

United States Patent

[11] 3,548,783

[72]	Inventor	Lowell W. Knapp Victor, N.Y.
[21]	Appl. No.	752,056
[22]	Filed	Aug. 12, 1968
[45]	Patented	Dec. 22, 1970
[73]	Assignee	Xerox Corporation Rochester, N.Y. a corporation of New York

[56]

References Cited

UNITED STATES PATENTS

3,094,293	6/1963	Schultz.....	226/44X
3,137,499	6/1964	Maidment	271/71

Primary Examiner—Richard A. Schacher

Attorneys—Paul M. Enlow, Norman E. Schrader, James J. Rababate, Ronald Zibelli and Barry J. Kesselman

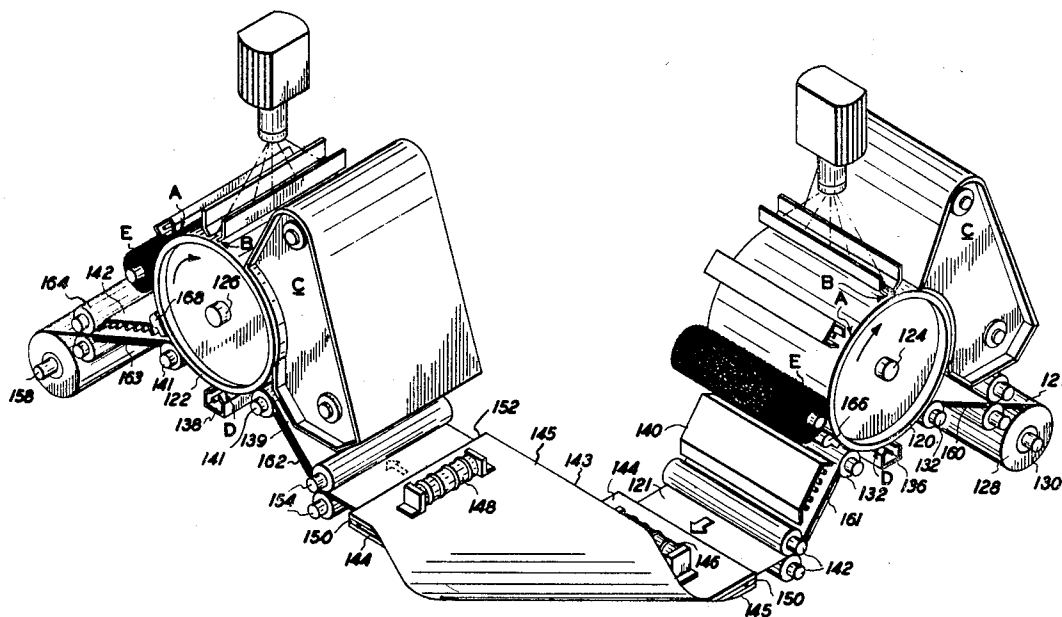
[54] PAPER TRANSPORT-SHEET TURNER
2 Claims, 6 Drawing Figs.

[52] U.S. Cl..... 118/224,

[51] Int. Cl. B05c 1/04.

[50] Field of Search..... B65h 23/32
118/637,
637(Liq. Digest); 271/68, 71; 226/196, 197;
355/3, 16, 26

ABSTRACT: A sheet transport apparatus for both cut sheet and web-type flexible material for changing the path of the material by driving it through guide means curved to change the direction of movement of the flexible material moved therethrough by rollers. By strategically preshaping curved units, paths of feed may be manipulated for inverting the material as the path is changed. A hollow guide track or strategically placed guides and drive rollers are used to change the path of the input.



PATENTED DEC 22 1970

3,548,783

SHEET 1 OF 5

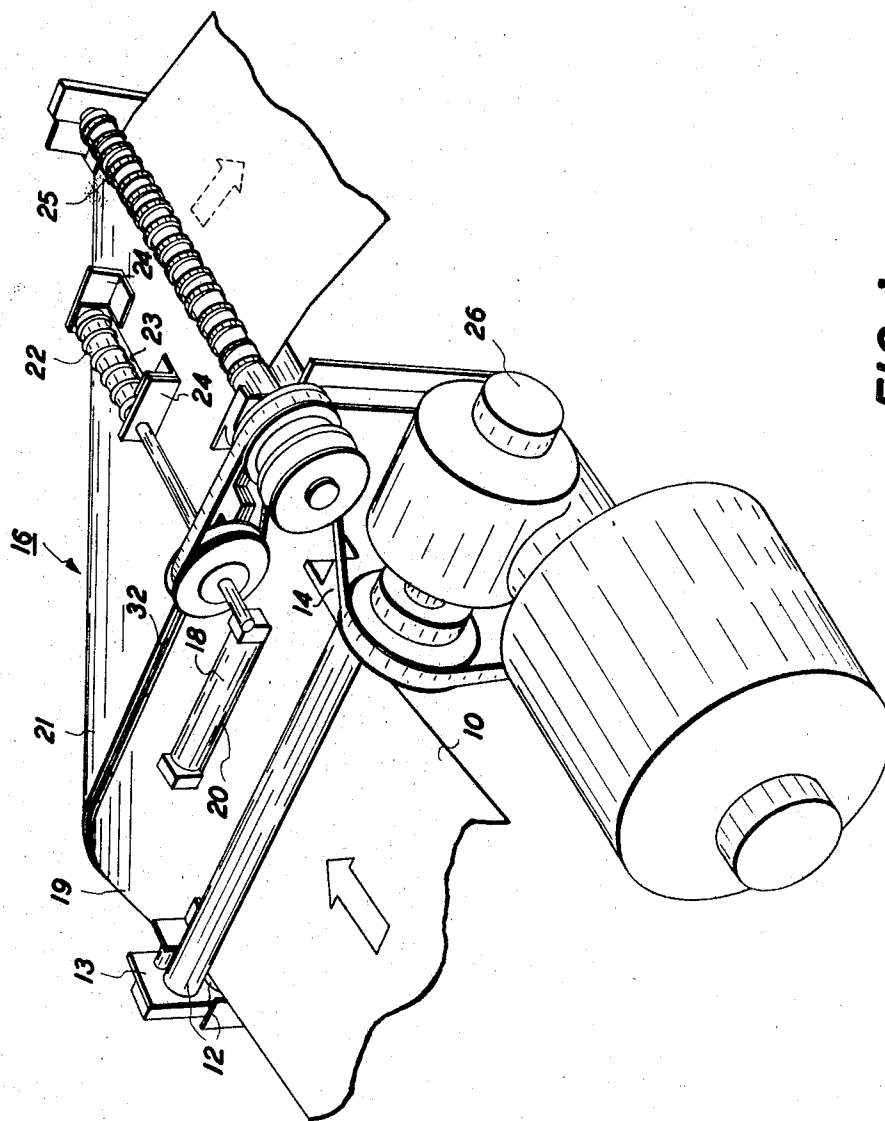
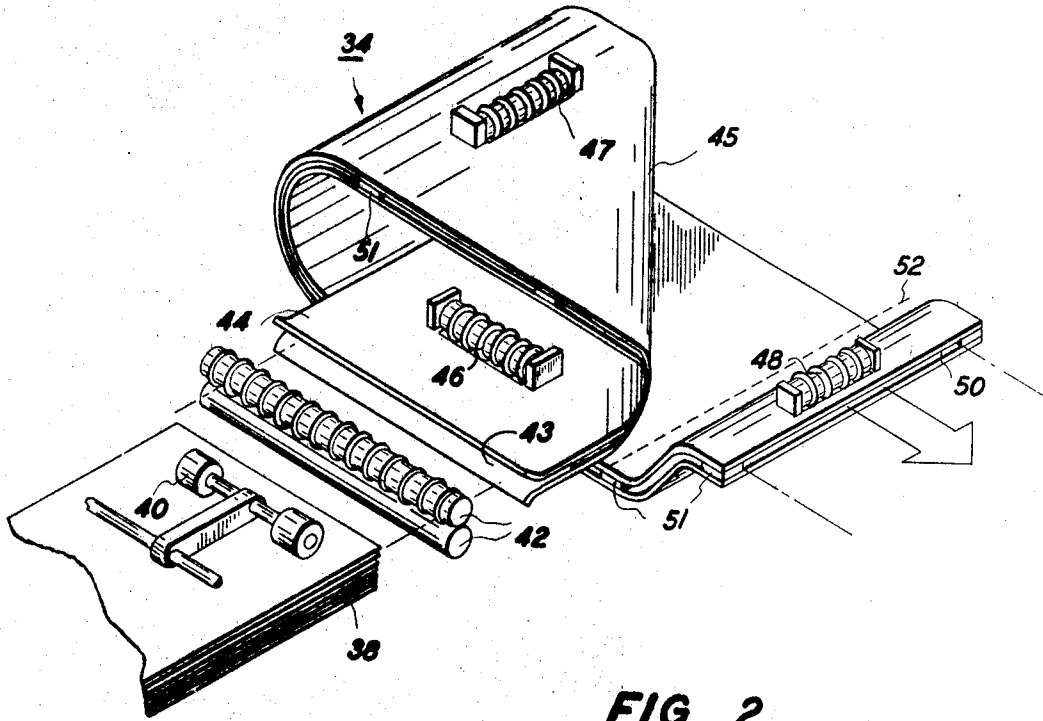
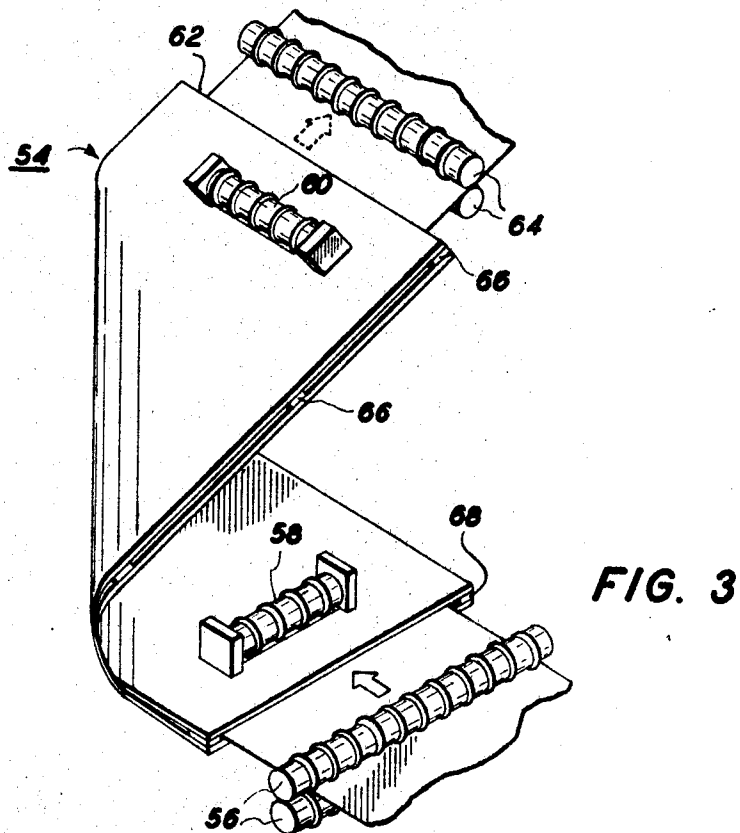


FIG. 1

INVENTOR.
LOWELL W. KNAPP

BY

Barry Jay Kesselman
James P. Schreiber
ATTORNEY



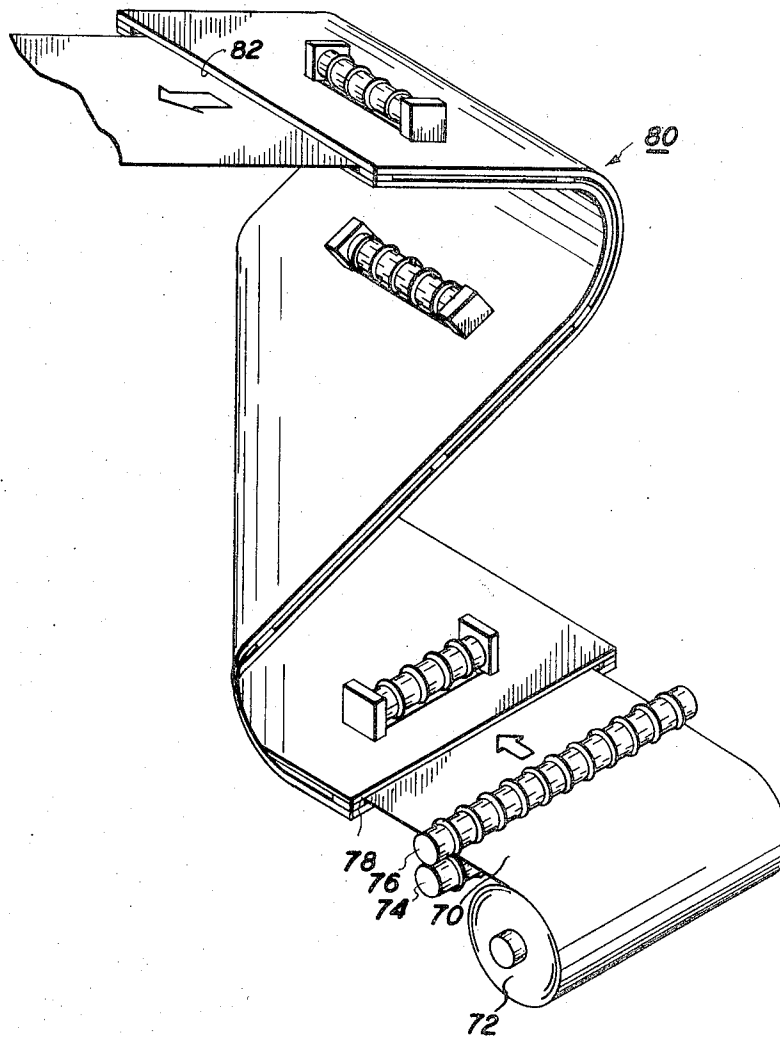
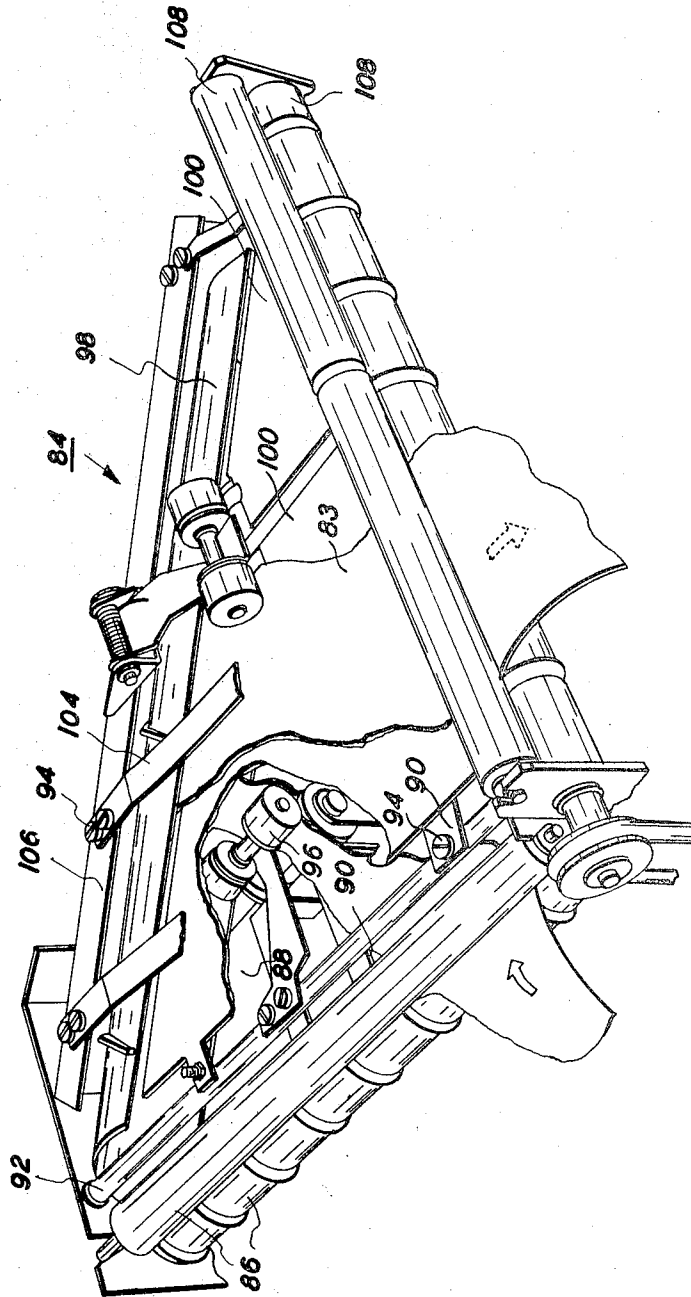


FIG. 4



501

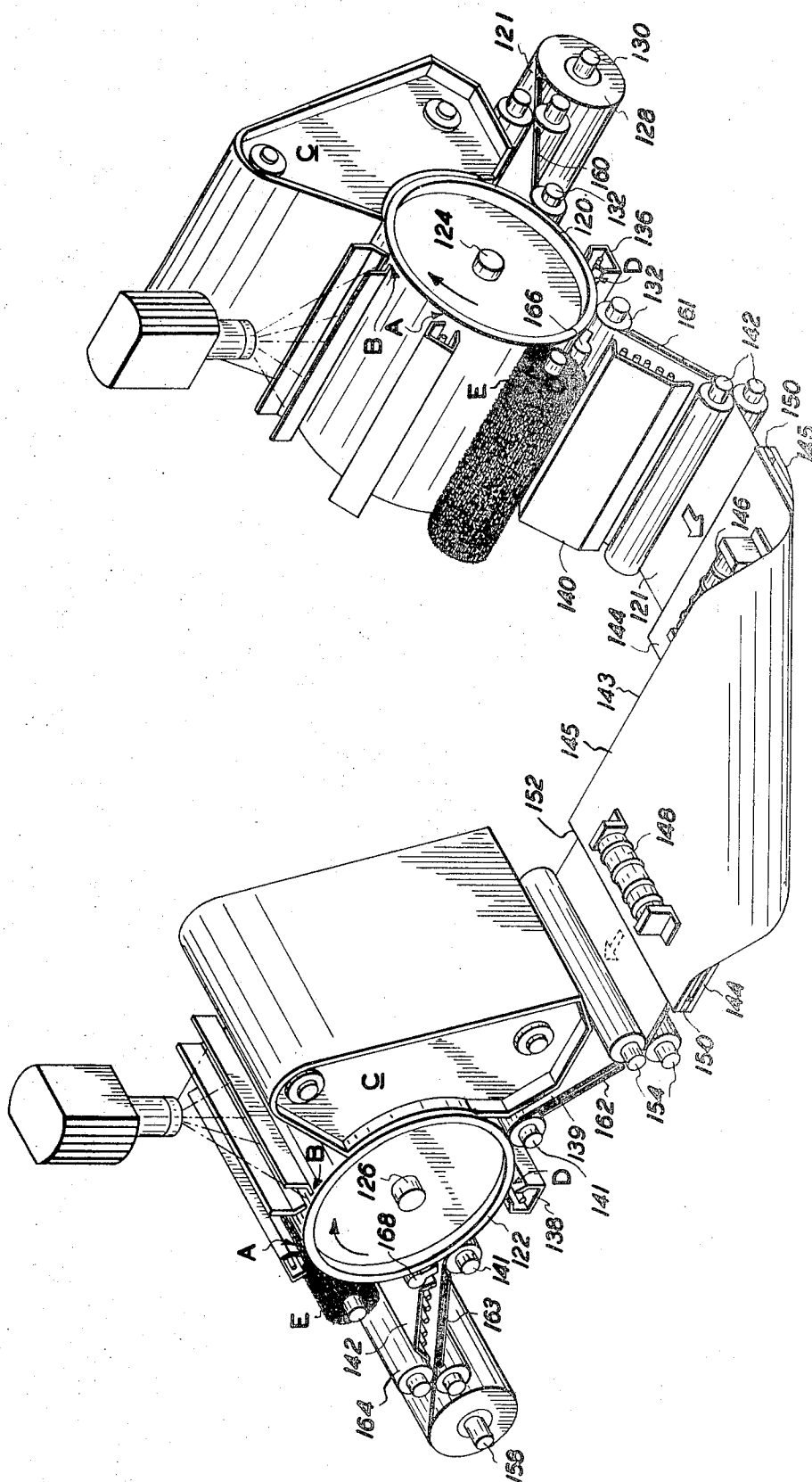


FIG. 6

PAPER TRANSPORT-SHEET TURNER

This invention relates to transport devices especially suitable for flexible sheets or continuous webs of such material as paper, and more particularly, relates to an improved apparatus for changing the path of such input.

In the past turning devices for use with continuous webs in web feeding machines were confined to turning bars over which the web was initially guided and was thereafter driven. The angle of the change of path or turn of the web was determined by changing the axis of the turning bar within its frame mechanism or by presetting the bar to the desired angle bringing about the desired change of path of the web fed thereover. Examples of such devices are shown in Mayer U.S. Pat. No. 1,630,713 issued May 31, 1927 and Brodie U.S. Pat. No. 2,760,773 issued Aug. 28, 1956. Devices of this type, however, are unsatisfactory for use with cut sheets of material, such as paper or card stock or for severe or complicated change in the path of travel.

With the advent of automatic machinery such as in the office copier field, especially automatic xerographic machines, it has become increasingly necessary to handle cut sheets of paper as well as web material used as support to maintain the image that is copied from an original document by such a machine. Due to the spatial requirements of many machines, it is necessary to maneuver the paper in such a way that a direction change in the path is necessary. This may be required in order to present the output of such a machine in a convenient position for a machine operator. Another reason necessitating a direction changing maneuver is to present the second side of a sheet for copying. A printing mechanism may then, on a second pass of the same sheet, print information on the unprinted or second side of the sheet.

It is an object of this invention to improve apparatus for changing the path of travel of support materials such as flexible sheets and webs.

Another object of this invention is to present both sides of support material at printout positions in automatic copying machines for duplexing.

For a better understanding of the invention, as well as other objects and further features thereof, reference is had to the following detailed description of the invention to be read in conjunction with the accompanying drawings wherein:

FIGS. 1-5 are diagrammatic isometric views of transport mechanisms; and

FIG. 6 is a schematic isometric view of a transport apparatus in conjunction with a xerographic machine having duplexing capabilities.

Referring now to the figures there is shown in FIGS. 1-5 mechanisms for moving flexible support material such as paper, card stock, and the like and either cut sheet or web form along a path determined by the structure of the guiding mechanisms.

FIG. 1 shows the intermediate part of a transport system for moving web material along a curvilinear path causing a change in direction and plane of the web material. The web material 10 is urged along a path of travel by a first set of pinch rollers 12 mounted in frames 13 and 14. The rollers 12 moved the web to the entrance of a curved guide member 16. The web is positively driven through the curved member 16 by idler roller 18 mounted on plate 19 and acting through a slot 20 therein, and by a pinch roller meeting idler roll 18 through the plate 21 of the curved guide member 16. As the web is driven through the curved member 16, the lead edge is deflected thereby. The web thus curves around and eventually is contacted by pinch rollers 22 active within the guide means 16 and contacting the web through the slot 23. The roll 22 is bracketed to plate 21 by brackets 24. Drive rollers 25 contact the web material at the exit of the guide member. The pinch rollers may be driven by a single motor means such as motor 26 or by individual motors and gear systems without deviating from the scope (and spirit) of the invention herein. Also the material can be fed in either direction by reversing the direction of rotation of the drive rollers.

The guide member 16 is itself formed as a sandwich of two plates 19 and 21 having adjacent portions spaced parallel to each other along their entire length. The plates 19 and 21 are separated by a small clearance space so that the web 10 fed into the guide member 16 passes between the two plates 19 and 21. To maintain the separation of the two plates, spacers are placed along the outer peripheral edge of the plates except at the entrance and exit portions thereof. These spacers 32 are of an internal thickness sufficient to ensure the unobstructed passing between plates 19 and 21 of the material fed therethrough.

Both plates 19 and 21 have slotted apertures 20 and 23 on their surfaces at adjacent positions so that pinch rollers and idler rollers such as 18 and 22 respectively may contact their mating rolls to give positive driving contact to any material traveling through the guide member formed by the two plates. It should be noted that the web 10, which is being driven with a first side upward along the feed path by the rolls 12 is diverted from this direction and path by the guide member 16 by contact with the outer plate 21 causing it to curve along the path formed by plates 21 and 19. The web is then driven by rollers 18 and 22, and due to the curved shape of the member 16 is constrained to follow an upwardly and laterally curved path whereby the web exits from the curved member and the drive rollers 25 with the first side downward as indicated by the dotted flow arrow. Advantage can be taken from this situation as is described with reference to FIG. 6 hereinafter.

FIG. 2 utilizes a differently curved member 34 in a transport system for cut-sheet-type flexible material such as support material for printing individual pages. The system can be used, however, for web material as was the system described in FIG. 1. Conversely, the system of FIG. 1 can be used with cut-sheet material such as is described in FIG. 2.

Shown in this figure is a stack 38 of cut sheets of paper or the like to be transported through the transport system for any operation to be performed upon it. The sheets are separated by a mechanism 40 of a type for example, such as that which is described in U.S. Pat. No. 3,062,109 issued to Rutkus on Nov. 6, 1962. As the top sheet of the stack 38 is separated from the remainder thereof by a mechanism such as separator 40, it is brought into contact with and engaged by a set of drive rollers 42 which are adapted to sequentially bring the sheets in the stack 38 to guide entrance 43 which is formed of flanged portions of the plates 44 and 45 forming the guide member 34. By flanging the entrance, there is less likelihood of sheets not engaging the curved member 34 while they move through the transport system. The curved guide member has several sets of pinch rollers implanted in its surface to continually maintain positive contact on any sheet moving therethrough. These sets of rollers 46 through 48 are spaced such a distance apart that the minimum expected sheet length of any sheet in the stack 38 will be greater than the distance between axes of the several sets of rollers spaced along the path of travel of the sheet through the curved guide member 34.

The physical structure of the curved member 34 of FIG. 2 is designed to cause the material passing therethrough to make several turns and move through several planes eventually egressing at the exit face 50 of the member 34 in the same plane as the entrance face 44 of the curved member 34. Spacing blocks 51 ensure that plates 44 and 45 are separated at adjacent positions sufficiently to permit free passage of sheets. Because of the maneuvering of the material passing through the curved guide member 34, the sheet egressing from the structure has the same face upward as it does when it enters the guide member 34. The design of the guide member could be such that the paper exits at some plane other than the same plane as it enters. This is accomplished by having the exit face placed at the imaginary line 52 shown in FIG. 2. If that were the situation, then one could maneuver a sheet or web-type material from the entrance face of a guide member of the exit face and present the material with either one side or the other of the material face upward. By comparing the materials exiting from the apparatus shown in FIG. 1 and FIG. 2 this result

can clearly be seen. Certain benefits are derived from presenting the sheet material with one or the other of its two faces upward. One example of this is shown in FIG. 6 described hereinafter.

FIG. 3 shows another design for the curved guide member of a transport system that is insertable into any flexible material transport using either web or sheet input as in FIG. 1 or FIG. 2. With this apparatus the flexible material entering the curved guide member 54 by drive rollers 56 is positively driven by intermediate drive rollers 58 through 60 to guide exit 62 where drive rollers 64 continue the material on its path of travel. The material here not only exits in a different direction from that which it enters the curved guide member but it is set upon a path of travel in a plane skewed to the first plane of travel of the flexible material. Here, as in FIG. 1, the side of the material entering the guide member 54 in an upward position exits in a downward position.

The guide member 54 is formed by taking two symmetrical plates and spacing them some distance apart sufficient to allow flexible material to pass therebetween. The plates are maintained a required distance apart by a separating means such as spacers 66 and 68. The material structure of the rollers, guide members and spacers can be metallic, plastic or any other material which can be maintained in the shape and is of a structure suitable for performing the functions described herein.

The apparatus shown in FIG. 4 operates on a flexible material such as a web 70 maintained on a supply roll 72. The web material is driven through rollers 74 and 76 to the entrance 78 of a curved guide member 80. As in the other FIGS., the curved guide member has several drive rolls implanted through slots therein to continually maintain positive contact on the material passing therethrough. The apparatus shown here takes the web material and presents it at the exit 82 of the guide member 80 in a face upward direction which means that the same side of the web material that enters the curved guide member face up exits the curved guide member face up. Once again, as in the apparatus shown in FIG. 3 the path of the flexible material at the exit 82 of the curved member is in a direction different from that followed by the web material entering the curved guide member and is also in a plane that is skewed to the original entrance plane.

FIG. 5 shows a modification of the guide member device used in a previous figure. The apparatus shown guides flexible material 83 of either sheet or web form in a manner and direction similar to that shown in FIG. 1; nevertheless, other embodiments can maneuver the path just as in the other figures and variations thereof. Here, however, the curved guide member 84 is not formed of two plates. Instead, after the material is driven into the turning member 84 by drive rollers 86, it rests upon a lower guide plate 88 and is prevented from curling out of the predetermined path set up by the guide member 84 by flexible strips 90 maintained above the path of travel of the flexible material so that the material is trapped between the strip 90 and the lower guide plate 88.

The flexible strips may be of mylar or similar construction and are maintained above the path of travel of the flexible material by being suitably fastened to a rod 92 by any means such as pins 94. The rods are preferably of a length sufficient to cover and slightly overlap the lower guide plate 88 and are spaced to avoid contact with intermediate drive rollers such as the roller 96 shown in FIG. 5.

As the flexible support material is driven over the plate 88 and maintained in contact therewith by the slight pressure exerted from the flexible strips 90, it strikes the concave surface of curved plate 98 which is maintained above the lower guide plate 88 and above the flexible strips 90. As the flexible support material is driven into the concave surface of plate 98, it bends, conforming to the shape of the surface, and thus turns until it strikes a second lower guide plate 100 whereby the flexible support material still being driven by roller 96 conforms to the surface of the plate 100 and straightens out to be driven along a path determined by the lower plate 100. Above

the plate 100 are several more flexible strips 104 all maintained on a rod 106 above the path of the flexible material such that the flexible material is held between the flexible strips 104 and the lower guide plate 100. The flexible strips are of the same type and function as the strips 90 described above, and preferably extend the length of plate 100 to the drive rollers 108 which positively grip the flexible material and continue it along the new direction and plane of its path of travel and determined by the curve of the guide plate 98 and the positioning of the lower guide plate 100.

An example of the possible use for one or more of the several embodiments of transport direction changing systems shown in the above figures is shown in FIG. 6.

This is a schematic representation of a xerographic copying apparatus composed of two xerographic members or photoreceptors formed in the shape of drums 120 and 122. The drums are mounted for rotation on shafts 124 and 126 respectively, each shaft suitably journaled to rotate in the direction indicated by the arrow to cause each drum surface sequentially to pass a plurality of xerographic processing stations. The drums have the same diameter and rotate at the same velocity as each other. For the purpose of the present disclosure, the several xerographic processing stations in the path of movement of the xerographic members may be described functionally as follows:

A charging station A to deposit a uniform electrostatic charge on the photoconductive layers of the drums 120 and 122.

An exposure station located preferably as shown by reference character B for exposing a light or radiation pattern of copy onto the xerographic surface to dissipate the charge on that surface in the exposed portions thereof forming a latent electrostatic image of the pattern of the object projected onto the drum. Projection shown only representatively onto drum 120 and 122 could be of a book such that odd pages are projected onto the drum 120 and transferred onto the web material 128 at such a portion on the web that the next succeeding even page of the same book are projected onto the drum 122 so that they are transferred to the web material 128 on the same portion but on the opposite side of the web.

Adjacent to the exposure station is a developing station C whereat the latent electrostatic image is developed by cascading an electrostatic developer over the drum forming a toner image corresponding to the latent electrostatic image on the drum.

An image transfer station D where the toner image is electrostatically transferred from the drum surface to the transfer material 128 next succeeds the developing station.

Next is a cleaning station E where the drum is cleaned of residual toner and is discharged in order to prepare the drum for the next cycle. The transfer material web 128 then passes through a fusing station F where heat is applied to the material in sufficient quantity to melt the electrostatic toner image formed thereon bonding it to the transfer material in the configuration with which it is adhered.

By proper sequencing and timing of the projection at the exposure station B of the xerographic members 120 and 122 odd and even pages of books could be copied onto the transfer material at the same portion but on opposite sides thereof by passing the material through a transport system such as the type shown here. Books are cited by way of example only and any input could be imaged on the drum without affecting the spirit of the invention disclosed in this embodiment.

A supply spool of web material 128 is wrapped around a drive shaft 130 which rotates to release the web material 128 at a velocity such that it has a no slip timed sequence with the linear velocity of the drum surfaces 120 and 122 as it passes in contact therewith at the transfer stations D thereof. The web is conducted past the drum 120 by guiding it over rollers 132 with its first side 121 contacting drum 120. An electrostatic generating device such as the corotron 136 or corotron 138 at each of the drums aids in transferring the toner image from the

drum surface aids in transferring the toner image from the drum surface and tacks it electrostatically to the support material surface. The support material then passes under a fuser 140. This melts the toner image into the support material so that a permanent fixed image is formed.

After the fixing of the image on the first side of web material 128 at fuser 140, the web is fed by pinch rollers 142 to a guide means 143 which changes the path of travel of the web material passing therethrough. The web is maintained between plates 144 and 145 as it is pulled through the guide member 143 by driving pinch rollers 146 and 148. Spacers 150 maintain the proper separation between the plates 144 and 145 and prevent the web from slipping out of the guide member 143 on the sides thereof and further help guide the web 128 to the exit 152 of the guide member 143. Pinch rollers 154 drive the web 128 from the exit 152 along a path which causes the web to contact drum 122 at the transfer station D thereof with its second side 139 upward or contacting the drum by guiding the web over rollers 141. The corotron 138 pulls the toner from the developed image on the drum 122 to the second side 139 of the web 128.

The previous image on the web having been fused by fuser 140 one side 121 is unaffected by the electrostatic charge generated by corotron 138. The web 128 with a fused image on one side, representing the image transferred from drum 120 and an unfused, unfixed image on the other, representing the image transferred from drum 122, then passes through fuser 142 which fuses and fixes the image on the second side of the web material 128 making a copy on both sides of the web material which can be substantially opposite each other depending on the timing of the images placed on the two drums 120 and 122 and the length of the support material. The web is then fed to a takeup spool 158 where it can be gathered for further operations such as cutting into sheets or any other processes which may be desirable to perform on the web 128. Suitable drive means rotate the drums, supply and takeup spools, and pinch rollers.

The embodiment shown can be modified to accommodate cut sheets of support material along the same path as that of the web 128. Instead of a supply roll, a stack of cut sheets such as for example, stack 38 of FIG. 2 is substituted. The path of travel remains the same and the baffles 161-163 ensure proper feeding as do the pinch rollers 164 which drive the sheets to a suitable sheet receptacle. Each drum has a puffer unit 166 and 168 which removes the sheet electrostatically tacked to the drum. A puffer unit similar to that described in U.S. Pat. No. 3,062,536 issued on Nov. 6, 1962 could be used. Additional baffles can easily be added to prevent misfeeds of sheets. The spacing of all the drive rollers including rollers 146 and 148 in the guide member 143 are spaced to maintain a continuous positive driving contact with the cut sheets.

A similar system using transport apparatus shown could involve coated papers in cut sheet or web form which are maneuvered to be imaged on both sides by guide apparatus such as that shown in whatever imaging process they function to give their printout.

While the invention has been described with reference to the structure disclosed herein, it is not confined to the details set forth, and this application is intended to cover such modifications or changes as may come within the purpose of the improvements or the scope of the following claims.

I claim:

1. In a xerographic reproducing apparatus for copying data from documents onto both sides of a support material, said apparatus being of the type having a plurality of moving xero-

graphic plates and a processing system for each plate for creating data-representing toner images on each plate, the improvement comprising:

first drive means being adapted to contact support material and move the material past a first xerographic plate in synchronous speed with the moving surface thereof whereby data-representing toner is transferred onto one side of the support material from the first plate; guide means positioned to intercept the support material after contact with the first xerographic plate; said guide means having at least one curved portion being adapted to contact the support material feedable within said guide means for displacing the support material in another direction different from the path of movement determined by said first drive means; said guide means shaped to maneuver the support material feedable therethrough so that the side which received the data-representing toner from the first xerographic plate is presented to a second xerographic plate away therefrom with the other side of the support material positioned for receiving data-representing toner from the second xerographic plate; and second drive means adapted to engage the support material feedable from said guide means and to drive the support material past the second xerographic plate whereby data-representing toner is transferred onto the second side of the support material whereby both sides of the support material receive data-representing toner.

2. Apparatus for moving flexible support material along a curvilinear path of travel and for maneuvering the support material traveling the curvilinear path of travel through a plurality of planes and directions, the combination comprising:

drive means being capable of contacting support material feedable thereby and moving the support material in a first direction;

guide means having an entrance and exit, said entrance positioned to intercept the support material movable by said drive means and feedable into said guide means;

said guide means having at least one curved portion between said entrance and exit being adapted to contact the support material feedable into said guide means and shaped to be capable of displacing the support material contacting it by deflecting the support material in another direction both planarly and angularly from the previous direction of movement of the support material;

said guide means exit positioned to set the path of travel for the support material feedable past said exit in a direction displaced from the first direction by the curved portions of the guide means;

said guide means including a first lower guide positioned under the path of travel of support material feedable into said guide means, said lower guide being capable of giving support to the flexible material entering said guide means, said first lower guide having associated therewith at least one flexible member extending generally along the material contacting surface of the first lower guide and positioned above the path of travel established for the support material, said flexible member capable of exerting slight pressure on the material to be fed between the member and first lower guide thereby maintaining the material along the path of travel determined by said first lower guide; and

other lower guides positioned along the path of travel after said curved portion of said guide means and being capable of supporting flexible material.