

[54] SHEET SORTING APPARATUS
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[51] Int. Cl. B65h 29/60
[58] Field of Search 271/173, 64, 65, 66;
270/58, 59, 60

[56] References Cited
UNITED STATES PATENTS
3,774,902 11/1973 Schulze 271/64 X
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[57] ABSTRACT

Sorting apparatus for collating both simplex and duplex copies from a copying machine in which tray assemblies are opened and fed sheets by reciprocating apparatus moved past the tray assemblies. Tray assemblies are hinged at one end to pivot through an arc of about 15° when engaged by camming member of reciprocating apparatus. Deflector fingers are operatively associated with reciprocating apparatus to deflect sheet from transport as tray assembly is pivoted opened.

5 Claims, 3 Drawing Figures

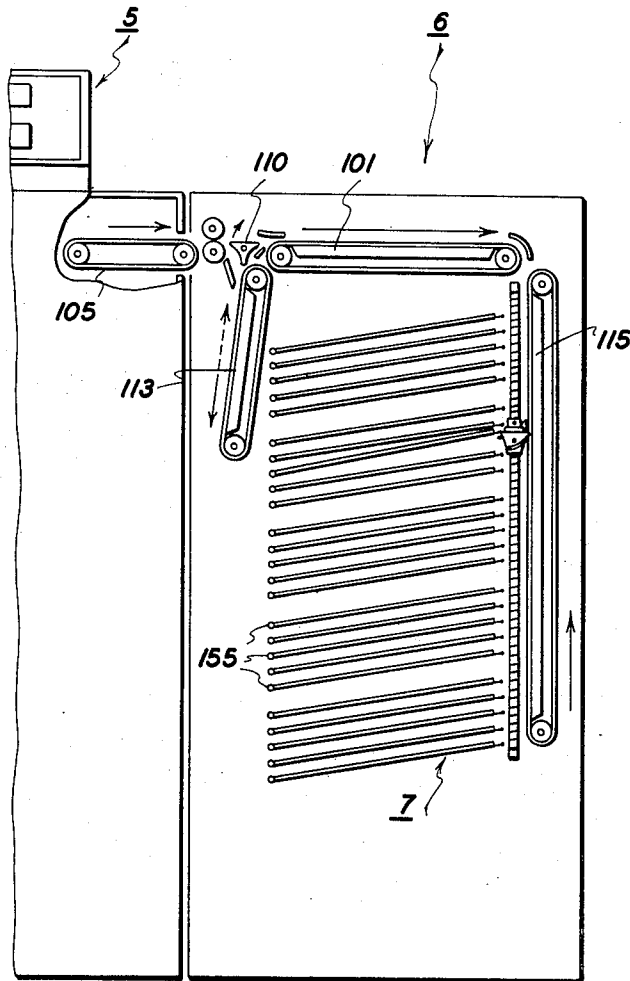
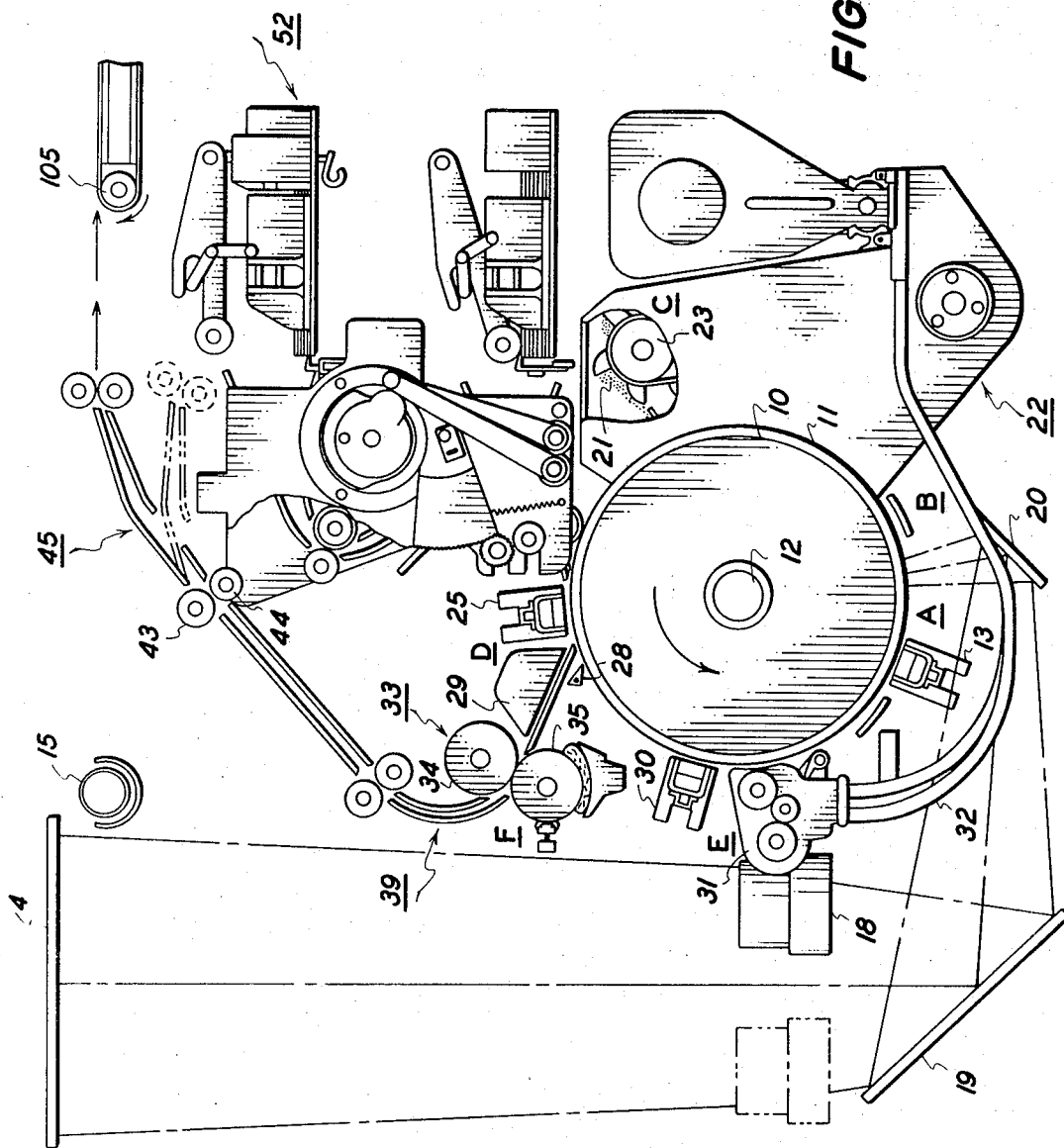


FIG. 1



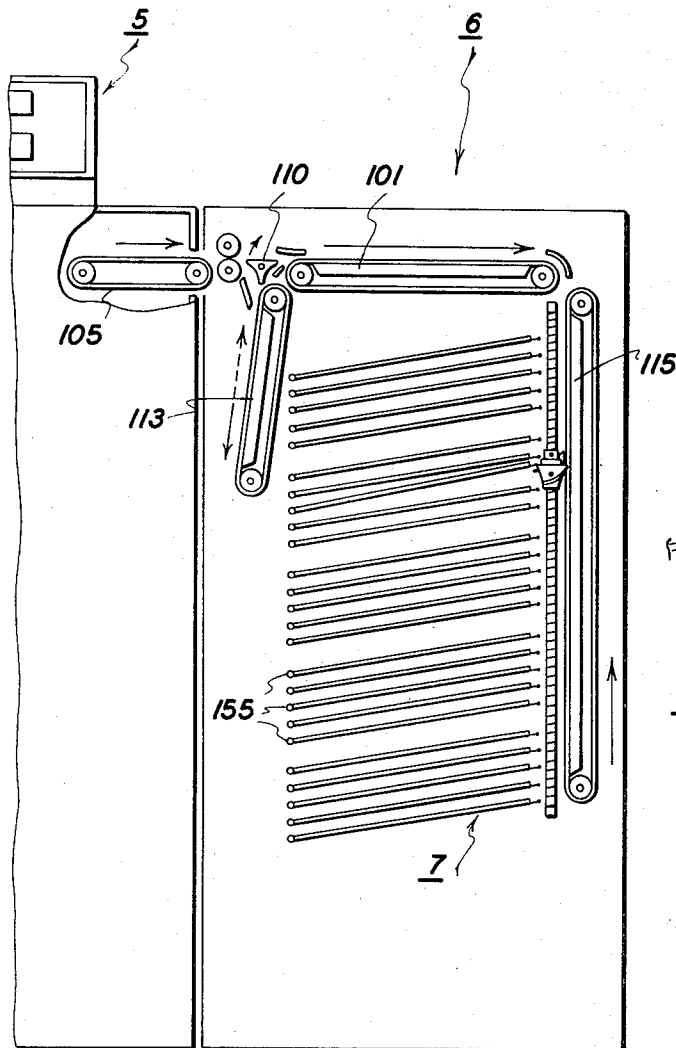


FIG. 2

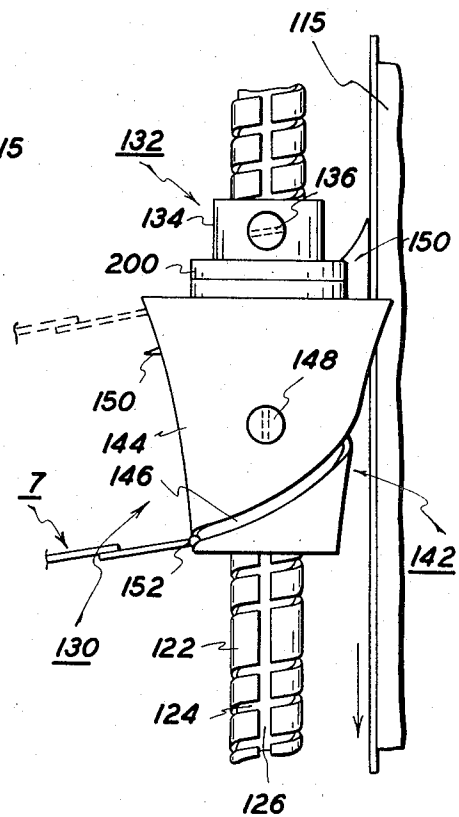


FIG. 3

SHEET SORTING APPARATUS

This invention relates to apparatus for sorting copies advanced from a high speed copier/duplicator into collated sets in a compact area.

In copier/duplicator systems sorters normally have included sorting bin modular units with a multitude of trays as described in U.S. Pat. Nos. 3,561,754, 3,356,362, 2,876,008, 2,951,697, and 3,076,647. While these constructions are satisfactory they have certain disadvantages such as the number of trays that can be accommodated in a compact space and the ease at which the trays can be unloaded.

The present invention is, generally speaking, a sorter/collator adapted for universal usage with the copier/duplicator of all types. The compact arrangement of the bins or trays and the manner in which they receive copy sheets enables a highly reliable copier sorter/collator system for rapid distribution of copy sheets into collated sets.

It is therefore a general object of this invention to improve distribution of copy sheets.

It is another object of this invention to enable the distribution of copy sheets in collated sets in a reliably manner.

It is still a further object of the invention to achieve sorting of copy sheets into a tray configuration which is simple and compact in construction.

It is still a further object of the invention to reduce significantly the level of noise normally associated with the sorting of sheet material.

The above and added advantages of the present invention will be more apparent after read the following detailed description which refers to the accompanying drawings in which:

FIG. 1 is a schematic view of a xerographic copier/duplicator machine producing copies to be sorted by sorting apparatus according to the present invention;

FIG. 2 is a side view of sorting apparatus according to the present invention; and

FIG. 3 is an exploded view illustrating details of the feed and tray lift apparatus of the invention.

FIG. 1 shows a schematic of the copier/duplicator system generally designated 2 including a copier machine 3, which is a high speed copier/duplicator capable of producing simplex or duplex copies at the option of a machine operator. The copier machine 3 has a platen 4 for receiving documents to be reproduced, and a control panel 5 (FIG. 2) which includes various control knobs, buttons, and switches for selecting various modes of operation such as simplex and duplex copies and the number of copies to be reproduced. In accordance with the invention, the copier/duplicator system includes a sorting apparatus 6 having tray assemblies 7 (FIG. 2).

The copier/duplicator system includes an automatic xerographic apparatus which includes a photosensitive plate including a photoconductive layer 10 that is placed over a conductive backing. The plate is formed in the shape of a drum 11 and the drum mounted upon a shaft 12 that is journaled for rotation in the machine frame. Basically, the xerographic drum is rotated in the direction indicated so as to pass sequentially through a series of xerographic processing stations. The photosensitive drum and the xerographic processing apparatus are driven at predetermined speeds relative to each other from a drive system (notshown) and the opera-

tion thereof coordinated in order to produce proper co-operation of the various processing mechanisms.

The original to be reproduced, is placed upon a transparent horizontally supported platen 4 and the original scanned by means of a moving optical scanning system and to produce a flowing light image of the original. The scanning system includes an elongated horizontal extended aperture lamp 15 and movable lens element 18.

The lamp and lens element moves in coordination across the object supported upon the platen to focus successive incremental bands of illumination reflected from the object onto the moving drum surface at synchronous speeds therewith. The optical path is folded by means of a pair of image mirrors 19 and 20 interposed between the lens and the drum surface, the drum is first uniformly charged by means of a corona generator 13 positioned in charging station A. Under the influence of the flowing light image, the uniformly charged photoconductive surface is selectively dissipated in the non-image areas to form what is commonly known as a "latent electrostatic image."

The latent electrostatic image is carried on the drum surface from the exposure station into the developing station C. The developing station primarily is comprised of a developer housing 22 adapted to support a supply of two-component developer material 21 therein. The developer material is transported by means of a bucket system 23 from the bottom of the developer housing to an elevated position where the material is delivered into the active development zone. The developer material is caused to flow downwardly in contact with the upwardly moving drum surface under closely controlled conditions wherein charged toner particles are attracted from the developer mix into the image areas on the plate surface thus making the image visible.

The moving drum surface next transports the developed xerographic image to a transfer station D. Cut sheets of final support material are also moved into the transfer station, the backside of the copy sheet is sprayed with an ion discharge from a transfer corotron 25 inducing on the sheet a charge having a polarity and magnitude sufficient to attract the toner material from the drum surface to the final support material. This induced charge also electrostatically tacks the final support material to the drum surface. In order to remove the copy sheet from the drum surface, a stripper finger 28 is positioned downstream from the transfer corotron. The finger is arranged to move between the drum surface and the copy sheet and lifts the sheet from the drum surface and the copy sheet is directed along a predetermined path of travel into contact with a stationary vacuum transport 29.

Although a preponderance of the toner material is transferred from the drum surface to the copy sheet during the transfer process, invariably some residual toner remains behind on the drum surface after transfer. This residual toner is transported on the drum surface into a cleaning station E where it is brought under the influence of a cleaning corotron 30 adapted to neutralize the electrostatic charge tending to hold the residual toner to the drum surface. The neutralized toner is mechanically cleaned from the drum surface by means of a brush or the like and the toner collected within a housing 31. A conveyor moving in an endless loop through tubes 32 transports the collected residual

toner back to the developer housing where it is deposited within the developer mix so that it can be once again re-used in the xerographic developing process.

The copy sheet, which has been removed from the drum surface after the transfer operation, is moved along stationary transport 29 into fusing station F. The fuser 33 is basically made up of an upper fuser roll 34 and a lower fuser roll 35 mounted in operative relation to each other and arranged to coact so as to support a sheet of material in pressure driving contact therebetween. The lower roll is heated. As the heated roll is rotated in the direction indicated, the heated surface of the lower roll is pressed into intimate contact with the image face of the support sheet. Mechanical and heat energy transported from the roll surface to the support sheet permanently bond the toner particles to the support material.

Upon leaving the fuser, the fixed copy sheet is passed through a curvilinear sheet guide system, generally referred to as 39, into cooperating advancing rolls 43 and 44. At this point, depending on the mode of operation selected, the copy sheet is either forwarded directly to the sorter or into the upper tray 52 by means of a movable sheet guide 45 before entering the sorter.

It is believed that the foregoing description is sufficient for purposes of the present application to show the general operation of a xerographic reproducing machine. For a more detailed explanation of the copier/duplicator xerographic components reference is made to U.S. Pat. No. 3,645,615 entitled Copying Apparatus.

Sorting Apparatus (FIG. 2 and 3)

Sorter apparatus 6 includes a vacuum transport 101 which receives copy sheets from a transport 105 of the copier machine. A deflector gate member 110 is positioned in front of the entrance to transport 101 to direct the copy sheet first onto another vacuum transport 113 when operating in the duplex mode of operation. Vacuum transport 113 is reversibly driven by any suitable device to reverse the copy sheet with trailing edge first onto transport 101. For simplex mode of operation the gate member 110 is positioned to permit the sheet to pass directly onto transport 101. The copy sheets advance from transport 101 onto another vacuum transport 115 from which they are directed to the tray assemblies 7 by a feed and tray lift apparatus as will be described hereinafter.

The feed and tray lift apparatus includes a cam member 122 which is formed with a spiral shaped groove 124 and a linear groove 126. A head assembly 130 includes a feed section 132 which includes a cylinder 134 carrying a pin member 136 which is received in spiral groove 124. A plurality of deflector fingers 150 are carried by the feed section. As cam member 122 rotates, cylinder 134 does not rotate. Cylinder 134 is indexed up or down upon each revolution of cam member 122. Pin member 136 serves to elevate the head assembly 130 due to a spiral groove 124.

A camming section 142 includes a tapered conical member 144 having a spiral groove 146 formed therein. Camming section 141 is attached to cylinder 134 through a bearing 200 such that bearing section 132 and camming section 142 are fixed in vertical relationship but able to rotate relative to each other. A pin member 148 is received in linear groove 126 causing conical member 144 to rotate with cam member 122 and yet enable conical member 144 to index up and

down with cylinder 134 which does not rotate. Groove 146 receives cam follower portion 152 extending from each of the tray assemblies 7. It will be noted that the tray assemblies which are closely spaced from about one-half inch to about five-eighths inch apart are pivotally mounted on pin members 155 to pivot through an angle of about 15° at the proper time or when a sheet is fed into the particular tray assembly.

In operation the feed and tray lift apparatus deflects a sheet from transport 115 into a particular tray assembly as feed section 134 and deflector fingers 150 move vertically pass the tray assemblies at the same time camming section 142 pivots a tray assembly into the opened position as best shown in the solid and dashed lines in FIG. 3. As the camming section opens the next tray assembly, deflector fingers 150 are positioned at the entrance of the opened tray assembly to pick off the next sheet. No motion of the tray assemblies is visible except for the tray assembly being supplied a sheet.

The tray assemblies are closely spaced and grouped into sets of five. This is so that the operator can insert the fingers on one hand between different groups of copy sets to unload multiple tray assemblies at the same time.

Sorting is accomplished by sorting the first set of copies into tray assemblies 1, 2, 3, etc. as the feed and tray lift apparatus moves down. The next set of copies can be deposited on the up movement of the apparatus and so on until all the copies are delivered to the tray assemblies. It should be understood that the apparatus can be reset to a starting position for subsequent runs through the use of suitable sheet detection and logic control. It will further be appreciated with the use of a copy inverter in conjunction with the sorter, that collation of both simplex and duplex copies is accomplished as well.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. Sorting apparatus comprising:

a frame;

an array of tray members arranged in a column each pivotally supported by said frame at one end thereof on a pivot axis;

conveyor means for conveying sheets past an inlet of the array of tray members; and

actuating means operatively associated with said conveyor means and moving in the same direction therewith, said actuating means including camming means rotatable on an axis extending in the direction which said actuating means is moved for pivoting each of said tray members into an opened position and deflecting a sheet into the opened tray member at predetermined positions along the array of tray members.

2. Apparatus according to claim 1, wherein said tray members are arranged in groups in which spacing between groups is greater than spacing between tray members.

3. Apparatus according to claim 1, including inverter means positioned upstream from said conveyor means.

4. Sorting apparatus comprising:

a frame;

an array of tray members arranged in a column each pivotally supported by said frame at one end thereof on a pivot axis;

conveyor means for conveying sheets past an inlet of the array of tray members;

actuating means operatively associated with said conveyor means and moving in the same direction therewith, said actuating means including camming means rotatable on an axis extending in the direction, which said actuating means is moved for pivoting each of said tray members into an opened position and deflecting a sheet into the opened tray member at predetermined positions along the array of tray members; and

wherein said actuating means includes a cam shaft member formed with a spiral groove, and camming means mounted on said shaft member for movement along said spiral groove, said camming means having a spiral groove formed therein which engages a cam follower positioned at the inlet side of each of said tray members.

5. Sorting apparatus comprising:

a frame;

an array of tray members arranged in a column each pivotally supported by said frame at one end thereof on a pivot axis;

conveyor means for conveying sheets past an inlet of the array of tray members;

actuating means operatively associated with said conveyor means and moving in the same direction therewith, said actuating means including camming means rotatable on an axis extending in the direction, which said actuating means is moved for pivoting each of said tray members into an opened position and deflecting a sheet into the opened tray member at predetermined positions along the array of tray members,

wherein said actuating means includes a cam shaft member formed with a spiral groove, and camming means mounted on said shaft member for movement along said spiral groove, said camming means having a spiral groove formed therein which engages a cam follower positioned at the inlet side of each of said tray members, and

wherein said actuating means includes a plurality of deflector finger members connected to a support member carried in said spiral groove formed on said cam shaft member.

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