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(54) Method and apparatus for collating rod-shaped articles

(57) Rod-shaped articles such as cigarettes are stored in a hopper (12) and transferred into a single cigarette column. The bottom cigarette in the column is pushed by an inserter rod (28) into an aperture (32) in a mandrel (30). The mandrel has a plurality of spaced apertures which can be filled with the desired collation. The mandrel is controlled by a Cartesian robot which moves the position of mandrel with respect to the inserter rod so that all the required apertures can be filled. The entire collation is then removed to a collation pocket (40) by a set of transfer rods spaced to match the apertures in the collation mandrel. In the pocket neighbouring cigarettes are brought into contact and the collation can then be packaged.

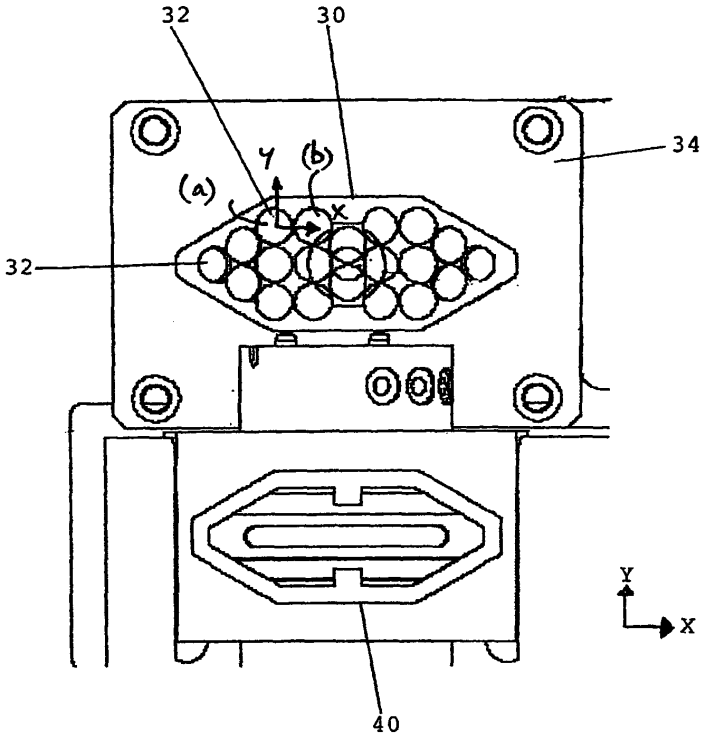


Figure 2

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Description

[0001] This invention relates to methods and apparatus for collating cigarettes or other rod-shaped articles. It is particularly concemed with the provision of different collations for packaging.

[0002] The arrangement of a bundle of cigarettes for packaging is referred to as a collation. In conventional cigarette packaging machines, a fixed collation is formed by pushing cigarettes into a pocket either row-by-row or by a single push on the entire bundle of cigarettes to be packaged. Thus, a conventional pack of 20 cigarettes comprises a row of six cigarettes between two rows of seven cigarettes. The individual rows can be pushed separately or the three rows formed and pushed in a single operation.

[0003] Conventional packaging machines use a series of vanes to feed cigarettes from a hopper. Each pair of vanes defines a channel with a width slightly greater than that of a single cigarette. The series of vanes hold a series of columns of cigarettes and the bottom of each column can be removed by a plunger in a horizontal direction along the cigarette axis from the rear to the front of the vanes. The pusher may either push a single cigarette from each column if the collation is being formed row-by-row, or several cigarettes from each column if the collation is being formed in a single operation.

[0004] Once pushed, the rows or bundles of cigarettes are received by a profiled pocket which then moves the collation on to the next part of the cigarette packaging operation.

[0005] The known method and apparatus for forming collations works well and provides for efficient collation formation which is suitable for high speed production. However, it is inflexible and does not permit easy variation of the collation formed. There is a requirement in the cigarette market to produce collations which can be used with unconventional packet shapes. Such packaging may often be used for a relatively small production run. It is therefore uneconomic to design and implement packaging machinery that can provide a specific non-standard collation.

[0006] The present invention addresses this problem with known packaging machines and, in one aspect provides an assembly which is configurable to provide a desired collation of cigarettes.

[0007] Broadly, the invention provides for rod-shaped articles such as cigarettes to be transferred individually to a collation mandrel. The mandrel has a series of apertures or through holes each of which can receive a rod-shaped article. The mandrel is movable so that the apertures can be aligned in-turn to receive a rod. When the required number of apertures has been filled, the articles may be transferred to a shaped pocket for packaging. Some or all of the apertures may be filled as desired.

[0008] More specifically there is provided apparatus for collating rod shaped articles, comprising a collation mandrel having a plurality of apertures each for receiving a rod-shaped article, a hopper for storing a reservoir of rod shaped articles, an inserter for transferring individually rod-shaped articles from the hopper into apertures of the mandrel, and a mandrel controller for controlling the position of the mandrel with respect to the inserter, whereby the inserter inserts rod shaped articles into a pre-selected number of the plurality of apertures of the mandrel.

[0009] The invention also provides a method for collating rod-shaped articles comprising:

a) providing a collation mandrel having a plurality of apertures arranged to define a collation;
b) providing a reservoir of rod-shaped articles and an inserter for presenting a rod-shaped article to the collation mandrel;
c) aligning an aperture of the collation mandrel with the inserter;
d) inserting an article into the aligned aperture;
e) moving the mandrel to align a further unfilled aperture with the inserter; and

repeating steps d) and e) until a pre-selected number of the apertures of the collation mandrel is filled with a rod-shaped article.

[0010] In a preferred embodiment of the invention, all the apertures in the mandrel are filled to form the collation.

[0011] Embodiments of the invention have the advantage that complex shaped collations of rod-shaped articles such as cigarettes may be easily provided. The articles are transferred one at a time and the collation mandrel is moved with respect to an inserter, which may be a push rod, and the mandrel may be configured to provide a desired collation.

[0012] Because the collation is determined only by the configuration of the collation mandrel and the manner in which it is moved with respect to the inserter, it is easy to change the collation mandrel to produce a different collation on the same machine. This is highly efficient both in terms of time and cost. It makes production of complex and interesting collations economic for relatively small product runs with the same apparatus being used for many different collations.

[0013] Preferably, means for receiving rod-shaped articles from the mandrel, and drawing the articles into contact with adjacent articles of the collation receives the rod-shaped articles from the mandrel. Preferably, this means comprises a shaped collation pocket. The transfer from the mandrel to the collation pocket is achieved by at least one transfer rod. Altematively, the rod-shaped article may be transferred directly to a foil or a pack with a profiled inner surface matching the collation. Preferably a set of transfer rods is provided which is equal in number to, and has a distribution which matches, the apertures in the collation mandrel. In this manner, the articles filling the collation mandrel can be transferred to the receiving and drawing means in a single actuation of the set of

transfer rods. In one alternative embodiment of the invention, a column or row of rods is provided for row by row or column by column transfer.

[0014] Preferably, to assist in registration between the articles and the collation mandrel, a tapered mouthpiece is provided between the inserter and the collation mandrel. Preferably, a tapered mouthpiece is also provided between the collation mandrel and the shaped pocket. This latter mouthpiece helps to bring the articles together from the mandrel in which they are spaced apart from one another in individual apertures to the pocket or other receiving and drawing means in which neighbouring articles abut one another.

[0015] Preferably, the mandrel controller comprises a Cartesian or other robot. The robot can be programmed with the co-ordinates of each of the apertures of the mandrel to enable the mandrel to be moved with respect to the inserter for filling the mandrel apertures.

[0016] The hopper preferably comprises a column of rod-shaped articles which may be defined by a pair of hopper vanes. These vanes may be parallel and spaced apart by a distance slightly greater than the diameter of the rod-shaped article. The inserter may comprise a reciprocating rod for inserting the bottom article in the column into the collation mandrel.

[0017] In one preferred embodiment of the invention, a plurality of hoppers is provided. Each hopper has its own inserter. In one embodiment, the mandrel controller controls the position of the collation mandrel with respect to the inserter of each hopper whereby the collation mandrel can be aligned to receive rod-shaped articles in its apertures from any of the inserters. This has the advantage that a single collation of articles may be formed containing articles from more than one hopper. Each hopper may be filled with a different type of article, for example, a different brand of cigarette, allowing a mixed collation to be provided.

[0018] In another preferred embodiment each hopper and inserter has a corresponding collation mandrel and collation pocket. This enables a number of collations to be formed simultaneously which is advantageous as the speed with which the collations can be formed may be lower than the speed with which subsequent packaging machinery can handle formed collations.

[0019] The collation mandrels are interchangeable to provide for the different collations. The mandrel controller requires reprogramming with co-ordinates for a new collation mandrel and the transfer rods comprising the set of transfer rods require repositioning to match the number and arrangements of the new collation mandrel. These are all relatively straightforward operations and enable a fresh collation to be formed and packaged very quickly.

[0020] Preferably, a sensor is arranged in the column of articles formed from the hopper. The sensor may detect defective articles, such as loose ends in cigarettes, or the absence of articles, for example a void in the column of cigarettes caused by a constriction in the hopper. Where a void is detected, the sensor may signal the void to the mandrel controller. When that void reaches the bottom of the column, instead of moving the mandrel after the inserter has attempted to insert a cigarette, but no cigarette has been inserted, the mandrel controller keeps the mandrel in the same position until another actuation of the inserter has been formed and the aperture filled. This avoids collations being formed with missing articles. In the prior art, such missing articles would only be detected once the entire collation has been formed requiring the entire collation to be discarded with the subsequent loss of acceptable articles.

[0021] Similarly, if the sensor indicates to the mandrel controller that a defective article has been detected, the mandrel controller will move the mandrel out of the path of the defective cigarette when it is pushed towards the mandrel by the inserter. The cigarette is discarded and the mandrel then moved back to the next position to be filled. Thus, only defective cigarettes are discarded. Prior art packaging systems include provision for detecting damaged or defective articles but again require the entire collation which contains the damaged article to be discarded. This preferred embodiment of the invention has the advantage of discarding only defective articles rather than entire packs which may only contain a single defective article.

[0022] Embodiments of the invention will now be described, by way of example only, and with reference to the accompanying drawings, in which:

Figure 1 is an end view of a portion of a collation apparatus embodying the present invention;
Figure 2 is an end view of a collation mandrel and shaped pocket forming a further portion of a collation apparatus embodying the present invention;
Figure 3 is a schematic diagram illustrating how the mandrel of Figure 2 is filled;
Figure 4 is a schematic diagram showing how cigarettes in a filled mandrel are transferred to a pocket;
Figure 5 is a flow diagram showing the main steps in the forming of a collation; and
Figures 6a) to m) are examples of alternative mandrels for producing different collations.

[0023] Figure 1 shows an end view of a portion of a collating apparatus for rod-shaped articles embodying the present invention. The apparatus is particularly suitable for collating cigarettes into desired configurations but may also be used to form collations of other articles such as confectionery products, coloured pencils or crayons or other rod-shaped articles.

[0024] The apparatus is illustrated generally at 10 and comprises a hopper 12 which receives cigarettes for collating for formation into packs and dispenses them individually. The hopper is of known configuration and has side walls 14, 16 that taper inwards from top to bottom, and the bottom walls 18, 20 that slope downwards from the side walls to a central exit aperture through which rods can exit to a channel 22 formed by a pair of hopper

vanes 24, 26. The vanes comprise parallel walls spaced apart by a distance slightly greater than the diameter of a cigarette. Thus, in Figure 1, the cigarette stack is in the channel 22 in a single column with the longitudinal axis of the cigarettes extending into the paper.

[0025] At the base of the single cigarette channel is arranged a single cigarette inserter. In the preferred embodiment the inserter comprises a reciprocating rod which, when actuated, for example by a servomotor, pushes the bottom most cigarette from the column formed in the channel towards a collation mandrel. The inserter rod 28 pushes the cigarette along its longitudinal axis. In Figure 1 this is normal to the plane of the paper.

[0026] Figure 2 shows a collation mandrel 30 and a collation pocket 40. The mandrel 30 comprises a block having a number of parallel apertures 32 extending through the block. Each aperture has a diameter slightly larger than the diameter of a cigarette. The mandrel is mounted as a plate 34 for movement in the X-Y plane with respect to the hopper 12 and the inserter rod 28 such that the inserter rod will push a cigarette into a different aperture of the mandrel. Thus the inserter rod is static in the x-y axes but moves in the z axis while the collation mandrel moves in the x-y axes. The mandrel is a block, for example of plastics material, through which the apertures, or through holes extend. It is approximately the length of a cigarette. The apertures are not exactly parallel but taper towards a centre point to close the gaps between the cigarettes as they are transferred to the collation pocket.

[0027] The mandrel is motor driven under the control of a computer such that it can be moved in the X-Y plane to line up each aperture of the collation mandrel in turn with a cigarette delivered by the inserter rod. Thus, the inserter rod delivers single cigarettes repeatedly along the z axis and the mandrel moves in the X and Y directions so that each cigarette is received in a different, unfilled, mandrel aperture. The movement of the mandrel is shown schematically in Figure 2. To assist insertion, a tapered mouthpiece 50 is provided between the inserter rod and the insertion end of the mandrel to ensure that the cigarette is correctly inserted into each mandrel aperture. The tapered mouthpiece is illustrated in Figure 3, which shows the arrangement of the column of cigarettes, the inserter 28, the mouthpiece 50 and the mandrel schematically to assist understanding.

[0028] Once all the apertures of the mandrel have been filled, the cigarettes are transferred from the mandrel to the collation pocket 40. The pocket is one example of a means for receiving rod shaped articles from the mandrel and for drawing them together into contact with neighbouring articles. As can be seen from Figures 2 and 4, this pocket is arranged beneath and behind the collation mandrel 30. The collation pocket has the internal shape of the final cigarette packet and, unlike the mandrel 30, receives the cigarettes such that they are in contact with each other as required. The cigarettes are transferred from the collation mandrel by a set of transfer rods, one for each aperture of the mandrel. The mandrel is moved from its position above the collection pocket shown in Figure 2 such that it is aligned with the collection pocket. The set of transfer rods is then actuated so that each cigarette is pushed into the pocket. It will be appreciated that the spacing between the cigarettes that is present in the mandrel is eliminated in the pocket. A tapered mouthpiece is arranged between the mandrel and the collation pocket to aid insertion. The number of transfer push rods is equal to the number of apertures in the collation mandrel and they are arranged to match the collation configuration. The transfer rods may be actuated, as a set, by a servomotor which moves the rods in the z direction, into the mandrel apertures, to push the cigarettes out of the mandrel. The transfer to the pocket takes place as a single action as operation. In an alternative embodiment, one or more rods could be used but less than the total number of apertures, but this would require more than one transfer operation and movement of the mandrel and is less desirable.

[0029] Once the collation pocket has been filled, the packaging operation may be completed using known packaging techniques.

[0030] Figure 5 is a flow chart which illustrates the sequence of events in the filling of the collation pocket via the collation mandrel. At step 100, one of the mandrel apertures is aligned with the inserter rod 28 that inserts cigarettes from the single cigarette stack formed in the channel between the hopper vanes. At step 102 the inserter is actuated to push the cigarette in the direction of its longitudinal axis to insert it into the aligned mandrel aperture. The system must then determine at step 104 whether there are further apertures to be filled. This may be done by referring to the XY coordinates of the mandrel. As the computer controlling the mandrel position is visiting a predetermined series of XY coordinates it will know when the last of that series has been visited and that all the apertures have been filled.

[0031] Thus, at step 106, if there are still unfilled apertures, the mandrel control computer adjusts the X-Y coordinates of the mandrel to bring the next aperture into registration within the inserter. The insertion step is then performed and the process repeated until all apertures are filled. Although it does not matter in what order the apertures are filled, it is desirable to move the mandrel as little as possible. Thus, referring to Figure 2 the first aperture a) may be the top left followed by aperture b) to its right and then working across the top row, incrementing the X coordinates and the Y coordinates as necessary. At the end of the row, the mandrel moves back, decrementing the X coordinate each time and adjusting the Y coordinate as necessary. Finally, the bottom row is transversed from right to left.

[0032] Cigarettes are fed to the inserter 28 by gravity. Once a cigarette has been inserted and the inserter rod retracted to its starting position, the cigarettes in the channel will move down with the next cigarette in the channel coming into communication with the inserter rod.

[0033] Once all apertures have been filled, the process moves on to step 108 and the mandrel is moved in the Y direction to align it with the set of transfer push rods than transfer the cigarettes of the filled mandrel to the collation pocket as shown in Figure 4.

[0034] Figure 4 shows how the position of the filled mandrel is changed, moving it below the individual cigarette inserter in the Y direction and aligning it with the set of transfer push rods and the collation pocket 40.. Finally, at 110, the transfer rods transfer the cigarettes to the collation pocket from where they are packaged, and the process retums to step 100 with the mandrel being retumed to its original position for insertion of cigarettes to form a new collation.

[0035] From the forgoing it will be understood that any collation of cigarettes can be achieved. To form a new collation, a new collation mandrel must be inserted together with a new collation pocket, and the robot controlled movement of the collation mandrel must be reprogrammed with the new coordinate data required to align the through holes or apertures of the new mandrel with the single cigarette inserter and to align the new mandrel with the new collator pocket. Moreover, the position of the set of push rods used to transfer the cigarettes from the mandrel to the collation pocket must be changed to match the new collation configuration. The number of rods in the set may also need to be changed.

[0036] Such changes are relatively minor. The new mandrel and collation pocket may simply be lifted out and replaced and the new mandrel coordinates may be selected from pre-stored coordinates for given cigarette collations.

[0037] Figures 6 a) to m) illustrates exemplary collation configurations that can be formed by the embodiment of the invention described. The embodiment is highly flexible enabling complicated collations to be produced using a simple reprogramming exercise. In prior art systems, individual machines would have had to be built for each collation which is both very slow and very expensive. It will be noted that in the collations of Figure 6, the number of cigarettes in the collation varies as shown next to the collation. The number per collation varies from 15 to 24 although any number of cigarettes may make up a collation. The shape of the collation is entirely a matter of choice. The examples of Figure 6 include triangles, diamonds, 'v' sections, circles, regular hexagons, ovals and other polygonal shapes, all of which have been very difficult to produce using prior art techniques.

[0038] Preferably, the collation mandrel is mounted on a two axis position system. This may be a servomotor Cartesian robot to allow accurate positioning of the aperture. The set of pusher rods may also be controlled by a single axis servomotor Cartesian robot.

[0039] In the embodiment described, a single hopper is provided. In an alternative embodiment, a plurality of hoppers may be provided each having a collation mandrel and collation pocket assembly as described. This is advantageous as the cycle time to fill a mandrel and transfer it to a pocket may be the order of a few seconds, typically 10 to 15 and the packing process operation on the collations may be capable of operating at higher speeds. A number of collation mandrel and pocket assemblies, for example 4, may supply collations to a single packaging assembly.

[0040] In a further embodiment of the invention, multiple hoppers can be used to supply cigarettes or other rod-shaped articles to a single collation mandrel and collation pocket assembly. This has the advantage of enabling different product types to be packaged within a single package. Each hopper is supplied with a particular product type and has an associated channel defined by hopper vanes as in the embodiment of Figure 1. A reciprocating single cigarette inserter is provided at the bottom of each channel. A single mandrel is provided which is programmed to move between the plurality of cigarette inserters thereby enabling a single collation mandrel to be filled with product from several different hoppers. Where the product is a cigarette, the end product may be a cigarette pack having two or more brands of cigarette. In an alternative example, the collation may comprise different flavours of a confectionery article. Because the articles are inserted individually, the exact position of each article within the collation is controlled. For some products, it may be desirable to use colouring or shading on the ends of the article to make patterns that are attractive to a consumer by selecting different end colours or shades from different hoppers.

[0041] The embodiment described may also be used to enhance the detection and rejection of defective articles or avoid the accidental production of a finished production having a missing article. Referring back to Figure 1, cigarettes are pushed individually from the bottom of a single cigarette column. Any cigarette in this column may be damaged or have a loose end which is spilling tobacco. Alternatively there may be a blockage in the column resulting in an empty space instead of one or more cigarettes.

[0042] A detector 60 may be located in the column, which can sense the absence of a product or a defective product. A suitable detector measures light reflected from the product. If the detector detects no product or a defective product it signals an error message to the mandrel movement controller. In the case of a defective product, such as a loose end, the controller then interrupts the mandrel movement sequence to move the mandrel out of alignment with the inserter rod so that a defective rod is ejected rather than inserted into the mandrel. The controller then moves the mandrel back to the next location to be filled. In the case of a void in the column, the error signal will cause the controller not to move the mandrel to the next location so that the mandrel is in the same place for two cycles of the inserter. The first pushes a non-existent cigarette and the second fills the aperture in the mandrel that should have been filled on the previous cycle.

[0043] The use of a detector in the column, together

with individual insertion of cigarettes avoids the possibility of a collation being formed that is incomplete. This in turn has economic benefit as incomplete packs would be otherwise rejected after packaging was complete. The detection of individual defective cigarettes and their individual rejection before formation of the collation minimises the number of cigarettes that are rejected. In the prior art, either an entire row of cigarettes, or an entire collation would have to be otherwise rejected which necessarily results in good product being rejected with bad product.

[0044] In an alternative embodiment of the invention, a master mandrel is used from which a pre-determined number of apertures is selected for filling. A large variety of collations is thus possible from a single master mandrel. The collation to be produced can be changed simply by changing the programming of the mandrel controller. In this embodiment, with only some of the plurality of apertures to be filled, the process of Figure 5 is adapted accordingly such that at step 104, the system checks the see whether all the required apertures have been filled rather than all of the apertures.

[0045] In a further alternative, the pocket into which rod-shaped articles are transferred from the mandrel is dispensed with. The purpose of the pocket is to bring the spaced apart articles held in the apertures of the collation mandrel into contact with adjacent articles. The pocket may be replaced by any means which performs this function. For example, the cigarettes may be pushed out of the collation mandrel directly into a foil or a pack through a profiled collar or guide. Alternatively, the foil or pack could have a profiled inner surface matching the collation, removing the need for a collar or guide.

[0046] In the embodiment described above, the articles are transferred from the collation mandrel in a single action of a set of transfer rods. In an alternative embodiment the articles are transferred row-by-row or column by column. While this increases transfer time, as several reciprocal operations are required, it also decreases the number of transfer rods required.

[0047] Many other variations and modifications to the embodiment described are possible and will occur to those skilled in the art without departing from the scope of the invention which is defined by the following claims.

Claims

1. Apparatus for collating rod shaped articles, comprising a collation mandrel having a plurality of apertures each for receiving a rod-shaped article, a hopper for storing a reservoir of rod shaped articles, an inserter for transferring individually rod-shaped articles from the hopper into apertures of the mandrel, and a mandrel controller for controlling the position of the mandrel with respect to the inserter, whereby the inserter inserts rod shaped articles into a pre-selected number of the plurality of apertures of the mandrel.

2. Apparatus according to claim 1, comprising means for receiving rod-shaped articles from the mandrel and drawing the articles into contact with adjacent articles of the collation and at least one transfer rod for pushing the rod-shaped articles from the mandrel into the receiving and drawing means.

3. Apparatus according to claim 2, wherein the at least one transfer rod comprises a set of rods arranged to correspond to the apertures of the collation mandrel, and wherein the mandrel controller controls the position of the mandrel with respect to the set of transfer rods whereby the transfer rods can transfer the rod-shaped articles from the mandrel to the receiving and drawings means in a single operation.

4. Apparatus according to claim 2 or 3, comprising a tapered mouthpiece arranged between the collation mandrel and the receiving and drawing means.

5. Apparatus according to any preceding claim, comprising a tapered mouthpiece arranged between the inserter rod and the collation mouthpiece for guiding rod-shaped articles into an aperture in the collation mandrel.

6. Apparatus according to any preceding claim, wherein the mandrel controller comprises a robot.

7. Apparatus according to any preceding claim, wherein the hopper comprises a column of rod-shaped articles and the inserter comprises a reciprocating rod for inserting the bottom article in the column of articles into an aperture in the collation mandrel.

8. Apparatus according to claim 2, 3 or 4, wherein the receiving and drawing means comprises a collation pocket.

9. Apparatus according to claim 2, 3, or 4 wherein the receiving and drawing means comprises a foil or a pack.

10. Apparatus according to claim 9, wherein the foil or pack has a shaped inner surface corresponding to the shape of the collation.

11. Apparatus according to any preceding claim, comprising a plurality of hoppers, each hopper having an inserter.

12. Apparatus according to claim 11, wherein the mandrel controller controls the position of the collation mandrel with respect to the inserter of each hopper whereby the collation mandrel can be aligned to receive rod-shaped articles in its apertures from any of the inserters.

13. Apparatus according to claim 11, wherein each hopper and inserter has a corresponding collation mandrel and receiving and drawing means.

14. Apparatus according to any preceding claim, wherein the collation mandrel is selected from a set of interchangeable collation mandrels each having a different arrangement of apertures, and wherein the mandrel controller is programmed to control the positioning of the mandrel apertures with respect to the inserter for each of the set of mandrels whereby a desired collation of rod-shaped articles can be formed.

15. Apparatus according to claim 7, wherein the hopper comprises a pair of parallel vanes defining the column of rod-shaped articles, comprising a sensor in the channel defined by the hopper vanes for detecting defective or missing rod-shaped articles, the sensor being coupled to the mandrel controller to enable sensed defective articled to be rejected prior to insertion into the mandrel and to enable missing articles to be replaced.

16. Apparatus according to any preceding claim, wherein the rod-shaped articles comprise cigarettes.

17. A method for collating rod-shaped articles comprising:

a) providing a collation mandrel having a plurality of apertures arranged to define a collation;
b) providing a reservoir of rod-shaped articles and an inserter for presenting a rod-shaped article to the collation mandrel;
c) aligning an aperture of the collation mandrel with the inserter;
d) inserting an article into the aligned aperture;
e) moving the mandrel to align a further unfilled aperture with the inserter; and

repeating steps d) and e) until a pre-selected number of the apertures of the collation mandrel are filled with a rod-shaped article.

18. A method according to claim 17, comprising transferring the rod-shaped articles from the mandrel to a means for receiving rod-shaped articles from the mandrel, and drawing the articles into contact with adjacent articles of the collation in which neighbouring rod-shaped articles in the collation abut one another.

19. A method according to claim 18, wherein the transferring of the rod-shaped articles comprises aligning the collation mandrel with respect to at least one transfer rod and pushing the rod-shaped articles from the collation mandrel into the receiving and drawing means with the at least one transfer rod.

20. A method according to claim 19, wherein the at least one transfer rod comprises a set of transfer rods equal in number to the number of apertures in the collation mandrel and arranged such that the pushing of the rod-shaped articles causes each of the set of transfer rods to push an article from the collation mandrel into the receiving and drawing means, whereby the articles in the mandrel can be transferred to the receiving and drawing means in a single stroke of the set of transfer rods.

21. A method according to claim 19 or 20, comprising passing the rod-shaped articles through a tapered mouthpiece between the collation mandrel and the receiving and drawing means.

22. A method according to any of claims 17 to 21 comprising passing each rod-shaped article through a tapered mouthpiece arranged between the inserter rod and the collation mandrel aperture to aid registration of the article with the mandrel aperture.

23. A method according to any of claims 17 to 22, comprising sensing the presence of a defective article in the reservoir of articles, and, when that defective article is to be delivered to the collation mandrel by the inserter, moving the collation mandrel away from the inserter, whereby the defective article is discarded.

24. A method according to any of claims 17 to 22, comprising sensing a void in the reservoir of articles and, when an article that should occupy the void is due to be delivered by the inserter, moving the inserter as if the article was present and inserting a further article with the collation mandrel in the same position.

25. A method according to any of claims 17 to 24, comprising a plurality of hoppers each having an inserter, wherein the step of moving the collation mandrel to align a further unfilled aperture comprises moving the collation mandrel to align with the inserter of any one of the plurality of hoppers.

26. A method according to any preceding claim, wherein the step of providing a collation mandrel comprises selecting the collation mandrel from a set of collation mandrels, each mandrel having a different collation shape.

27. Apparatus for packaging rod-shaped articles comprising:

apparatus for forming a collation of rod-shaped articles according to any of claims 1 to 16; and
apparatus for packing the collation.

28. A reconfigurable apparatus for collating rod-shaped articles for packaging comprising:

a movable collation mandrel having a plurality of apertures each for receiving a rod-shaped article, the apertures being spaced to define the collation and the collation mandrel being interchangeable according to the desired collation;
a hopper for storing a reservoir of rod-shaped articles;
an inserter for transferring a rod-shaped article from the hopper into an aperture of the collation mandrel; and
a mandrel controller for controlling the position of the moveable collation mandrel with respect to the inserter, whereby the inserter can insert rod-shaped articles into each of the plurality of apertures of the collation mandrel.

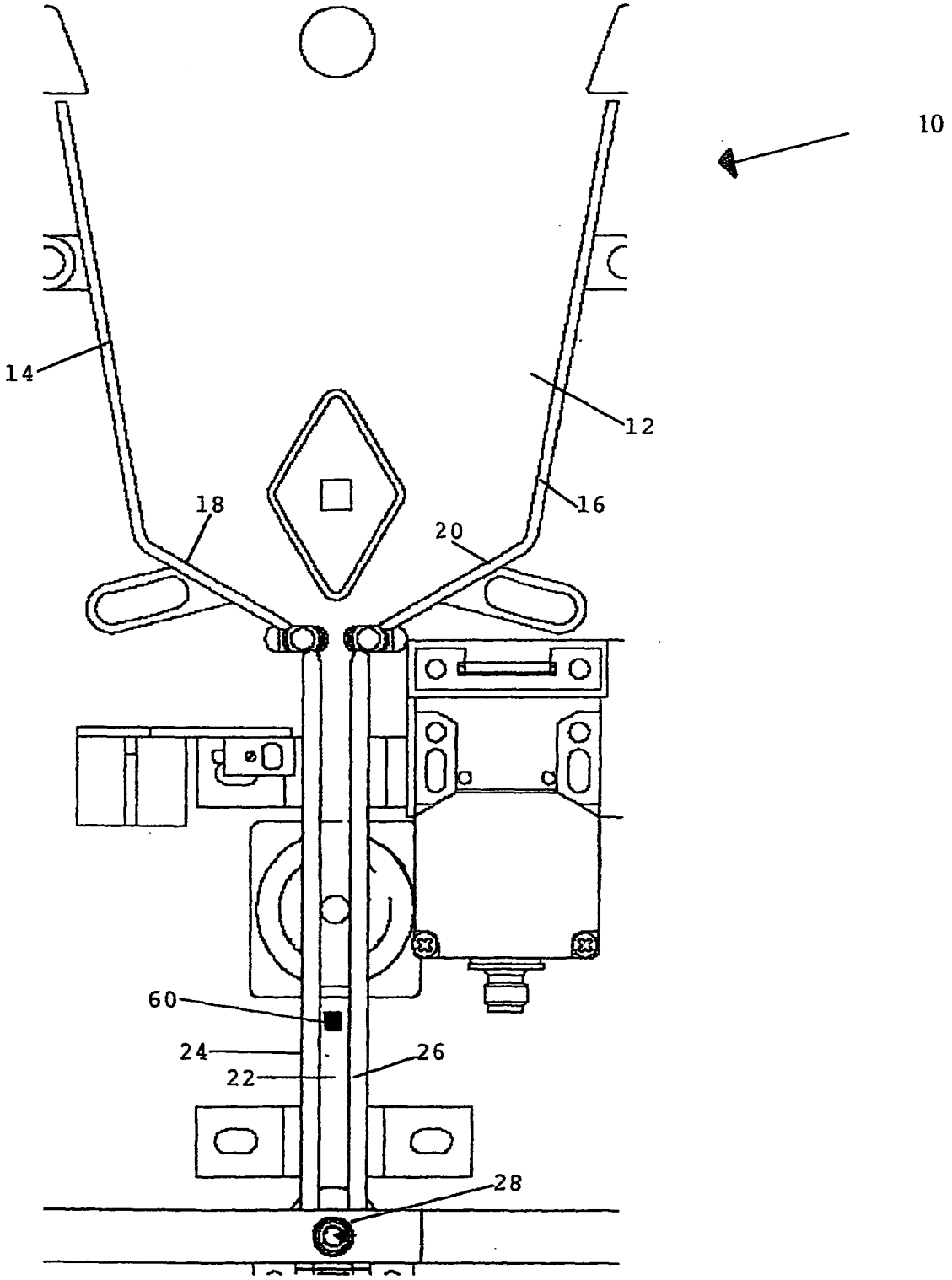


Figure 1

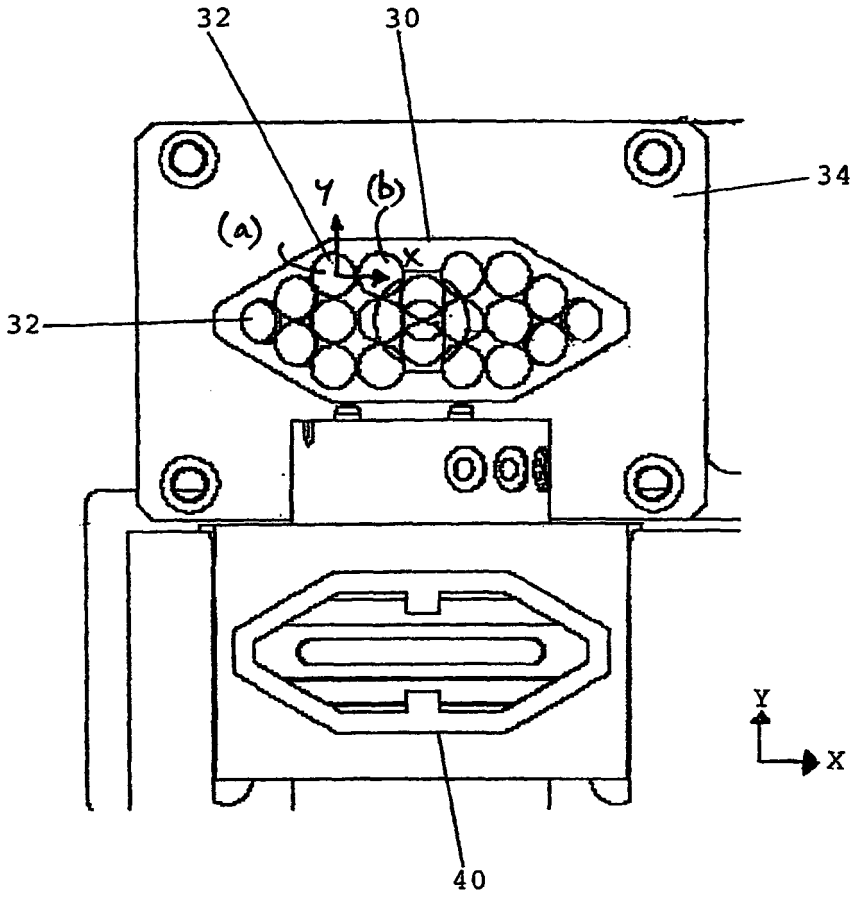


Figure 2

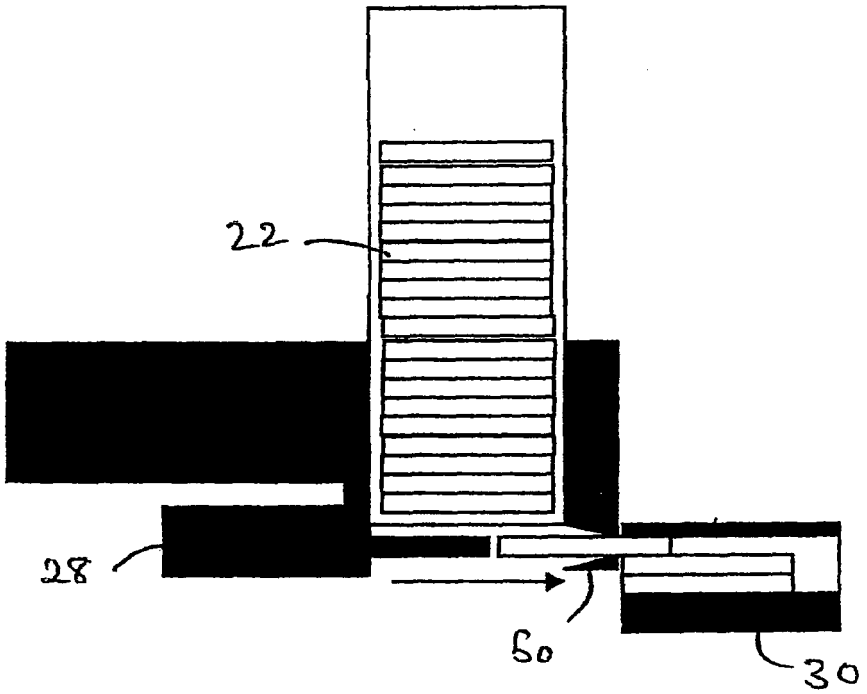


Figure 3

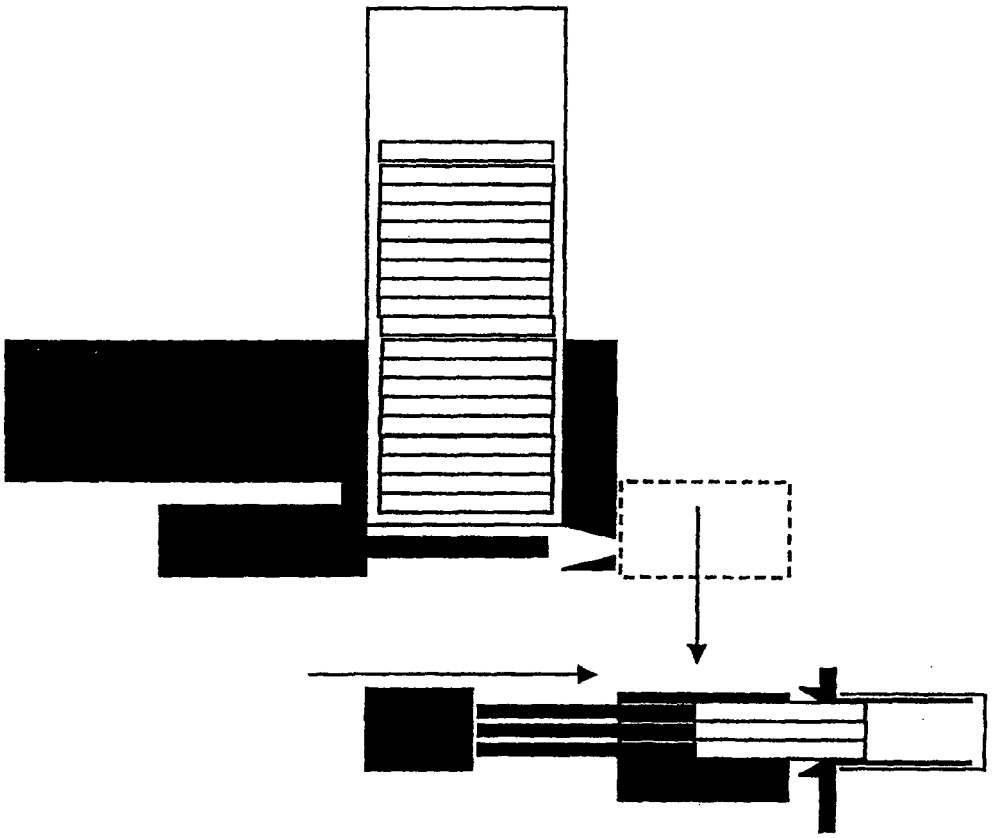


Figure 4

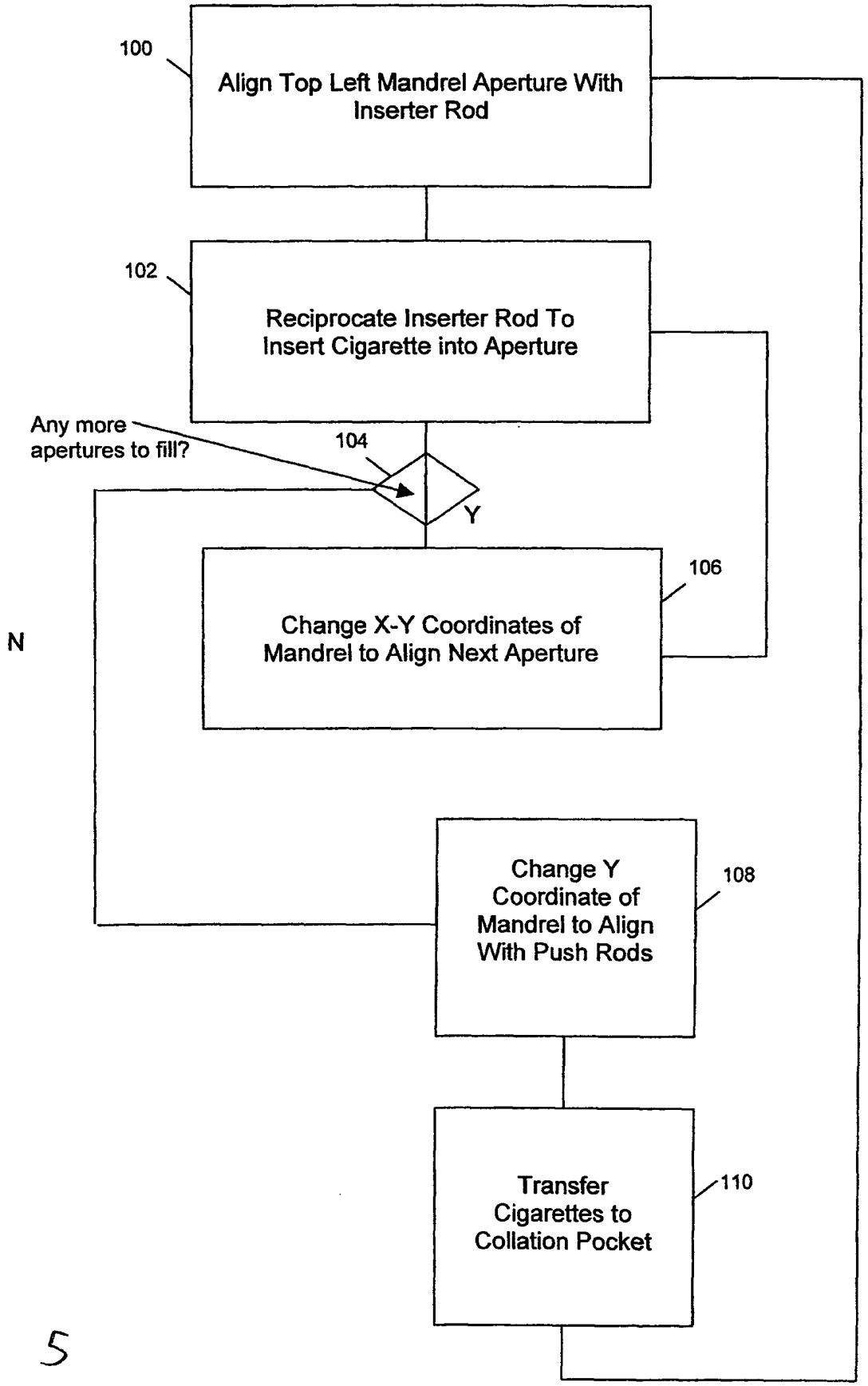

100
Align Top Left Mandrel Aperture With Inserter Rod
102
Reciprocate Inserter Rod To Insert Cigarette into Aperture
Any more apertures to fill?
104
Y
N
106
Change X-Y Coordinates of Mandrel to Align Next Aperture
Change Y Coordinate of Mandrel to Align With Push Rods
108
Transfer Cigarettes to Collation Pocket
110

Figure 5

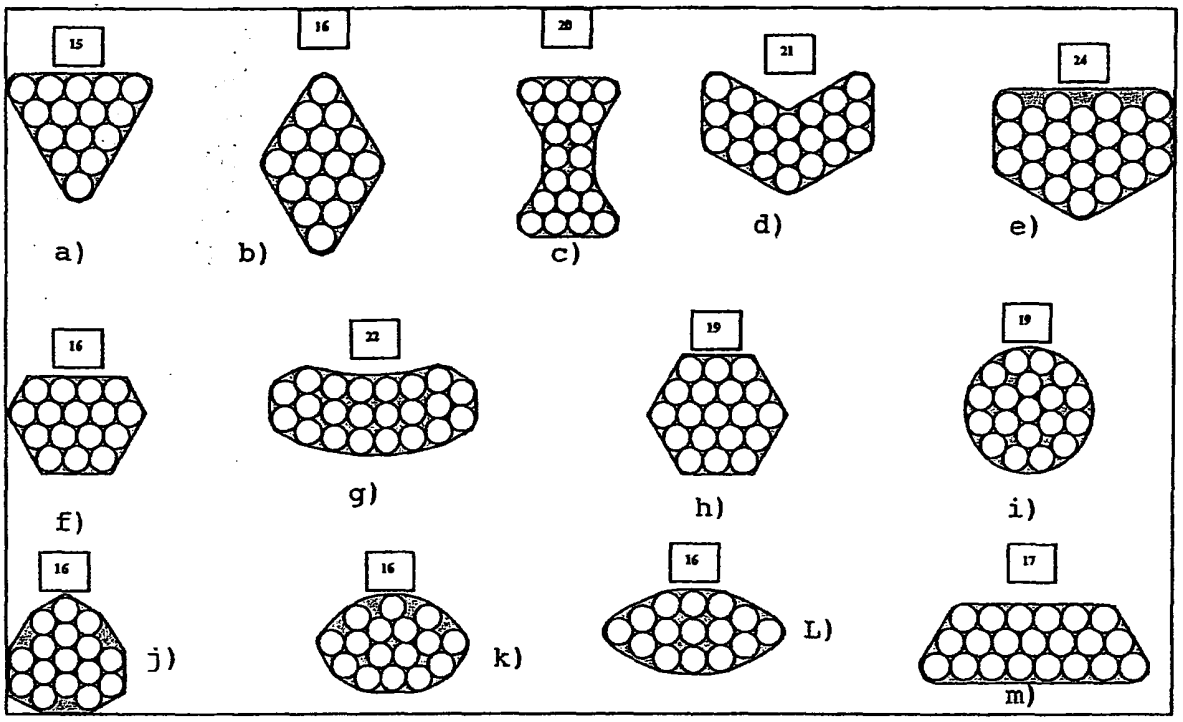


Figure 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 25 4824

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	EP 0 723 913 A (GD SPA) 31 July 1996 (1996-07-31) * abstract; figure 2 * -----	1,17,27, 28	B65B19/04 B65B59/00 B65B59/04

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 January 2005	Grentzius, W

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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1

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82