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(54) MACHINE FOR PRINTING HOLLOW ARTICLES

MASCHINE ZUM BEDRUCKEN VON HOHLKÖRPERN

MACHINE D'IMPRESSION D'ARTICLES CREUX

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Description

Technical Field

[0001] The invention relates to a machine for printing hollow articles such as cans, tubes, cartridges, other types of containers or closures.

Background Art

[0002] Corresponding machines are known. Often, they include offset printing stations that are integrated within machine lines that include associated stations arranged upstream or downstream, respectively. An example for an upstream station is a base coating station (with a corresponding drying station). Examples of downstream stations are drying or over varnish stations (with corresponding further drying stations).

[0003] The stations are arranged along a main transport direction. Together with further stations such as the initial forming stations as well as intermediate or final necking stations, long machine lines are assembled, all stations working simultaneously, allowing for a high throughput. In addition to the arrangement along the main transport direction (which is usually a horizontal direction), the stations may be stacked in order to reduce the extension of the machine line along the main transport direction. In particular, intermediate storage or buffer stations as well as drying stations may be arranged above or below the other stations.

[0004] Often, the hollow articles are transported from one station to the other using a transport chain. The chain may be provided with chain pins, whereas each pin may be accommodated within one of the hollow articles in order to hold the respective article. The pins are inclined with respect to a horizontal plane in order to ensure that the articles are safely held on the chain, an angle of inclination amounts to about 2 - 15°, in particular about 6 - 8°. The inclination may be achieved by having a corresponding design of the chain and pins, respectively, or by inclining the entire machines (including the transport chain linking the stations) about the corresponding angle. Usual designs of decorating sections, including base coating, printing and over varnish stations, feature a single transport chain linking all these stations. This means that all stations are mechanically linked, i. e. if one station is running, all stations will be running.

[0005] Usually, the different stations of the machine line are arranged in a common working plane, the chain or chains having an operation plane which coincides or is at least parallel with the working plane throughout the entire machine.

[0006] For example the EP 1 661 699 A1 (Hinterkopf) discloses an apparatus for printing and other decoration of hollow bodies, which comprises several processing stations as well as a conveyor chain arrangement for serving the processing stations. The conveyor chain arrangement is composed of several conveyor chain sections being able to be linked together to form a closed loop to perform a circulating motion in operation with alternatively different paths. Unused chain sections are uncoupled from the rest of the conveyor chain and immobilized.

[0007] As mentioned, these machine lines allow for high throughput. They are especially well suited for the production of large lots. Due to the fact that the change over of the printing station for a new lot of hollow articles requiring a different print image and the subsequent proofing takes considerable time, the throughput is substantially reduced when smaller lots are processed as there is a lot of down time of the machine line.

Summary of the invention

[0008] It is the object of the invention to create a machine pertaining to the technical field initially mentioned, that allows for high throughput also in case of smaller lots.

[0009] The solution of the invention is specified by the features of claim 1. According to the invention, the machine comprises the following:

a) at least two printing stations;

b) at least two drying stations, a first drying station arranged downstream from a first of the printing stations and being associated to the first of the printing stations and a second drying station arranged downstream from a second of the printing stations and being associated to the second of the printing stations;

c) a transport chain mechanism for transferring the hollow articles between the printing stations and the drying stations; and

d) a selection mechanism allowing for switching between a first mode, in which hollow articles provided by a previous station pass through the first printing station and the first drying station, omitting the second printing station and the second drying station, and a second mode, in which the hollow articles pass through the second printing station and the second drying station, omitting the first printing station and the first drying station, wherein the selection mechanism comprising a selector station having a first transport chain constituting an infeed and a first outfeed, a second transport chain constituting a second outfeed, and a selectively engageable transfer mechanism for removing hollow articles from the first transport chain and for feeding the removed hollow articles to the second transport chain.

[0010] Having two independent printing stations with associated drying stations allows for rapidly switching between using the first printer and dryer and using the second printer and dryer. Furthermore, as both printing

stations have an associated drying station, test prints may be done on the "offline" printer during production on the "production" (inline) printer. Thus, proofing may be effected off-line and changeover time may be minimized or entirely spared. This substantially increases the throughput of the machine line, especially in the case of processing smaller lots.

[0011] As a matter of course, an actual manufacturing line for cans, tubes, cartridges, other types of containers or closures will include additional stations such as an extrusion press, cutting, brushing and washing machines, coating machines with corresponding dryers, a necking machine and/or a packing machine. Furthermore, buffer storage stations (accumulators) will be arranged in between the aforementioned stations in a manner known as such. According to the invention, the selection mechanism comprises a selector station having a first transport chain both constituting an infeed and a first outfeed, a second transport chain constituting a second outfeed, and a selectively engageable transfer mechanism for removing hollow articles from the first transport chain and for feeding the removed hollow articles to the second transport chain. In one operation mode, the hollow articles may thus remain on the first transport chain, being essentially unaffected by the selector station. As soon as the selection mechanism is switched to another operation mode by engaging the transfer mechanism, the hollow articles will be removed from the first transport chain and fed to the second transport chain. Using two separate transport chains allows for the division of the path of the articles into two paths, furthermore, the movement of the chains in both paths may be independently controlled. As an example, one of the chains may be non-active or run at a manual control or test speed whereas the other chain is running at production speed. It is preferred that the selection mechanism is built up in such a way that the transfer mechanism may be engaged or disengaged during production, i. e. the engagement (or disengagement) happens in between the arrival of two subsequent articles at the transfer mechanism. This allows for switching between one outfeed and the other without any effect on the production speed.

[0012] In a preferred embodiment, the first transport chain and the second transport chain comprise each a U-shaped section arranged in a common operation plane, where the transfer mechanism in its activated state cooperates with the U-shaped section of the first transport chain for mechanically removing hollow articles fed by the first transport chain in a lateral direction with respect to the common operation plane and for feeding the removed hollow articles to a conveyor mechanism for feeding the removed hollow articles to the second transport chain by moving the articles back against the lateral direction. Accordingly, to divide the flow of articles, a side moving conveyor is used.

[0013] The U-shaped sections may be arranged side-by-side. Alternatively, they are arranged in a substantially vertical distance, which allows for transferring the articles by gravitation.

[0014] As an example, the articles may be captured at the base of the U-shaped section of the first transport chain by v-shaped baskets and moved in the lateral direction away from the first transport chain until they are completely removed from the chain pins of the first transport chain. During removal of the articles the baskets are moved in the transport direction of the first transport chain at the same speed as the first transport chain. In a next step, the baskets are moved further until the base of the U-shaped section of the second transport chain is reached. In this section, the baskets are moved back against the lateral direction mentioned above, and the articles are synchronously fed to the chain pins of the second transport chain. The movements of the baskets being synchronized to the movement of the two transport chains allows for automatically switching between the two outfeeds without any effect on processing speed and without any manual interaction.

[0015] It is to be noted that the operating speed of the two transport chains is required to match as long as the hollow articles are transported from the first chain to the second. However, if the hollow articles remain no the first chain, the second chain may be operated by a different (in particularly lower) operating speed or even stand still.

[0016] As an alternative to the lateral arrangement, the transport chains may be arranged in such a way that the base of the U-shaped section may be moved down or up (in or out of the baskets) instead of having a lateral deviation.

[0017] As an alternative, the transfer may be effected using vacuum transfer drums.

[0018] In a preferred embodiment, the transfer mechanism comprises a first drum for temporarily accommodating hollow articles, the first drum cooperating with the first transport chain, and a second drum for temporarily accommodating hollow articles, the second drum cooperating with the second transport chain, wherein hollow articles accommodated by the first drum may be selectively fed to the second drum. The drums may be vacuum transfer drums that are known as such, that are designed and configured in such a way that hollow articles fed by the first transport chain may be accommodated by the first drum and transferred to the second drum and to the second transport chain in a first mode, whereas hollow articles remain on the first transport chain in a second mode.

[0019] The two drums may comprise carriages that are axially movable, i. e. linearly movable along an axis that is parallel to the rotation axis of the drum. In a first axial position, the carriages may cooperate with the transport chain cooperating with the respective drum, in order to remove articles from the chain or to feed articles to the chain. In a second axial position, the articles are temporarily accommodated by the drum, independent from the respective chain.

[0020] Advantageously, at least the first drum compris-

es axially movable carriages for holding hollow articles, the axial movement of the carriages being selectively controlled by a first cam for feeding the hollow articles to the second drum or by a second cam for keeping the hollow articles on the first transport chain. Controlling the movement of the carriages by cams, i. e. mechanically, is a simple and mechanically stable solution, which allows for high throughput. A switch will be provided to select between the first cam (e. g. a cam that leads to axial displacement of the carriages in a certain sector of the drum) and the second cam (e. g. a straight cam, keeping the carriages in their first position).

[0021] In a preferred embodiment, the first printing station and the second printing station are arranged in different lateral positions with respect to a main operation plane of the transport chains. This allows for crossing the transport chains used for transporting the articles between the stations in the two modes in a region where they run in different operation planes and thus for a space-saving arrangement, where the printing stations are both arranged in a first horizontal plane and the drying stations are both arranged in a second horizontal plane, in particular above the printing stations.

[0022] In particular, a transport chain of the transport chain mechanism linking the selection mechanism to the first printing station includes twisted sections. Employing the twisted sections, the chain may extend out from its main operation plane into a secondary operation plane and back into the main operation plane. This allows for transferring the articles between two laterally offset planes without having to employ additional lateral shifting mechanisms.

[0023] In particular, the first printing station is arranged next to the selection mechanism, and the operation plane of the infeed chain coincides with the operation plane of the outfeed chain of the selection mechanism. The distance between the selection mechanism and the second printing station is larger (i. e. the second printing station is arranged in a downstream direction of the first printing station), and the second printing station has an operation plane of the infeed chain that is different from the operation plane of the outfeed chain of the selection mechanism. The change of operation plane is achieved by the twisted sections mentioned above. Due to the fact that the distance is relatively large, a rather small inclination angle of the transport chain with respect to the two operation planes is needed. An angle of about 4 - 8° is adequate and may be reached by employing the twisted sections.

[0024] As an alternative to twisting, the chain may be bent. This alternative is feasible depending on the design of the chain actually used.

[0025] Preferably, the transport chain mechanism comprises a first transport chain running through the first printing station and the first drying station and a second transport chain being different from the first transport chain running through the second printing station and the second drying station. If needed, each of these transport chains may be constituted by a number of cooperating chains. Having separate chains for each of the printing and drying station pairs provides for higher flexibility in the product flow, especially in the downstream direction. As an example, if a station upstream from the selection mechanism, e. g. the drying station for the base coat, needs to be stopped, the following stations may continue running, evacuating and further processing the products without any product damage. Furthermore, it is possible to run one of the printer/dryer combinations at production speed and simultaneously the other printer/dryer combination at testing/proofing speed.

[0026] It is to be noted that the stations and transport chains will be supplemented by a suitable number and suitably arranged buffer storage stations in a manner known as such. These buffer storage stations provide the flexibility that is needed to account for short-term fluctuations of the output of the upstream station as well as for short-term fluctuations of the capacity of the downstream station.

[0027] Advantageously, the machine comprises a first manual infeed for feeding hollow articles to the second printing station and the second drying station in the first mode and a second manual infeed for feeding hollow articles to the first printing station and the first drying station in the second mode. In this context, "manual infeed" relates to an infeed that may be manually controlled on a demand basis. As a matter of course, the feeding of the hollow articles may be effected not only manually but in addition or exclusively by automated means. Having manual infeed for both printing and drying stations allows for proofing parallel to the production in the first as well as in the second mode.

[0028] Preferably, the selector station comprises a manual infeed for feeding hollow articles to the second transport chain. In the first mode, articles received from the infeed will remain on the first transport chain, and the second transport chain will be essentially unaffected and its operation may be independently controlled. Accordingly, it is possible to include a manual infeed in the selector station, using which hollow articles may be fed to the first transport chain. Therefore, there is no need for an additional manual infeed station for the second mode, and costs and space requirements are reduced.

[0029] Instead or in addition to manual feeding, a certain number of hollow articles may be deviated to the printer which is in setup mode automatically by correspondingly controlling the selector station. This will lead to a certain gap in the production but allows for rapidly performing test prints without the need for manual feeding.

[0030] Preferably, manually infeed hollow articles are processible by the second printing station and the second drying station in the first mode and by the first printing station and the first drying station in the second mode, in parallel with running production on the first printing station and the first drying station in the first mode or on the second printing station and the second drying station

in the second mode. Accordingly, independent of the forthcoming switch between printing/drying stations, proofing may be effected off-line, in parallel to full production.

[0031] The machine preferably comprises a takeout station for selectively singling out hollow articles being processed by the second printing station and the second drying station in the first mode and by the first printing station and the first drying station in the second mode. This allows for automatically discharge sample/test print/setup/proofing articles after drying in the respective drying station. This ensures that these articles are not fed into the actual production run.

[0032] The takeout station may include a blower mechanism for selectively blowing out the hollow articles to be singled out from the chain pins they are held on.

[0033] In a particularly preferable embodiment, the machine comprises the following stations:

a) a selector station being part of the selection mechanism;

b) the first printing station;

c) the first drying station arranged downstream from the first printing station;

d) a manual infeed station;

e) the second printing station;

f) the second drying station arranged downstream from the second printing station;

g) a takeout station; and

h) a merging station for feeding hollow articles processed by the first printing station and the first drying station or the second printing station and the second drying station, respectively, to a common outfeed.

[0034] These stations are linked to each other as follows:

i) a first outfeed of the selector station is linked to the first printing station,

j) a second outfeed of the selector station is linked to the manual infeed station,

k) the manual infeed station is linked to the second printing station,

l) outfeeds of the first drying station and the second drying station are linked to the takeout station, and

m) the takeout station is linked to the merging station.

[0035] Two or more of the stations mentioned may be integrated into a single unit.

[0036] The merging station may be designed in such a way that the incoming transport chains coming from the first and the second drying station, respectively, lie in two different planes having a lateral distance from each other, and that the hollow articles fed in from the two transport chains are moved in a lateral direction to a common outfeed plane. In particular, the outfeed plane may correspond to one of the infeed planes or lie in between the infeed planes. This makes a second inclined chain (with twisted sections) unnecessary, i. e. the separation of the operation planes is achieved by employing an inclined chain, in particular between the selection mechanism and the second printing station, whereas the merging of the operation planes is effected locally at the merging station.

[0037] The crossing of the two chains linking the selector station with the first printing station and linking the selector station with the manual infeed station, respectively, may be arranged in the region of the manual infeed station. This is where the two chains run in different operation planes.

[0038] The manual infeed station is used for feeding test articles to the second printing station in the first mode of the machine. In this mode, it will be possible to run the outfeed of the manual infeed station at another speed (in particular lower speed) than the (empty) infeed chain linking the manual infeed station to the selector station. In the second mode of the machine articles arriving from the second outfeed of the selector station will be forwarded to the second printing station. In this case, the speeds of both respective chains will be identical. In the second mode, test articles may be advantageously manually infed at the selector station, to the outfeed that links it with the first printing station.

[0039] The selector station, the manual infeed station and the merging station may be designed in a similar way, featuring an infeed chain and an outfeed chain both comprising a U-shaped section, both sections being arranged in a common operation plane. They further include a selectively engageable transfer mechanism for removing hollow articles from the infeed chain and for feeding the removed hollow articles to the outfeed chain.

[0040] This has been described in more detail for the selector station above. When used as the manual infeed station, the station may hand over all articles from the infeed chain to the outfeed chain in a first operating mode, whereas in a second operating mode, articles may be manually fed to the transfer mechanism, which will feed the articles to the outfeed chain.

[0041] When used as the merging station, there will be two infeeds (either chains or other means such as discharge drums) with which the transfer mechanism selectively cooperates. Articles fed from any of the two infeeds will then be fed to the outfeed (chain).

[0042] In particular, the transfer mechanism is designed to move the articles in a lateral direction with re-

spect to the operation plane of the chain(s). This allows for removing the articles from chain pins and for feeding the removed articles to the chain pins of another chain. In the context of the merging station, this allows for merging article flows arriving in different operation planes that are laterally spaced from each other.

[0043] Other advantageous embodiments and combinations of features come out from the detailed description below and the totality of the claims.

Brief description of the drawings

[0044] The drawings used to explain the embodiments show:

Fig. 1 a block diagram of the printing section of a machine line according to the invention;

Fig. 2 a side view of the printing section;

Fig. 3 a top view showing the lower level of the printing section;

Fig. 4 a side view of the printing section showing the involved transport chains;

Fig. 5A, B schematic side views showing the printing section in two operating modes;

Fig. 6 a schematic top and side view of a selector station of the embodiment;

Fig. 7A, B schematic top and side views of a merging station of the embodiment in two operating modes;

Fig. 8A, B schematic front and side views of a selector station of another embodiment of the invention.

[0045] In the figures, the same components are given the same reference symbols.

Preferred embodiments

[0046] Figure 1 is a block diagram of the printing section of a machine line according to the invention, e. g. a machine line for the manufacture of aluminium aerosol cans. As known from the prior art, the machine line 1 comprises a number of sections related to different processing steps, such as a forming section, a cutting section, a coating section, the printing section, an over varnishing section, a necking section, a packing section etc. Each section not only comprises the respective station but auxiliary devices such as conveyors, (buffer) storages (accumulators), dryers etc. The printing section according to the invention and as described in the following may be used in the context of machine lines of different configurations. In principle it may replace prior art printing sections when down times due to the changeover of printing stations are to be reduced.

[0047] At the entrance, receiving pre-processed articles, the printing section 100 of the machine line 1 comprises a selector station 110. This station selectively routes the articles to a first path 101 or to a second path 102. In the first path 101, the selector station 110 comprises a manual inserting mechanism 111. On the first path 101, the selector station 110 is linked to a first printing station 151 and further to a first drying station 161. On the second path 102, the selector station 110 is linked to a manual inserting station 140, to a second printing station 152 and further to a second drying station 162. The output of both drying stations 161, 162 pass a takeout station 170, where individual articles may be selectively singled out. The articles that are not singled out at the takeout station 170 are further conveyed to a merging station 180, where the two paths 101, 102 are merged and the articles are delivered at a single output 181.

[0048] Figure 2 is a side view of the printing section. Figure 3 is a top view showing the lower level of the printing section, i. e. the level of the printing stations as well as of the selector, infeed, takeout and merging stations, including the respective transport chains. The paths of the chains within the drying stations are not shown. They may be chosen according to prior art designs. The Figures show in more detail the components of the printing section 100 mentioned above, in connection with Figure 1, the main transport direction is from right to left. In particular, Figures 2 and 3 show on a lower level the selector station 110, left to which the first printing station 151 is arranged. Again left, the manual inserting station 140 is arranged, followed by the second printing station 152, the takeout station 170 and the merging station 180.

[0049] In the region shown in Figures 2 and 3, the upper level features from right to left four drying stations. The first drying station is arranged downstream of a base coating station that does not form part of the printing section. Next, the two drying stations 161, 162 are arranged to the left, followed by a further drying station arranged downstream of an over varnish station. Again, the latter does not form part of the printing section.

[0050] The different station and devices are linked by transport chains (cf. below, Figure, 4). The stations and devices mentioned before are linked as follows: From the rightmost drying station (which is assigned to the upstream base coating station), the articles are fed to the infeed of the selector station 110. The selector station 110 features two outfeeds, one of them is linked to the first printing station 151 and further to the first drying station 161. The other outfeed of the selector station 110 is linked to the manual inserting station 140, from there to the second printing station 152 and further to the second drying station 162. The outputs of both drying stations 161, 162 are linked with the takeout station 170 and further with the merging station 180.

[0051] It is clearly visible from Figure 3, that the trans-

port chain 202 linking the selector station 110 with the manual inserting station 140 deviates from the main transport direction by an angle of about 5°, such that in the infeed region of the manual inserting station 140 the two transport chains 202, 204 lie in two planes that are clearly separated from each other in a lateral direction, which allows for crossing the two transport chains in this region. The second printing station 152 lies in the plane that is defined by the respective transport chain, i. e. it is laterally shifted with respect to the first printing station 151. As shown in more detail below, the articles are transported back to a single common plane in the merging station 180.

[0052] Figure 4 is a side view of the printing section showing the involved transport chains. In order to facilitate the understanding of the Figure, the paths of the chains are slightly simplified. Only the lower level is displayed. Where necessary, different chains are indicated by different line styles. A first chain 202 (short-dashed) links the drying station of the base coating station with the infeed of the selector station 110, the second outfeed of the selector station 110 and the infeed of the manual inserting station 140. This is the chain 202 which includes a section that is inclined with respect to the usual operation planes of the chains, namely the section linking the second outfeed of the selector station 110 with the infeed of the manual inserting station 140 as well as the parallel section running in the opposite direction, linking the outfeed of the base coating drying station with the infeed of the selector station 110. In order to allow for the required change of direction, the chain 202 includes two regions 202c, 202d, in which the chain 202 is slightly twisted (2.5° per chain link). One of the region, namely region 202c is arranged at the upper end of a U-shaped section constituting the infeed and the second outfeed of the selector station 110, the other region, namely region 202d, is arranged substantially above the infeed of the manual inserting station 140.

[0053] A further chain 203 (solid line) links the first outfeed of the selector station 110 with the infeed of the first printing station 151. Another chain 204 (solid line) links the outfeed of the first printing station 151 with the first drying station 161 and further with the takeout station 170 and the merging station 180.

[0054] A further chain 205 (short-dashed) links the outfeed of the manual infeed station 140 with the infeed of the second printing station 152. Finally, a further chain 206 links the outfeed of the second printing station 152 with the second drying station 162 and further with the takeout station 170 and the merging station 180. As can be seen from Figure 3, chain 204 linking the first printing station 151 with the takeout station 170 and the merging station 180 and chains 205, 206 linking the manual inserting station 140 with the second printing station 151 as well as the second printing station 152 with the takeout station 170 and the merging station 180 operate in parallel planes.

[0055] Figures 5A, B are schematic side views showing the printing section in two operating modes. In the operating mode shown in Figure 5A, the first printing station is in production mode, whereas the second printing station is available for preparation, manual testing or proofing. In Figure 5B, the second printing station is in production mode, whereas the first printing station is available for preparation, manual testing or proofing. Chain segments transporting articles in production mode are indicated by solid lines, chain segments transporting articles for testing/proofing are indicated by dotted lines, chain segments where no articles are transported are indicated by dashed lines.

[0056] In the first operating mode shown in Figure 5A, articles received from the drying station of the base coating station are fed on chain 202 to the infeed of the selector station 110. There, they are transported to the first outfeed, i. e. they are removed from chain 202 and loaded to chain 203. Subsequently, they are transported to the first printing station 151, taken over by chain 204 and fed to the drying station 161 associated to the first printing station 151. From the drying station 161, the articles pass the takeout station 170 (usually unaffected) and reach the merging station 180. There, the articles are loaded onto another chain transporting the articles to the next station. It is possible to manually feed articles in the manual inserting station 140 (arrow 141). These manually fed articles are transported to the second printing station 152 by chain 205; there they are taken over by chain 206 and transported to the drying station 162 associated to the second printing station 152. From the drying station 162, the articles are transported further to the takeout station 170. There, all articles originating from the second printing station 152 and the associated drying station are blown out, e. g. into a container. They may be inspected, and the setup of the second printing station 152 may be accordingly adjusted.

[0057] In the second operating mode shown in Figure 5B, articles received from the drying station of the base coating station are fed on chain 202 to the infeed of the selector station 110. There, they remain unaffected, i. e. they remain on chain 202. Subsequently, they are transported to the manual inserting station 140 where they are removed from chain 202 and loaded to another chain 205. In this operating mode, the manual inserting station 140 has no manual insertion purpose, but it forwards all articles to the second printing station 152. There, the articles are taken over by chain 206 and fed to the drying station 162 associated to the second printing station 152. From the drying station 162, the articles pass the takeout station 170 (usually unaffected) and reach the merging station 180. There, the articles are loaded onto another chain transporting the articles to the next station. It is possible to manually feed articles in the selector station 110, using the manual inserting mechanism (arrow 112). These manually fed articles are transported to the first printing station 151 by chain 203; there they are taken over by chain 204 and transported to the drying station 161 associated to the first printing station 152. From the

drying station 161, the articles are transported further to the takeout station 170. There, all articles originating from the first printing station 151 and the associated drying station are blown out, e. g. into a container. They may be inspected, and the setup of the first printing station 151 may be accordingly adjusted.

[0058] Figure 6 is a schematic top view and a schematic side view of a selector station of the embodiment. Two chains, namely chain 202 coming from the accumulator and linking the selector station 110 to the second printing station, and chain 203 linking the selector station 110 to the first printing station, run in the same operation plane and constitute U-shaped sections, the bases of which being at the same height, slightly above a conveyor mechanism 120. The conveyor mechanism 120 comprises v-shaped channels that are arranged in succession and parallel to each other on a belt conveyor, the longitudinal extension of the v-shaped channels being perpendicular to the transport direction. The v-shaped channels are movable along their longitudinal extension and have annular end faces, such that they may engage the articles 2 held on the pins 202a, 203a of the chains 202, 203 and transport them in transport direction as well as in a perpendicular direction thereto.

[0059] The movement of the v-shaped channels may be controlled e. g. by selectively engageable cams or by using servo controls. In Figure 6, the transport path 121 defined by the movement of the v-shaped channels is schematically indicated. In the mode shown in Figure 6, the articles 2 transported on the incoming chain 202 are not affected by the selector station 110, i. e. the situation corresponds to the second operating mode as discussed above. Articles 2 may be manually fed to the v-shaped channels, in a feeding region 122. The channels move laterally and push the articles 2 onto the pins 203a of the first outfeed chain 203. In this mode, the conveyor mechanism 120 and the first outfeed chain 203 may be operated at a speed that is different from the operating speed of the chain 202 coming from the accumulator.

[0060] In the first mode (not shown), the articles 2 fed on chain 202 are grasped by the v-shaped channels, removed by lateral movement of the channels and fed back to first outfeed chain 203. Both chains and the conveyor mechanism 120 will run at the same operating speed and synchronized to each other.

[0061] Figures 7A, B are schematic top and side views of a merging station 180 of the embodiment in two operating modes. In Figure 7A, processed articles are taken over from the first printing station, whereas in Figure 7B, processed articles are taken over from the second printing station.

[0062] The articles 2 are fed on one of two discharge drums 182, 183, articles 2 coming from the first drying station associated with the first printing station are fed to drum 182, whereas articles 2 coming from the second drying station associated with the second printing station are fed to drum 183. Due to the fact that in both modes all articles coming from one of the printing stations are blown out at the preceding takeout station, articles 2 will always arrive only at one of the two drums 182, 183. A chain 207 constitutes a U-shaped section, the bases of which being at the same height, slightly above a conveyor mechanism 184. The transport plane of the chain 207 corresponds to the transport plane of the first drum 182.

[0063] Again, the conveyor mechanism 184 comprises v-shaped channels that are arranged in succession and parallel to each other on a belt conveyor, the longitudinal extension of the v-shaped channels being perpendicular to the transport direction. The v-shaped channels are movable along their longitudinal extension and may accommodate articles delivered on either the first drum 182 or the second drum 183, depending on their lateral position in the region of the drums 182, 183. They may transport them in transport direction as well as in a perpendicular direction thereto.

[0064] The movement of the v-shaped channels may be controlled e. g. by selectively engageable cams or by using servo controls. The transport paths 185, 186 defined by the movement of the v-shaped channels are schematically indicated in Figures 7A, 7B.

[0065] In the first operating mode according to Figure 7A, the articles arrive on the first drum 182. They are taken over from the v-shaped channels of the conveyor mechanism 184, are transported simultaneously in the transport direction and in a lateral direction, away from the first drum 182. In a second phase, the channels move back laterally and push the articles 2 onto the pins 207a of the chain 207.

[0066] In the second operating mode according to Figure 7B, the articles arrive on the second drum 183. They are taken over from the v-shaped channels of the conveyor mechanism 184, are transported in the transport direction in a first phase. In a second phase, the channels move back laterally and push the articles 2 onto the pins 207a of the chain 207.

[0067] Apparently, the selector station 120 shown in Figure 6 is very similar to the merging station 180 shown in Figures 7A, 7B. Another very similar station is the manual inserting station 140 shown e. g. in Figures 2 and 4. In principle, it corresponds to the selector station 120. In the first operating mode, the manual inserting station 140 is used for manual insertion of articles. Accordingly, it will be configured just like the selector station 120 in Figure 6. In the second operating mode, the manual inserting station 140 forwards all articles to the second printing station. Accordingly, it will be configured similar to the configuration of the merging station 180 shown in Figure 7A, i. e. the articles will be removed by the conveyor mechanism from the incoming chain 202 and pushed on to the pins of outgoing chain 205.

[0068] The Figures 8A, 8B are schematic front and side views of a selector station of another embodiment of the invention. It may be used in place of the selector station 110 described above, in connection with Figure 6. Again, a very similar station may be used in place of the merging station 180 described above, in connection with Figure

7. The remaining components of the printing section, including the transport chains and the layout of the stations, may remain unchanged.

[0069] Two chains, namely chain 202 coming from the accumulator and linking the selector station 310 to the second printing station, and chain 203 linking the selector station 310 to the first printing station, run in the same operation plane and constitute U-shaped sections, running along a section of the circumference of two vacuum drums 311, 312. The plane defined by the chains 202, 203 coincides with the back end of the drums 311, 312, the pins holding the articles have an axial direction, i. e. extend parallel to the rotation axes of the drums 311, 312 pointing to the front surface of the drums 311, 312. As described above, the chains 202, 203 and accordingly the drums 311, 312 include a slight angle with a vertical plane in order to ensure that the articles are safely held on the pins of the chains 202, 203.

[0070] Carriages 311a, 312a are supported on the drums in such a way that they are movable in an axial direction. Depending on their rotational position the axial position is controlled by a cam, the carriages 311a, 312a may be displaced from a position A, in which they cooperate with the respective chain 202, 203 to a position B, in which the articles are released from the respective chain 202, 203. In a first mode, in which the articles are to be handed over from chain 202 to chain 203, displayed in Figure 8B, the articles released from the chain 202 will be transferred by gravity from the first vacuum drum 311 to the second vacuum drum 312 in a region which is close to the smallest distance of the two vacuum drums 311, 312 (cf. arrow 313).

[0071] In a second mode, selectable by changing a mechanical switch, such that the carriages 311a of the first vacuum drum 311 are controlled by a different (straight) cam, the carriages will retain their axial position, which means that the articles remain on the first transport chain 202 and will be transported to the second printing station.

[0072] In this embodiment, manual feeding of articles will be effected on the chain loop just after the respective vacuum drum 311, 312.

[0073] If a similar station is used for merging articles coming from the first drying station associated with the first printing station and articles coming from the second drying station associated with the second printing station, two respective incoming vacuum drums (that may be in different planes) may cooperate with a single outgoing vacuum drum. The carriages of the outgoing vacuum drum will be controlled in such a way that articles may be received from the respective incoming drum. Again, control of the carriages may be effected by different cams, and a mechanical switch may be provided to select the appropriate cam.

[0074] The invention is not limited to the described embodiments. In particular the specific arrangement of the stations and the build-up of the individual stations may be different. Additional station, in particular accumulators, may be arranged in between the described stations. In summary, it is to be noted that the invention provides a machine for printing hollow articles such as cans, tubes, cartridges or other types of containers that allows for high throughput also in case of smaller lots.

Claims

1. A machine for printing hollow articles (2), comprising:

a) at least two printing stations (151, 152);
b) at least two drying stations (161, 162), a first drying station (161) arranged downstream from a first of the printing stations (151)[1] and being associated to the first of the printing stations (151) and a second drying station (162) arranged downstream from a second of the printing stations (152)[2] and being associated to the second of the printing stations (152);
[1] Originally filed claim 13 c
[21] Originally filed claim 13 f
c) a transport chain mechanism for transferring the hollow articles (2) between the printing stations (151, 152) and the drying stations (161, 162); and
d) a selection mechanism allowing for switching between a first mode, in which hollow articles (2) provided by a previous station pass through the first printing station (151) and the first drying station (161), omitting the second printing station (152) and the second drying station (162), and a second mode, in which the hollow articles (2) pass through the second printing station (152) and the second drying station (162), omitting the first printing station (151) and the first drying station (161), wherein the selection mechanism comprising a selector station (110) having a first transport chain constituting an infeed and a first outfeed, a second transport chain constituting a second outfeed, and a selectively engageable transfer mechanism for removing hollow articles (2) from the first transport chain and for feeding the removed hollow articles (2) to the second transport chain.[3]
[3] Originally filed claim 2

2. The machine as recited in claim 1, **characterized in that** the first transport chain and the second transport chain comprise each a U-shaped section arranged in a common operation plane, where the transfer mechanism in its activated state cooperates with the U-shaped section of the first transport chain for mechanically removing hollow articles (2) fed by the first transport chain in a lateral direction with respect to the common operation plane and for feeding the removed hollow articles (2) to a conveyor mechanism (120) for feeding the removed hollow articles (2) to

the second transport chain by moving the articles (2) back against the lateral direction.

3. The machine as recited in claim 2, **characterized in that** the transfer mechanism comprises a first drum (182) for temporarily accommodating hollow articles (2), the first drum (182) cooperating with the first transport chain, and a second drum (183) for temporarily accommodating hollow articles (2), the second drum (183) cooperating with the second transport chain, wherein hollow articles (2) accommodated by the first drum (182) may be selectively fed to the second drum (183).

4. The machine as recited in claim 3, **characterized in that** at least the first drum (182) comprises axially movable carriages (311a, 312a) for holding hollow articles (2), the axial movement of the carriages (311a, 312a) being selectively controlled by a first cam for feeding the hollow articles (2) to the second drum (183) or by a second cam for keeping the hollow articles (2) on the first transport chain.

5. The machine as recited in any of claims 1 to 4, **characterized in that** the first printing station (151) and the second printing station (152) are arranged in different lateral positions with respect to a main operation plane of the transport chains.

6. The machine as recited in claim 5, **characterized in that** a transport chain of the transport chain mechanism linking the selection mechanism to the first printing station (151) includes twisted sections.

7. The machine as recited in any of claims 1 to 6, **characterized in that** the transport chain mechanism comprises a first transport chain (202) running through the first printing station (151) and the first drying station (161) and a second transport chain being different from the first transport chain running through the second printing station (152) and the second drying station (162).

8. The machine as recited in any of claims 1 to 7, comprising a first manual infeed (140) for feeding hollow articles (2) to the second printing station (152) and the second drying station (162) in the first mode and a second manual infeed for feeding hollow articles (2) to the first printing station (151) and the first drying (161) station in the second mode.

9. The machine as recited in one of claims 1 to 4 and claim 6, **characterized in that** the selector station (110) comprises a manual infeed for feeding hollow articles (2) to the second transport chain.

10. The machine as recited in claims 8 or 9, **characterized in that** manually infed hollow articles (2) are processible by the second printing station (152) and the second drying station (162) in the first mode and a by the first printing station (151) and the first drying station (161) in the second mode, in parallel with running production on the first printing station (151) and the first drying station (161) in the first mode or on the second printing station (152) and the second drying station (162) in the second mode.

11. The machine as recited in claim 10, **characterized by** a takeout station (170) for selectively singling out hollow articles (2) being processed by the second printing station (152) and the second drying station (162) in the first mode and by the first printing station (151) and the first drying station (161) in the second mode.

12. The machine as recited in any of claims 1 to 11, **characterized by**

    a) a selector station (110) being part of the selection mechanism;
    b) the first printing station (151);
    c) the first drying station (161) arranged downstream from the first printing station (151);
    d) a manual infeed station (140);
    e) the second printing station (152);
    f) the second drying station (162) arranged downstream from the second printing station (152);
    g) a takeout station (170); and
    h) a merging station (180) for feeding hollow articles (2) processed by the first printing station (151) and the first drying station (161) or the second printing station (152) and the second drying station (162), respectively, to a common outfeed,
    where
    i) a first outfeed of the selector station (110) is linked to the first printing station (151),
    j) a second outfeed of the selector station (110) is linked to the manual infeed station (140),
    k) the manual infeed station (140) is linked to the second printing station (152),
    l) outfeeds of the first drying station (161) and the second drying station (162)are linked to the takeout (170) station, and
    m) the takeout station (170) is linked to the merging station (180).

Patentansprüche

1. Maschine zum Bedrucken von hohlen Gegenständen (2), umfassend:

    a) wenigstens zwei Druckstationen (151, 152);
    b) wenigstens zwei Trocknungsstationen (161,

162), wobei eine erste Trocknungsstation (161) stromabwärts von einer ersten der Druckstationen (151) angeordnet ist und der ersten der Druckstationen (151) zugeordnet ist, und eine zweite Trocknungsstation (162) stromabwärts von einer zweiten der Druckstationen (152) angeordnet ist und der zweiten der Druckstationen (152) zugeordnet ist;

c) ein Transportkettenmechanismus zum Überführen der hohlen Gegenstände (2) zwischen den Druckstationen (151, 152) und den Trocknungsstationen (161, 162); und

d) einen Auswahlmechanismus, der es ermöglicht, zwischen einem ersten Modus, in dem die von einer vorherigen Station bereitgestellten hohlen Gegenstände (2) durch die erste Druckstation (151) und die erste Trocknungsstation (161) laufen, wobei die zweite Druckstation (152) und die zweite Trocknungsstation (162) ausgelassen werden, und einem zweiten Modus, in dem die hohlen Gegenstände (2) durch die zweite Druckstation (152) und die zweite Trocknungsstation (162) laufen, wobei die erste Druckstation (151) und die erste Trocknungsstation (161) ausgelassen werden, zu schalten, wobei der Auswahlmechanismus eine Auswählstation (110) umfasst, die eine erste Transportkette, die eine Einspeisung und einen ersten Abzug darstellt, eine zweite Transportkette, die einen zweiten Abzug darstellt, und einen selektiv einrückbaren Transfermechanismus, um die hohlen Gegenstände (2) von der ersten Transportkette zu entfernen und die entfernten hohlen Gegenstände (2) in die zweite Transportkette einzuspeisen, aufweist.

2. Maschine nach Anspruch 1, **dadurch gekennzeichnet, dass** die erste Transportkette und die zweite Transportkette jeweils einen U-förmigen Abschnitt umfassen, der in einer gemeinsamen Betriebsebene angeordnet ist, in welcher der Transfermechanismus in seinem aktivierten Zustand mit dem U-förmigen Abschnitt der ersten Transportkette zusammenwirkt, um die von der ersten Transportkette zugeführten hohlen Gegenstände (2) in einer seitlichen Richtung in Bezug auf die gemeinsame Betriebsebene mechanisch zu entfernen und um die entfernten hohlen Gegenstände (2) zu einem Fördermechanismus (120) zu führen, um die entfernten hohlen Gegenstände (2) zu der zweiten Transportkette zu führen, indem die Gegenstände (2) gegen die seitliche Richtung zurückgeführt werden.

3. Maschine nach Anspruch 2, **dadurch gekennzeichnet, dass** der Transfermechanismus eine erste Trommel (182) zur vorübergehenden Aufnahme der hohlen Gegenstände (2), wobei die erste Trommel (182) mit der ersten Transportkette zusammenwirkt, und eine zweite Trommel (183) zur vorübergehenden Aufnahme der hohlen Gegenstände (2), wobei die zweite Trommel (183) mit der zweiten Transportkette zusammenwirkt, umfasst, wobei die von der ersten Trommel (182) aufgenommenen hohlen Gegenstände (2) selektiv zur zweiten Trommel (183) geführt werden können.

4. Maschine nach Anspruch 3, **dadurch gekennzeichnet, dass** wenigstens die erste Trommel (182) axial bewegliche Wagen (311a, 312a) zum Halten der hohlen Gegenstände (2) umfasst, wobei die axiale Bewegung der Wagen (311a, 312a) selektiv durch einen ersten Nocken zum Zuführen der hohlen Gegenstände (2) zu der zweiten Trommel (183) oder durch einen zweiten Nocken zum Halten der hohlen Gegenstände (2) auf der ersten Transportkette gesteuert wird.

5. Maschine nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die erste Druckstation (151) und die zweite Druckstation (152) in unterschiedlichen seitlichen Positionen in Bezug auf eine Hauptbetriebsebene der Transportketten angeordnet sind.

6. Maschine nach Anspruch 5, **dadurch gekennzeichnet, dass** eine Transportkette des Transportkettenmechanismus, die den Auswahlmechanismus mit der ersten Druckstation (151) verbindet, gewundene Abschnitte beinhaltet.

7. Maschine nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** der Transportkettenmechanismus eine erste Transportkette (202), die durch die erste Druckstation (151) und die erste Trocknungsstation (161) läuft, und eine zweite Transportkette, die sich von der ersten Transportkette unterscheidet und durch die zweite Druckstation (152) und die zweite Trocknungsstation (162) läuft, umfasst.

8. Maschine nach einem der Ansprüche 1 bis 7, umfassend eine erste manuelle Einspeisung (140) zum Zuführen von hohlen Gegenständen (2) zu der zweiten Druckstation (152) und der zweiten Trocknungsstation (162) im ersten Modus und eine zweite manuelle Einspeisung zum Zuführen von hohlen Gegenständen (2) zu der ersten Druckstation (151) und der ersten Trocknungsstation (161) im zweiten Modus.

9. Maschine nach einem der Ansprüche 1 bis 4 und 6, **dadurch gekennzeichnet, dass** die Auswählstation (110) eine manuelle Einspeisung zum Zuführen von hohlen Gegenständen (2) zur zweiten Transportkette umfasst.

10. Maschine nach Anspruch 8 oder 9, **dadurch gekennzeichnet, dass** manuell eingespeiste hohle Gegenstände (2) parallel zur laufenden Produktion in der ersten Druckstation (151) und der ersten Trocknungsstation (161) im ersten Modus oder in der zweiten Druckstation (152) und der zweiten Trocknungsstation (162) im zweiten Modus durch die zweite Druckstation (152) und die zweite Trocknungsstation (162) im ersten Modus und durch die erste Druckstation (151) und die erste Trocknungsstation (161) im zweiten Modus bearbeitet werden können.

11. Maschine nach Anspruch 10, **gekennzeichnet durch** eine Entnahmestation (170) zum selektiven Herausschleudern von hohlen Gegenständen (2), die durch die zweite Druckstation (152) und die zweite Trocknungsstation (162) im ersten Modus und durch die erste Druckstation (151) und die erste Trocknungsstation (161) im zweiten Modus bearbeitet wurden.

12. Maschine nach einem der Ansprüche 1 bis 11, **gekennzeichnet durch**

a) eine Auswählstation (110), die Teil des Auswahlmechanismus ist;
b) die erste Druckstation (151);
c) die erste Trocknungsstation (161), die stromabwärts von der ersten Druckstation (151) angeordnet ist;
d) eine Station zur manuellen Einspeisung (140);
e) die zweite Druckstation (152);
f) die zweite Trocknungsstation (162), die stromabwärts von der zweiten Druckstation (152) angeordnet ist;
g) eine Entnahmestation (170); und
h) eine Zusammenführstation (180), um hohle Gegenstände (2), die durch die erste Druckstation (151) und die erste Trocknungsstation (161) bzw. die zweite Druckstation (152) und die zweite Trocknungsstation (162) bearbeitet wurden, zu einem gemeinsamen Abzug zu führen,
wobei
i) ein erster Abzug der Auswählstation (110) mit der ersten Druckstation (151) verbunden ist,
j) ein zweiter Abzug der Auswählstation (110) mit der Station zur manuellen Einspeisung (140) verbunden ist,
k) die Station zur manuellen Einspeisung (140) mit der zweiten Druckstation (152) verbunden ist,
l) Abzüge der ersten Trocknungsstation (161) und der zweiten Trocknungsstation (162) mit der Entnahmestation (170) verbunden sind, und
m) die Entnahmestation (170) mit der Zusammenführstation (180) verbunden ist.

Revendications

1. Machine pour imprimer des articles creux (2), comprenant:

a) au moins deux stations d'impression (151, 152);
b) au moins deux stations de séchage (161, 162), une première station de séchage (161) étant agencée en aval d'une première des stations d'impression (151) et étant associée à la première des stations d'impression (151), et une seconde station de séchage (162) étant agencée en aval d'une seconde des stations d'impression (152) et étant associée à la seconde des stations d'impression (152);
c) un mécanisme de chaîne transporteuse pour transférer les articles creux (2) entre les stations d'impression (151, 152) et les stations de séchage (161, 162); et
d) un mécanisme de sélection qui permet de commuter entre un premier mode, dans lequel des articles creux (2) fournis par une station précédente passent à travers la première station d'impression (151) et la première station de séchage (161), en omettant la seconde station d'impression (152) et la seconde station de séchage (162), et un second mode, dans lequel les articles creux (2) passent à travers la seconde station d'impression (152) et la seconde station de séchage (162), en omettant la première station d'impression (151) et la première station de séchage (161), dans laquelle le mécanisme de sélection comprend une station de sélecteur (110) qui présente une première chaîne transporteuse constituant une entrée et une première sortie, une seconde chaîne transporteuse constituant une seconde sortie, et un mécanisme de transfert à engagement sélectif pour enlever des articles creux (2) de la première chaîne transporteuse et pour transférer les articles creux enlevés (2) à la seconde chaîne transporteuse.

2. Machine selon la revendication 1, **caractérisée en ce que** la première chaîne transporteuse et la seconde chaîne transporteuse présentent chacune une section en forme de U qui est agencée dans un plan de fonctionnement commun, dans laquelle le mécanisme de transfert dans son état activé coopère avec la section en forme de U de la première chaîne transporteuse pour enlever mécaniquement des articles creux (2) fournis par la première chaîne transporteuse dans une direction latérale par rapport au plan de fonctionnement commun et pour transmettre les articles creux enlevés (2) à un mécanisme de convoyeur (120) afin de transférer les articles creux enlevés (2) à la seconde chaîne transporteuse en renvoyant les articles (2) en arrière contre la direction

latérale.

3. Machine selon la revendication 2, **caractérisée en ce que** le mécanisme de transfert comprend un premier tambour (182) pour contenir temporairement des articles creux (2), le premier tambour (182) coopérant avec la première chaîne transporteuse, et un second tambour (183) pour contenir temporairement des articles creux (2), le second tambour (183) coopérant avec la seconde chaîne transporteuse, dans laquelle des articles creux (2) contenus par le premier tambour (182) peuvent être transmis de façon sélective au second tambour (183).

4. Machine selon la revendication 3, **caractérisée en ce qu'**au moins le premier tambour (182) comprend des chariots déplaçables axialement (311a, 312a) pour supporter des articles creux (2), le déplacement axial des chariots (311a, 312a) étant commandé de façon sélective par une première came pour transmettre les articles creux (2) au second tambour (183) ou par une seconde came pour maintenir les articles creux (2) sur la première chaîne transporteuse.

5. Machine selon l'une quelconque des revendications 1 à 4, **caractérisée en ce que** la première station d'impression (151) et la seconde station d'impression (152) sont agencées dans des positions latérales différentes par rapport à un plan de fonctionnement principal des chaînes transporteuses.

6. Machine selon la revendication 5, **caractérisée en ce qu'**une chaîne transporteuse du mécanisme de chaîne transporteuse qui relie le mécanisme de sélection à la première station d'impression (151) comporte des sections torsadées.

7. Machine selon l'une quelconque des revendications 1 à 6, **caractérisée en ce que** le mécanisme de chaîne transporteuse comprend une première chaîne transporteuse (202) qui court à travers la première station d'impression (151) et la première station de séchage (161), et une seconde chaîne transporteuse, qui est différente de la première chaîne transporteuse, qui court à travers la seconde station d'impression (152) et la seconde station de séchage (162) .

8. Machine selon l'une quelconque des revendications 1 à 7, comprenant un premier dispositif d'alimentation manuel (140) pour amener des articles creux (2) à la seconde station d'impression (152) et à la seconde station de séchage (162) dans le premier mode, et un second dispositif d'alimentation manuel pour amener des articles creux (2) à la première station d'impression (151) et à la première station de séchage (161) dans le second mode.

9. Machine selon l'une des revendications 1 à 4 et la revendication 6, **caractérisée en ce que** la station de sélecteur (110) comprend un dispositif d'alimentation manuel pour amener des articles creux (2) à la seconde chaîne transporteuse.

10. Machine selon la revendication 8 ou 9, **caractérisée en ce que** des articles creux (2) introduits manuellement (2) peuvent être traités par la seconde station d'impression (152) et la seconde station de séchage (162) dans le premier mode et par la première station d'impression (151) et la première station de séchage (161) dans le second mode, en parallèle avec la production en cours sur la première station d'impression (151) et la première station de séchage (161) dans le premier mode ou sur la seconde station d'impression (152) et la seconde station de séchage (162) dans le second mode.

11. Machine selon la revendication 10, **caractérisée par** une station de prélèvement (170) pour dissocier de façon sélective des articles creux (2) traités par la seconde station d'impression (152) et la seconde station de séchage (162) dans le premier mode et par la première station d'impression (151) et la première station de séchage (161) dans le second mode.

12. Machine selon l'une quelconque des revendications 1 à 11, **caractérisée par**

a) une station de sélecteur (110) qui fait partie du mécanisme de sélection;
b) la première station d'impression (151);
c) la première station de séchage (161) agencée en aval de la première station d'impression (151);
d) une station d'alimentation manuelle (140);
e) la seconde station d'impression (152);
f) la seconde station de séchage (162) agencée en aval de la seconde station d'impression (152);
g) une station de prélèvement (170); et
h) une station de rassemblement (180) pour amener des articles creux (2) traités par la première station d'impression (151) et la première station de séchage (161) ou par la seconde station d'impression (152) et la seconde station de séchage (162), respectivement, à une sortie commune,
dans laquelle
i) une première sortie de la station de sélecteur (110) est reliée à la première station d'impression (151),
j) une seconde sortie de la station de sélecteur (110) est reliée à la station d'alimentation manuelle (140),
k) la station d'alimentation manuelle (140) est

reliée à la seconde station d'impression (152),
l) des sorties de la première station de séchage (161) et de la seconde station de séchage (162) sont reliées à la station de prélèvement (170), et
m) la station de prélèvement (170) est reliée à la station de rassemblement (180).

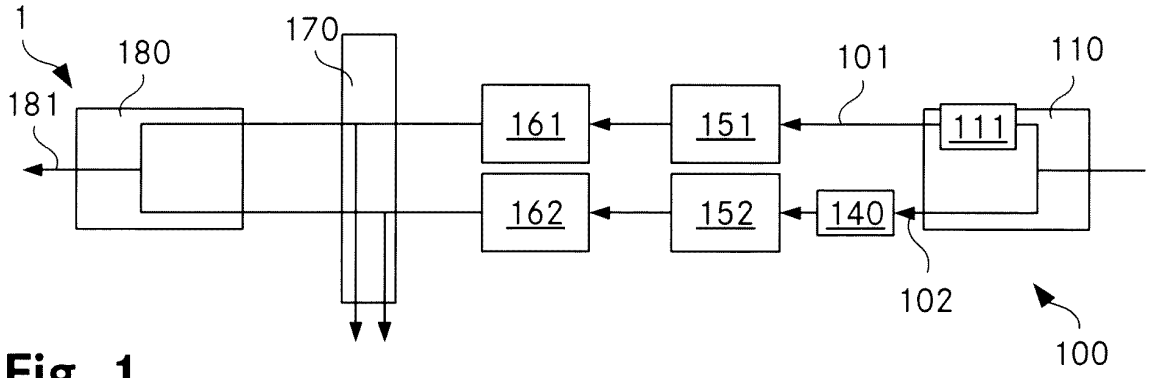

Fig. 1

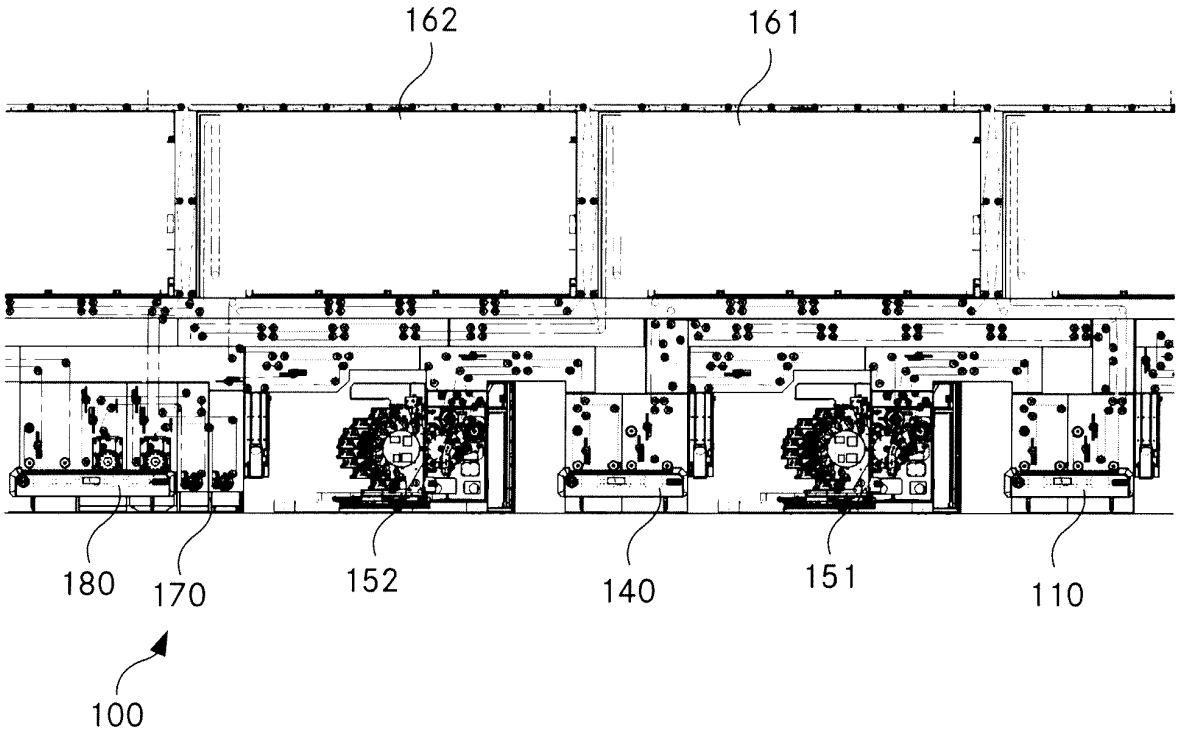

Fig. 2

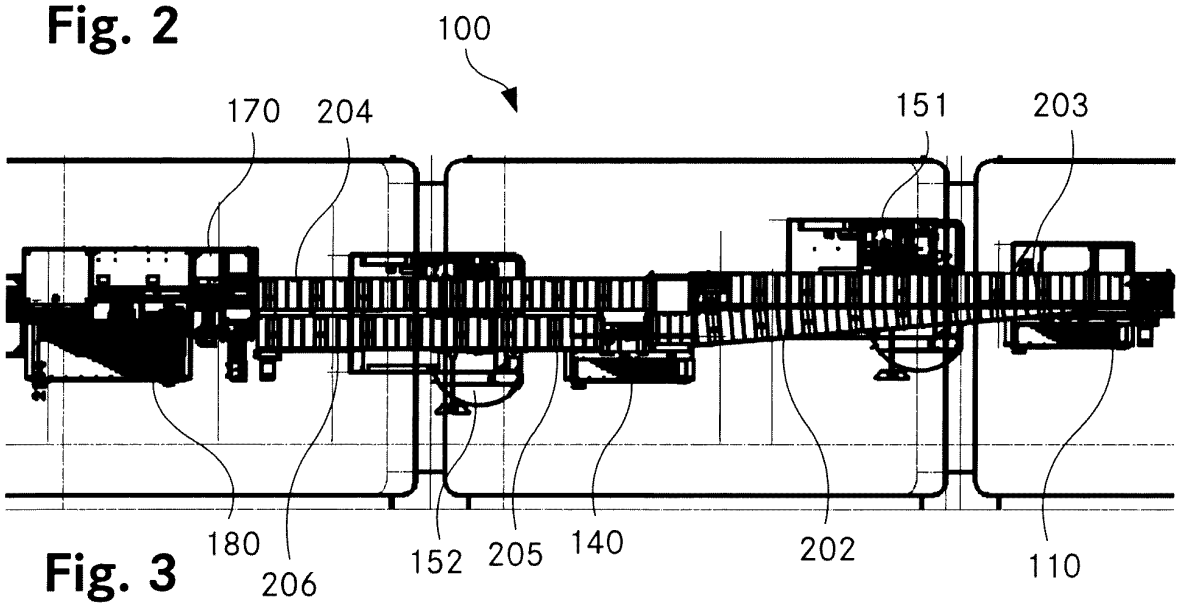

Fig. 3

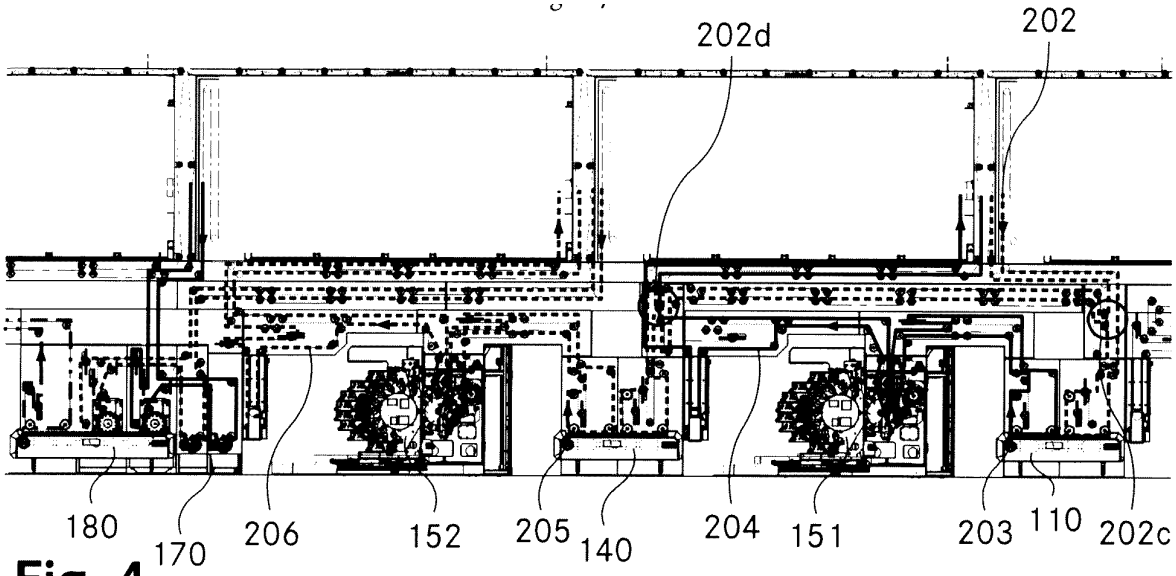

Fig. 4

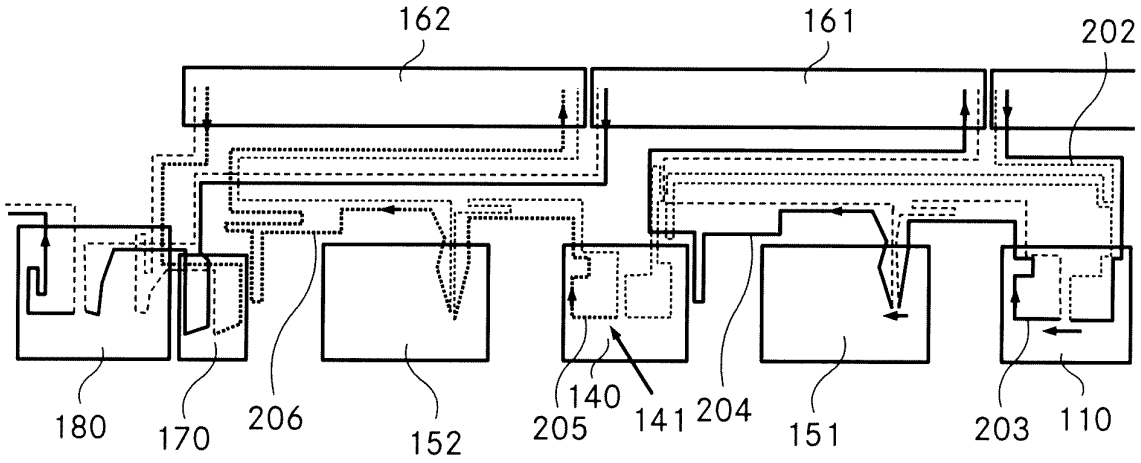

Fig. 5A

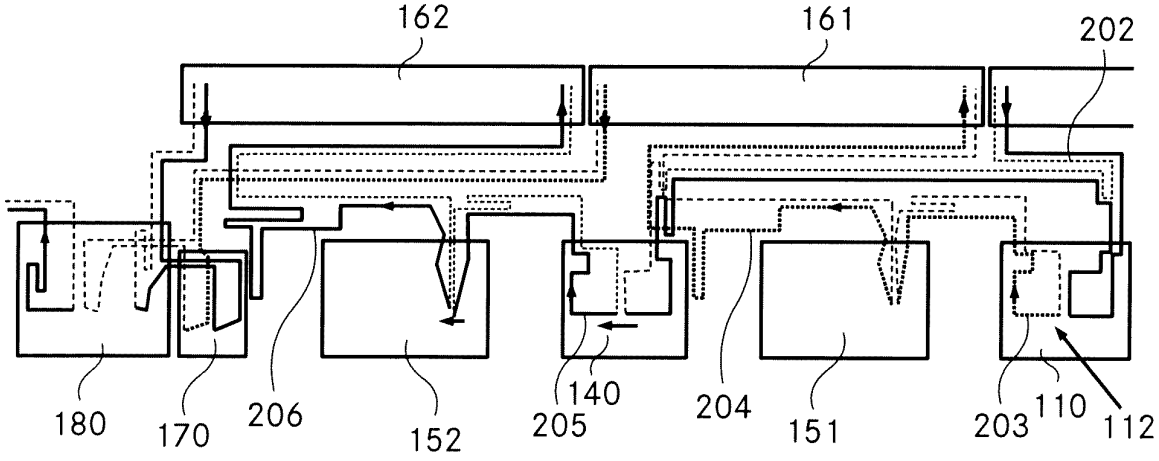

Fig. 5B

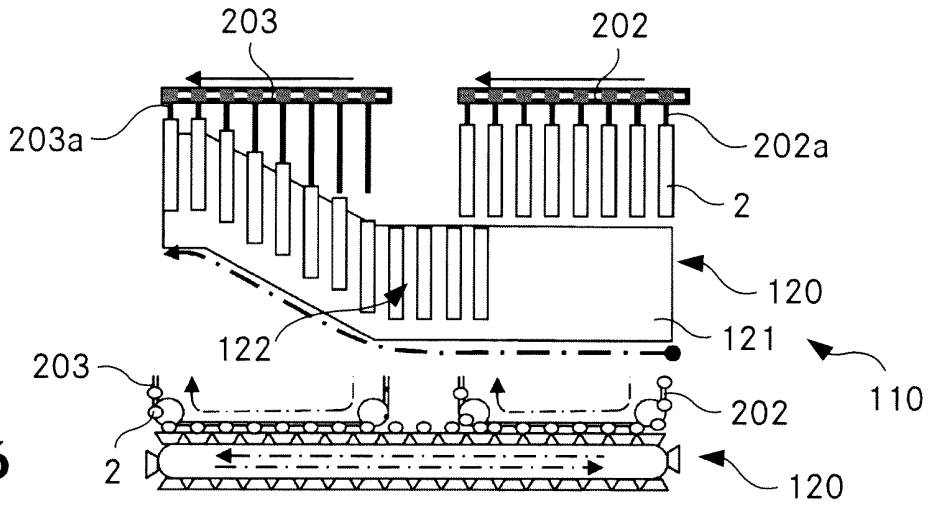

Fig. 6

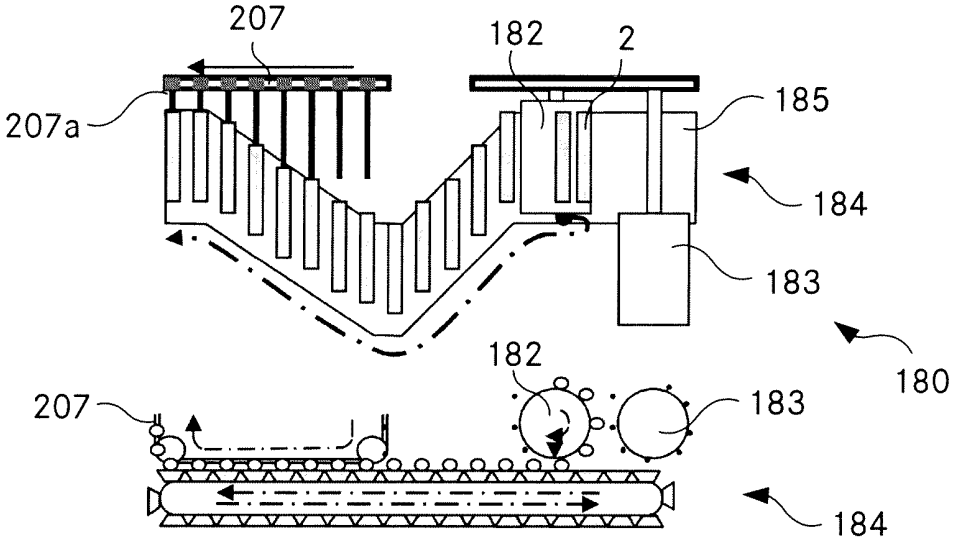

Fig. 7A

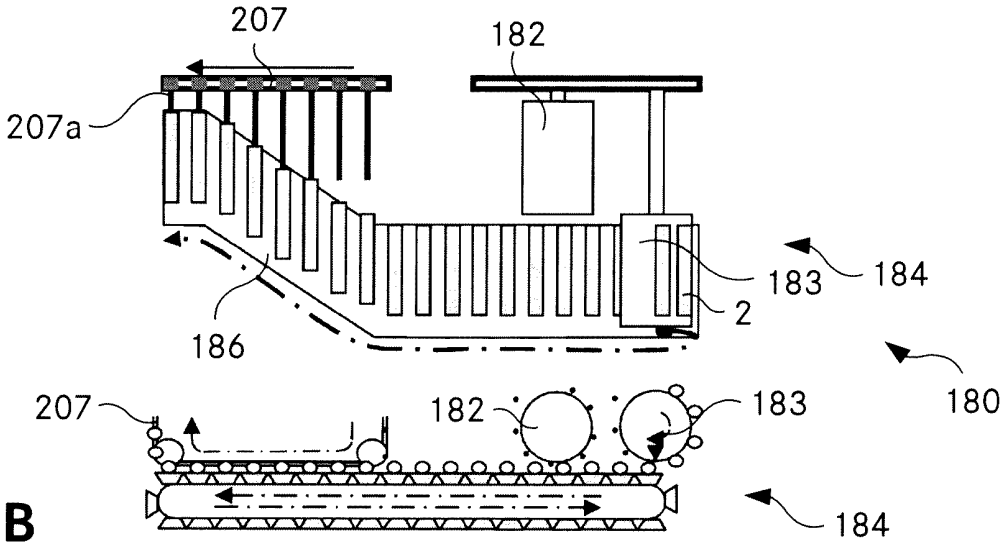

Fig. 7B

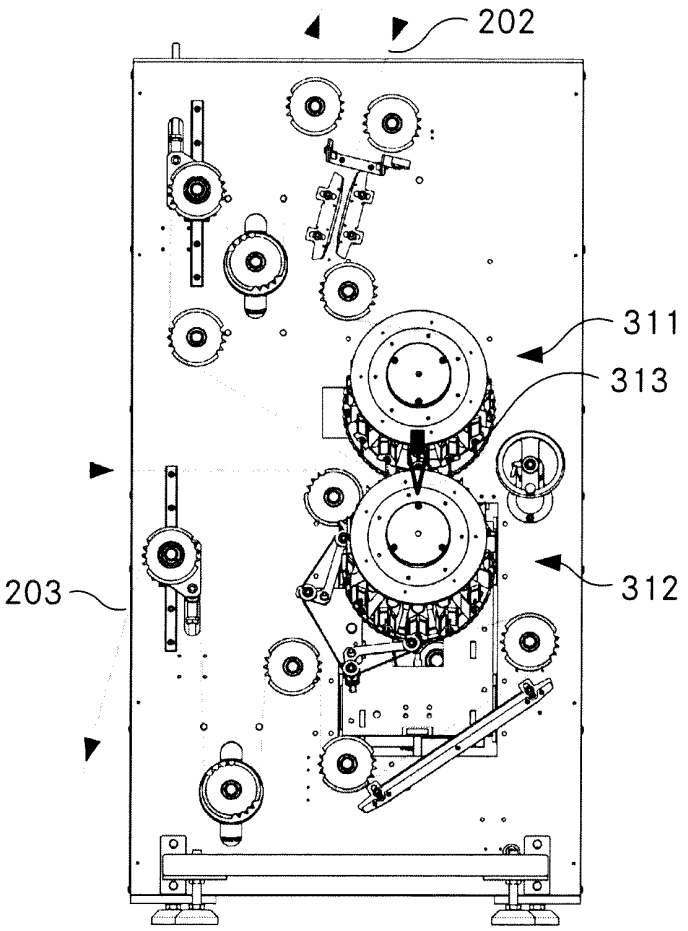

Fig. 8A

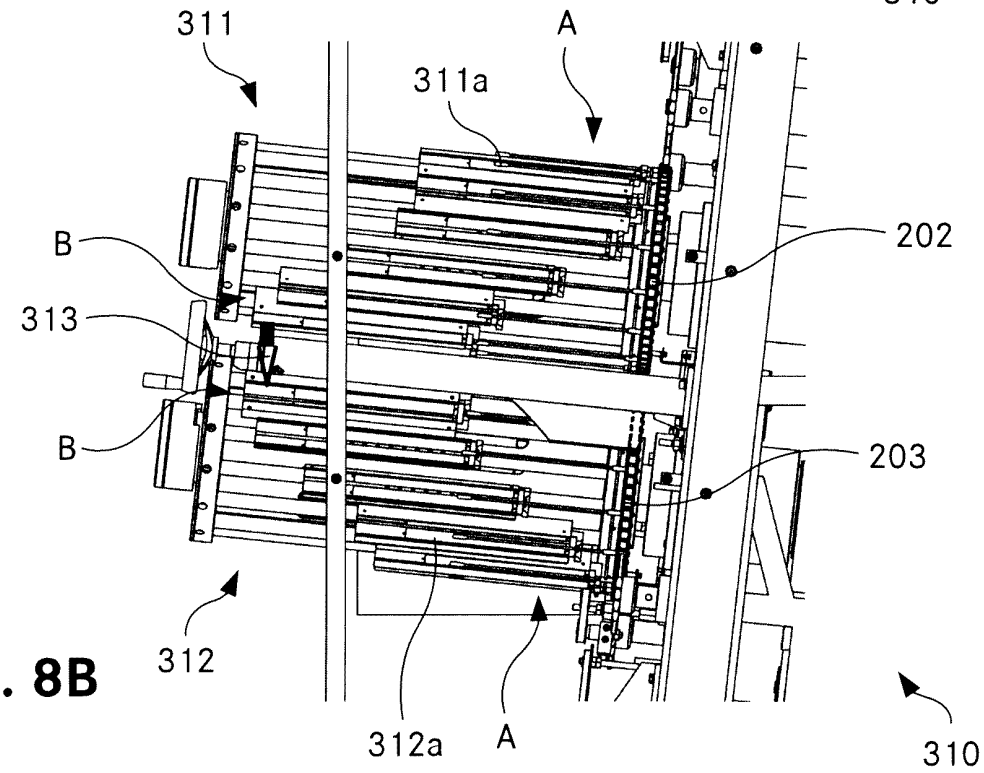

Fig. 8B

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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