Title: PRINTING PROCESS APPLICABLE TO PRINTING DEVICES WITH HEADS

Abstract: A printing device with n print heads (A, B, C, D, etc) which move together and are arranged equidistantly with a separation (d) between their centres which print on an inked printing ribbon (X) which advances when the heads (A, B, C, D, etc) are stopped and which stops when the print heads (A, B, C, D, etc) print on the same and where the printing ribbon X is divided into S sectors of L length. The printing by the heads (A, B, C, D, etc) is accompanied by the displacement of the ribbon for a d + 1 distance to optimise the operation times while using all the sectors S of the ribbon X in the printing process.
OBJECT OF THE INVENTION

The present invention is concerned with the area of printing devices equipped with various print heads, especially those for printing continuously on a web.

The object of the invention refers to a process for printing on an inked printing ribbon which transfers the ink to a web or substrate. The invention consists of obtaining an optimised sequence of movements for advancing the ribbon in co-ordination with the print heads of the printing device in order to achieve greater speed in printing using the ribbon, reducing dead time.

BACKGROUND TO THE INVENTION

Various printing devices are known in which, generally, the substrate or web to be printed is supplied from a reel operated by a step motor and with a head which prints, with the aid of an inked printing ribbon, a figure or legend for example, on the web each time the latter stops.

The printing ribbon is the object on which the print head initially prints to transfer the ink to the web, which moves crosswise.
The printing ribbon normally advances the length needed to print on the next free section to prevent overprinting on two successive sectors.

The use of a single print head greatly limits the ribbon's performance since each time the ribbon stops, printing takes place on contiguous sectors to those printed previously and then the amount of times this happens in the printing of all the sectors on the ribbon is ultimately very high.

To speed up the printing process, several heads are used which are arranged uniformly and equidistantly above the place in which the ribbon advances, where all the heads work at the same time, printing in different sectors of the ribbon. The heads print on the ribbon in a downward and translational movement, retracting afterwards to allow the ribbon to advance.

Since the heads are spaced apart, the marks obtained at the initial printing are also spaced apart, so that the ribbon must be displaced in order that the next printing takes place on the intermediate unprinted sectors between these marks.

Various solutions are already known to the printing dynamics, depending on the area in which printing takes place, as well as the device itself and depending on the design which is to be printed by each head.

One of the most common printing sequences used in printing devices with several heads consists of moving the ribbon step-by-step for a length that, at each step, is the same as the length of the printing sector. Thus the ribbon is
printed until all its intermediate sectors between the marks already printed have been covered and the ribbon is then moved by a length that equals the addition of the distances between heads plus of one printing in order to print again on a virgin length of ribbon following the sequence described above.

This method of printing can be optimised since the time taken for this last movement of the ribbon is especially long and delays the continuous printing process.

DESCRIPTION OF THE INVENTION

The printing process proposed in the present invention allows printing of S sectors by means of n print heads on an inked printing ribbon from which the ink is transferred from the web which is to be printed so that a optimal use is made of the total surface of the ribbon, reducing operating times and thus giving a greater performance from the printing process.

The printing process applies to a printing device with n print heads whose centres are equidistant from distance d, which descend and move at each printing stroke over the ribbon, defining a printing length a that is less than or equal to the length l of the sectors S in which the printing ribbon is divided.

The printing process involves the following steps described below:

a) Performing of printing using the n heads on the ribbon, defining printing sectors of length a.
b) The movement of the web of a distance \( d + 1 \).

c) Consecutive execution of operations a) and b)

Provided that

\[ n \leq d/l + 1 \]

being \( n \geq 2 \),

By means of this printing process unequal advances are avoided, some of them long duration, as it happened previously; since the advance is the same at each step of the same size \( d+1 \), which ultimately reduces considerably the printing device's operating time.

DESCRIPTION OF DRAWINGS

To supplement the description which is being conducted and to help a better understanding of the characteristics of the invention, according to a preferred example of its practical embodiment, this description is accompanied by a set of drawings, which forms an integral part of said description, and illustrating but not limiting the same:

Figure 1.- Shows a diagram of successive printings on the printing ribbon for different advances of the inked ribbon according to the printing process described for a printing device with three heads.
Figure 2.- Shows the diagram of Figure 1 for a printing device with five heads.

PREFERRED EMBODIMENT OF THE INVENTION

Referring to the above figures, a printing process is described for application to a printing device equipped with more than two print heads (A, B, C, D, etc) which prints on the inked printing ribbon X below the print heads, and which moves in a longitudinal direction when the print heads (A, B, C, D, etc) are stopped and which stops when the print heads (A, B, C, D, etc) print on the same, transferring the ink to a web or substrate that moves in a crosswise direction.

Figure 1 shows a printing device with three print heads (A, B, C) in which it can be seen that the distance between their centres is defined by d. The printing ribbon X is divided into S sectors of a l length on which the marks are printed by the heads (A, B, C) with a printing length a less than or equal to the l length of S sectors. In this case, for three heads, according to the formula [*] verifies that n ≤ d/l + 1 being d > 2l.

Figure 1 shows that at moment t1 the heads (A, B, C) descend and move over the ribbon, printing the marks (Ai), (Bi), (Ci), each one of which with a length a, the print heads (A, B, C) then lift, allowing the subsequent movement of the ribbon, which advances a distance d+l until it stops at a later time t2 in which the heads (A, B, C) print the marks (A2), (B2), (C2) again on the printing ribbon X.
As can be seen in Figure 1, according to this process and for the proposed number of print heads, all the spaces on the ribbon are marked, obtaining a used ribbon full of contiguous marks at the point which the print head leaves the ribbon.

Figure 2 shows the process for a device with 5 heads in which, according to the formula [*] verifies that for n=5, the relation $d \geq 4I$.

In this case printing is carried out on the printing ribbon $X$ divided into $S$ sectors of $I$ length by means of the print heads (A, B, C, D, E). At the time $t_1$, with the printing ribbon $X$ stopped, the marks $(A_1)$, $(B_1)$, $(C)$, $(D_1)$, $(E_1)$ are printed on the same and the ribbon advances by a distance of $d+I$, and it stops to allow printing by the print heads (A, B, C, D, E) again for another time $t_2$, giving the marks $(A_2)$, $(B_2)$, $(C_2)$, $(D_2)$, $(E_2)$, and so on successively until time $t_4$ in which all the contiguous sectors $S$ have been marked on the ribbon $X$ that are leaving the printing device. This succession continues indefinitely, the output of the ribbon with all its sectors $S$ printed being assured.

In all the cases shown, the length of each printing a will be less than or equal to the length $I$ of each $S$ sector of the ribbon $X$. 
CLAIMS

1. Printing process applicable to printing devices with n print heads (A, B, C, D, etc) disposed equidistantly with a separation d between their centres, which print on an ink printing ribbon (X) that is divided into contiguous sectors (S) of length (l) and is placed under the print heads, and which advances in a longitudinal direction when the heads (A, B, C, D, etc) are stationary and stops when the heads (A, B, C, D, etc) are printing on it, transferring the ink to a web or substrate that moves in a transverse direction, characterised in that it has the following stages:

   a) Performing a printing by the print headers (A, B, C, D, etc) on the ribbon (X) defining printed sectors (A-i), (Bi), (Ci), (Di),... of length a,
   b) Displacement of the ribbon (X) by a distance d + l,
   c) Consecutive execution of operations a) and b) on the ribbon X,

Provided that n ≤ d/l + 1, being n ≥ 2.
INTERNATIONAL SEARCH REPORT

According to International Patent Classification (IPC) or to both national classification and IPC:

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C. See patent family annex.

Special categories of cited documents:

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'A' document member of the same patent family.

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