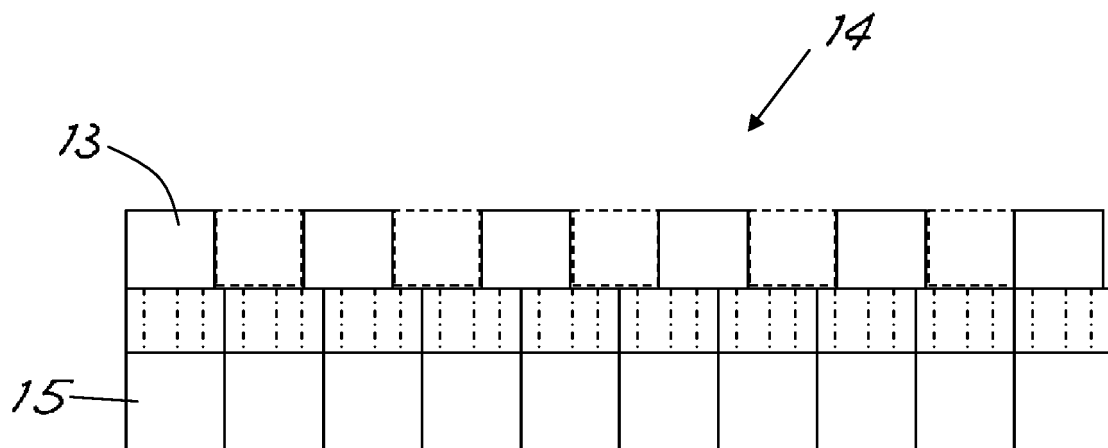


Fig. 7



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 Application Number
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Place of search The Hague		Date of completion of the search 15 November 2017	Examiner Lemmen, René
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