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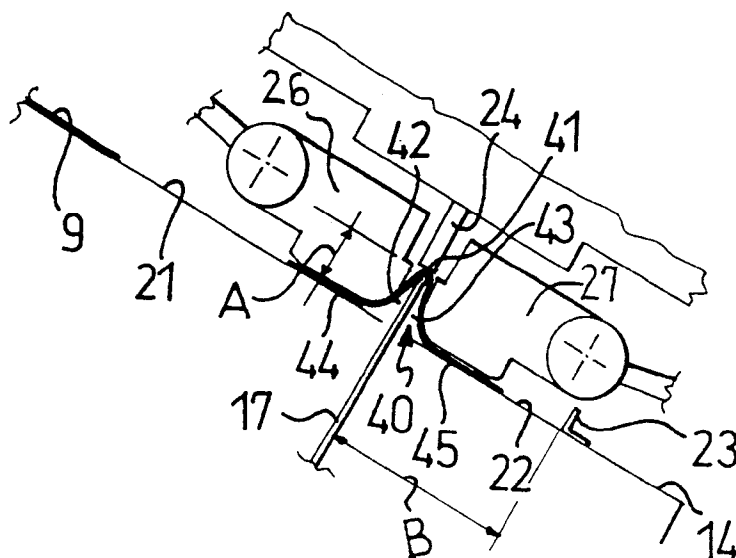
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### (54) **Method of forming signatures and folding machine therefor**

(57) A method of forming signatures (3) for sending to a sewing machine (2), preferably but not necessarily obtained from sheets (9) output by a photocopying machine, in a production line (1) for the reprographic production of books, includes a stage in which the sheets are folded into an approximate omega shape, resulting

in signatures in which a section (7a) of each leaf (7) beginning at the spine (6) is closed and the remaining section (7b) of each leaf (7) further from the spine (6) is open, the said signatures being such that they can be shot directly onto a saddle (5) of the sewing machine (2), which they straddle.



**FIG. 5**

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## Description

The present invention relates to a method of forming signatures for sending to a sewing machine, preferably but not necessarily obtained from sheets output by a photocopying machine, in a production line for the reprographic production of books.

As is known, in the production of books and especially in the reprographic production of books, i.e. in medium-to-short runs, a need exists for production which is adaptable, fast and flexible.

The book production lines used hitherto, which basically adopt the concepts of lines for producing printed books in long-to-very long runs, are very complicated and difficult to set up.

The problem tackled by the present invention is that of devising a method of the specified type, and also a folding machine for carrying it out, which will overcome the disadvantages cited above with reference to the prior art.

This problem is solved by a method of the specified type that is characterized in that it includes a stage in which the sheets are folded into an approximate omega shape, resulting in signatures in which a section of each leaf beginning at the spine is closed and the remaining section of each leaf further from the spine is open.

Other features and the advantages of the method according to the present invention will be clear from the description given below of an example, given by way of non-restrictive indication, of an embodiment of a folding machine for carrying out the said method. The description refers to the accompanying drawings, in which:

- Figure 1 is a front elevation of a production line for the reprographic production of books, incorporating a folding machine according to the invention,
- Figure 2 is a plan view of the production line shown in Figure 1,
- Figure 3 is a side elevation of the production line shown in Figure 1,
- Figure 4 is a side elevation, partly in section and on a larger scale, of a detail of the folding machine according to the invention, at one stage of its operation, and
- Figures 5, 6, 7 and 8 are side elevations, partly in section and further enlarged, of a detail of the folding machine according to the invention, at successive stages of its operation.

Referring to the accompanying figures, 1 is a general indication for a line for the reprographic production of books.

The production line 1 comprises a sewing machine 2 for sewing the signatures, which are all marked 3. The sewing machine 2 is known per se and is provided with a mobile saddle 4 and a fixed saddle 5, these both extending in a longitudinal direction X-X.

In each signature 3 there is a spine or back 6 and

two leaves 7 extending from the spine.

The production line 1 also comprises a folding machine 8 which is situated upstream of the sewing machine 2. The folding machine 8 is for forming the signatures 3 which are then passed to the sewing machine 1. The signatures 3 are preferably but not exclusively produced from sheets 9 output by a photocopying machine (conventional per se) situated upstream of the folding machine 8 and not illustrated in the figure.

The folding machine 8 comprises in a frame 10 a paper holder 11, containing a load 12 of sheets 9 produced by the photocopying machine and photocopied by the latter in a manner known per se.

Formed in the frame 10 is a folding station 13 that comprises a sloping slide 14.

The sheets follow a path, marked 15, from the paper holder 11 to the slide 14 along a transverse direction Y-Y perpendicular to the direction X-X.

Transversely to the path of the sheets 15, a slit 16 is formed in the slide 14, through which a folding blade 17 can pass. The folding blade 17 is movable, under the action of drive means 18 consisting for example of a motor 19 and a crank-and-rod mechanism 20, between a retracted position, in which the blade is completely withdrawn below the slide and a projecting position in which it rises above the slide to a specified distance marked A.

The slit 16 divides the slide 14 into an upward section 21 and a downward section 22.

On the downward section 22 of the slide 14 is a stop 23 which can be adjusted to arrest a sheet 9 to be folded, in such a way that the centre line of the sheet is over the slit 16.

The stop 23 is thus positioned at a distance B from the slit 16 substantially equal to half the total width of the sheet to be folded, that is to say equal to the width of the leaf 7 of the signature 3 that is to be formed. It is important to note that the distance A to which the blade is to be raised above the slide 14 is less than the said distance B, e.g. it is between one quarter and one half of the distance B and preferably equal to one third of the distance B.

On board the frame 10 is a fixed striker plate 24 arranged transversely to the path of the sheets 15 and parallel to the slit 16 below it. The fixed striker plate 24 is positioned at a specified distance from the slide, substantially equal to the projection A of the blade, so that an edge 25 of the folding blade 17 comes into virtual pressing contact with it.

Two jaws 26 and 27 travel in a guided manner on board the frame 10 so as to be movable along the transverse axis Y-Y in opposite directions to each other. Each jaw 26 and 27 has an active head 28 and 29, respectively, that oppose each other and face opposite sides 30 and 31 of the folding blade 17 when the latter rises above the slide.

The jaws 26 and 27 have respective faces 32 and 33. Each face 32 and 33 lies above a respective section of the slide: specifically face 32 lies above the upward

section 21 and face 33 lies above the downward section 22.

Within the range of each jaw 26, 27, between the heads 28, 29 and the face 32, 33, a zone 26a, 27a having a long radius is formed.

The jaws 26 and 27 are driven by drive means 34 and 35, between respective positions in which the heads of the jaws are far apart and respective positions in which the heads are brought into pressing contact with each other.

The drive means 34 and 35 are preferably pneumatic, and comprise, for each jaw that is to be driven, a cylinder-and-piston unit 36 powered by compressed air from a line 37 that includes a pressure regulating valve 38. Each cylinder-and-piston unit 36 acts on its particular jaw via a knuckle-joint mechanism 39.

An approximately omega-shaped seat 40 is defined inside the folding machine 8 according to the invention, said seat 40 having an upper section 41, two opposing lateral sections 42 and 43 and two base sections 44 and 45.

The upper section 41 is defined between the striker plate 24 and the edge 25 of the folding blade.

The lateral sections 42 and 43 are defined between the head 28 of the jaw 26 and the side 30 of the folding blade 17, and between the head of the jaw 27 and the side 31 of the same folding blade, respectively.

The base sections 44 and 45 are defined between the face 32 of the jaw 26 and the upward section 21 of the slide 14, and between the face 33 of the jaw 27 and the downward section 22 of the same slide, respectively.

The said seat 40 is designed to accommodate a sheet 9 and form a signature 3 in the manner described below.

A sheet 9, referring to the folding machine in an initial condition (see Figure 4), in which the folding blade is in its retracted position and the jaws are apart from each other, positions itself on the slide 14 against the stop 23.

As the folding blade 17 is pushed out (see Figure 5), the sheet 9 is folded in such a way that its central portion extends between the jaws 26 and 27 and lies astride the folding blade 17, where it is stopped by the striker plate 24, and the remaining edge portions still lie on the slide 14.

In this position the sheet 9 is basically trapped between the jaws, the striker plate and the slide.

The blade is then retracted into its withdrawn position in the slide (see Figure 6). The jaws are now pushed together (see Figure 7) and close on the sheet, thereby forming the spine 6 and the signature 3. The only part of the signature that is closed is a section marked 7a of the leaves 7, whose length is equal to the above-mentioned distance A.

Remaining sections, marked 7b, of the leaves 7 are still trapped between the faces of the heads and the upward and downward sections of the slide.

The signature 3 has now been formed, but the only

part that is closed is a section 7a of each leaf 7 extending from the spine 6, and the remaining sections 7b of the leaves further from the spine are still open.

The jaws are now drawn apart and the signature can be shot directly through to the fixed saddle, which it straddles (see Figure 8).

Because of the great radius of curvature of the zone of the join between the head and the face of each jaw, the sections 7a and 7b re-form themselves into flat leaves that lie on the saddle.

The present invention provides a method of forming signatures for sending to a sewing machine, preferably but not necessarily obtained from sheets output by a photocopying machine, in a production line for the reprographic production of books, with the aid of a stage in which the sheets are folded into an approximate omega shape, resulting in signatures in which a section of each leaf beginning at the spine is closed and the remaining section of each leaf further from the spine is open.

The main advantage of the folding method and machine according to the present invention is that the signatures obtained can be shot directly through to straddle the fixed saddle of the sewing machine, with unusually fast cycle times and with unusually continuous and reliable output.

Another advantage of the invention is the versatility with which signatures of different thicknesses can be formed, because the pneumatic drive of the two jaws allows them to stop automatically one against the other on either side of the signature, whatever the thickness of the signature.

Even the force with which the jaws press on the sheet can easily be adjusted quickly and accurately by adjusting the pressure of the air sent to the pneumatic cylinder-and-piston units.

Another advantage of the method and machine according to the present invention is the reliability with which books are produced, due to the complete elimination of delicate components such as suckers and grippers and the like, which have had to be employed hitherto for opening signatures before laying them astride the saddle.

Obviously, in order to satisfy particular and local requirements, a person skilled in the art will be able to make numerous modifications to and variations of the process and folding machine according to the present invention, all such modifications and variations being however contained within the scope of protection of the invention as defined in the following claims.

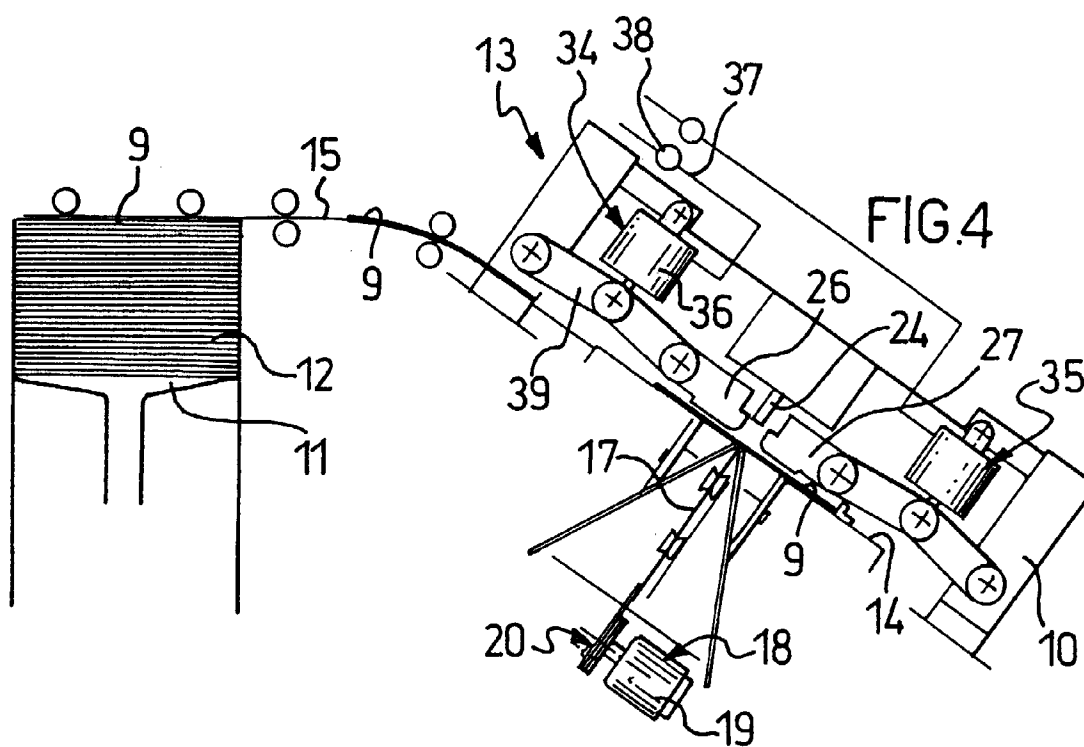
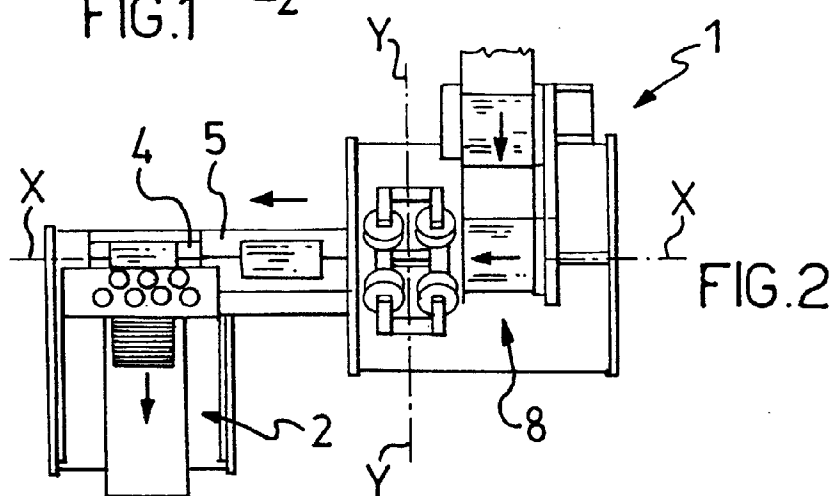
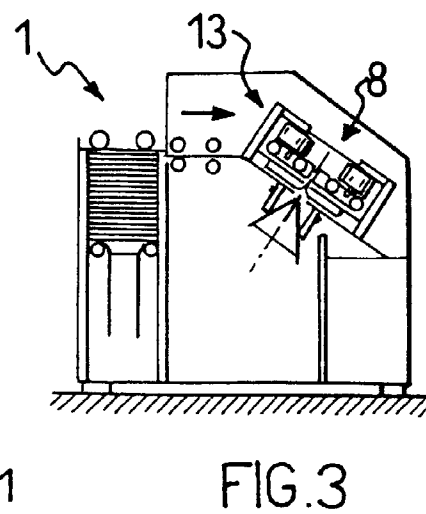
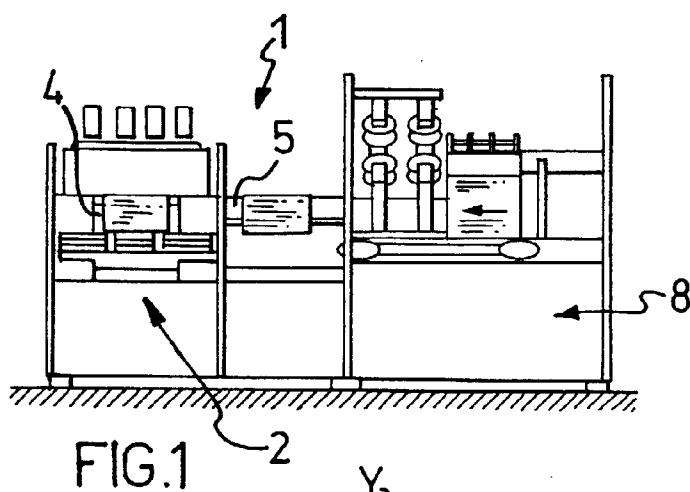
## Claims

1. Method of forming signatures for sending to a sewing machine (2), preferably but not necessarily obtained from sheets (9) output by a photocopying machine, in a production line (1) for the reprograph-

ic production of books, the said method being characterized in that it includes a stage in which the sheets are folded into an approximate omega shape, resulting in signatures in which a section (7a) of each leaf (7) beginning at the spine (6) is closed and the remaining section (7b) of each leaf (7) further from the spine (6) is open.

27a) for the join between the active head (28, 29) and the face (32, 33) nearest the slide, of specified considerable length.

2. Folding machine (8) for forming signatures (3) for sending to a sewing machine (2), preferably but not necessarily obtained from sheets output by a photocopying machine, in a production line (1) for the reprographic production of books, the said method being characterized in that it includes in a frame (10) an approximately omega-shaped seat (40), with an upper section (41), two opposing lateral sections (42, 43) and two opposing base sections (44, 45), the said omega-shaped seat (40) being designed to take the sheets (2).  
20
3. Folding machine (8) according to Claim 2, characterized in that the two opposing lateral sections (42, 43) of the approximately omega-shaped seat (40) are defined between two opposing sides (30, 31) of a folding blade (17) and respective active heads (28, 29) of two respective jaws (26, 27) facing the said sides (30, 31).  
25
4. Folding machine (8) according to Claim 3, characterized in that the two base sections (44, 45) of the approximately omega-shaped seat (40) are each defined between a slide (14) and one face (32, 33), facing the slide (14), of a respective jaw (26, 27).  
30
5. Folding machine (8) according to Claim 4, characterized in that the upper section (41) of the approximately omega-shaped seat (40) is defined between a fixed striker plate (24) mounted on the frame (10) and an active edge (25) of the folding blade (27).  
35  
40
6. Folding machine (8) according to Claim 5, characterized in that the jaws (26, 27) are controlled by pneumatic drive means (34, 35).  
45
7. Folding machine (8) according to Claim 6, characterized in that the said pneumatic drive means (34, 35) comprise a pneumatic cylinder-and-piston unit (36) that is active on each jaw (26, 27) via a respective knuckle-joint mechanism (39).  
50
8. Folding machine (8) according to Claim 7, characterized in that it comprises pressure regulating means (38) on a compressed air line (37) supplying each pneumatic cylinder-and-piston unit (36).  
55
9. Folding machine (8) according to Claim 8, characterized in that each jaw (26, 27) has a radius (26a,



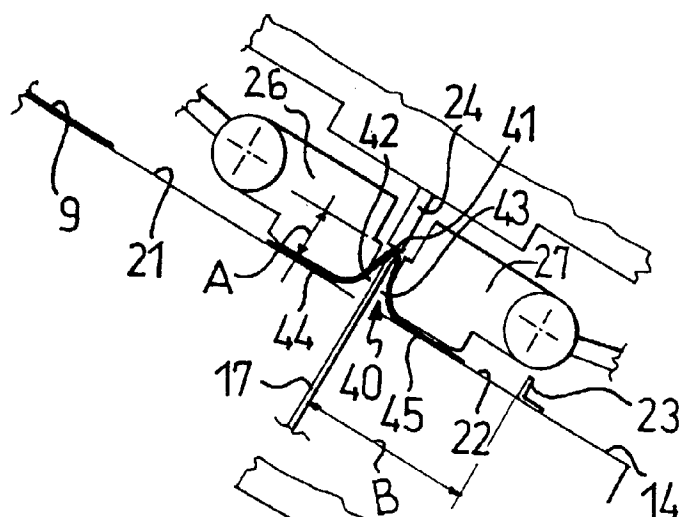


FIG. 5

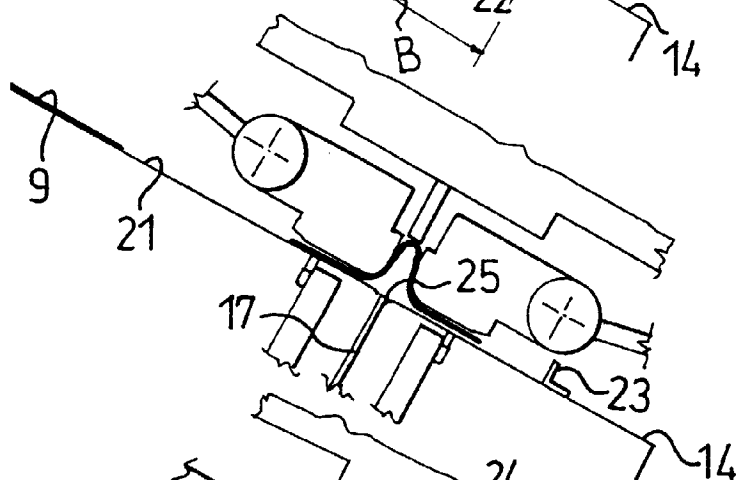


FIG. 6

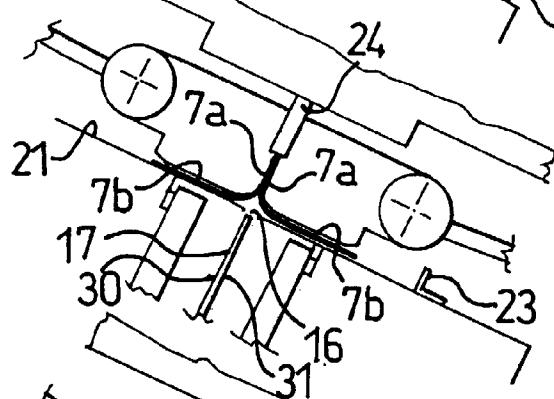


FIG.7

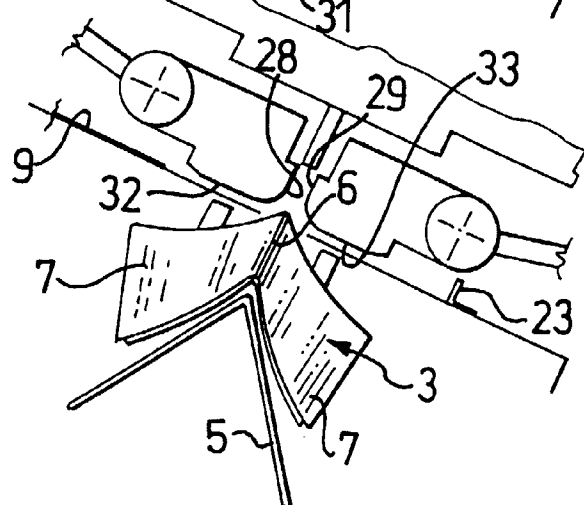


FIG. 8



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# EUROPEAN SEARCH REPORT

Application Number  
EP 97 20 3578

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                            |                                                          |                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document with indication, where appropriate, of relevant passages              | Relevant to claim                                        | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
| X<br>Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | FR 2 309 450 A (BIELOMATIC LEUZE)<br>* page 4, line 28 - page 7, line 14;<br>figures 1-4 * | 1,2<br>3-6,9                                             | B42B2/00<br>B65H45/18                        |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | DE 289 169 C (GEBR. TELLSCHOW)<br>* the whole document *                                   | 3-6,9                                                    |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | DE 290 926 C (GEBRÜDER TELLSCHOW)<br>* the whole document *                                | 1,2                                                      |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | EP 0 038 942 A (ERNST NAGEL)<br>* page 19, line 12 - page 24, line 27;<br>figures 14,15 *  | 1,2                                                      |                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                            |                                                          | TECHNICAL FIELDS<br>SEARCHED (Int.Cl.6)      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                            |                                                          | B65H                                         |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                            |                                                          |                                              |
| Place of search<br><b>THE HAGUE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                            | Date of completion of the search<br><b>16 March 1998</b> | Examiner<br><b>Loncke, J</b>                 |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>&amp; : member of the same patent family, corresponding document</p> |                                                                                            |                                                          |                                              |

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