

[54] SHEET REVERSING APPARATUS AND A DUPLEX REPRODUCING APPARATUS EMPLOYING SAME

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[58] Field of Search ..... 355/23, 11, 14; 271/3; 242/67.3 R, 67.4

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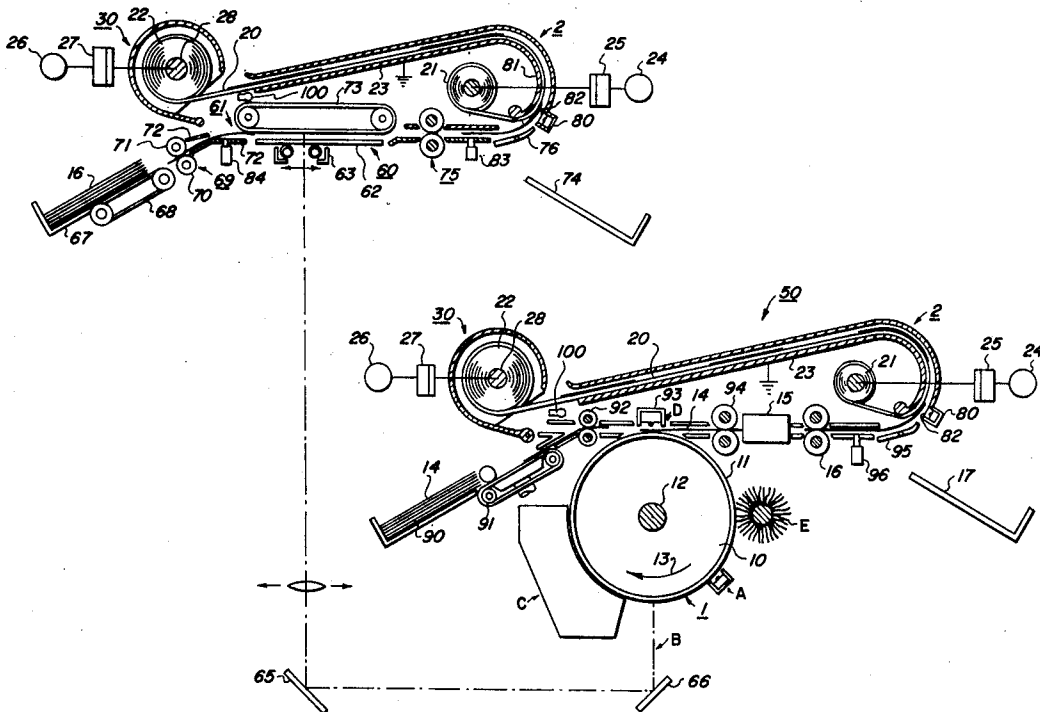
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[57] ABSTRACT

A sheet reversing apparatus for reorienting sheets so that a first side and an opposing side of the sheets may be operated upon is provided including means for storing the sheets. The storing means comprises a web wherein the sheets are supported between adjacent layers. Means are provided which act on the web to deliver the sheets therefrom in a reversed orientation. Preferably the delivering means deflects the web through an arcuate path to reposition it so that the sheets may be ejected with the proper orientation. A reproducing apparatus employing the above sheet reversing system for original documents and/or copy sheets is also provided as well as a process for reversing and reproducing sheets.

53 Claims, 7 Drawing Figures



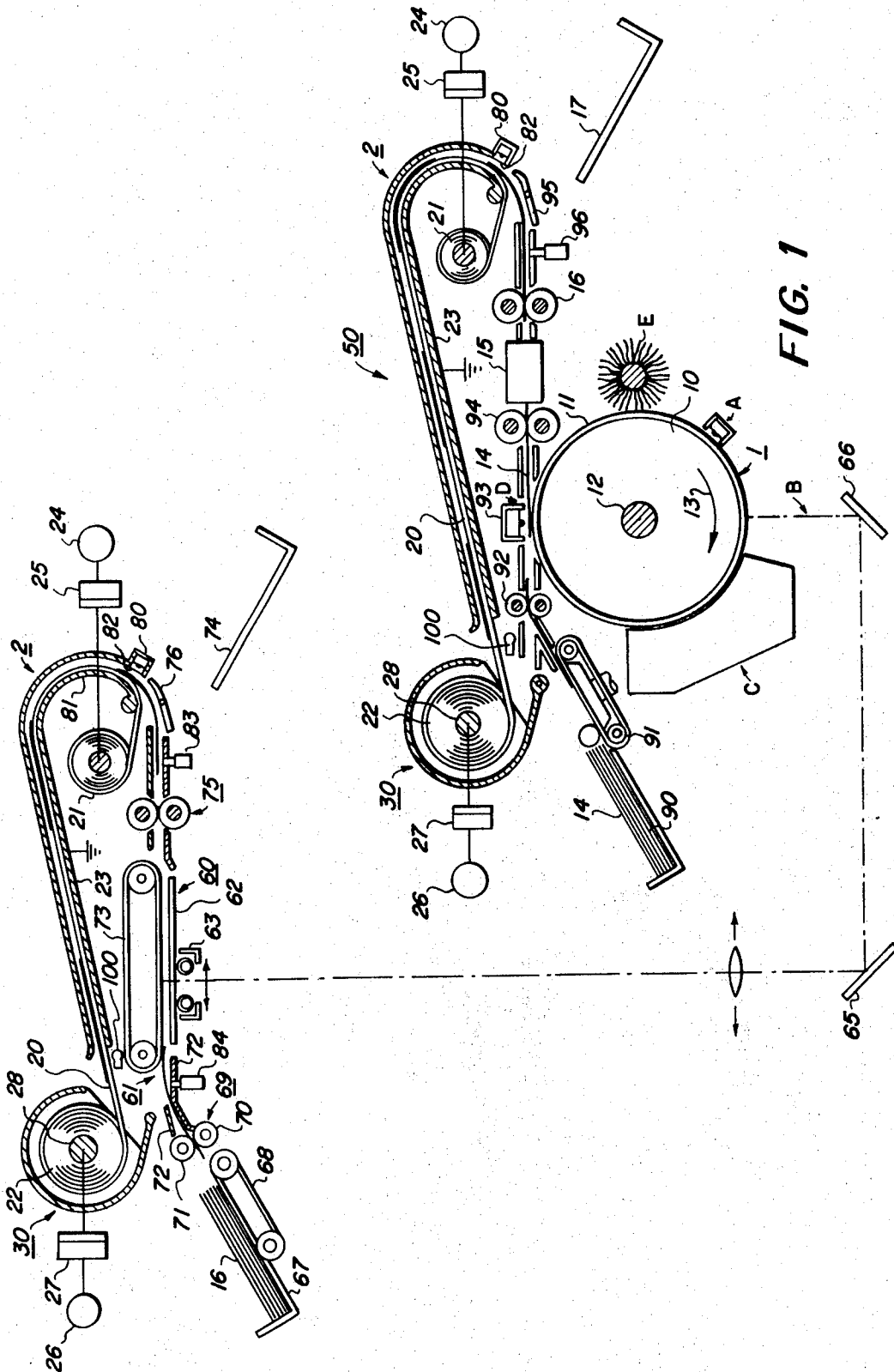
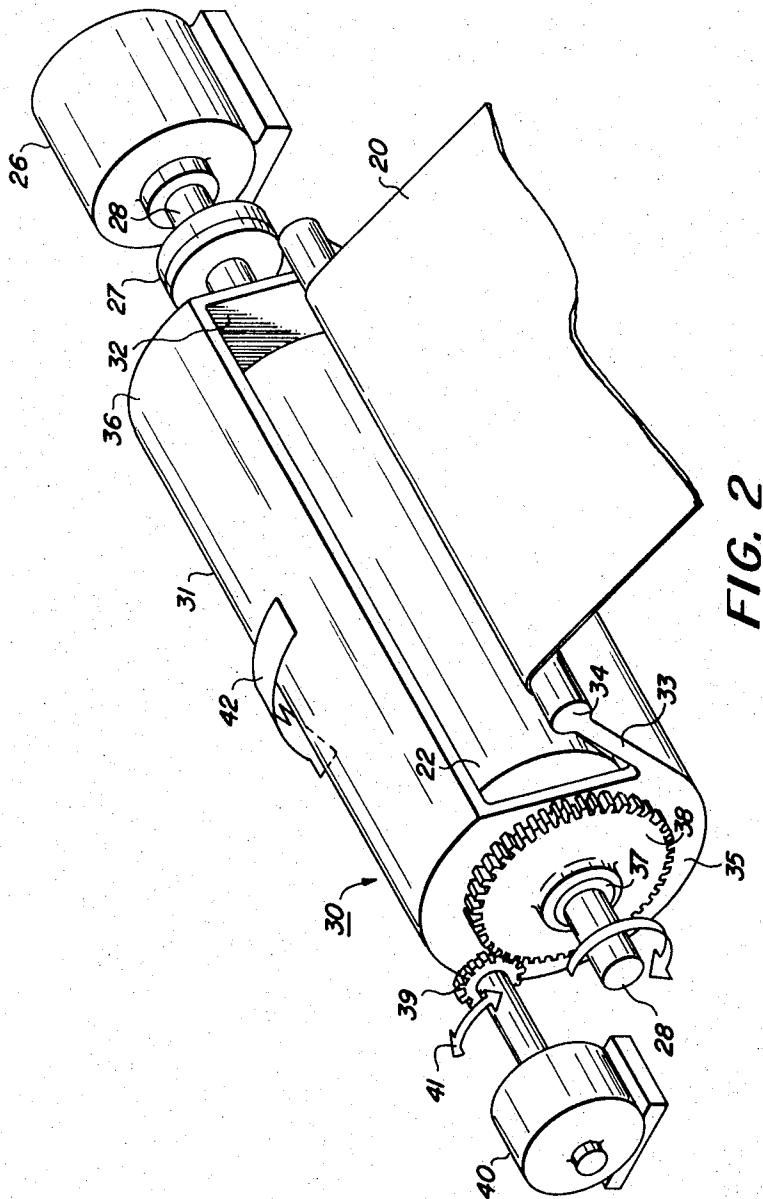
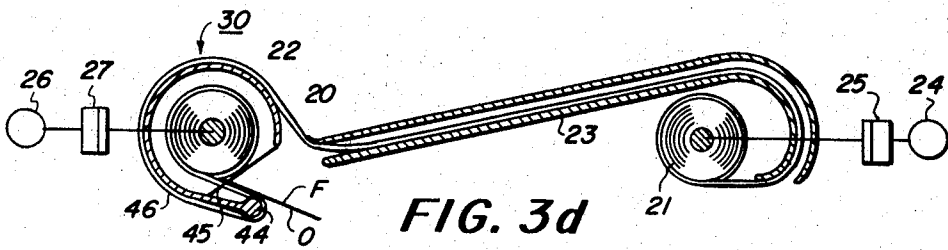
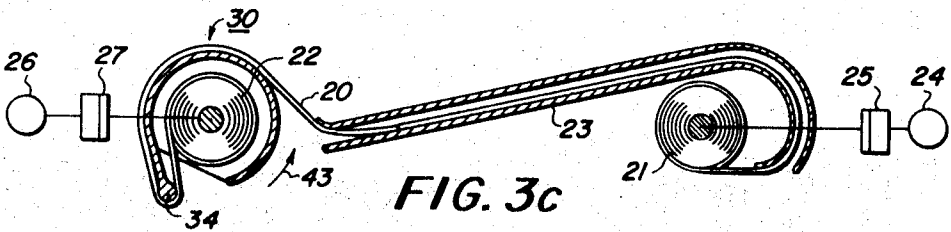
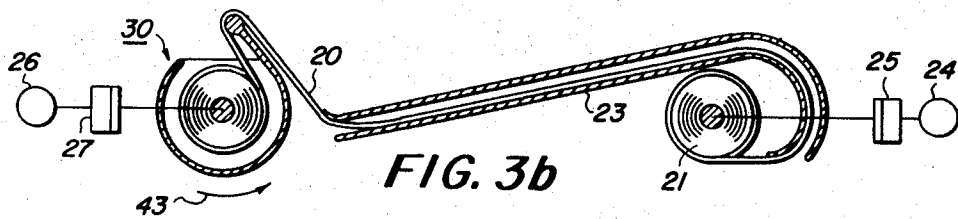
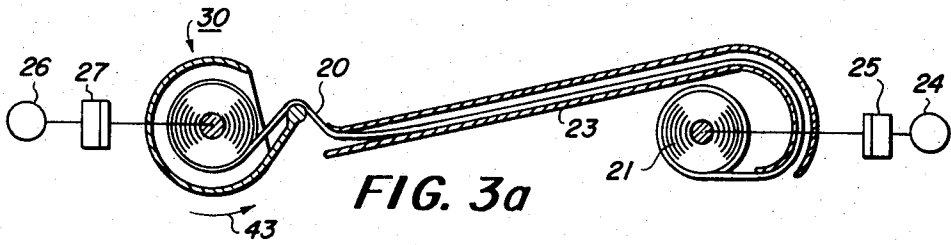


FIG. 1





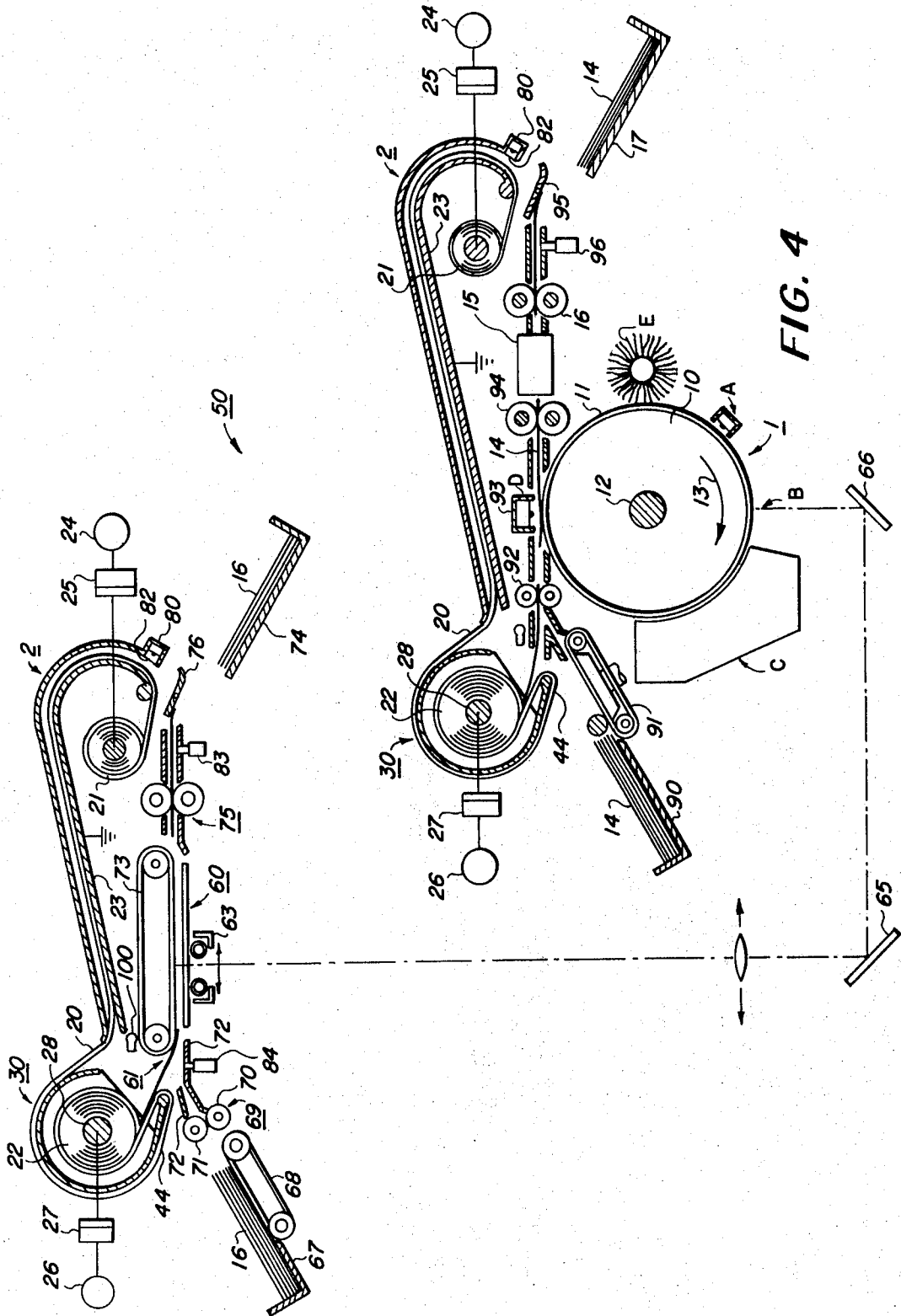


FIG. 4

## SHEET REVERSING APPARATUS AND A DUPLEX REPRODUCING APPARATUS EMPLOYING SAME

This invention relates to a sheet reversing apparatus and to a reproducing machine incorporating the sheet reversing apparatus.

A wide variety of reproducing machines of the xerographic type have been developed which are capable of forming images on both sides of the copy sheets. This process is commonly referred to in the art as duplexing. Illustrative of these machines are those set forth in U.S. Pat. Nos. 3,227,444, 3,318,212, 3,506,347, 3,580,670, 3,615,129, and 3,645,615.

The art has also developed a variety of apparatuses capable of storing, transporting and delivering articles as exemplified by those set forth in U.S. Pat. Nos. 1,838,065, 2,981,492, 3,074,663. These patents all disclose the use of a web type member for storing articles. U.S. Pat. No. 1,838,065 discloses the storage transporting and delivering of articles to an accounting type machine. The articles are stored and supported between the adjacent layers of a band of material in roll form and are delivered from the storage roll by ejection from the band as it is being unrolled.

### SUMMARY OF THE INVENTION

In accordance with this invention a sheet reversing apparatus and a process employing the apparatus is provided which is capable of turning over sheets to expose a first side and then an opposing side for processing. The apparatus may include means for processing the sides of the sheet.

The sheet reversing apparatus includes means for storing the sheets after they have been processed on the first side. The storage means comprises a web in the form of a roll wherein the sheets are supported between adjacent layers of the web. The apparatus also includes means for delivering the sheets from the storage means to a processing means with the opposing side of the sheet being oriented for processing by the processing means. The delivering means preferably includes a recycling member which deflects the web through an arcuate path to reposition the web so that the sheet may be ejected from the storage roll with the opposing side oriented for processing. The web material is comparatively thin so that a large number of sheets can be stored in this manner without having the storage roll become too large in diameter.

The sheet reversing apparatus is used in accordance with one embodiment of this invention in a reproducing machine wherein it is desired to produce an image on both sides of the sheet. The apparatus may be employed in such a machine for reversing the orientation of the copy sheets and/or the original documents. The process in accordance with this invention includes processing the sheets on a first side, storing the sheets between adjacent layers of a web, deflecting the web through a desired path to deliver the sheets oriented for processing on their opposing sides. The processing may comprise reproducing an original.

The aforementioned sheet reversing apparatus and process and the reproducing machines and reproducing processes of this invention provide an improved duplexing mode of operation. Problems of multi-feeding associated with various of the prior art devices for duplexing are avoided in accordance with this invention since the copy sheets and/or the documents are spaced

along the web in the sequence in which they are to be acted upon so that there is no possibility of multi-feeding. This is a particularly important improvement since multi-feeding in a duplexing operation is disastrous, since it results in an improper sequence of images on the respective sheets.

Therefore, it is an object of this invention to provide a sheet reversing apparatus for processing both a first and an opposing side of a sheet.

It is a further object of this invention to provide an apparatus as above for transporting, storing and delivering sheets which have been processed on a first side for processing on the opposing side.

It is a further object of this invention to provide an automatic reproducing apparatus incorporating the abovenoted reversing apparatus.

It is a further object of this invention to provide a process for reversing sheets so they may be processed on first and opposing sides.

It is a further object of this invention to provide a process for transporting, delivering and storing sheets processed on a first side for processing on an opposing side.

It is a further object of this invention to provide a process as above wherein the processing comprises reproducing an original document.

These and other objects will become more apparent from the following description and drawings in which:

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of an automatic reproducing machine incorporating the sheet reversing apparatus of this invention.

FIG. 2 is a perspective view of the recycling member which forms part of the reversing apparatus.

FIG. 3 shows a series of schematic views illustrating the operation of the recycling member.

FIG. 4 shows a schematic view of the reproducing apparatus of FIG. 1 wherein the reversing apparatus is positioned to deliver the sheets for processing on the opposing side of the sheet.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, there is shown by way of example an electrostatographic reproducing machine 1 which incorporates the improved sheet reversing apparatus 2 of the present invention. The reproducing machine 1 depicted in FIG. 1 illustrates the various components utilized therein for xerographically reproducing copies from an original document. Although the sheet reversing apparatus of the present invention is particularly well adapted for use in an automatic xerographic reproducing machine 1, it should become evident from the following description that it is equally well suited for use in a wide variety of processing systems including other electrostatographic systems and it is not necessarily limited in its application to the particular embodiment or embodiments shown herein.

The reproducing machine illustrated in FIG. 1 employs an image recording drum-like member 10, the outer periphery of which is coated with a suitable photoconductive material 11. One type of suitable photoconductive material is disclosed in U.S. Pat. No. 2,970,906, issued to Bixby in 1961. The drum 10 is suitably journaled for rotation within a machine frame (not shown) by means of a shaft 12 and rotates in the

direction indicated by arrow 13, to bring the image retaining surface thereon past a plurality of xerographic processing stations. Suitable drive means (not shown) are provided to power and coordinate the motion of the various cooperating machine components whereby a faithful reproduction of the original input scene information is recorded upon a sheet 14 of final support material such as paper or the like.

The practice of xerography is well-known in the art, and is the subject of numerous patents and texts, including *Electrophotography* by Schaffert, published in 1965, and *Xerography and Related Processes*, by Des-sauer and Clark, published in 1965. The various processing stations for producing a copy of an original are herein represented in FIG. 1 as blocks A to E. Initially, the drum 10 moves photoconductive surface 11 through charging station A. In charging station A an electrostatic charge is placed uniformly over the photoconductive surface 11 of the drum 10 preparatory to imaging. The charging may be provided by a corona generating device of a type described in U.S. Pat. No. 2,836,725, issued to Vyverberg in 1958.

Thereafter, the drum 10 is rotated to exposure station B where the charged photoconductive surface 11 is exposed to a light image of the original input scene information, whereby the charge is selectively dissipated in the light exposed regions to record the original input scene in the form of a latent electrostatic image. A suitable exposure system may be of the type described in U.S. Pat. No. 3,062,110, issued to Shepardson, et al. in 1962. After exposure, drum 10 rotates the electrostatic latent image recorded on the photoconductive surface 11 to development station C wherein a conventional developer mix is applied to the photoconductive surface 11 of the drum 10 rendering the latent image visible. A suitable development station is disclosed in U.S. Pat. No. 3,707,947, issued to Reichart in 1973. The patent describes a magnetic brush development system utilizing a magnetizable developer mix having carrier granules and a toner colorant. The developer mix is continuously brought through a directional flux field to form a brush thereof. The electrostatic latent image recorded on photoconductive surface 11 is developed by bringing the brush of developer mix into contact therewith.

The developed image on the photoconductive surface 11 is then brought into contact with a sheet 14 of final support material within a transfer station D and the toner image is transferred from the photoconductive surface 11 to the contacting side of the final support sheet 14. The final support material may be paper, plastic, etc., as desired. After the toner image has been transferred to the sheet of final support material 14, the sheet with the image thereon is advanced to a suitable fuser 15 which coalesces the transferred powder image thereto. One type of suitable fuser is described in U.S. Pat. No. 2,701,765, issued to Codichini, et al. in 1955. After the fusing process the sheet 14 is advanced by rolls 16 to catch tray 17 for subsequent removal therefrom by the machine operator.

Although a preponderance of the toner powder is transferred to the final support material 14, invariably some residual toner remains on the photoconductive surface 11 after the transfer of toner powder image to the final support material 14. The residual toner particles remaining on the photoconductive surface 11 after the transfer operation are removed from the drum 10

as it moves through cleaning station E. The neutralized toner particles are then mechanically cleaned from the photoconductive surface 11 by conventional means as, for example, the use of a brush as set forth in U.S. Pat. No. 3,572,923, issued to Fisher in 1971.

It is believed that the foregoing description is sufficient for purposes of the present application to illustrate the general operation of an automatic xerographic copier 1 which can embody the sheet reversing apparatus of the present invention.

The sheet reversing apparatus 2 in accordance with this invention will now be described in greater detail by reference to FIGS. 1 through 3. The sheet reversing apparatus 2 comprises a long web or belt-type member 20 supported between two rolls 21 and 22. The web member 20 is supported between the rolls 21 and 22 by means of a support plate 23. The roll 21 comprises the supply roll and is driven by a suitable means such as motor 24 which is connected to the roll by means of a clutch 25 such as a conventional electromagnetic clutch. Similarly, the roll 22 which comprises the storage roll is driven by means of a motor 26 connected to the roll through clutch 27.

In the storage mode of operation for the sheet reversing apparatus 2, the storage roll 22 is driven and the supply roll 21 is disengaged from its drive motor 24 so that the web is unwound from the supply roll and wound up on the storage roll. In the sheet delivering mode of operation the supply roll 21 is driven and the storage roll 22 is disconnected from its drive motor so that the web member is unwound from the storage roll and wound up on the supply roll. The clutches 25 and 27, when disengaged are arranged to provide a frictional drag on the web member 20 to keep it taut between the rolls 21 and 22. Both the supply roll 21 and the storage roll 22 are journaled for rotation in a machine frame (not shown).

An essential aspect of the present invention comprises a recycling member 30 which acts upon the storage web 20 in a manner which will be described in more detail hereinafter to provide for delivery of the sheets in a reversed or turned over orientation. Referring to FIG. 2, the recycling member 30 is shown in greater detail. It comprises a substantially cylindrical shell 31 having a longitudinally extending opening 32 therein to provide access to the storage roll 22. A lip 33 is provided extending out tangentially from the shell 31 coextensive with longitudinal opening 33. The lip 33 includes at its free end a bulbous rounded portion 34 coextensive with the lip 33 which is adapted to engage the web 20. End plates 35 and 36 are provided at the respective ends of the shell 31. The shaft 28 of the storage roll 22 extends through each of the end plates 35 and 36. The shell 31 is journaled for rotation about the storage roll shaft 28 by means of bearings 37 in the end plates 35 and 36. As aforementioned, the storage roll 22 is connected to a drive motor 26 by means of a suitable clutch 27. The drive for the recycling member 30, comprises a gear 38 affixed to end wall 35, which in turn engages the drive gear 39 mounted to the shaft of motor 40. The motor 40 is a reversing type motor and is adapted to rotate the drive gear 39 in opposing directions as shown by the arrow 41. This motion is transmitted by means of meshing gear 38 to the recycling member 30 so that it may be rotated in opposing directions about the storage roll shaft 28 as shown by arrow 42. The recycling member 30 rotates freely about the stor-

age roll shaft 28 and motion is imparted to it only by means of the drive motor 40 which is locked in position by any conventional means when the member 30 is not being actuated.

Referring now to FIGS. 1 and 3, the operation of the sheet reversing apparatus 2 of the present invention will be illustrated. The copy sheets 14 or original documents 16 after processing on a first side are fed from the respective processing station D or 17 onto the moving web member 20 which is being unwound from the supply roll 21 and wound onto the storage roll 22. The sheets are caused to adhere to the web member 20 by any conventional means as will be described in more detail hereinafter. The sheets 14 and 16 are transported by the web member 20 until they reach the storage roll 22 where they are wound up on the storage roll 22. In this manner the sheets 14 or 16 are supported between adjacent layers of the web member 20 for storage.

Referring now to FIG. 3, sheet reversing is accomplished by rotating the recycling member 30 as shown in FIGS. 3A through 3D. Bulbous portion 34 of the lip 33 engages the web member 20 so as to deflect it through an arcuate path as the recycling member 30 is rotated in the direction shown by arrow 43. As the recycling member 30 is progressively rotated through a portion of one revolution as shown in FIGS. 3A through 3D, the web member 20 is caused to wrap around the shell 31 which acts to support and guide it during the sheet delivering mode of operation. A sharp substantially U-shaped bend 44 is formed in the web member 20 between the nip 45 formed between the web and the storage roll 22 and the portion 46 of the web which is supported about the shell 31. This U-shaped portion 44 of the web 20 enhances stripping of the sheets from the web during sheet delivering as will be described in more detail hereinafter. The recycling member 30 is rotated until it achieves an appropriate orientation for sheet delivery to the desired processing station as shown, for example, in FIG. 3D.

An examination of FIGS. 1 and 3 will clearly reveal the sheet reversing action of the apparatus 2 of this invention. The sheets 14 or 16 which have been fed to the web 20 with the processed first side F facing down and the opposing side O contacting the web are fed from the web with the processed first side F facing up and the opposing side O which contacted the web facing down.

In the sheet delivering position as shown in FIG. 3D, the supply roll 21 is driven and the storage roll 22 is disengaged. The web member 20 is recoiled on the supply roll 21 and the sheets stored between the adjacent layers of the web 20 on the storage roll 22 are ejected and delivered from the storage roll 22 to the appropriate processing station.

A reproducing machine in accordance with this invention incorporating the sheet reversing apparatus 2 will now be described in greater detail by reference to FIGS. 1 and 4. Referring first to the processing station 60 where a light image is created of an original document there is shown an automatic document feeder 61 which is capable of feeding original documents 16 one at a time to a viewing platen 62 wherein a light image of the original input scene information is created for transmission to the charged photoconductive surface 11 by means of the scanning light source 63 and lens 64 and mirrors 65 and 66 as shown.

The document feeder 61 may have any desired configuration as are well known in the art. Particularly useful document feeders are described and shown in U.S. Pat. Nos. 3,506,257 and 3,567,214. A document feeder substantially of the type described in U.S. Pat. No. 3,506,257 is shown schematically in FIGS. 1, and 4.

The feeder 61 includes a tray 67 for supporting a stack of original documents 16, a belt feeder 68 adapted to frictionally engage the bottom most document in the tray. A sheet separator 69 of the friction retard type is located downstream of the belt feeder 68 and is adapted to limit the sheet feeding to a single document at a time. The separator comprises an advancing roll 70 and a retard roll 71. The documents 16 are guided by means of guide plates 72 to a belt transport 73 which positions the document on the platen 62. After the document 16 has been scanned the desired number of times the belt transport 73 is energized to clear the document from the platen 62 and feed it either to the sheet reversing apparatus 2 in accordance with this invention, as shown in FIG. 1, or the discharge tray 74 as shown in FIG. 4.

Further details of the feeder 61 and its mode of operation including document registration may be obtained by reference to U.S. Pat. No. 3,506,257. In the storage mode of operation as shown in FIG. 1, the documents 16 are transported off the platen 62 by the belt transport 73 and are then transported to the web 20 by means of pinch rolls 75. A pivotable gate 75 is provided to close the sheet transport path and guide the sheet 16 into contact with the web member 20.

The documents 16 may be affixed to the web member 20 by any desired means such as, for example, the use of a plurality of spaced apart transport rolls similar to those shown for feeding the documents into the apparatus 2. Preferably, in accordance with this invention, the documents 16 are tacked or caused to adhere to the web 20 electrostatically. The electrostatic tacking in accordance with this invention may be provided by any desired means, as for example, those described in U.S. Pat. Nos. 2,576,882 and 3,717,801. The former patent shows electrostatic tacking of articles to a belt or web type transport device. The latter patent describes the use of a corona generating device for providing the requisite electrostatic tacking.

In accordance with the embodiment shown in FIG. 1, a corona generating device 80 is used to electrostatically tack the sheets 16 to the web 20. The tacking device 80 is positioned at the entrance to the sheet reversing apparatus 2.

The web, in accordance with this invention, is preferably formed of a non-conductive material such as Teflon or Mylar to provide effective electrostatic tacking. The electrostatic tacking is effective to maintain the adherence between the sheet 16 and the web 20 even as it passes about the curved portion 81 of the conductive support plate 23. The corona generating device 80 includes a plurality of spaced apart guide wires 82 about its opening to prevent the lead edge of the sheet 16 from jamming into the shield of the device and to properly guide the sheet into contact with the web 20.

Referring now to FIG. 4, the apparatus 2 is shown in the sheet delivery mode of operation. The recycling member 30 has been rotated to the sheet delivery position. In this position the web 20 includes a sharp U-shaped bend portion 44 which acts to strip the sheets 16 from the web 20 as they are fed from the storage roll



22. In operation, sheet delivering is accomplished by disengaging the storage roll clutch 27 and engaging the supply roll clutch 25 followed by driving the supply roll 21 to unwind the web 20 from the storage roll 22 and rewind it upon the supply roll. As the web 20 is unwound from the storage roll 22, the documents 16 which have been sandwiched between the adjacent layers of the web 20 on the storage roll are fed out from the sheet reversing apparatus 2 to the transport belt 73 of the document feeder 61. The transport belt 73 registers the document 16 as it is fed from the web 20 onto the platen 62. The document is oriented so that its opposing side is adapted to be scanned to form a light image thereof in the same manner in which its first side was scanned.

It is evident that the operation of the sheet reversing apparatus 2 of the present invention must be appropriately sequence in order to receive and feed sheets in an appropriately timed relationship to the operation of the desired processing station. The sequencing may be accomplished by conventional means, as for example, those described in U.S. Pat. No. 1,838,065.

One approach, for example, which could be employed is to use sensing devices 83 and 84 to detect the sheets at appropriate points in the apparatus 2 to thereby activate an appropriate control circuit (not shown) of conventional design which would operate the apparatus 2 for the desired timed sequences.

Referring to FIG. 1, in the sheet storage mode of operation a sheet 16 exiting from the document feeder 61 is sensed by an optical sensor 83 which signals the control circuit to activate the sheet reversing apparatus 2 or more specifically to drive the storage roll 22 for a period sufficient to affix the sheet to the web 20. In the storage mode of operation the gate 76 is in its closed position and the motor 24 for the supply roll 21 is disengaged while the motor 26 for the storage roll 22 is engaged by means of clutch 27. A selector switch (not shown) is employed to signal the control circuit to select and change modes of operation, namely, sheet storage, sheet delivery and changing from one to the other. The mode changing first includes winding a further portion of the web 20 onto the storage roll 22 to insure that all sheets 16 tacked to the web are wound on the roll prior to rotating the recycling member 30. After this period the control circuitry would activate the recycling member 30 causing it to rotate to its sheet delivery position. After the recycling member 30 has been properly positioned, the storage roll motor 26 would be disengaged from the storage roll 22 and the supply roll motor 24 would be engaged to the supply roll 21 through clutch 25.

Referring to FIG. 4, the supply roll motor 24 would then be driven until the trailing edge of the sheet 16 is sensed by an optical sensor 84 which signals the control circuit to provide a timed sequence during which the apparatus 2 is inactivated to allow the sheet 16 to be registered on the platen 62 and scanned the desired number of times depending on the number of copies to be produced. After the scanning has been completed, the supply roll motor 24 would again drive the supply roll 21 to cause a second sheet 16 to be ejected from the storage roll 22 and sensed and processed as in the case of the previous sheet. In this manner sheets 16 can be stored and delivered from the sheet reversing apparatus 2 of this invention in an appropriate sequence for processing. Further, this sequencing of the movement

of the web 20 allows the greatest density of sheets 16 to be stored on the web. Various types of conventional control circuitry and sensing devices could be employed, to obtain the desired sequencing. The aforementioned example is meant to be merely illustrative, and other approaches could be employed, as for example, those set forth in U.S. Pat. No. 1,838,065.

Referring again to FIGS. 1 and 4, the operation of the sheet reversing apparatus 2 of the present invention will be described with respect to the handling of the copy sheets 14. The operation of the apparatus 2 for copy sheets 14 is in most respects similar to that for original documents 16. A copy sheet from the stack 90 is separated and transported therefrom by means of a vacuum transport 91 to a pair of registration pinch rolls 92. The pinch rolls 92 feed the sheet 14 in an appropriately timed sequence to the transfer station D of the reproducing machine 1. The developed latent electrostatic image present on the drum 10 is transferred to the sheet 14 under the action of a transfer corona generating device 93. Following transfer, the sheet 14 is transported by means of pinch rolls 94 through a fusing apparatus 15 and then to pinch rolls 16 which transport the sheet to the sheet reversing apparatus 2. A pivoting gate 95 is positioned to close the sheet transport path and guides the sheet 14 into contact with the storage web 20 to which it is tacked by means of the corona generating device 80 as in accordance with the document handling apparatus. The sheet 14 tacked to the storage web 20 is then transported to and wound up on the storage roll 22.

In the copy sheet delivery mode of operation, as shown in FIG. 4, the recycling member 30 has been rotated to the sheet delivery position. The copy sheet 14 is delivered from the storage roll 22 by unwinding the web 20 therefrom. The copy sheet 14 is delivered to the pinch rolls 92 which serve to register the sheet in appropriate sequence for transfer of the developed image to the opposing side of the sheet. After image transfer, the sheet 14 is then transported to the pinch rolls 94 which transport it through the fuser 15. The pivoting gate 95 is now positioned to deflect the sheet 14 so that it will fall into the output tray 17.

The various aspects of the copy sheet handling following delivery from the storage apparatus 2 including transport and registration prior to imaging may be accomplished by any desired means, as for example, those shown and described in U.S. Pat. Nos. 3,615,129 and 3,645,615.

In normal operation the sheets 14 or 16 should remain tacked to the web 20 as they are fed off the storage roll 22. In order to prevent any possibility of the sheets 14 or 16 adhering to the backside of the storage roll 22 instead of to the original web surface to which they were tacked, preferably some means is provided for stripping the sheets off the roll 22, as for example, the use of puffers 100 as shown. The puffers 100 provide a stream of air which is effective to strip the sheets 14 or 16 from the roll 22. While a puffer 100 is preferred in accordance with this invention, other approaches could be employed as for example the use of a detacking corona generating device or mechanical stripping fingers.

Therefore, in accordance with this invention a sheet reversing apparatus 2 has been provided which is capable of storing/transporting and delivering sheets so that the sheets may be processed on their first and opposing

sides. In a reproducing machine the sheet reversing apparatus may be employed in conjunction with a document feeding apparatus 61 to enable the documents to be imaged on both their first and opposing sides and similarly it can be employed to enable the copy sheets to be imaged on their first and opposing sides. The apparatus of this invention is adapted to make multiple duplex copies of a plurality of originals in a given arrangement or single duplex copies of a plurality of originals. Where multiple copies of the originals are made, the plurality of copy sheets for each original are stored on the storage web in the sequence in which they are made and are delivered from the storage web in the same sequence to the transfer station for imaging on their reverse sides. Where a plurality of copies are made from each respective original document, a suitable sorting apparatus, as are known in the art, can be employed to obtain fully collated copies of the documents or reports.

Storage rolls employed in accordance with this invention are capable of storing in a relatively small volume a comparatively large number of documents or copy sheets. For example, if 200 sheets, 5 mils thick, plus a storage web 5 mils thick, are wound onto a storage roll which is initially 4 inches in diameter, the final diameter of the roller will be approximately 6 inches. The storage capacity of the sheet reversing apparatus of this invention is governed solely by the diameter of the roll which can be accommodated in the machine.

Preferably, the recycling member is rotated to the sheet delivery position over a path of from about 180° to about 360° and more preferably from about 270° to about 360°.

The term "processing" as applied to the work performed on the first and opposing sides of the sheet includes any means or process for acting or operating on the sides of the sheet. The term "sheet reversing" refers to the operation of turning over the sheet with respect to a given point or work station to expose the opposing side of the sheet thereto. The term "reversed orientation" refers to a sheet which has been turned over with respect to a given point or work station to expose the opposing side of the sheet thereto. The terms "sheet" and "document" as used in this application are meant to include both singular and plural sheets and documents irrespective of whether the terms are expressed in the singular or plural form.

The patents and texts referred to specifically in the detailed description of this application are intended to be incorporated by reference into the description.

It is apparent that there has been provided in accordance with this invention, a sheet reversing apparatus and a reproducing machine incorporating the sheet reversing apparatus which fully satisfies the objects, means and advantages set forth hereinbefore. While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications and variations as fall within the spirit and broad scope of the appended claims.

What is claimed is:

1. A sheet reversing apparatus for reorienting sheets so that a first side and an opposing side of the sheets may be operated upon comprising:

means for storing said sheets comprising a web wherein the sheets are supported between adjacent layers thereof; and

means acting on said web to deliver therefrom the sheets stored thereon in a reversed orientation, wherein said delivering means deflects said web through a path to reposition said web so that the sheets may be ejected from the storage means with the opposing side oriented to be operated upon.

2. An apparatus as in claim 1, wherein said delivering means deflects said web through an arcuate path.

3. An apparatus as in claim 2, wherein the deflection of said web is provided by a recycling member which is adapted to rotate from about 180° to about 360°.

4. An apparatus as in claim 1, wherein said web having said sheets supported between adjacent layers thereof is in the form of a storage roll.

5. An apparatus as in claim 4, wherein said web is supported between a supply roll and the storage roll, said storage means further including means for driving said storage roll for winding said web upon said storage roll and storing said sheets between the adjacent layers thereof and means for driving said supply roll for winding said web upon said supply roll and unwinding said web from said storage roll for ejecting said sheets from said storage roll.

6. An apparatus as in claim 5, further including conductive means for supporting said web positioned between said supply roll and said storage roll.

7. An apparatus as in claim 6, further including means for affixing said sheets to said web.

8. An apparatus as in claim 7, wherein said affixing means comprises a corona generating device.

9. An apparatus as in claim 4, wherein said recycling member is adapted to form a sharp bend in said web to aid in stripping said sheets from said web during sheet delivery.

10. An apparatus as in claim 9, wherein said recycling member comprises a substantially cylindrical shell having a longitudinally extending opening therein to provide access to said storage means, a lip extending out tangentially from said shell coextensive with said longitudinal opening and a bulbous rounded portion at the free end of said lip coextensive with said lip, said bulbous rounded portion being adapted to engage said web to deflect it about said arcuate path.

11. A reproducing apparatus for providing an image on a first side and an opposing side of a copy sheet or sheets comprising:

means for forming an image on said sides of said sheets;

means communicating with said imaging means for storing said sheet following imaging on a first side thereof, said storing means comprising a web wherein the sheet is supported between adjacent layers thereof;

and means acting on said web to deliver therefrom the sheet stored thereon in a reversed orientation to said imaging means so that an image may be formed on the opposing side thereof.

12. An apparatus as in claim 11, wherein said delivering means deflects said web through an arcuate path to reposition the web so that the sheets may be ejected from the storage means with the opposing side oriented to be operated upon.

13. An apparatus as in claim 12, wherein the deflection of said web is provided by a recycling member

which is adapted to rotate from about 180° to about 360°.

14. An apparatus as in claim 11, wherein said web having said sheets supported between adjacent layers thereof is in the form of a storage roll.

15. An apparatus as in claim 14, wherein said web is supported between a supply roll and the storage roll, said storage means further including means for driving said storage roll for winding said web upon said storage roll and storing said sheets between the adjacent layers thereof and means for driving said supply roll for winding said web upon said supply roll and unwinding said web from said storage roll for ejecting said sheets from said storage roll.

16. An apparatus as in claim 15, further including conductive means for supporting said web positioned between said supply roll and said storage roll.

17. An apparatus as in claim 16, further including means for affixing said sheets to said web.

18. An apparatus as in claim 17, wherein said affixing means comprises a corona generating device.

19. An apparatus as in claim 14, wherein said recycling member is adapted to form a sharp bend in said web to aid in stripping said sheets from said web during sheet delivery.

20. An apparatus as in claim 19, wherein said recycling member comprises a substantially cylindrical shell having a longitudinally extending opening therein to provide access to said storage means, a lip extending out tangentially from said shell coextensive with said longitudinal opening and a bulbous rounded portion at the free end of said lip coextensive with said lip, said bulbous rounded portion being adapted to engage said web to deflect it about said arcuate path.

21. In a reproducing apparatus including means for supporting an original document, means for feeding said document to said support means and means for forming an image of said document, the improvement wherein said apparatus includes:

means communicating with said support means for receiving and storing said document after a first side thereof has been imaged, said receiving and storing means comprising a web wherein the document is supported between adjacent layers thereof; and means acting on said web to deliver therefrom the document stored thereon in a reversed orientation to said support surface for imaging the opposing side thereof.

22. An apparatus as in claim 21, wherein said delivering means deflects said web through an arcuate path to reposition the web so that the sheets may be ejected from the storage means with the opposing side oriented to be operated upon.

23. An apparatus as in claim 22, wherein the deflection of said web is provided by a recycling member which is adapted to rotate from about 180° to about 360°.

24. An apparatus as in claim 21, wherein said web having said sheets supported between adjacent layers thereof is in the form of a storage roll.

25. An apparatus as in claim 24, wherein said web is supported between a supply roll and the storage roll, said storage means further including means for driving said storage roll for winding said web upon said storage roll and storing said sheets between the adjacent layers thereof and means for driving said supply roll for winding said web upon said supply roll and unwinding said

web from said storage roll for ejecting said sheets from said storage roll.

26. An apparatus as in claim 25, further including conductive means for supporting said web positioned between said supply roll and said storage roll.

27. An apparatus as in claim 26, further including means for affixing said sheets to said web.

28. An apparatus as in claim 27, wherein said affixing means comprises a corona generating device.

29. An apparatus as in claim 24, wherein said recycling member is adapted to form a sharp bend in said web to aid in stripping said sheets from said web during sheet delivery.

30. An apparatus as in claim 29, wherein said recycling member comprises a substantially cylindrical shell having a longitudinally extending opening therein to provide access to said storage means, a lip extending out tangentially from said shell coextensive with said longitudinal opening and a bulbous rounded portion at the free end of said lip coextensive with said lip, said bulbous rounded portion being adapted to engage said web to deflect it about said arcuate path.

31. In a reproducing apparatus for forming images on a first and an opposing side of a copy sheet or sheets comprising:

means for supporting an original document having a first and an opposing side;

means for reproducing the original input scene information on said first and opposing sides of said document on the respective first and opposing sides of said copy sheet, the improvement wherein:

a first means communicating with said supporting means are provided for receiving and storing said document after a first side thereof has been reproduced, said first receiving and storing means comprising a web wherein the document is supported between adjacent layers thereof;

and a first means acting on said first web to deliver therefrom the document stored thereon in a reversed orientation to said support surface for reproducing said opposing side thereof;

and wherein said apparatus further includes a second means for receiving and storing said copy sheet after said first side has been provided with said reproduction of said first side of said document, said second receiving and storing means comprising a web wherein the sheet is supported between adjacent layers thereof;

and a second means acting on said second web to deliver therefrom the sheet stored thereon in a reversed orientation so that the opposing side thereof may be provided with a reproduction of said opposing side of said document.

32. An apparatus as in claim 31, wherein each of said first and second delivering means deflects said first and second webs through an arcuate path to reposition said webs so that the document or sheet respectively may be ejected from the each of the first and second storage means with the opposing sides oriented to be operated upon.

33. An apparatus as in claim 32, wherein the deflection of said first and second webs are provided by respective recycling members which are adapted to rotate from about 180° to about 360°.

34. An apparatus as in claim 31, wherein said first and second webs having said document or sheet sup-

ported between adjacent layers thereof are in the form of respective storage rolls.

35. An apparatus as in claim 34, wherein said first and second webs are each supported between a supply roll and the respective storage roll, each of said first and second storage means further including means for driving each of said storage rolls for winding said first and second webs upon said storage rolls and storing said document or sheet between the adjacent layers thereof and means for driving each of said supply rolls for winding said first and second webs upon said supply rolls and unwinding said webs from said storage rolls for ejecting said document or sheet from said storage rolls.

36. An apparatus as in claim 35, further including a conductive means for supporting each of said first and second webs, said support means being positioned between each of said supply rolls and each of said respective storage rolls.

37. An apparatus as in claim 36, further including a means for affixing said document or sheet to each of said webs.

38. An apparatus as in claim 37, wherein said affixing means comprises corona generating devices.

39. An apparatus as in claim 34, wherein each of said recycling members is adapted to form a sharp bend in each of said webs to aid in stripping said documents or sheets from their respective said webs during sheet delivery.

40. An apparatus as in claim 39, wherein each of said recycling members comprises a substantially cylindrical shell having a longitudinally extending opening therein to provide access to said storage means, a lip extending out tangentially from said shell coextensive with said longitudinal opening and a bulbous rounded portion at the free end of said lip coextensive with said lip, said bulbous rounded portion being adapted to engage said web to deflect it about said arcuate path.

41. A process of reversing the orientation of a sheet so that a first and an opposing side of the sheet may be operated upon comprising:

- storing said sheets on a web wherein the sheets are supported between adjacent layers thereof;
- deflecting said web to reposition it so that sheets may be ejected therefrom with the opposing side oriented to be operated upon;
- and delivering said sheets from said web.

42. A process as in claim 41, wherein said web is deflected through an arcuate path.

43. A process as in claim 42, wherein said arcuate path traverses from about 180° to about 360°.

44. A process as in claim 42, wherein said storing step comprises winding up said web on a roll with said sheets sandwiched between adjacent layers thereof.

45. A process as in claim 44, wherein said delivery step comprises unwinding said web from said roll to eject the sheets therefrom.

46. A process as in claim 45, wherein said delivery step further includes winding up said web upon a supply roll.

47. A process as in claim 46, further including the step of electrostatically tacking said sheets to said web.

48. A process as in claim 47, wherein said step of deflecting said web further includes forming a sharp bend therein which operates to strip said tacked sheets from said web during said delivery step.

49. A process as in claim 48, wherein prior to said storing step said sheets are imaged on said first side and wherein subsequent to said delivery step said sheets are imaged on said opposing side.

50. A process as in claim 48, wherein prior to said storing step a light image of the original input scene information on said first side of said sheet is formed and wherein subsequent to said delivery step a light image of the original input scene information on the opposing side of said sheet is formed.

51. An apparatus as in claim 11, wherein said delivering means deflects said web through a path to reposition the web so that the sheets may be ejected from the storage means with the opposing side oriented to be operated upon.

52. An apparatus as in claim 21, wherein said delivering means deflects said web through a path to reposition the web so that the sheets may be ejected from the storage means with the opposing side oriented to be operated upon.

53. An apparatus as in claim 31, wherein each of said first and second delivering means deflects said first and second webs through a path to reposition said webs so that the document or sheet respectively may be ejected from each of the first and second storage means with the opposing sides oriented to be operated upon.

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