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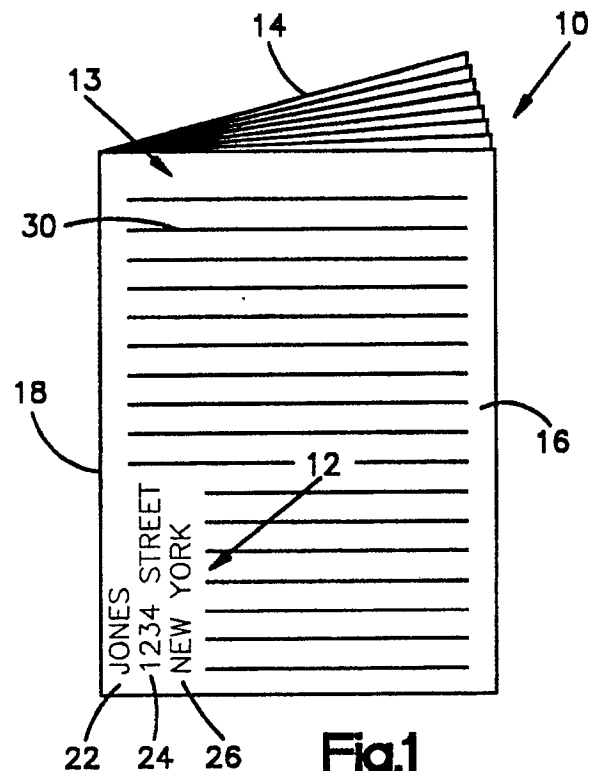
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(54) Collator with printer.

(57) A collating apparatus is used to form groups of preprinted and folded signatures. The collator includes a printer or printers to print personalized information on one or more of the signatures in each group of signatures. The apparatus includes a longitudinally extending main conveyor of the saddle type. A plurality of signatures feed assemblies are disposed along the main conveyor to sequentially feed preprinted folded signatures onto the main conveyor to form groups of signatures. At least one of the feed assemblies is operable to print personalized information on a major side surface of a signature with lines of characters extending perpendicular to a fold in the signature.



**Fig.1**  
(PRIOR ART)

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## COLLATOR WITH PRINTER

### Background of the Invention

The present invention relates to an apparatus for use in forming groups of folded signatures with personalized information printed on one or more of the signatures.

A known apparatus for forming groups of signatures with personalized information printed on one or more of the signatures is disclosed in U.S. Patent No. 4,395,031 issued July 16, 1983 titled "Apparatus for Printing Books of Signatures and Method for Same". In this known apparatus, groups of signatures are formed on a saddle type conveyor. An ink jet printer is utilized to print personalized information on the signatures.

When this known apparatus is used to print personalized information on a signature, the lines of characters setting forth the personalized information extend parallel to the fold in the signature. Thus, as the signature is being moved by the saddle type conveyor in a direction parallel to the fold in the signature, each printer head of a plurality of printer heads prints a line of characters which extends parallel to the path of movement of the signature. However, preprinted material on the signature conventionally extends perpendicular to the fold. Therefore, the personalized information which is printed on the signature is disposed in an orientation which is different than the other material printed on the signature.

### Summary of the Invention

The present invention provides an apparatus which is operable to form groups of signatures and to print personalized information, on one or more of the signatures. The personalized information is printed in one or more lines of characters extending perpendicular to a fold in the signature.

The apparatus includes a longitudinally extending main conveyor, which may be of the well known saddle type, having a plurality of receiving locations. A plurality of signature feed assemblies are disposed in an array along the main conveyor to sequentially feed preprinted folded signatures onto the main conveyor at each of the receiving locations. At least one of the signature feed assemblies includes a printer which prints at least one line of characters on one of the signatures. The line of characters extends perpendicular to the fold in the signature.

The signature feed assembly in which the

printing occurs, includes a hopper for holding preprinted folded signatures. A transfer assembly sequentially transfers the signatures to the main conveyor. A secondary conveyor moves the signatures from the hopper to the transfer assembly. A printer, which may be of the ink jet type, is disposed adjacent to the secondary conveyor and prints at least one line of characters on each of the signatures in turn. The printed line of characters extends perpendicular to the fold in the signature.

Accordingly, it is an object of this invention is to provide a new and improved apparatus in which groups of signatures are formed on a main conveyor and in which information is printed on the signatures in one or more lines of characters extending perpendicular to a fold in the signature.

Another object of this invention is to provide a new and improved apparatus for use in forming groups of signatures wherein the signatures are moved from a supply hopper to an assembly which sequentially transfers the signatures to a main conveyor and wherein a line of characters is printed on each of the signatures in turn as the signature is moved from the supply hopper to the transfer assembly.

### BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects and features of the present invention will become more apparent upon a consideration of the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is an illustration of a known signature having personalized information printed on the signature with lines of characters extending parallel to a fold in the signature;

Fig. 2 is an illustration of a signature having personalized information printed on the signature with lines of characters extending perpendicular to a fold in the signature in accordance with one of the features of the present invention;

Fig. 3 is a schematic illustration of an apparatus constructed in accordance with the present invention to form groups of preprinted folded signatures; and

Fig. 4 is an elevational view, taken generally along the line 4-4 of Fig. 3, illustrating a printer for printing at least one line of characters on a signature as it is moved from a supply hopper to a transfer assembly.

# DESCRIPTION OF ONE SPECIFIC PREFERRED EMBODIMENT OF THE INVENTION

A group 10 of signatures having personalized information 12 printed on an outer signature 13 in a known manner is illustrated in Fig. 1. The signature 13 includes a pair of opposite major sides 14 and 16 which are separated by a fold 18. The personalized information 12 includes a plurality of lines 22, 24, and 26 of characters. Lines 22, 24, and 26 of characters extend parallel to the fold 18. However, preprinted material, indicated schematically at 30, on the signature 13 includes lines of characters which extend perpendicular to the fold 18. Thus, the personalized information 12 and the preprinted material 30 extend transversely relatively to each other rather being oriented in the same direction.

The outer signature 34 (Fig. 2) of a second group 35 of signatures also has a pair of major sides 36 and 38 which are interconnected at a fold 40. Personalized information 42 is printed on the major side 38 of the signature 34. The personalized information 42 includes a plurality of lines 44, 46, and 48 of characters.

In accordance with a feature of the present invention, the lines 44, 46, and 48 of characters on the signature 34 extend perpendicular to the fold 40. Preprinted material, indicated schematically at 52 in Fig. 2, also contains lines of characters which extend perpendicular to the fold 40. Thus, both the preprinted material 52 and the personalized information 42 on the major side 38 of the signature 34 extend perpendicular to the fold 40 and have the same orientation relative to the signature. Since the material 52 and personalized information 42 are both printed in the same orientation on the major side 38 of the signature 34, both areas of material can be readily read.

Although the personalized information is printed on only the outer signature 34 of the group 35 of signatures, personalized information could be printed on other signatures of the group of signatures. This personalized information would also be printed in one or more lines of characters extending perpendicular to a fold in the signature.

A collator apparatus 60 constructed in accordance with the present invention is illustrated schematically in Fig. 3. The collator forms groups 35 of preprinted folded signatures with personalized information printed on at least one signature 34 of the group of signatures, as illustrated in Fig. 2. Thus, the personalized information is printed on the signature 34 in lines 44, 46, and 48 of characters which extend perpendicular to a fold 40 in the signature.

The apparatus 60 includes a longitudinally extending main conveyor assembly 62. The main

conveyor assembly 62 is of the well known saddle type. The conveyor assembly 62 includes a plurality of pusher fingers or lugs 64 which are connected to a conveyor chain and cooperate with each other to form signature receiving locations 66.

The signature receiving locations 66 are moved along a linear path in the direction of the arrow 68, by the main conveyor 62. Signature feeder assemblies 72, 74, 76 and 78 are disposed in a linear array along the main conveyor 62. The signature feed assemblies 72-78 sequentially feed preprinted folded signatures to each of the receiving locations 66 on the main conveyor 62 to sequentially form groups 35 of signatures.

As each of the signature receiving locations 66 moves past each of the signature feed assemblies 72-78 in turn, a group 35 of signatures is formed at the receiving location. The pusher finger 64 engages a trailing edge portion of the group 35 of signatures and moves the signatures in the direction of the arrow 68.

Since the main conveyor 62 is of the well known saddle type, the groups 35 of signatures hang downwardly from the main conveyor 62. The opposite major sides of each of the signatures extends downwardly on opposite sides of the saddle conveyor 62. The fold which separates the major sides of each signature is disposed along the center line of the saddle conveyor 62. The saddle conveyor 62 has opposite side surfaces which slope downwardly and outwardly from a peak portion of a conveyor. These side surfaces engage inner side surfaces on the lowermost signature in a group 35 of signatures to support the group of signatures in a known manner.

The signature feed assemblies 72, 74, and 76 each include a hopper 82 which holds different preprinted and folded signatures. A signature transfer assembly 84 is provided in each of the signature feed assemblies 72, 74, and 76 to sequentially feed signatures from a hopper 82 to receiving locations 66 on the main conveyor 62 as the receiving locations sequentially move past the transfer assemblies 84. The signature feed assemblies 72, 74, and 76 all have the same construction. However, the signature feed assembly 78 differs from the signature feed assemblies 72, 74, and 76 in that the signature feed assembly 78 includes a secondary conveyor 86 which sequentially moves signatures 34 from a hopper 82 to a transfer assembly 84.

A printer assembly 88 in the signature feed assembly 78 (Fig. 4) prints personalized information on each of the preprinted and folded signatures 34 as it is moved from the hopper 82 to the transfer assembly 84 by the secondary conveyor 86. The personalized information is printed on each of the signatures 34 in lines 44, 46, and 48 of

characters which extend perpendicular to the fold 40, in the manner illustrated in Fig. 2.

The preprinted and folded signatures 34 are moved from the hopper 82 to the secondary conveyor 86 with the folds 40 leading. The secondary conveyor 86 moves the signatures 34 toward the main conveyor 62 along a path which extends perpendicular to the longitudinal central axis of the main conveyor 62 with the major sides 38 horizontal and facing upwardly and the with the major sides 36 horizontal and facing downwardly. As each signature 34 is moved through the printer assembly 88 by the secondary conveyor 86, personalized information is printed on the signature. The personalized information is printed in lines 44, 46, and 48 of characters which extend parallel to the path of movement of the signature and perpendicular to the path of movement of the main conveyor 62. The personalized information may be printed either directly on the signature or on a label disposed on the signature.

The signatures 34 with the personalized information printed on the major sides 38, are sequentially transferred to the main conveyor 62 by the transfer assembly 84. When the signatures 34 are transferred to the main conveyor assembly 32, the lines 44, 46, and 48 of characters printed by the printer assembly 88 extend perpendicular to the longitudinal central axis of the main conveyor 62 and the path of movement of the signatures by the main conveyor.

The signature feed assembly 78 includes a hopper 82 (Fig. 4) which holds a supply of preprinted and folded signatures 34. The signatures are held in the hopper 82 with the folded edges 40 of the signatures downwardly and with the major sides 38 facing toward the right (as viewed in Fig. 4). A rotary separator drum 92 disposed adjacent to the hopper 82 sequentially grips the signatures and removes them from the hopper. The drum 92 releases the signatures at the receiving locations 94 disposed on the secondary conveyor 86 between pusher fingers or lugs 96. The pusher fingers 96 engage the trailing edges of the signatures 34 to sequentially move them through the printer assembly 88.

The printer assembly 88 is of the known ink jet type. The printer assembly 88 includes a nozzle for each line of characters to be printed on the major side of a signature. Charged droplets from the nozzles pass between deflection plates and are deflected to form characters. The printer assembly 88 includes an upper set of nozzles 102 which can print lines of characters on the upwardly facing major side 38 of each of the signatures 34 in turn. A lower set of nozzles 104 is also provided to print lines of characters on the downwardly facing major side 36 of each of the signatures in turn. Either or

both sets of nozzles 102 and 104 can be used to print on each of the signatures as they move through the printer 88.

After the signatures 34 pass through the printer assembly 88, they move to the transfer assembly 84. In transfer assembly 84, grippers on a rotary feed drum 108 grip each of the signatures 34 in turn. The feed drum 88 moves each signature 34 in turn part way around the drum and then releases the signature. The transfer cylinder 110 engages the open edges of the signature and carries it to an opener cylinder 112. The signature 34 is opened by cooperation between the transfer and opener cylinders 110 and 112 and is dropped downwardly onto the main conveyor assembly 62. The transfer assembly 84 may have many different known constructions, such as those illustrated in U.S. Patent Nos. 2,251,943; 2,855,195; 3,692,300; 3,809,384; and 3,692,300.

The signature 34 is placed on main saddle conveyor 62 with the fold 40 extending parallel to the path of movement of the main conveyor and with the lines 44, 46, and 48 of characters printed on the signature by the printer assembly 88 extending perpendicular to the longitudinal axis of the main conveyor. The main conveyor 62 moves the group 35 of signatures, including the signatures 34, to additional stations where further operations are performed on the signatures. For example, the signatures may be moved to a stitcher assembly in which the group 35 of signatures is stapled along the folds 40.

In view of the foregoing description, is apparent that the present invention provides an apparatus 60 which is operable to form groups 35 of signatures and to print personalized information, on one or more of the signatures. The personalized information is printed in one or more lines of characters 44, 46, and 48 extending perpendicular to a fold 40 in the signature 34.

The apparatus includes a longitudinally extending main conveyor 62, which may be of the well known saddle type, having a plurality of receiving locations. A plurality of signature feed assemblies 72, 74, 76, and 78 are disposed in an array along the main conveyor 62 to sequentially feed preprinted folded signatures onto the main conveyor at each of the receiving locations 66. At least one of the signature feed assemblies includes a printer 88 which prints at least one line of characters on one of the signatures 34. The line of characters extends perpendicular to the fold 40 in the signature 34.

The signature feed assembly 78 in which the printing occurs, includes a hopper 82 for holding preprinted folded signatures 34. A transfer assembly 84 sequentially transfers the signatures 34 to the main conveyor. A secondary conveyor 86 moves the signatures 34 from the hopper 82 to the

transfer assembly 84. A printer 88, which may be of the ink jet type, is disposed adjacent to the secondary conveyor 86 and prints at least one line of characters on each of the signatures 34 in turn. The printed line of characters extends perpendicular to the fold 40 in the signature 34.

Although the printer 88 has been described herein as being operable to print on the outermost signature 34 of the group 35 of signatures, additional printers could be provided in association with the signature feed assemblies 72, 74, and/or 76. These printers would be operable to print personalized information on signatures disposed within the group 35 of signatures. The personalized information printed on the signatures within the group 35 of signatures would also extend perpendicular to the folds in the signatures.

## Claims

1) An apparatus for use in forming groups of preprinted folded signatures, said apparatus comprising a longitudinally extending saddle conveyor having a plurality of receiving locations which are sequentially movable along a path, and a plurality of signature feed means disposed in an array along said saddle conveyor for sequentially feeding preprinted folded signatures onto said saddle conveyor at each of said receiving locations in turn to form a plurality of groups of signatures with each signature in a group of signatures having side portions disposed on opposite sides of said saddle conveyor and extending downwardly from a fold in the signature, at least one of said signature feed means including printer means disposed adjacent to said saddle conveyor at a location between opposite ends of said saddle conveyor for printing at least a line of characters on a preprinted folded signature of each group of signatures with the line of characters extending perpendicular to the fold in the signature, said saddle conveyor means including means for moving each of the groups of signatures along the path with the line of characters printed on a signature in each group of signatures by said printer means extending perpendicular to the path of movement of the group of signatures after the line of characters has been printed on a signature by said printer means.

2) An apparatus as set forth in claim 1 wherein said one of said signature feed means includes means for moving signatures toward said saddle conveyor, said printer means including means for printing on the signatures while they are moving toward said saddle conveyor.

3) An apparatus as set forth in claim 1 wherein said one signature feed means includes hopper means for holding a plurality of the one signatures, opener

means for sequentially opening the signatures from said hopper means and releasing them at receiving locations on said saddle conveyor, and transfer means for sequentially moving the signatures from said hopper means to said opener means, said printer means being disposed between said hopper means and said opener means and being operable to print on each of the signatures from said hopper means in turn as they are being moved by said transfer means.

4) An apparatus as set forth in claim 3 wherein said transfer means includes conveyor means for sequentially moving the signatures from said hopper means with a major side facing upwardly and a major side facing downwardly, said printer means being operable to print on a surface area on at least one of the major sides of each of the signatures from said hopper means in turn while the signatures are being moved by said conveyor means with their major sides facing up and down.

5) An apparatus as set forth in claim 4 wherein said printer means includes an ink jet printer for printing directly on a major side of each of the one signatures from said hopper means in turn while they are being moved by said conveyor means.

6) An apparatus as set forth in claim 4 wherein said printer means includes an ink jet printer for printing on the surface of labels disposed on each of the one signatures from said hopper means.

7) An apparatus as set forth in claim 4 wherein said printer means includes means for printing on the upwardly and on the downwardly facing major sides of each of the signatures from said hopper means in turn.

8) An apparatus as set forth in claim 4 wherein said conveyor means includes means for sequentially moving the signatures from said hopper means with the fold in each of the signatures extending parallel to at least a portion of the path along which said saddle conveyor moves signatures.

9) An apparatus for use in forming groups of signatures, said apparatus comprising a longitudinally extending main conveyor having a plurality of receiving locations which are sequentially movable along a path, and a plurality of signature feed means disposed in an array along the path of movement of the receiving locations for sequentially feeding signatures onto said main conveyor at each of the receiving locations in turn to form a plurality of groups of signatures, at least one of said signature feed means including hopper means for holding a plurality of the signatures, transfer means for sequentially transferring the signatures to said main conveyor, secondary conveyor means for sequentially moving signatures from said hopper means to said transfer means, and printer means disposed adjacent to said secondary conveyor means for printing at least a line of char-

acters on each of the signatures from said hopper means in turn as each of the signatures are being moved by said secondary conveyor means.

10) An apparatus as set forth in claim 9 wherein said printer means is operable to print at least a line of characters on each of the signatures from said hopper means in turn with the line of characters extending perpendicular to the path of movement of the receiving locations of said main conveyor.

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11) An apparatus as set forth in claim 9 wherein said transfer means is operable to sequentially transfer signatures to said main conveyor with the line of characters extending perpendicular to the path of movement of the receiving locations of said main conveyor.

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12) An apparatus as set forth in claim 9 wherein each of the signatures from said hopper means is folded, said printer means being operable to print at least a line of characters on each of the signatures from said hopper means in turn with the line of characters extending perpendicular to the fold in the one signature.

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13) An apparatus as set forth in claim 9 wherein each of the signatures of each group of signatures is folded, said main conveyor being a saddle conveyor having surface means for engaging inner side surface areas on a signature of each group of signatures and supporting each of the signatures with opposite side portions of the signatures disposed on opposite sides of said saddle conveyor and extending downwardly from a fold.

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14) An apparatus as set forth in claim 9 wherein said printer means includes means for printing on opposite sides of each of the signatures from said hopper means in turn as each of the signatures is being moved by said secondary conveyor means.

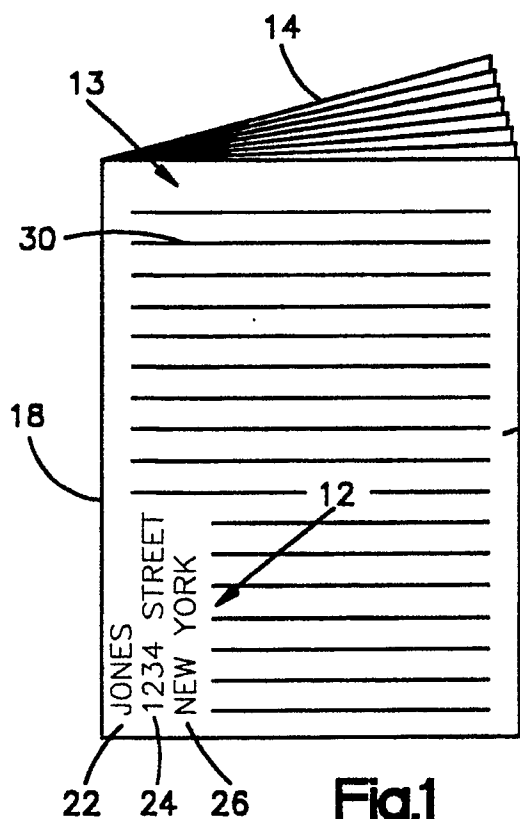
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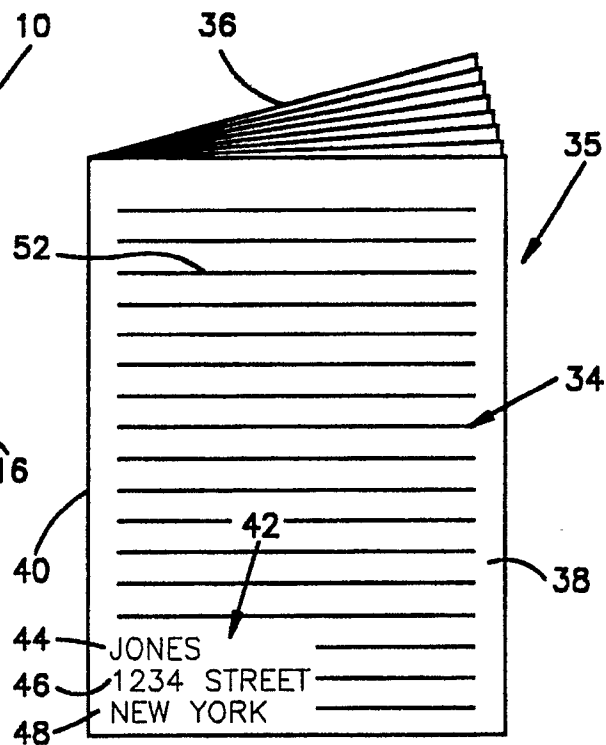
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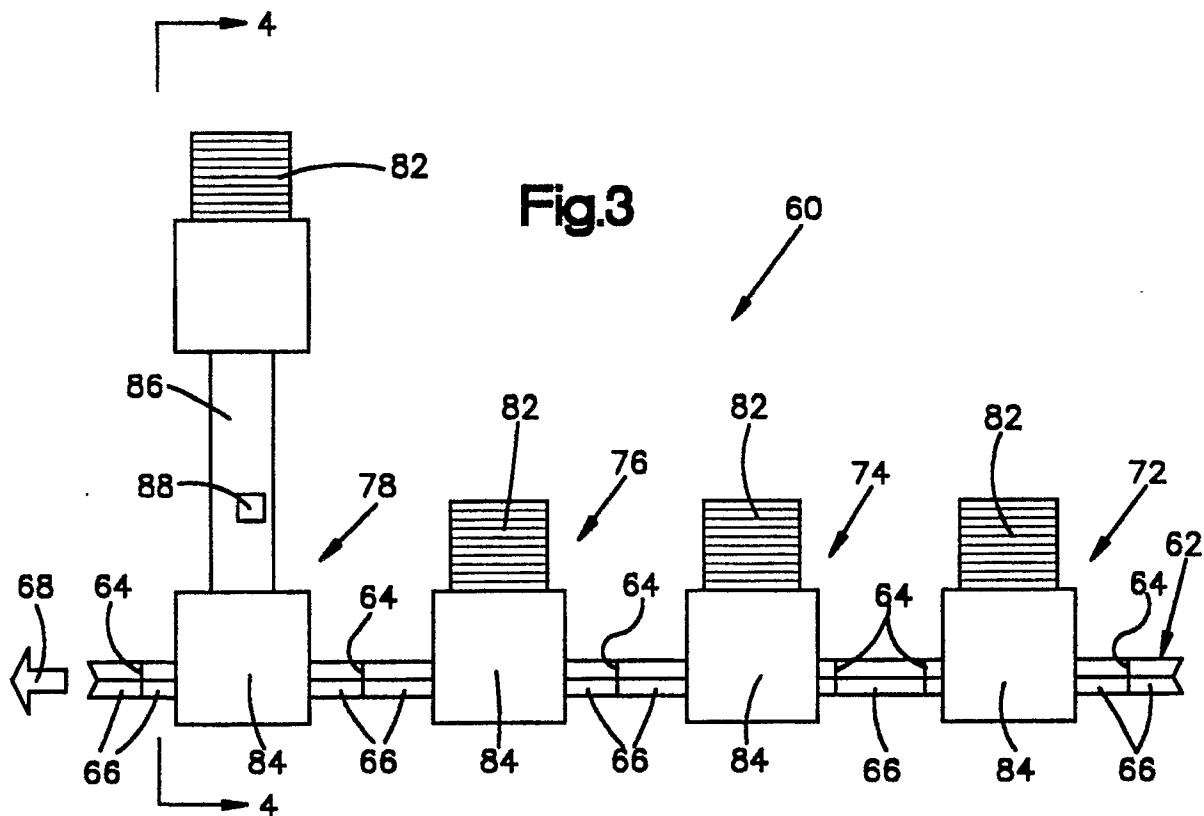
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**Fig.1**  
(PRIOR ART)



**Fig.2**



**Fig.3**

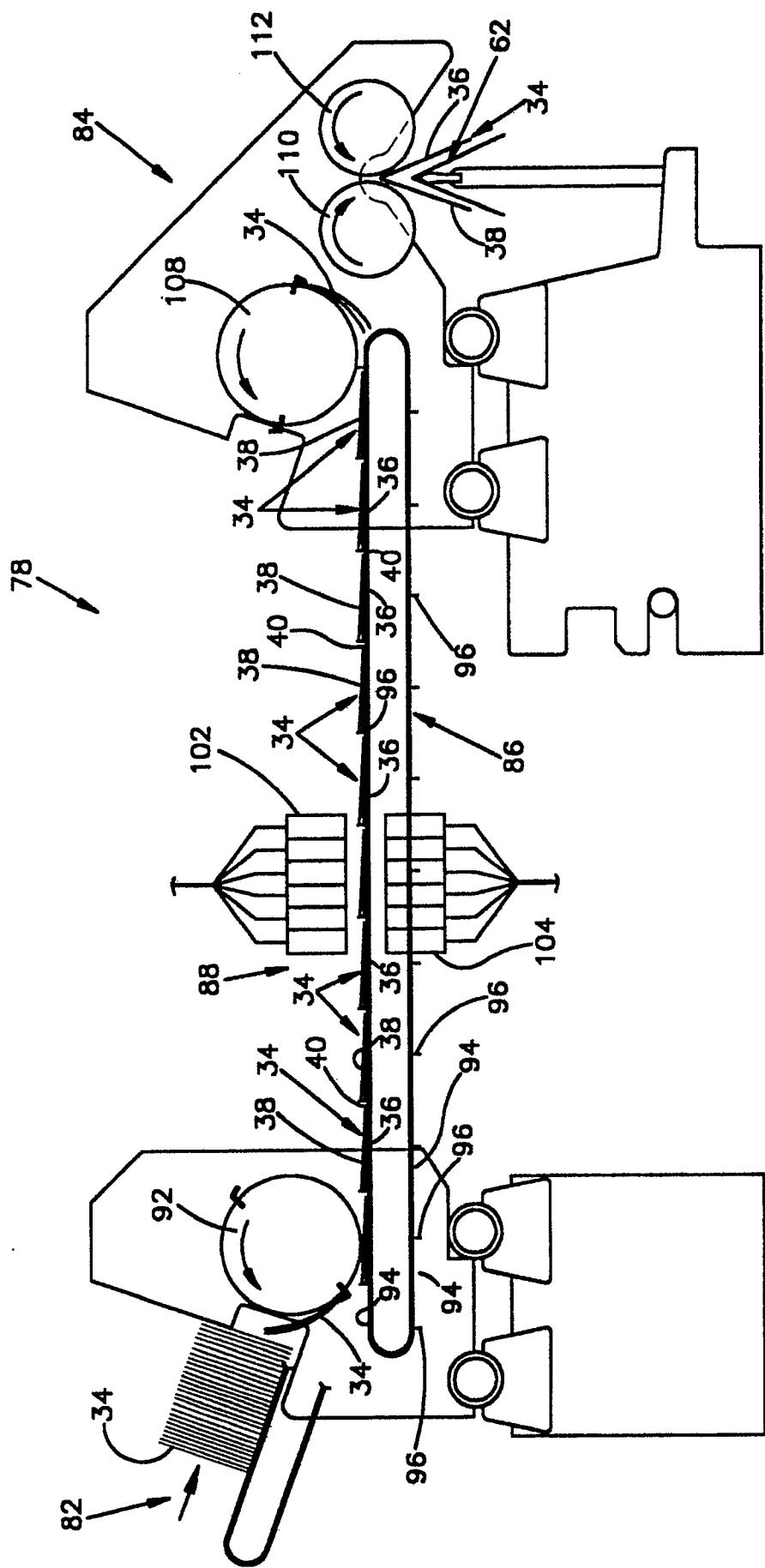


Fig.4