(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 606 134 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **94300009.1**

(51) Int. Cl.[5] : **G03G 15/00**

(22) Date of filing : **04.01.94**

(30) Priority : **04.01.93 US 329**

(43) Date of publication of application :
13.07.94 Bulletin 94/28

(84) Designated Contracting States :
DE FR GB

(71) Applicant : **XEROX CORPORATION**
Xerox Square
Rochester New York 14644 (US)

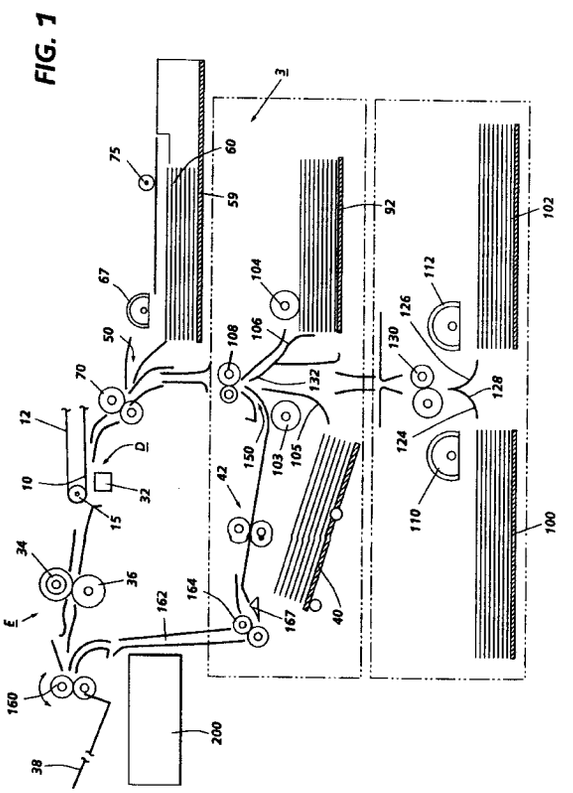
(72) Inventor : **Bober, Henry T.**
1349 Ayrault Road, Apt. 22
Fairport, New York 14450 (US)
Inventor : **Devito, Gerald M.**
2115 Evergreen Lane
Ontario, New York 14519 (US)
Inventor : **Johnston, Donald E.**
128 Beacon Hills Drive South
Penfield, New York 14526 (US)

(74) Representative : **Goode, Ian Roy et al**
Rank Xerox Patent Department,
Albion House,
55-59 New Oxford Street
London WC1A 1BS (GB)

(54) Copy sheet handling device having stacked trays.

(57) A sheet handling device for transporting sheets from multiple stacks (40,92,100,102) of sheets to a process station (D,E) of an image processing device comprising an upper drawer for supporting a plurality of the stacks of sheets (40,92) for transport to the process station, and apparatus (128,130) for transporting sheets from another stack of sheets (100,102) in a lower drawer, to the process station between two of the plurality of the stacks of sheets supported by said upper drawer. The upper drawer has an aperture therein for defining a sheet path therethrough to permit the transport of sheet by the transport apparatus. The drawer may also support a plurality of stacks of sheets (100,102).

FIG. 1



EP 0 606 134 A1

This invention relates generally to sheet handling devices and more specifically to copy sheet handler devices having stacked copy sheet input trays.

Sheet handling devices are well known and are generally referred to in two categories being document handlers, which are used to transport sheets of material bearing images including, for example, Mylar, vellum, paper and the like, and copy sheet handlers, which transport sheets of similar material which, at least initially, generally are not image bearing. Both types of handlers are frequently employed with electrophotographic printing machines. That is, printers, duplicators and copiers commonly employ sheet handling devices to transport sheets to and from image imprinting stations (e.g., a transfer station in an electrophotographic printing machine) and image reproduction or imaging input stations (e.g., an image input scanning station in an electrophotographic printing machine). This invention relates to both types of sheet handling devices, generally, but is more particular directed to application and use in copy sheet handlers which employ multiple trays for stacking sheets for selective feeding therefrom.

For example, in electrophotographic printing machines requiring copy sheet handling, the copy sheet handling devices often include at least one tray or bin for receiving copy sheets for transport to an image transfer station where the transported sheets are imaged by receiving an image developed from a latent electrostatic image on a photoconductive surface. For the convenience of the user and to increase the utility and functionality of the overall machine, such copy sheet handling devices are often provided with multiple trays so that sheets of different material and/or sizes can be used, and so that the trays can be put to different uses (e.g., a buffer tray for recirculating sheets for duplex imaging). In general, these multiple trays are arranged to feed copy sheets to a sheet transport for transport to the transfer station in which sheets may be stacked by the operator and/or by mechanical means (e.g., a buffer tray for recirculating sheets for duplex imaging).

Various apparatus and techniques have been developed and used to arrange multiple sheet trays in an effective and efficient manner. These devices include mounting the sheet trays in a stacked or vertical arrangement for feeding sheets into a common transport path and arranging the sheet trays in a horizontal substantially co-planar arrangement for feeding sheets into a common transport path. Nevertheless, there exists a need to provide for a greater number of sheet trays to increase the convenience, utility and versatility of such sheet handler devices without significantly expanding laterally the space required in those having horizontally arranged sheet trays or the vertical space in those having vertically arranged sheet trays.

US-A-4,901,117 discloses a sheet feeder having plural copy sheet trays for retaining sheets to be fed therefrom to a common path for transport to a transfer station of an electrophotographic printing machine. The sheet trays are arranged in a substantially horizontal plane with respect to each other.

US-A-4,660,963 discloses a sheet feeder having plural copy sheet trays for retaining sheets to be fed therefrom to a common path for transport to a transfer station of an electrophotographic printing machine. As further disclosed within this reference, both trays from which copy sheets are fed are disposed in a substantially horizontal co-planar arrangement in a unitary drawer which can be slide away from the printing machine to load sheets, as desired. The device also includes a mechanical loading apparatus for one of the trays so that sheet previously imaged are returned for later duplex imaging.

US-A-4,605,215 discloses a plurality of trays of a sheet handling device arranged in a stack fashion for feeding sheets along a common path to a processing station. In this reference, the sheets are fed from vertically arranged sheet trays so that sheets fed by a collecting roller from a lower tray pass the entrance area where sheets from other trays feed into the common path.

In accordance with one aspect of the present invention, there is provided a sheet handling device for transporting sheets from multiple stacks of sheets to a process station of an image processing apparatus, which comprises means for supporting at least two stacks of sheets having respective leading edges opposed from one another. The invention further comprises means, disposed in the region of the leading edges of the two stacks of sheets, for moving sheets to the process station from either of the two stacks of sheets with sheets being moved from one stack in a direction opposed to the direction of movement from the other stack and along a common path to the process station, and means for supporting a third stack of sheets and advancing sheets therefrom between the stacks of sheets of the two stacks of sheets to the common path. The supporting means of this aspect can include a drawer defining apertures to form a sheet path therethrough, and further that the drawer supports the two stacks of sheets substantially opposite one another. The moving means of this aspect can also comprise means for feeding sheets from said two stacks of sheets.

In accordance with a further aspect of this invention, there is provided a sheet handling device for transporting sheets to a process station of an image processing apparatus along a common path comprising means for supporting at least two stacks of sheets having respective leading edges opposed from one another, first means for feeding sheets from one of the two stacks of sheets to the common path, second means for feeding sheets from the other of the two stacks of sheets to the common path, and third

means, receiving sheets from the first feeding means and the second feeding means for feeding sheets to the image processing apparatus. The supporting means of this aspect may comprise a drawer for supporting the two stacks of sheets wherein the drawer defines an aperture with the third feeding means including a sheet path extending through the aperture in the drawer. The first and second feeding means of this aspect of the invention also can include opposite, upwardly inclined surfaces formed in the drawer and means for urging sheets along the surfaces with the aperture in the drawer being disposed between the upwardly inclined surfaces as to transport sheets fed by the first, the second and the third sheet feeding means in the common path and also include a first tray and a second tray supported in the drawer with the first tray and the second tray being adapted to receive sheets. This aspect of the invention can also comprise means for automatically delivering sheets to one of the trays so that the delivered sheet are retained for feeding to the common path.

According to yet another aspect of the present invention there is provided a method for transporting sheets from multiple stacks of sheets to a process station of an image processing device along a common path comprising the steps of: supporting within a drawer a plurality of stacks of sheets, feeding sheets from the plurality of the stacks of sheets to the process station along the common path, and transporting sheets between two of the plurality of stacks of sheets supported by the drawer from another stack of the multiple stacks of sheets along the common path. This method can further comprise the step of urging sheets from a stack of the multiple stacks of sheets between two of the stacks of sheets supported by the drawer to the common path. This aspect can also further comprise the steps of supporting a stack of sheets in a second drawer and moving the sheets from the stack in the second drawer through an aperture within the first drawer.

According to still yet a further aspect of the present invention there is provided a sheet handling device for transporting sheets from multiple stacks of sheets to a process station of an image processing apparatus comprising means for supporting at least two stacks of sheets having respective leading edges opposed from one another, means for supporting a third stack of sheets, and means, disposed in the region of the leading edges of said stacks of sheets, for moving sheets to the process station from either of the three stacks of sheets with sheets being moved from one of said two stacks in a direction opposed to the direction of movement from the other of the stacks and along a common path to the process station, and from the third stack of sheets between the stacks of sheets of the two stacks of sheets to the common path. The two stack supporting means of this aspect of the invention can define an aperture to form a sheet path therethrough and can be a first drawer. The third stack supporting means can also support a fourth stack, and, in addition, moving means can be included for urging sheets from the fourth stack to the common path. The third stack supporting means can also be a second drawer.

According to yet another aspect of the present invention there is provided in a printing machine of the type having drawers for storing sheets, sheet feeders, and connecting sheet paths for feeding the sheets to a process station of the printing machine, an improvement comprising at least two separate drawers, and sheet feeding means and a connecting sheet path for feeding the sheets from one of said drawers centrally through the other of said drawers to the process station. The drawers of this aspect of the invention may comprise a lower drawer, and an upper drawer superimposed over said lower drawer, and, further the upper drawer may be formed to have at least two sheet trays therein with sheets from the lower drawer being fed therebetween to the process station. The lower drawer of this aspect may be formed to have at least two sheet trays therein with sheets from either of the sheet trays being fed centrally between the sheet trays of the upper drawer to the process station.

Other aspects of the present invention will become apparent as the following description proceeds and upon reference to the drawings, in which:

Figure 1 is an enlarged elevational view of a sheet handler system incorporating the features of the present invention therein; and

Figure 2 is an exploded perspective view showing the drawers of the Figure 1 sheet handler system.

The invention will now be discussed in greater detail with respect to Figure 1 which represents a copy sheet handling device or transport 3 constructed in accordance with the present invention. The transport in this embodiment is adapted for feeding sheets to image processing stations. In this embodiment, the sheets are fed to stations D and E of an illustrative electrophotographic printing machine (otherwise not shown). The station D is a transfer station having a belt 10 with a photoconductive surface 12 and corona generator device 32 positioned thereat. The exemplary fusing station E comprises a heated roll 34 engaged by a pressure roll 36 forming a sheet receiving nip. A motor (not shown) is suitably connected to actuate the rollers so that sheets in the nip are urged therethrough.

The copy sheet transport 3 depicted in Figure 1 includes a sheet feeding means which includes a removable cartridge or cassette 59 in which sheets 60 may be positioned for feeding by a segmented roll 67 along a path 50 to registration rolls 70. The feeding means also includes a bypass feeding means which includes a driving roll 75 for transporting sheets un-

der the segmented roll 67, in the position shown, to the path 50 and registration rolls 70.

The copy sheet transport 3 also includes a first sheet tray 40 and a second sheet tray 92 on a substantially horizontal plane, with a third sheet tray 100 and a fourth sheet tray 102 positioned substantially vertically below the trays 40 and 92, respectively. Both trays 100 and 102 are positioned in substantially the same horizontal plane. Preferably, the trays 40 and 92 are supported in a slidable drawer mechanism, as are the trays 100 and 102. This aspect of the present invention will be discussed in greater detail below with respect to Figure 2.

Sheets positioned in each of the stacks may be selectively fed to the depicted stations D and E. Sheets from the stack disposed in trays 40 and 92 are fed by feed rolls 103 and 104, respectively. These feed rolls and the trays may be mounted in a suitable known manner, but it is preferred that they are mounted on a toggle carriage, substantially as described and disclosed in US-A-4,660,963, to enable selective feeding from the trays 40 and 92. Sheets fed by the feed roll 103 from tray 40 are urged along a concave baffled surface 105 for transport upwardly from the stack of sheets to take away rolls 108. Sheets from the stack of sheets in tray 92 are fed by the feed roll 104 along a baffle surface 106 to the take away rolls 108.

Sheets from the stack of sheets in the tray 100 and sheets from the stack of sheets in tray 102 are fed from their respective stacks in substantially the same manner by selectively actuable segmented feed rolls 110 and 112, respectively. The feed rolls 110 and 112, when feeding sheets from the respective stacks with which they are associated, are rotated into frictional engagement with the top sheet to urge the top sheet along one of concave surfaces 124 and 126 of double sided baffle 128 to the lower take away rolls 130. The lower take away rolls 130 urge sheets therein upwardly to the take away rolls 108 through an aperture 132 formed between the baffle surface 105 and the baffle surface 106. Sheets engaged by the take away rolls 108 are transported in a common transport path to the process stations D and E.

Specifically, sheets selectively fed from the trays 40, 92, 100, and 102, as well as sheets fed along a path 150 at the end of a trayless duplex path (see below), follow a common path through the take away rolls 108. These sheets are urged along the common path by the take away rolls 108 to registration rolls 70 to promote registered transport of the sheets through the transfer station D and to urge the sheets through the station D and to the fusing station E. The fuser station E, comprising heating roll 34 and pressure roll 36, is actuated so that toner images on sheets passing therethrough are fixed to the sheets and the sheets are also urged to reversible rolls 160. The reversible rolls 160 initially are rotated to urge a sheet partly into output tray 38. The action of the rolls 160 may continue so as to deposit the sheet in the tray 38 or may be reversed to drive a sheet therein along a return path 162, which includes driving rolls 164 and a gate 167. The gate is selectably positionable to direct sheets along immediate or trayless duplexing path 42 for return along the path 150 to the common path through the take away rolls 108, or into tray 40 for selective return to the common path, for second side imaging.

It will be understood that known sheet feeding enhancements and apparatus are contemplated to be used in connection with the above described feeding of sheets from the trays 40, 92, 100 and 102, as well as the transport of sheets along the path 150. The following are provided by way of example and are not meant to be limiting. Retard pads may be positioned on the baffle surfaces 105 and 106 to inhibit feeding of multiple sheets when sheets are fed from the trays 40 and 92, respectively Furthermore, these alternative sheet feeding apparatus usable herein, for example, and without limitation, include forward buckle snubber feeders and retard belt feeders used to feed sheets from one or more of the trays, as is also well known in the art.

Further, some or all of the trays 40, 92, 100, and 102 are preferably supported so that they are either actuable from a first loading position to a feeding position or biased by a spring mechanism. Thus, as the stack height is reduced (and presumably the weight) the tray or a portion thereof is raised so that the distance between the top sheet in a tray and its associated sheet feeding means remains relatively constant, regardless of the number of sheets supported within the tray (assuming that the sheets are within a reasonable limit and that there is at least one sheet in the tray). US-A-4,660,963, by way of example, provides and discloses the preferred method and apparatus for constructing, operating, and supporting the feed trays used in connection with this invention.

Finally, as will be also understood, the control signals for the sheet handler operation are provided by controller 200, which is preferably a conventional microprocessor system, as exemplified, for example, in US-A-4,475,156. It is contemplated that the controller controls all machine steps and functions described herein, as well as that of any and/or all apparatus and devices associated with the sheet handler, such as, for example, an electrophotographic printing machine.

Reference is now made to Figure 2, which is an exploded perspective view of an arrangement of the trays 40, 92, 100, and 102 within a housing 169 comprising a first and a second module 170 and 172, respectively. Specifically, the first and the second trays 40 and 92 are disposed in the first module 170 which includes a frame 176 and a drawer 178. The drawer is slidably mounted in the frame, and the first

and the second trays 40 and 92 are supported within the drawer 178.

The third and the fourth trays 100 and 102 are disposed in the second module 172 having a frame 186 and a drawer 188. The drawer 188 is slidably supported in the frame 186, and the drawer 188 supports the third and the fourth trays 100 and 102. It will be understood that the drawers 178 and 188 are slidable from their respective frames 176 and 186 to enable access to the trays for loading sheets therein, and for clearing jams and misfeeds, servicing, and for other like activities. In this instance, a second housing 190 positioned on top of the housing 169 is of the type used to house an electrophotographic printing machine. It will be understood that its inclusion herein is illustrative and not limiting. Furthermore, it will also be understood that the sheet feeding apparatus for feeding sheets from the trays 42, 90, 100 and 102, as well as a return path for mechanically stacking sheets in tray 42, for example, have not been shown for clarity. It will also be appreciated that a single module for supporting the drawers 178 and 188 can be used instead of the first and second modules 170 and 172.

In recapitulation, a sheet handling system which transports sheets from multiple stacks of sheets to a process station of an image processing apparatus has been described. Specifically, the device includes a drawer for supporting a plurality of stacks of sheets for feeding to the process station and a sheet transport for transporting sheets to the process station between two of the plurality of stacks of sheets supported by the drawer from another of the multiple stacks of sheets A sheet path defined through the drawer has also been described so that sheets disposed in a lower drawer may be directed therethrough. Further, a sheet handling device for transporting sheets along a common path has been described.

Claims

1. A sheet handling device for transporting sheets from multiple stacks of sheets to a process station (D,E) of an image processing apparatus comprising:

   means for supporting at least two stacks of sheets (40,92) having respective leading edges opposed from one another;

   means (103,104), disposed in the region of the leading edges of said two stacks of sheets, for moving sheets to the process station from either of said two stacks of sheets with sheets being moved from one stack in a direction opposed to the direction of movement from the other stack and along a common path (108) to the process station; and

   means for supporting a third stack of sheets (100) and means (130) for advancing sheets therefrom between the stacks of sheets of said two stacks of sheets to the common path.

2. The device of claim 1, wherein said supporting means comprises a drawer (178) defining apertures to form a sheet path therethrough.

3. A sheet handling device for transporting sheets to a process station (D,E) of an image processing apparatus along a common path (108), comprising:

   means for supporting at least two stacks of sheets (40,92) having respective leading edges opposed from one another;

   first means (103) for feeding sheets from one of said two stacks of sheets to the common path (108);

   second means (104) for feeding sheets from the other of said two stacks of sheets to the common path (108); and

   third means (42) for receiving sheets already fed by said first feeding means or said second feeding means and re-feeding such sheets to the common path for second side imaging.

4. The device of claim 3, wherein said supporting means comprises a drawer (178) for supporting said two stacks of sheets.

5. The device of claim 4, wherein said drawer defines an aperture (132), said third feeding means including a sheet path extending through the aperture in said drawer.

6. The device of claim 5, wherein said first and second feeding means include opposite, upwardly inclined surfaces (105,106) formed in said drawer and means (103,104) for urging sheets along said surfaces with the aperture (132) in said drawer being disposed between said upwardly inclined surfaces so as to transport sheets fed by said first, said second and said third sheet feeding means into the common path

7. A method for transporting sheets from multiple stacks of sheets (40,92) to a process station (D,E) of an image processing device along a common path (108) comprising the steps of:

   supporting within a drawer (178) a plurality of stacks of sheets (40,92);

   feeding sheets from the plurality of the stacks of sheets to the process station along the common path; and

   transporting (128,130) sheets between two of the plurality of stacks of sheets supported by the drawer from another stack (100) of the multiple stacks of sheets along the common path.

8. A printing machine of the type having drawers for storing sheets, sheet feeders, and connecting sheet paths for feeding the sheets to a process station of the printing machine, the machine including:

at least two separate drawers (178,188); and

sheet feeding means (128,130) and a connecting sheet path for feeding the sheets from one of said drawers (188) centrally through the other of said drawers (178) to the process station.

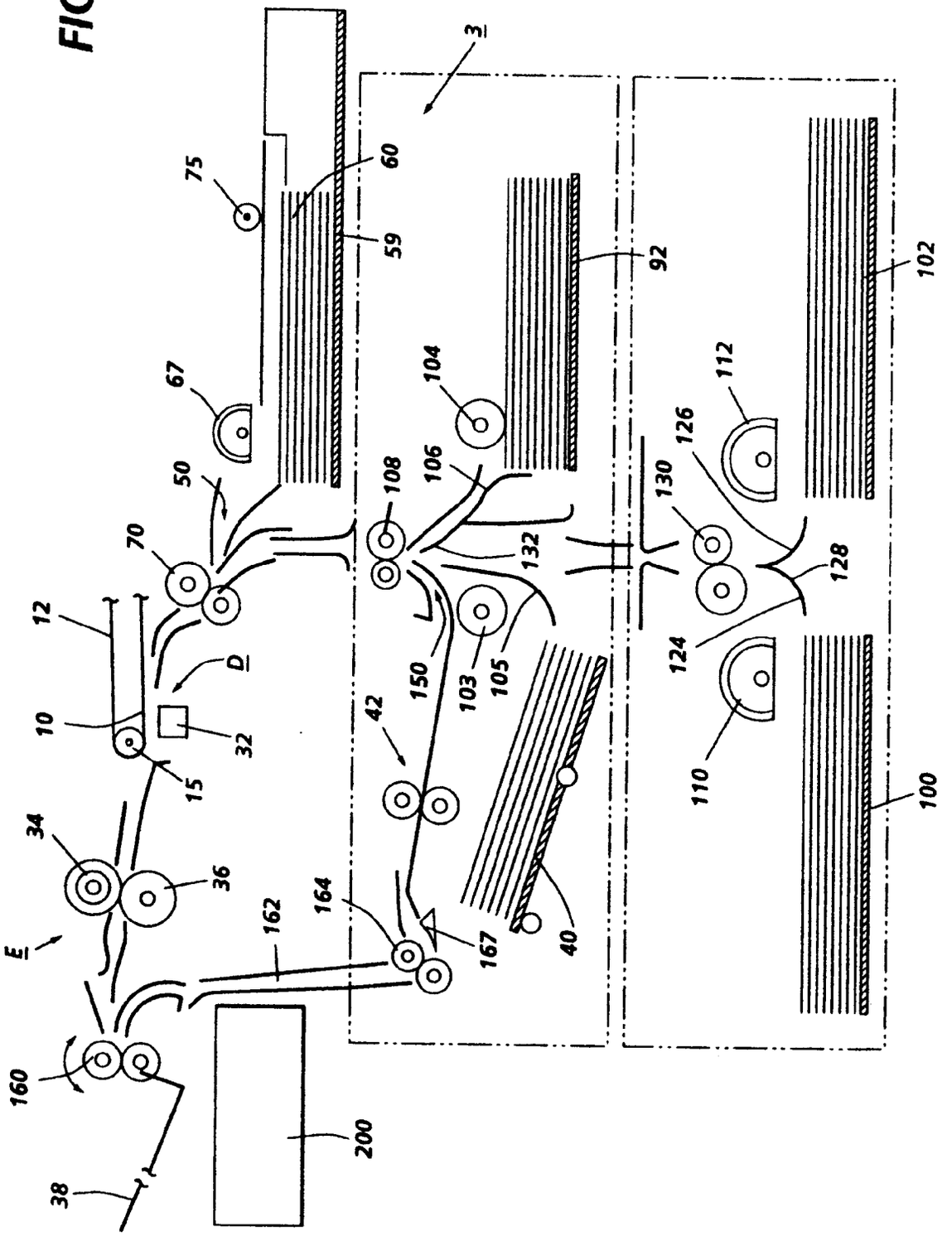
9. The printing machine of claim 8, wherein said drawers comprise:

a lower drawer (188); and

an upper drawer (178) superimposed over said lower drawer.

10. The printing machine of claim 9, wherein said upper drawer (178) has at least two sheet trays (40,92) therein with sheets from said lower drawer being fed therebetween to the process station.

FIG. 1


3
75
60
59
92
102
67
104
112
50
108
106
126
130
70
132
128
12
D
150
103
105
124
10
32
42
15
34
36
110
100
E
162
164
167
40
160
200
38

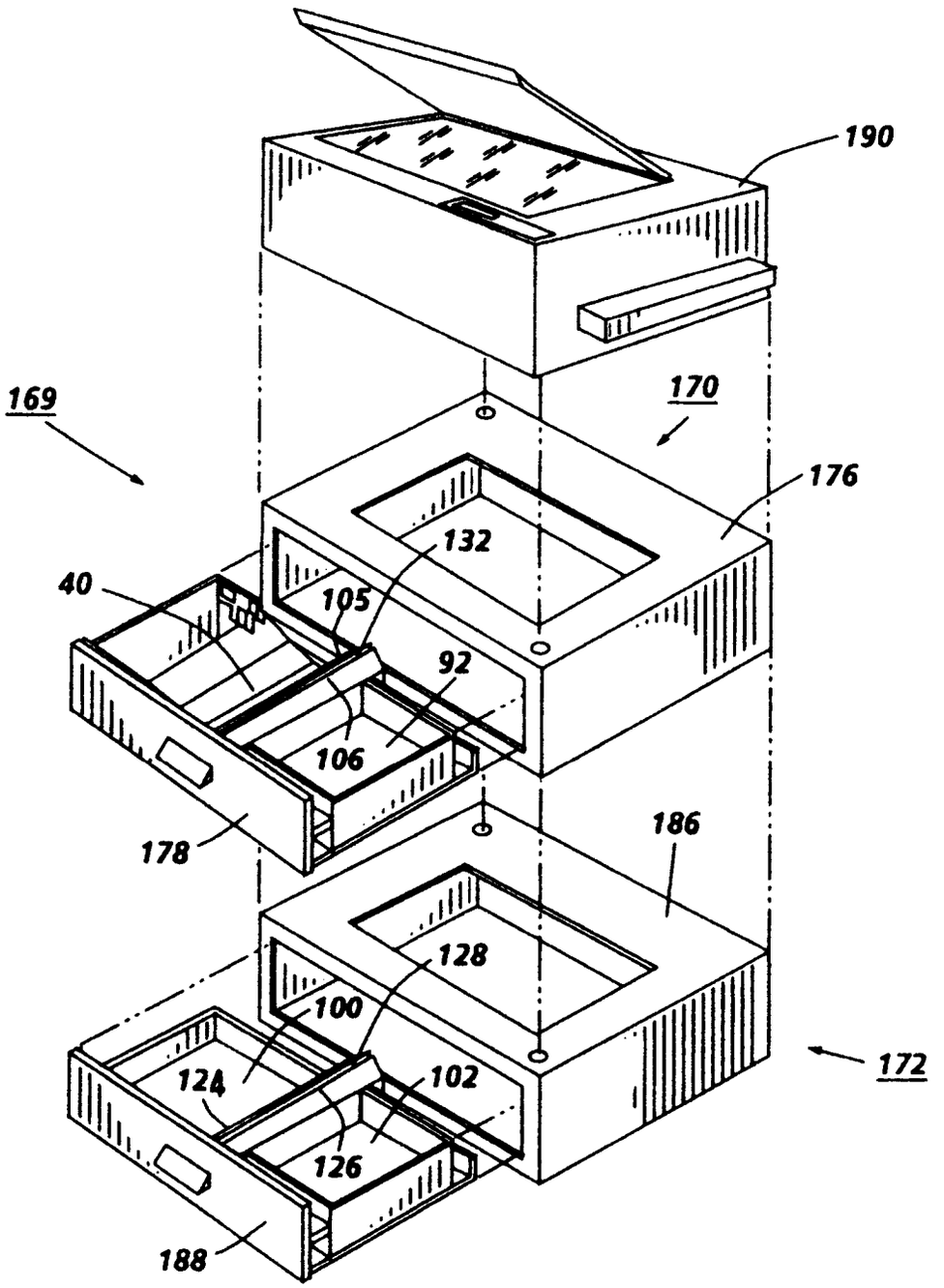

190
169
170
176
132
40
105
92
106
178
186
128
100
172
124
102
126
188

FIG. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 0009

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.5)
X Y	US-A-5 049 946 (HARADA) * abstract; figures 8-11 * * column 7, line 24 - column 10, line 31 *	1-5,8-10 6,7	G03G15/00
D,Y D,A	EP-A-0 238 761 (XEROX CORP.) * the whole document *	6,7,10 1-5,8,9	
X Y	US-A-5 130 759 (FUSHIMI ET AL.) * abstract; figures * * column 3, line 51 - column 4, line 24 * * column 5, line 13 - line 50 *	8,9 10	
D,A	EP-A-0 141 566 (MERCANTE INTERNATIONAL A/S) * the whole document *	1,3,7,8	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)
G03G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 April 1994	Leisner, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)