

## **On-line package printing system**

The present invention relates to an on-line package printing system, in particular for printing cigarette packets and cartons, whereby the packets are printed by means of print head technology. In many production sectors, including cigarette production in particular, it is often necessary to apply markings in the form of texts, codes, bar codes or similar as late as possible in the production sequence. This is totally different from printing cuttings of the packet where the cutting is produced in the print shop, for example, or generally prior to actually packaging the product, for example the block of cigarettes. The purpose of printing at such a late stage, in particular after packaging a block cigarettes with the cutting, is usually to record the date of manufacture but also the production unit in the print (in plain text or encrypted format). However, other applications are also conceivable, for example individual printing of package parts for advertising purposes, etc..

Devices and methods of printing cigarette packets on conveyor lines are known from patent specifications WO 01/54 986 A1, WO 02/04 297 A1 and DE 100 04 022 A1, for example. Patent specifications DE 103 11621 A1 and DE 102 21 837 A1 also discloses methods and systems for coding cigarette packets and cigarette packaging units.

In printing systems which operate on the basis of print head technology, in other words using ink jet print heads for example, stoppages can occur if the nozzles of the print heads become dirty or the printed image does not conform to requirements for other reasons.

The objective of the invention is to propose an on-line package printing system which can be integrated in packaging units of the cigarette industry and permit on-line printing at high production speeds, avoiding stoppages as far as possible.

This objective is achieved by means of a system of the type defined in claim 1 and a method as defined in claim 7. The dependent claims specify preferred embodiments of the invention.

In the on-line package printing system proposed by the invention, at least two print heads are provided as a means of producing the imprint as well as a control system for activating and deploying them. In other words, for the purpose of the invention, a "surplus capacity" is provided even during normal operation. That is to say, at least two print heads are provided, each of which could in principal carry out the necessary printing work alone. Specifically, one might say that there are two print heads for producing a single imprint, i.e. an imprint containing the same information for example, on different packets, although each of the print heads could also apply the imprint to all the packets.

Since the print heads may be deployed simultaneously, at least two of them have different printing positions. Furthermore, separate positions may be provided for the print heads which are not being deployed at any one time, namely replacement, maintenance and parked positions.

The system advantageously has a print quality monitoring system connected downstream of the printing positions and the monitored print quality is used as an input variable for the control system. Accordingly, if the print quality is not good enough, a displacement system for the print heads may be deployed which

moves the print heads out of the printing position into another position or moves another (or overridden) print head into the printing position in order to restore the requisite quality.

In a preferred embodiment of the invention, the print heads may be ink jet print heads, in particular drop-on-demand print heads, of the type currently available on the market.

The advantages of the on-line package printing method proposed by the invention are that an imprint can be produced by at least two print heads and either one print head or several print heads are deployed simultaneously. Accordingly, there is a certain redundancy but the entire printing process may also be performed with a single print head, thereby enabling stoppages to be avoided.

In the basic operating state, the imprint may be produced by at least two print heads, which print packets or cartons in alternation. During other operating states, however, the imprint may be produced by only one print head. This being the case, in one embodiment, a control system activates and deploys the print heads and a print quality monitoring system is specifically connected downstream, in which case the monitored print quality is used as an input variable for the control system. The control system may also control the movement of the print heads into positions into which they are moved when they are not being deployed, in particular in replacement, maintenance and parked positions.

The invention may also be described as providing a printing system comprising several print heads, preferably two heads, more particularly preferably two ink jet

heads. This being the case, each of these print heads has a separate printing position, a separate cleaning position and a separate parked position (which prevents the ink from drying if ink jet print heads are used). In the event of a variance from the quality standard, the monitoring system is able to transmit a message to an ejection station connected downstream, where co-operating packets are ejected. Furthermore, cleaning or replacement of the print head responsible for the unsatisfactory quality can be initiated.

A system of correlation can be set up whereby the print heads always print packages in sequence. If there are two print heads, the first print head always prints the packages with uneven numbers, in other words packages No. 1, 3, 5, 7, ..., and the second print head always prints the "evenly numbered" packages No. 2, 4, 6, 8, ... . The monitoring system can therefore make a direct correlation to the print quality of the two print heads.

However, the mechanical and electronic systems of the print heads are designed so that each print head could print all the packages alone without reducing the production speed of the packaging machine. If the nozzles become soiled or an ink cartridge is empty, the other print head can therefore take over printing of the packages of the defective print head. The defective print head simultaneously moves on a print head guide into the cleaning station or is replaced. This enables the production process to be maintained, even if a print head is delivering unsatisfactory quality. Corresponding arrangements are also possible with 3, 4 or more print heads. As a rule, however, these would only be necessary if, on failure of one print head, a second print head is not able to achieve the 100% higher printing speed. Using a three- or four-head printing system would increase the printing speed by 50 % respectively 33 %. However, a slightly more complicated but perfectly feasible guide system, mechanical system and control

system would be needed for this.

In order to make the system even more user-friendly, an additional print head could be provided for the purpose of the invention, which sits in stand-by in a parked position waiting for the failure of a print head which is in service. This will make the system even less dependent on a rapid replacement of empty or defective print heads.

The invention will be explained in more detail below on the basis of an example of an embodiment and with reference to the appended drawings. All of the characterising features described may be used individually or in any combination. Of the drawings:

- Figure 1 shows an example of a printing system proposed by the invention in which two print heads are being deployed;
- Figure 2 shows the system illustrated in Figure 1 with a print head moved away into a cleaning position; and
- Figure 3 shows the system illustrated in Figure 1 with a print head moved away into a parked position.

Figure 1 is a schematic diagram illustrating a printing system proposed by the invention. As illustrated from above, a conveyor belt 3 is provided, on which the cigarette packets 1 are conveyed in the direction of the arrow. As also illustrated in Figure 1, as well as in Figures 2 and 3, there are respectively printing positions 7a and 7b for two ink jet print heads 5a and 5b, cleaning positions 9a, 9b as well as parked positions 11a and 11b for the print heads 5a, 5b.

Figure 1 illustrates the normal operating state, i.e. the printing system under

normal production conditions. The individual cigarette packets 1 are transported on the conveyor belt 3, in which case they may be positioned standing on the narrow face or on any other face. If necessary, they are laterally supported by belts or rails (not illustrated). The two print heads 5a, 5b are illustrated in their printing position 7a, 7b; the respective position is indicated by the print head with black shading.

As the packets 1 are fed along by the conveyor belt 3 underneath the print heads 5a, 5b in the direction of the arrow, the print heads 5a, 5b apply print to the respective packets intended for them. This is schematically indicated by the letters a and b on the packets. The fact that different letters have been chosen is merely intended to symbolise the correlation to the print head 5a respectively 5b and does not mean that the imprint is different. In the normal operating state, the cleaning positions 9a, 9b and the parked positions 11a and 11b are not occupied.

Figure 2 illustrates the situation when a print head fails, namely during failure of the print head 5a. If the nozzles of the print head 5a become blocked, for example, this will have a knock-on effect and reduce the print quality for the packets on which the letter a is being printed in Figure 1. A monitoring unit 2 detects the reduced print quality and reports this to a control system for a print head guide system, although in order to retain clarity in the drawings neither of these is illustrated. Figure 2, however, illustrates the state assumed when the print head guide system has moved the print head 5a out of the printing position 7a into the cleaning position 9a. In this state, the print head 5b takes over the work of the defective print head; it operates twice as fast and each of the packets is now printed by print head 5b; it applies the marking denoted by b. In position 9a, the print head 5a is cleaned and can then be returned to its deployment position 7a.

Figure 3 illustrates a state in which an ink cartridge of the print head 5b is empty. In this instance, the print head 5b is moved into the parked position 11b where the cartridge can be replaced, and this time print head 5a takes over the work of the empty print head 5b; it operates twice as fast and marks all the packets, as indicated by the letter a printed on every packet. Once the empty cartridge has been replaced, the print head 5b is also returned to its printing position 7b and the state illustrated in Figure 1 is restored, in other words the normal operating state.

## Claims

1. On-line package printing system, in particular for printing cigarette packets and cartons, whereby the packets (1) are printed by means of print head technology, characterised in that at least two print heads (5a, 5b) are provided as a means of providing an imprint as well as at least one control system for activating and deploying them.
2. System as claimed in claim 1, characterised in that at least two print heads (5a, 5b) have different printing positions.
3. System as claimed in claim 1 or 2, characterised in that positions are provided for the print heads (5a, 5b) into which they are moved when not being deployed.
4. System as claimed in claim 3, characterised in that the positions are replacement, maintenance and parked positions.
5. System as claimed in one of claims 1 to 4, characterised in that it incorporates a print quality monitoring system connected downstream of the printing positions, and the monitored print quality is used as an input variable for the control system.
6. System as claimed in one of claims 1 to 5, characterised in that the print heads are ink jet print heads.
7. On-line package printing method, in particular for printing cigarette packets and cartons, whereby the packets (1) are printed by means of print head technology and whereby an imprint can be applied by at least two print heads

(5a, 5b), and either one print head may be deployed or several print heads (5a, 5b) simultaneously.

8. Method as claimed in claim 7, whereby the imprint is made by at least two print heads (5a, 5b) which print the packets or cartons (1) in alternation during the normal operating state.

9. Method as claimed in claim 8, whereby the imprint is made by only one print head in other operating states.

10. Method as claimed in one of claims 7 to 9, whereby a control system controls activation and deployment of the print heads (5a, 5b).

11. Method as claimed in claim 10, whereby a print quality monitoring system is connected downstream of the printing positions and the print quality is used as an input variable for the control system.

12. Method as claimed in claim 10 or 11, whereby the control system controls the movement of the print heads (5a, 5b) to positions to which they are moved when they are not being deployed, in particular into replacement, maintenance and parked positions.

13. Method as claimed in one of claims 7 to 12, whereby a replacement print head is provided separately, which takes the place of a print head to be replaced.