

[54] BINLESS SORTING APPARATUS

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[22] Filed: Dec. 29, 1972

[21] Appl. No.: 319,838

[52] U.S. Cl. 270/58

[51] Int. Cl. B65h 39/00

[58] Field of Search 270/52, 58, 60; 242/67.3, 242/67.4; 271/3, 4

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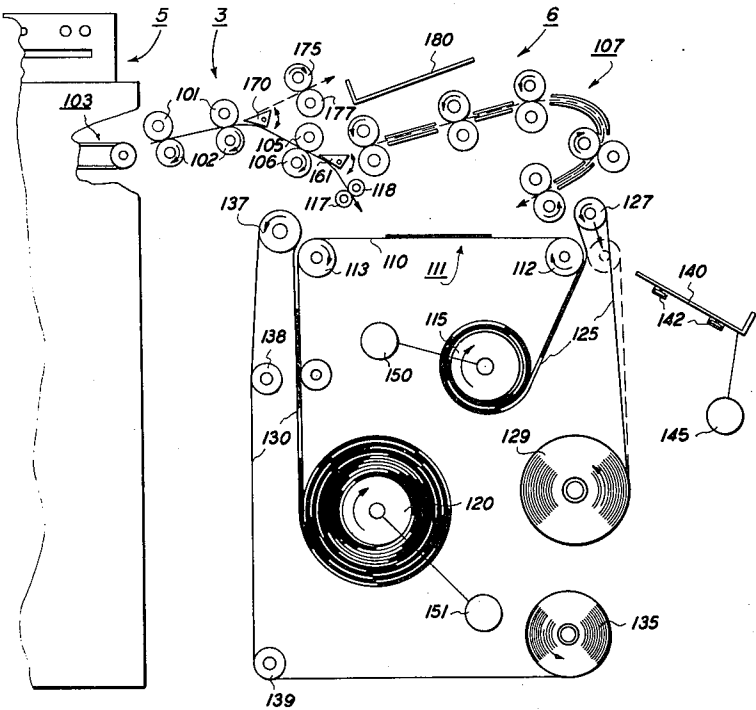
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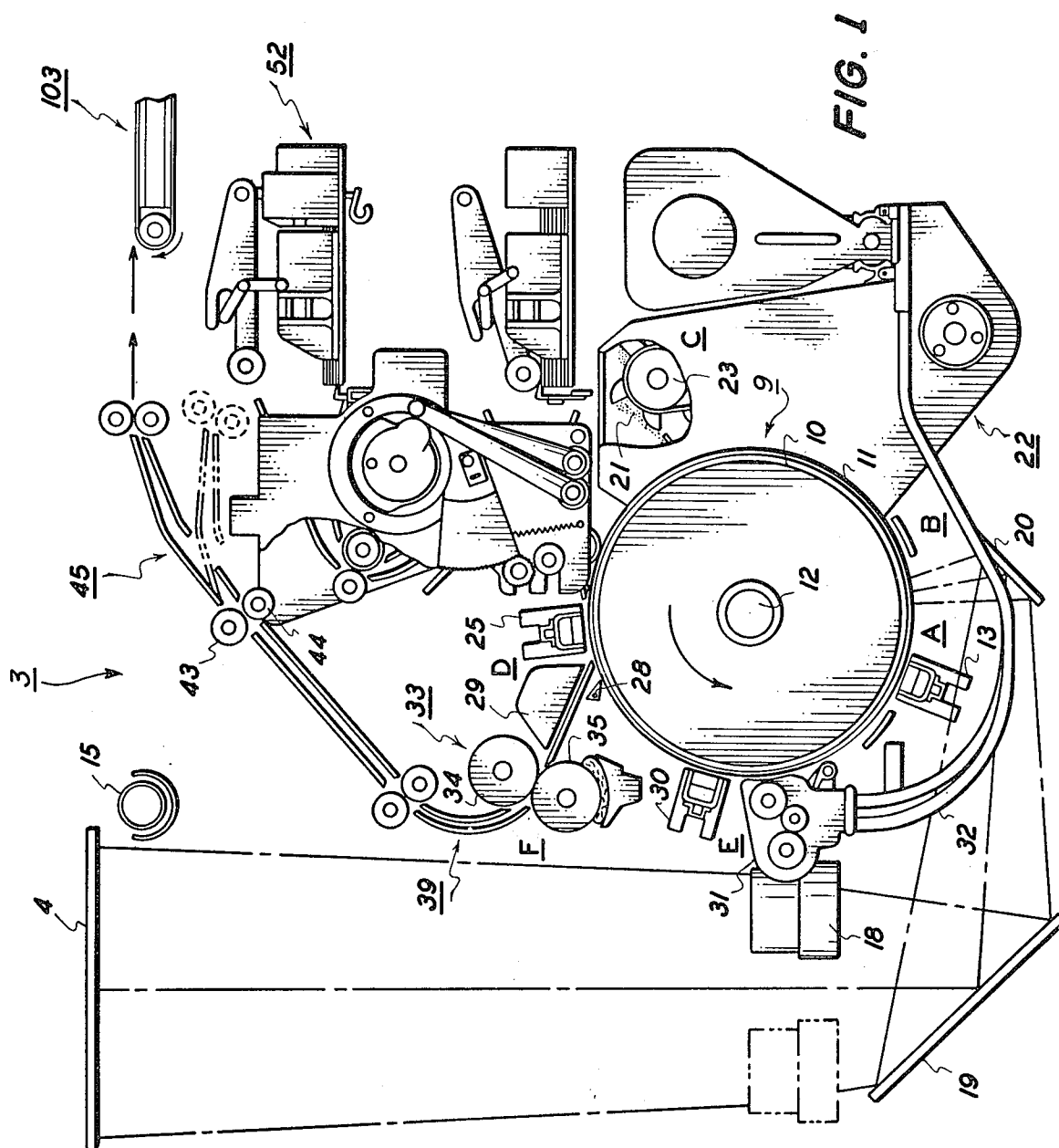
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[57] ABSTRACT

This invention relates to a web sorting apparatus for receiving and collating sheets from a copying machine. Roll members having a pair of belt members wound thereon are rotated in first one direction to separate and load copies of sheet No. 1 and then the opposite direction to separate and load copies of sheet No. 2. While sheets are not in the loading area they are trapped between layers of a belt on one of the rolls for temporary storage and protection. The operation is repeated until all the pages are loaded between the belt members. At this time the belts separate to unload the collated sets of copies into a receiving tray. By virtue of two separate paths, to the loading station simplex and duplex sorting modes of operation is accomplished.

3 Claims, 2 Drawing Figures





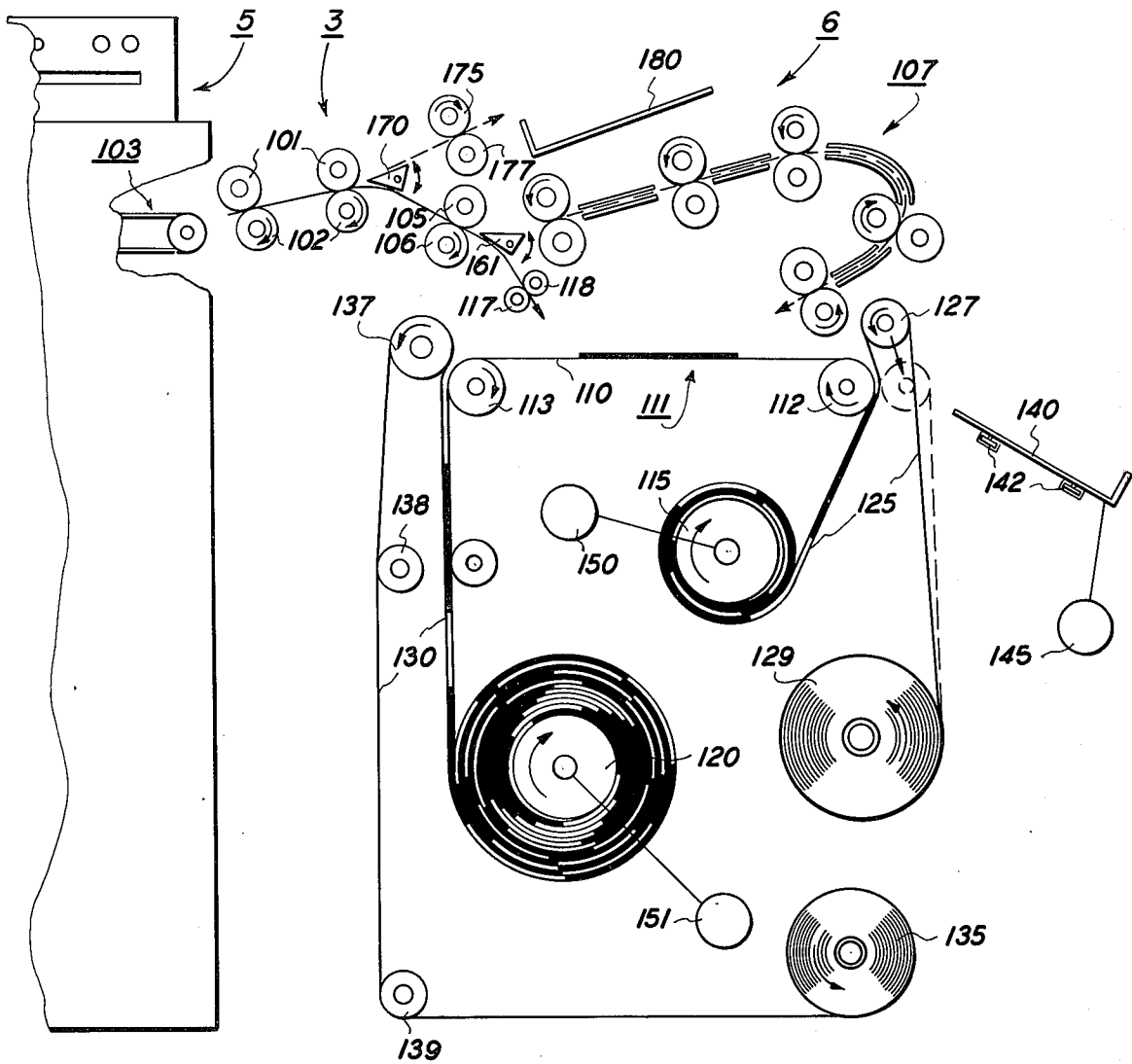


FIG. 2

BINLESS SORTING APPARATUS

This invention relates to apparatus for sorting copies advanced from a copier/duplicator into collated sets.

In copier/duplicator systems there has been a growing concern for the distribution and handling of the copy sheets in a collated fashion. In the past, sorting systems have included large and bulky sorting bin modular units with a multitude of trays arranged for movement relative to the sheet path as described in U.S. Pat. Nos. 3,356,362 and 3,561,754. Another approach for the sorter has been a rotating housing carrying bins or trays past a copy sheet path as described in U.S. Pat. Nos. 2,876,008, 2,951,697 and 3,076,647. While these devices are satisfactory in one sense, there are certain disadvantages such as the number of trays that can be accommodated in a given space as well as other considerations including simplicity of operation.

The present invention is a binless sorter/collater adapted for universal usage with copier/duplicators of all types. Generally, speaking, the sorter/collator of the invention uses webs to hold copy sheets in a wrapped configuration until unloaded into a receiving tray.

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 reliable manner.

It is still a further object of the invention to simplify the collating of copy sheets received from a reproduction machine capable of producing simplex and duplex copies.

It is still a further object of the invention to achieve sorting of copy sheets in a space more compact than heretofore.

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 reading the following detailed description which refers to accompanying drawings in which:

FIG. 1 is a schematic view illustrating the xerographic components of the copier/duplicator system incorporating a sorter/collator apparatus according to the present invention; and

FIG. 2 is a schematic view of the sorter/collator apparatus illustrating details of the invention.

FIG. 1 shows a reproduction 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 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 sorter apparatus 6 for collating copies into sets in both simplex and duplex modes of operation.

The machine includes an automatic xerographic apparatus which includes a photosensitive plate 9 including a photoconductive layer 11 that is placed over a conductive backing 10. The plate is formed in the shape of a drum and the drum mounted upon a shaft 12 that is journaled for rotation in the machine frame. Basically, a 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 (not shown) and the operations thereof coordinated in order to produce proper cooperation 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 a 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. The 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 after transfer. The residual toner is transported on the drum surface into a cleaning station E where it is brought under the influence of 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 transport the collected residual toner back to the developer housing where it is deposited within the developer mix so that it can be once again reused 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 to 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 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 104 or into the upper supply 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.

In accordance as seen in FIG. 2 with the present invention the sorter apparatus receives the sheets from transport 103 and includes sheet transport rolls 101 and 102 which discharge duplex and simplex sheets to rolls 105, 106 or to transport 107, respectively, and then onto a belt member 110 at a loading station 111 in a manner which will become more apparent. Belt member 110 is wound around a roll 115 at one end and a roll 120 at the other end after passing idler rolls 112 and 113, respectively. Also wound on roll 115 is a second belt member 125 which is threaded over idler roll 127 before being received on take-up roll 129. Similarly, roll 120 has a second belt member 130 wound thereon which belt member is received on take-up roll 135 after passing over idler rolls 137, 138 and 139.

In operation each of the rolls 115 and 120 is rotated in a first direction until multiple copy sheets representing duplex copies of a set are deposited by rolls 117 and 118 after passing gate member 161 one at a time at regular intervals on belt member 110 at loading station 111. The copy sheets are sandwiched between belt member 110 and associated members 125 or 130 depending on the receiving roll 115 or 120 respectively. It will be appreciated that the sheets are wound onto rolls 115 and 120 along with the belt members after being deposited on belt member 110 at the loading station. The rolls 115 and 120 are then rotated in the opposite direction to receive the next copy sheets, e.g. pages 3 and 4 for duplex operation in overlying operation to the copy sheet previously received. This operation

continues by reversing direction for the next copy sheets until all the copy sheets are received from the copy processor. Thus a plurality of collated sets are produced by arranging sheets from homogenous sets.

The copy sheets are then unloaded in output tray 140 by displacing moveable idler roll 127 to enable the sets to be received in the tray. Tray 140 is slideable on guide members 142 and is moved in reciprocating fashion by a motor 145 or any suitable drive mechanism to receive each copy set indexed or offset from the previous set to maintain the copy sets in separately identifiable sets.

The drive for rolls 115 and 120 may take any suitable arrangement, such as, a motor with clutch for each of the rolls indicated as 150, 151 respectively. Alternatively, one drive which is reversible could be used.

By virtue of the unique arrangement of the web sorting apparatus, rapid collation of many copy sets is effected in a minimum of time and space. More than this, the simplicity of the dual sheet transport arrangement enables both simplex and duplex sorting. To accomplish this diverter gate member 161 is positioned to divert copies as for example simplex copies to a curvilinear path of transport 107 which flips the copies over prior to being received at the opposite side of the loading stations. As a result the copies are deposited face down in tray 140 when unloaded. A second diverter gate 170 is provided adjacent pinch rolls 101 and 103 to direct copies to pinch rolls 175 and 177 which deposit the copies into a tray 180 in a case where sorting is not required.

By the above described invention copies from a reproduction machine are sorted in collated identifiable sets in both simplex and duplex sorting modes of operation. Heretofore, many bins or trays were used to sort the copies into stacks requiring prolix parts and a great deal of space. With the present invention sorting is accomplished simply and compactly. In other words by eliminating the conventional tray configuration, the effective capacity of collated copy sets is greatly increased with a much smaller space.

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. In a reproduction apparatus in which copy sheets reproduced from document information are distributed, an improved sorting apparatus comprising:

a frame

first roll means positioned on said frame including first and second belt members adapted to receive copy sheets advanced along a path therebetween, second roll means on said frame for receiving one of said belt members arranged along a path which has a copy sheet loading station located at a planar portion of the belt path at which copy sheets are loaded thereon and a third belt member adapted to receive copy sheets subsequent to loading of the sheets on the loading belt member therebetween, drive means for driving said first and second roll means to move said loading belt member past said copy sheet loading station to receive and separate

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copy sheets by positioning each copy sheet at a separate location on said loading belt member and then moving said loading belt member into loaded contact with another of said belt members to trap copy sheets therebetween,
means to reverse said roll drive means at predetermined intervals to move the belt members in an opposite direction to position subsequent copy sheets in overlying relation to sheets previously loaded on said loading belt member to store at least partially completed copy sets on said roll means,

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means associated with one of said roll means for separating said belt member to unload copy sets into a receiving tray member.

2. Apparatus according to claim 1 wherein said tray member is reciprocated at predetermined intervals to effect separation of the copy sets.

3. Apparatus according to claim 1 including gate means positioned in the sheet path to direct the copy sheets along an alternate path to enter the sheet loading zone in inverted form.

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