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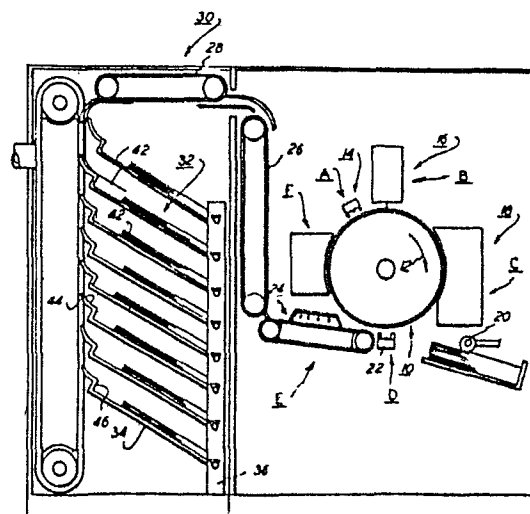
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54 **Apparatus for collecting sheets.**

57 Apparatus (30) for collecting sheets in which the sheets are collected in a sheet receiving bin (32). A pneumatic system (not shown) moves a guide (44) from a first position to a second position. In the first position, the guide (44) is inoperative and the sheet is transported past the bin (32). Contrawise, in the second position, the guide (44) is operative and the sheet is collected in the bin (32). In one configuration the apparatus comprises a sorter having a plurality of bins (32) and guides (44) associated with each of the bins (32).



**FIG. 1**

**EP 0 012 025 A1**

### Apparatus for collecting sheets

This invention relates to apparatus for collecting sheets including at least one sheet receiving bin, a transport for delivering sheets to the bin and a guide for guiding sheets from the transport into the bin.

Frequently, it is highly desirable to reproduce a plurality of copies of the same original document. Moreover, if several original documents are reproduced, it is desirable to form a plurality of collated sets of copies. This may be achieved by the utilization of a sorting apparatus. Generally, the sorting apparatus comprises a plurality of bins wherein each bin is designed to collect one set of copies of the original documents. A variety of sorters are known in the art. One typical sorter employs tray members which are spaced apart and extending in a linear row. Another type of sorting apparatus has tray members extending radially outwardly from the axis of rotation. These are the two basic types of sorters generally used commercially, i.e. a linear type and a rotary type.

Copy sheets may be collected in the bins of the sorter in a number of ways. The most common technique is to utilize a sheet transport to advance the copy sheets past the bin openings and deflection fingers to guide the sheets from the transport into the respective bin. Another technique comprises the use of moving deflection fingers which move from bin to bin to deflect the copy sheets into the respective bin. Yet still another approach is to move the bins past the sheet ejecting portion of the transport. In this way, the bins collect successive sheets therein. However, in all of the foregoing types of systems, the bins are articulated by a mechanical or electro-mechanical system.

Various types of devices have herein before been employed to control the movement of sorter bins. Thus Japanese

publication no. 53-15145 discloses a sheet sorting unit comprising a plurality of bin trays. A pawl and lever system open successive trays to receive copy sheets. And British Patent No. 1,486,166 describes a sorting apparatus having a plurality of sheet receiving trays positioned horizontally above each other. A motor and cam system articulates successive trays into the sheet path to receive the sheets therein.

The present invention is characterised by pneumatic mechanism, coupled to the guide for moving the guide from a first position in which it is inoperative to guide the sheets from the transport into the bin to a second position in which it is operative to guide the sheet from the transport into the bin.

In order that the invention may be more readily understood, reference will now be made to the accompanying drawings, in which:-

Figure 1 is a schematic elevational view of an electro-photographic printing machine having a sorting apparatus according to the invention coupled thereto;

Figure 2 is a fragmentary perspective view of one embodiment of the Figure 1 sorting apparatus;

Figure 3 is a fragmentary schematic elevational view of another embodiment of the Figure 1 sorting apparatus;

Figure 4 is an elevational view, partially in section, showing the pneumatic system of the Figure 1 sorting apparatus;

Figure 5 is an elevational view of the Figure 4 pneumatic system; and

Figure 6 is an elevational view showing the valve used

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in the Figure 4 pneumatic system.

Referring to Figure 1, the electrophotographic printing machine illustrated comprises a photoconductive drum 10 arranged to rotate in the direction of arrow 12 through a charging station A at which the photoconductive surface of drum 10 is charged; an exposure station B at which a light image of an original document being copied is projected on to the drum by an exposure system 16 to form an electrostatic latent image; a development station C at which the latent image is developed in to visible form by a magnetic brush development system 18; a transfer station D, having a transfer corotron 22, at which the visible image is transferred to sheet of support material advanced to the transfer station by a sheet feeding apparatus 20; and a cleaning station F at which residual particles remaining on the drum following transfer are removed from the drum. After transfer, the sheet is separated from the drum and passed through a fusing station E, includes a fuser assembly 24 which heats the visible toner powder image sufficiently to permanently affix it to the sheet.

With continued reference to Figure 1, after a sheet exits fuser 24, it is transported by sheet transport 26 to input transport 28 of the sorting apparatus, indicated generally by the reference numeral 30. In the sorting arrangement shown, the sheets which exit from the fuser are imaged face-up. However, these sheets are delivered into the sorter bins 32 face-down.

With continued reference to Figure 1, sorting apparatus 30 includes a plurality of sheet receiving bins 32. In the embodiment depicted, bins 32 are arranged sequentially in a vertically extending row. Each bin 32 includes a generally planar portion 34. Planar portions 34 are supported in a parallel spaced apart arrangement to define the respective bins 32. One end of each planar portion 34 is pivotably supported in frame 36. The opposed end of each planar portion 34 is supported by means of a pneumatically actuated mechanism. The detailed structure of the pneumatic actuation mechanism will be described hereinafter with reference to Figures 2 through 6, inclusive. Each planar portion 34 has an upwardly extending rear stop 38 (Figure 2) integral therewith. The sheets supported in the bin are backed against rear stop 38. A vertical transport 40 of the vacuum type is provided to advance a sheet 42 past the bin openings.

A sheet guide 44 is integral with each bin i.e. planar portion 34, being arranged to deflect and strip sheet 16 from vertical transport 40 and to guide the sheet into bin 32. Preferably, the sheet guide includes a curved or arcuate portion. The curved portion serves to deflect sheets from transport 40 and guide them into bin 32. The sheet receiving bin 32 may also include a stepped portion 46. Stepped portion 46 has one end integral with curved portion 44 with the other end being integral with planar portion 34. Stepped portion 46 is provided to guide sheets over the stack of sheets 16 already positioned on planar portion 34.

Each planar portions 34 is movable between a first position wherein curved portion 44 is arranged to intercept a sheet transport 40 and is operative to

deflect the sheet into a bin 32, and a second position wherein curved portion 44 is inoperative to deflect sheets from transport 40 into bin 32. The first position is depicted in Figure 1 for all the bins exclusive of the first in the line of sheet travel on transport 40. The second position is illustrated for the first bin in the line of sheet travel. As a sheet travels along transport 40, it is deflected into the second bin along its line of travel which is in the first position. After a sheet 16 is received in bin 32, planar portion 34 is pivoted to the second position so that the next arriving sheet will be fed into the next adjacent downstream bin 32.

Referring now to Figure 2, it is shown that the curved portion 44 includes spaced apart fingers. Bins 48 are provided at one end of planar portion 34 and project through a pie-shaped slot 50 in frame 36 so as to pivotably support planar portion 34 for movement between the respective first and second positions. The side marginal regions of planar portion 34 include a tab 52 which is supported by means of a pivotable link 54. Planar portion 34 is held in engagement with link 54 by means of a spring 56 which biases it into a slot 58 in link 54. Each link 54 is pivotably supported about pin 60 near one of its ends with slot 58 being located adjacent the opposite end. The pneumatic system includes a plurality of bellows 62. Each bellows is pivotably connected to link 54 at a position located between pin 60 and slot 58.

Curved portion 44, which is illustrated in Figure 2, is shown in the first position wherein bellows 62 is compressed and pivotable link 54 is arranged generally vertically, at a rest position. In this position, curved portion or fingers 44 project through the path of sheet travel defined by the surface of belts 64 adjacent the bin openings so as to intercept and deflect

any sheet 42 being transported by transport 40 onto planar portion 34. A gap 66 between adjacent belts 64 is of a sufficient width to permit curved fingers 44 to project therethrough. In this way, curved fingers 44 project through the sheet feed path between the respective belts 64.

To move curved fingers 44 to their second position, the respective bellows 62 is selectively actuated by the pneumatic system depicted hereinafter in greater detail with reference to Figures 4 through 6, inclusive. Upon actuation of bellows 62, bellows 62 applies a force to link 54 causing it to rotate in a counterclockwise direction about pin 60 so as to pivot planar portion 34 and curved fingers 44 up to their second position. In the second position, curved fingers 44 are spaced from the path of sheet travel, i.e. they are inoperative, and they do not intercept and deflect a sheet from transport 40 into a bin 32.

The sorting apparatus shown in Figure 1 includes a vertical transport 40 and a vertical array of sheet receiving bins 32. The present invention can alternatively include a horizontal sheet transport and a horizontal array of sheet receiving bins as depicted in Figure 3. Any desired orientation for the bin array may be employed.

In the embodiment depicted in Figures 1 and 2, sheets 42 were deflected by curved fingers 44 onto the planar portion 34 integral therewith. In accordance with the horizontal embodiment shown in Figure 3, the curved fingers 44 serve to deflect a sheet 42 into the next adjacent bin 32.

Transport 40 advances the sheets past the entrance openings of the respective bins 32. The incoming sheets 42 travel along the top surface of the transport as they are received from the electrophotographic printing machine. They proceed through a 180°

turnaround and onto the lower transport surface for delivery to their respective bins 32.

Each bin 32 includes a planar portion 34. One end of planar portion 34 is supported pivotably at pivot 68. This end also includes an upwardly extending stop portion 38 for supporting a side of a stack of sheets in the bin 32.

The opposing end of planar portion 34 has a curved portion 44 integral therewith for deflecting sheets into one of the bins. Curved portion 44 is bent back on itself with the free end thereof being spaced above the backside of planar portion 34 by an amount sufficient to guide a sheet over any sheets already supported upon the back of planar portion 34. When planar portion 34 is in the first position curved fingers 44 pass through the path of sheet travel. Movement of planar portion 34 to the first position is provided by means of a pneumatically actuated mechanism comprising bellows 62 connected to extension 70 of planar portions 34 on the other side of pivot axis 68. To begin a sorting operation, bellows 62 applies a force on extension 70 opposed to that of spring 72 so as to pivot planar portions 34 in a clockwise direction causing curved fingers 44 to project through the path of sheet travel defined by the belt of the vacuum transport 40. In this way, curved fingers 44 intercept sheets on transport 40. As a sheet is delivered into a bin, the respective bellows associated therewith and spring 72 apply a force on extension 70 causing planar portion 34 to pivot in a counterclockwise direction spacing curved fingers 44 from the path of sheet travel. In this fashion, sheets are delivered into each respective bin with the curved fingers being pivoted from the first to the second position so as to provide the proper sheet distribution in each bin.

Referring now to Figure 4, there is shown

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the detailed structure of the pneumatic system, indicated generally by the reference numeral 74, for actuating each bin. As shown in Figure 4, a pressure source 74 furnishes a compressed fluid or gas, preferably air, to valve 76 via conduit 78. Valve 76, in turn, is connected via a suitable fluid-tight frame 80 to a plurality of bellows 62. The number of bellows 62 corresponds to the number of bins employed in the sorting apparatus. The detailed operation of valve 76 will be described hereinafter with reference to Figure 6. However, valve 76 couples successive bellows 62 to conduit 78. In this manner pressurized fluid flows to bellows 62 causing it to pivot the respective sheet guide to the inoperative or second position from the first position wherein it deflects the sheets from the transport to the respective bin. Thereafter, valve 76 is indexed to actuate another bellows 62. In this manner, each bellows 62 sequentially receives pressurized fluid and applies a force on the respective planar portion to actuate the appropriate bin for receiving a sheet from the transport.

Turning now to Figure 5, there is shown the detailed structure of frame 80. Preferably, frame 80 is formed from a thermowelded laminated plastic sheet with bellows 62 being integral therewith. As shown in Figure 5, frame 80 includes a plurality of conduits 82 connecting the region in the vicinity of valve 76 with a bellows. Thus, openings 84 and conduits 82 are sequentially coupled to pressure supply 74 via valve 76. Indexing a portion of valve 76 connects one opening 84 with pressure supply 74. In this way, pressurized fluid passes from pressure source 74 through opening 84 and conduit 82 to each bellows 62 coupled thereto.

Referring now to Figure 6, the detailed description of valve 76 will be discussed hereinafter.

As shown in Figure 6, valve 76 is a three-piece assembly comprising a stationary disc 86 having a groove 88 therein. Disc 86 is connected via conduit 78 (Figure 4) to pressure supply 74 (Figure 4). Thus, the pressurized fluid flows into groove 88. Disc 90 is also stationary and includes openings 84 coupling conduits 82 with the respective bellows 62. Finally, disc 92 is rotatable and includes two openings therein. One opening is an exhaust opening and the other opening is a supply opening. The supply opening connects grooves 88 with one of the openings 84. In this way, the pressurized fluid passes through conduit 78 into groove 88 and then through the supply opening of disc 92 into the corresponding opening of disc 90. As disc 92 indexes, it couples different supply openings with pressurized fluid source 74. In this manner, the bellows are sequentially actuated. The detailed structure of each disc is depicted in Figures 6(a) through 6(c).

Turning now to Figure 6(a), disc 86 includes a circular member 94 having a groove 88 therein. Disc 86 is stationary and comprises an opening 96 substantially normal to and in communication with groove 88.

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In this manner, conduit 78 is coupled to opening 96 permitting pressurized fluid to flow into groove 88.

Referring now to Figure 6(b), there is shown rotatable disc 92. Disc 92 is coupled to a suitable indexing motor such as a stepping motor which sequentially moves supply opening 98 and exhaust opening 100 through a discrete angle. The centers of exhaust opening 100 and supply opening 98 are located at a radial distance corresponding to the radial distance of the center line of groove 88. In this way, pressurized fluid passes into groove 88 and, in turn, out therefrom via opening 98 into bellows 62, and being exhausted via opening 100.

Stationary disc 90 is depicted in Figure 6(c). As shown thereat, disc 90 includes a plurality of open-

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ings 84 which, in turn, are coupled to conduit 82. In this way, each opening 84 is in communication with one of the bellows 62. As disc 92 rotates, supply opening 98 is positioned co-linearly with opening 84. This enables the pressurized fluid to pass from supply opening 98 into opening 84 and in turn through the corresponding conduit 82 to the respective bellows 62. It is thus evident that by indexing disc 92 successive bellows are sequentially coupled to the pressurized source. As each successive bellows is coupled to the source of pressurized fluid, it applies a force on the planar portion to pivot the respective planar portion from the first position wherein the curved portion or fingers intercept the sheet to the second position wherein the curved portions or fingers are spaced therefrom.

The detailed structure of the sorting apparatus, exclusive of the pneumatic system herein described, is discussed in co-pending U. S. patent application No. 599,740 filed July 28, 1975, the relevant portions thereof being hereby incorporated into the present patent application.

In recapitulation, it is evident that the sorting apparatus of the present invention comprises a plurality of pneumatically actuated bins for collecting sheets therein. The pneumatic system is relatively inexpensive and readily lends itself to mass production techniques for use in a sorter,

Claims:

1. Apparatus for collecting sheets, including at least one sheet receiving bin (32), a transport for delivering sheets to the bin (32) and a guide (44) for guiding sheets from the transport (40) into the bin (32), characterised by pneumatic mechanism (74), coupled to the guide (44), for moving the guide (44) from a first position in which it is inoperative to guide the sheets from the transport (40) into the bin (32) to a second position in which it is operative to guide the sheet from the transport (40) into the bin (32).
2. Apparatus according to Claim 1, in which the guide (44) is integral with at least a portion of the bin (32).
3. Apparatus according to Claim 2, in which the bin (32) includes a generally planar portion (34), and the guide (44) includes a curved portion integral with one end of the planar portion (34).
4. Apparatus according to Claim 3, in which the planar portion (34) is mounted pivotably at the end thereof opposed from the end having the curved guide portion (44) integral therewith.
5. Apparatus according to Claim 3 or 4, in which the bin (32) includes a stepped portion (46) having one end thereof integral with the planar portion (34) with the other end thereof being integral with the curved portion (44).
6. Apparatus according to any preceding claim, in which the transport (40) includes a vacuum transport comprising a plurality of spaced belts (64) and the guide

(44) includes a plurality of spaced fingers which, in said second position of the guide, interfit between the belts (64) to intercept a sheet supported thereon and, in said first position of the guide, are spaced from the belts (64).

7. Apparatus according to any preceding claim, in which the pneumatic mechanism (74) includes a means (74) for supplying pressurised fluid, means (62) for resiliently urging the guide (44) to move from the first position to the second position in response to the supplying means (74) being coupled to the urging means (62) and means (76) for coupling the supplying means (74) to the urging means (62) to furnish pressurized fluid thereto and for decoupling the supplying means (74) from the urging means (62).

8. Apparatus according to any preceding claim, further including a second sheet receiving bin (32).

9. Apparatus according to Claim 8, in which the guide (44), in the first position, is operative to guide the sheets from the transport (40) into the second bin (32).

10. Apparatus according to any of claims 1 to 7 including a plurality of sheet receiving bins (32) each having a guide (44) associated therewith, said guides (44) being actuatable in sequence for depositing sheets in some or all of the bins (32) in turn.

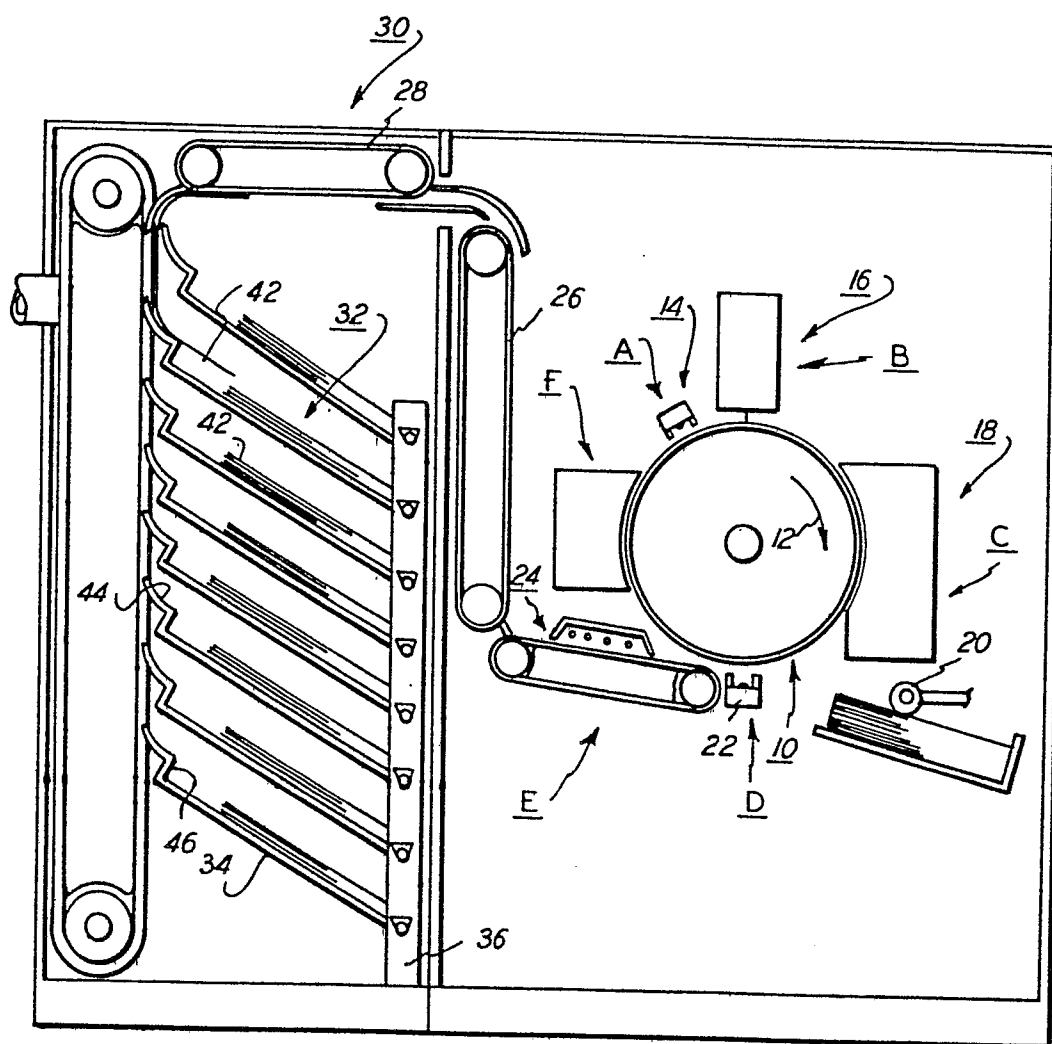
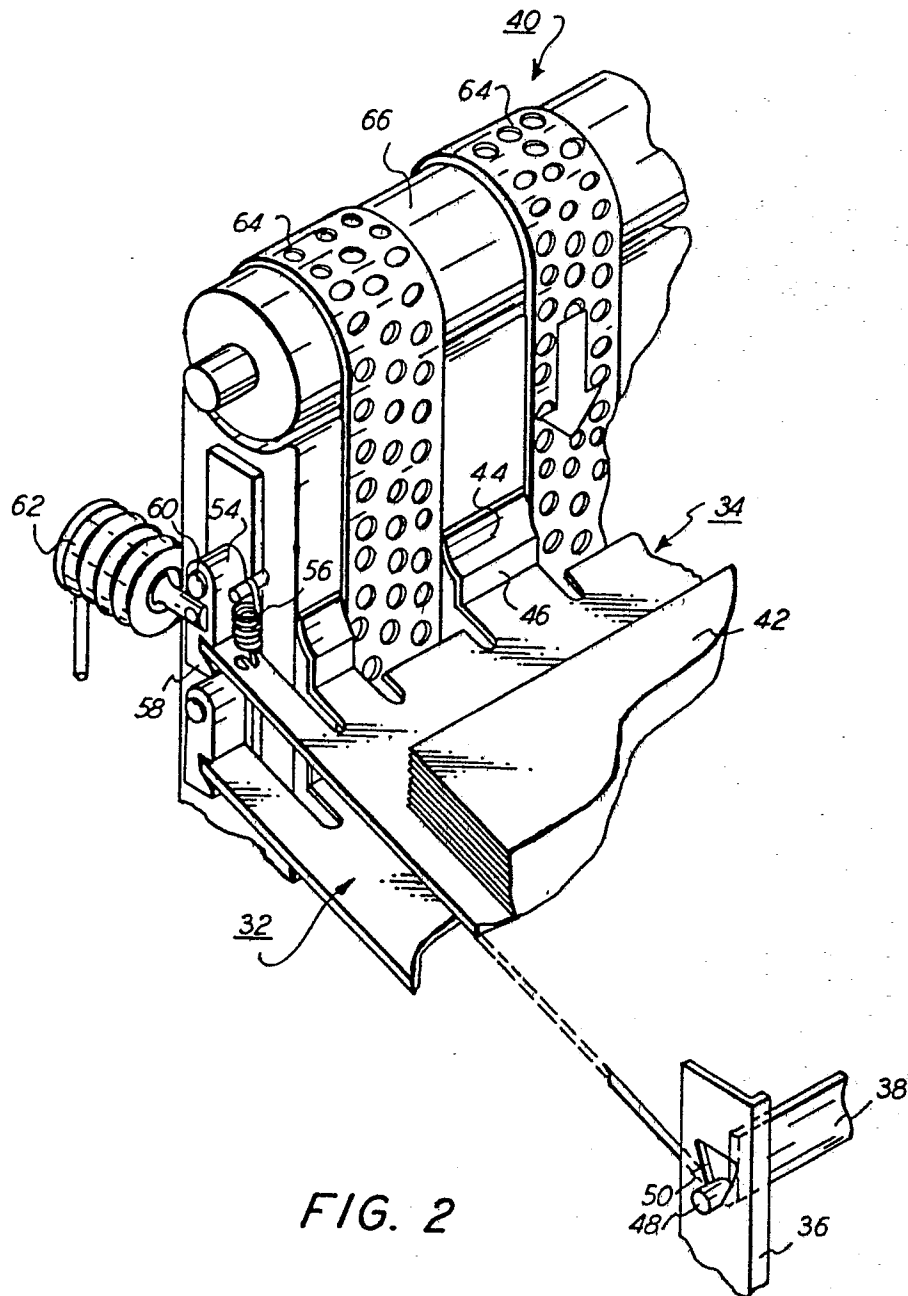
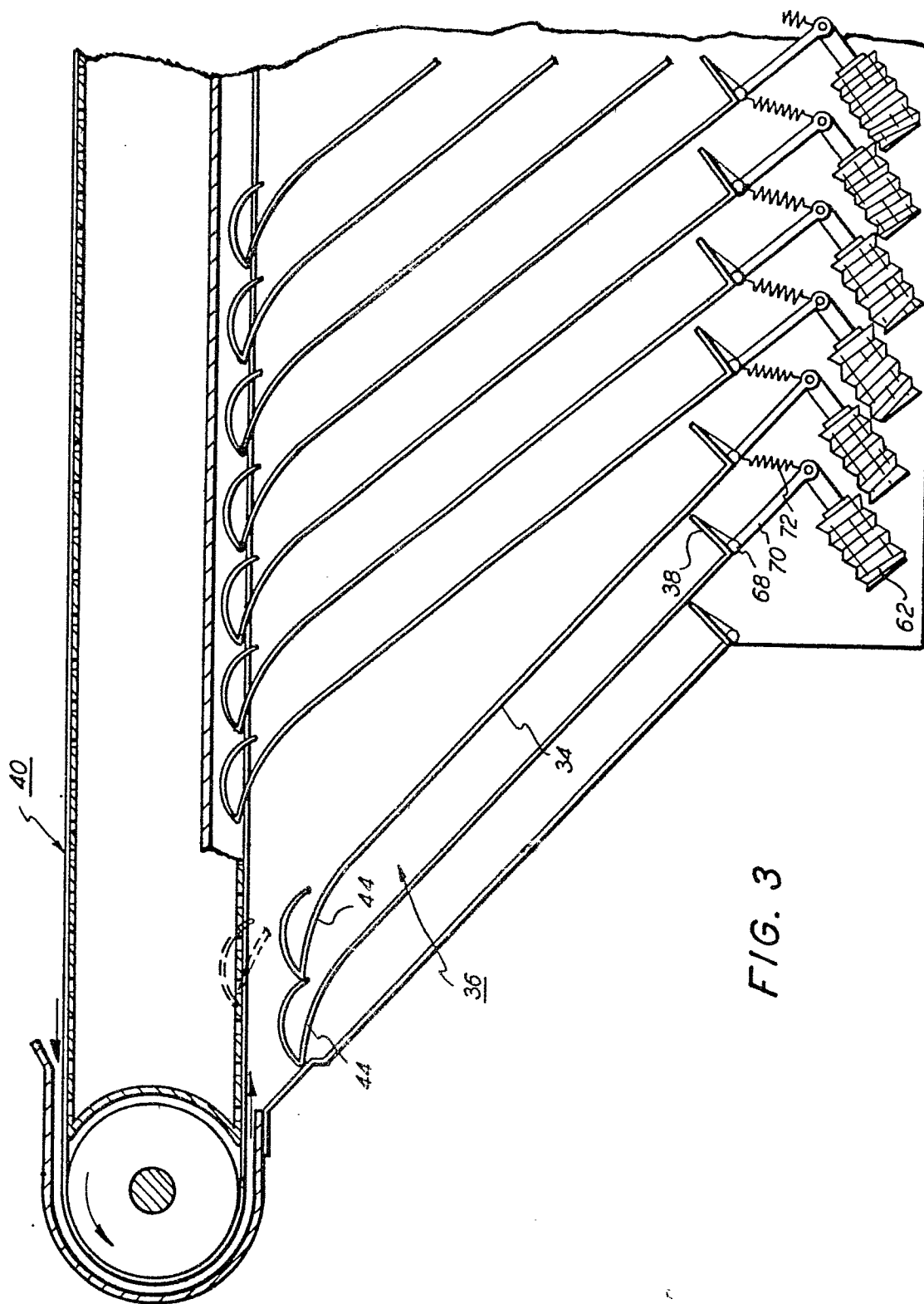
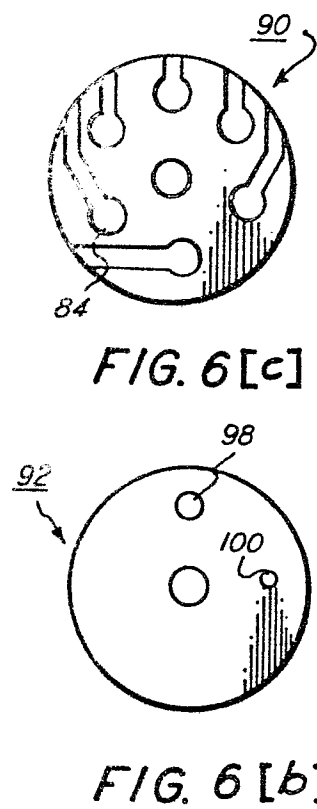
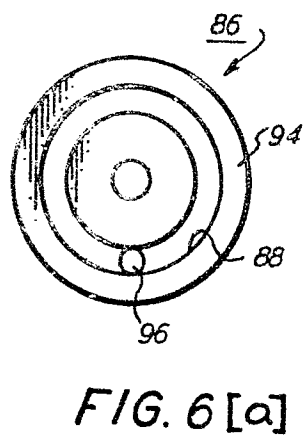
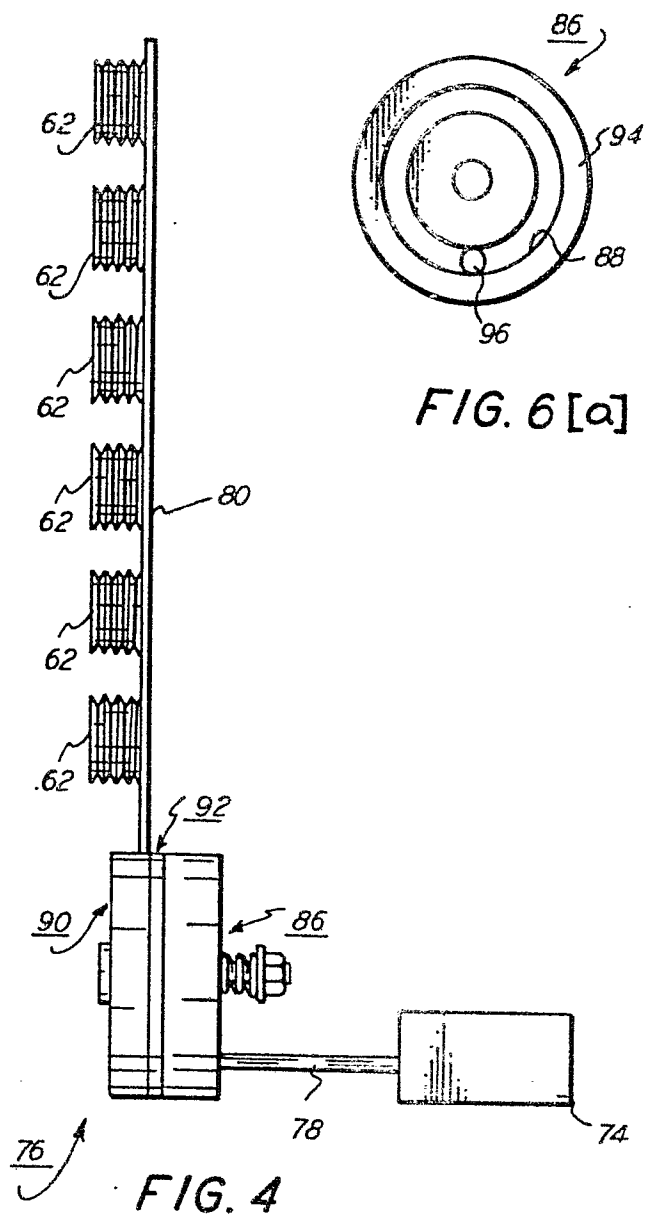


FIG. 1







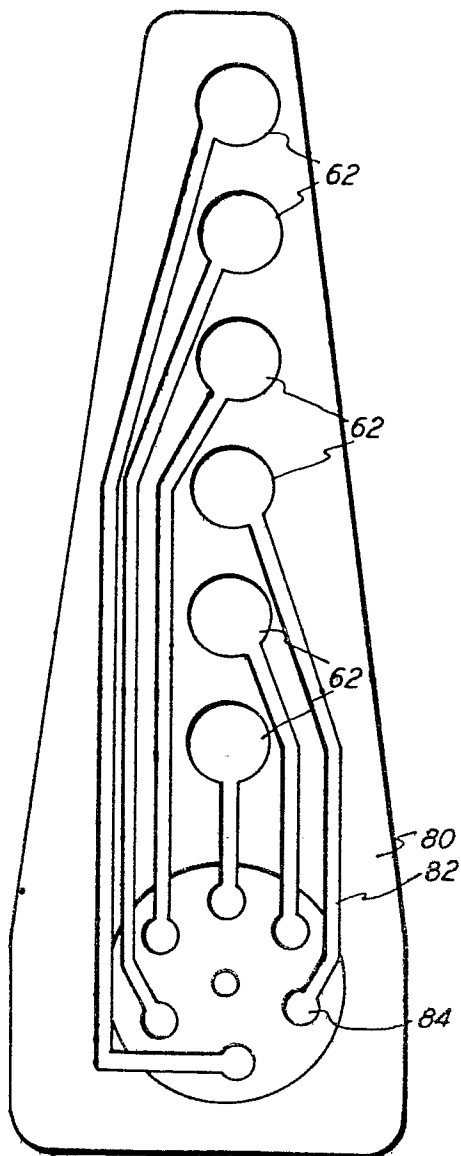


FIG. 5

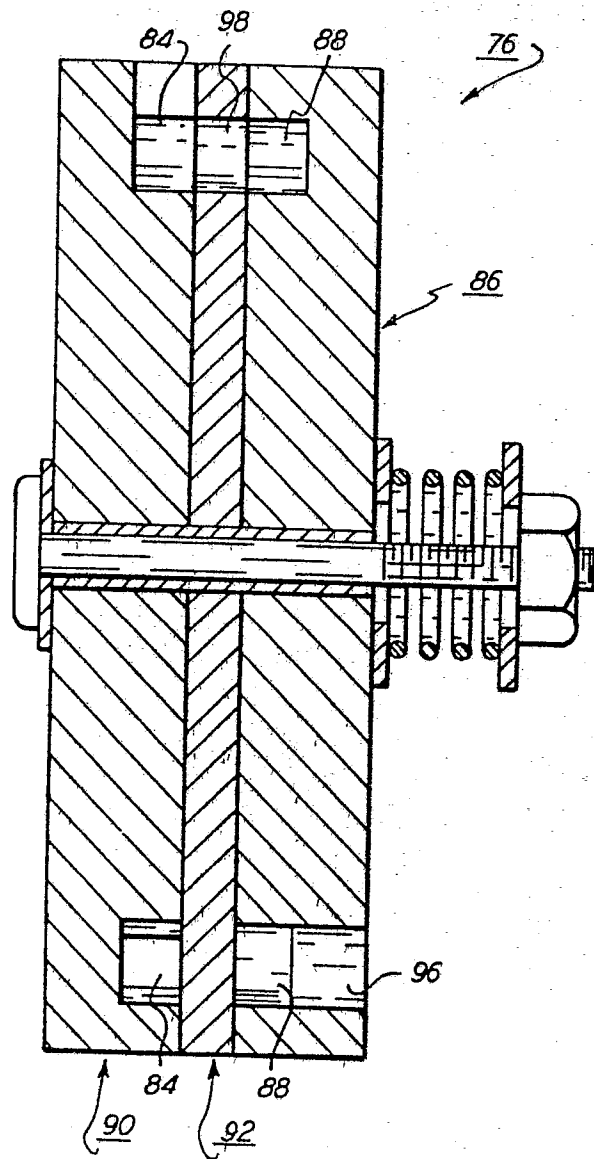


FIG. 6



European Patent  
Office

# EUROPEAN SEARCH REPORT

0012025

Application number  
EP 79 30 2735

| DOCUMENTS CONSIDERED TO BE RELEVANT  |   |                          | CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)   |
|--|---|--------------------------|--|
| Category   | Citation of document with indication, where appropriate, of relevant passages   | Relevant to claim        |  |
|  | <p>FR - A - 2 319 559 (ON APPLICANTS' NAME)</p> <p>* The complete description *</p> <p>--</p> <p>DE - A - 2 426 217 (HARRIS)</p> <p>* Page 6, lines 14-20; figure 3 *</p> <p>----</p> | <p>1-6,8-10</p> <p>1</p> | <p>B 65 H 31/24<br/>29/03</p>  |
|  |   |                          | TECHNICAL FIELDS SEARCHED (Int. Cl. 3)   |
|  |   |                          |  |
|  |   |                          | CATEGORY OF CITED DOCUMENTS  |
|  |   |                          | X: particularly relevant<br>A: technological background<br>O: non-written disclosure<br>P: intermediate document<br>T: theory or principle underlying the invention<br>E: conflicting application<br>D: document cited in the application<br>L: citation for other reasons |
|  |   |                          | &: member of the same patent family, corresponding document  |
| <input checked="" type="checkbox"/> The present search report has been drawn up for all claims |   |                          |  |
| Place of search  | Date of completion of the search  | Examiner                 |  |
| The Hague  | 12-02-1980  | LONCKE                   |  |