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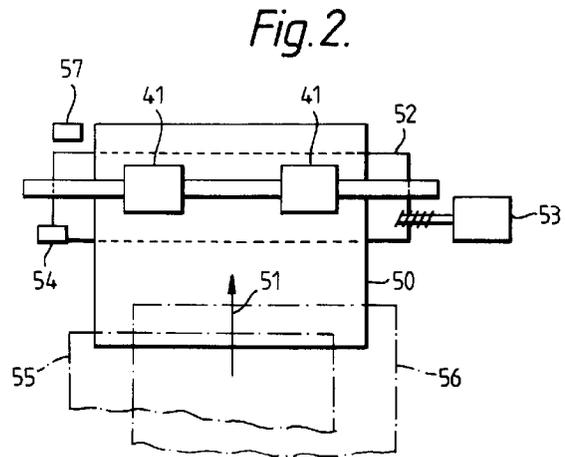
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Sheet feeding apparatus with lateral registration.

Sheet feeding apparatus including feed rollers (41, 42) for feeding sheets (50) in a process direction and registration means (52, 53) for registering each sheet in a direction laterally of the process direction. The registration means comprises shifting means (53) for laterally shifting a carriage (52) on which the feed rollers are mounted. A sensor (57) is arranged to provide a signal on detecting the presence of a sheet, and control means controls the lateral shifting means in response to the signal. The control means is arranged such that if the sheet (50) is not detected by the sensor (57) on initial entry of the sheet into the feed rollers the shifting means (53) is activated to move the feed rollers laterally towards the sensor until the sheet is detected by the sensor whereupon said lateral movement is stopped, or if the sheet is detected on initial entry of the sheet into the feeding means the shifting means is first activated to move the feed rollers laterally away from the sensor until the sensor no longer detects the sheet and is then activated to move the feed rollers back towards the sensor until the sheet is again detected by the sensor.



This invention relates to a sheet feeding apparatus which is particularly, although not exclusively, useful in a copier or printer such as a xerographic copier or printer.

In copier and printers, it is necessary to register copy sheets both in the process direction and in a direction laterally of the process direction, to ensure correct placement of the image in each sheet. The present invention is concerned with the lateral registration of sheets in a sheet feeding apparatus.

A number of devices for lateral shifting and registration of sheets are known, such as the lateral sheet shifting or offsetting mechanisms of US-A-4 712 786 and US-A-4 480 825. In US-A-4 712 786 a printing apparatus is disclosed that includes a sorter and an offsetting device. The offsetting device is positioned within the printer and is adapted to translate sheets en route to the sorter alternately front and rearward such that sheets are offset before they are driven into the sorter with subsequent sheet sets being offset from each other within bins of the sorter. An apparatus for separating sets of copy sheets from a copier is disclosed in US-A-4 480 825 that includes a mechanism that delivers alternate sets of sheets to a stationary tray along overlapping laterally spaced paths. Sheets are fed first through a transversely fixed assembly of opposing feed rollers and then through a second, transversely movable assembly of feed rollers into a stacking tray. Sheets belonging to alternate sets are offset by shifting the second set of rollers laterally.

US-A-4 823 159 discloses a lateral shifting and registration arrangement in which the sheet is fed between two co-operating nip rollers which are stopped with the sheet still in the nip between them and shifted laterally until an edge of the sheet is detected by a sensor. The sheet is then registered laterally of the process direction and may be fed to the next stage in its process by rotation of the rollers. In this way, the sheet can be registered laterally while it is still held the nip in between the rollers. After each sheet has been fed out of the rollers, the roller assembly is shifted in the opposite lateral direction to the registration direction, back to a "home" position.

An arrangement of the kind described in US-A-4 823 159 is especially useful in copying machines which make duplex, i.e. two-sided copies, and in which copy sheets carrying a first-side image are stopped, and then fed back in the opposite direction to receive an image on their second side. Before being fed back, the sheet must be re-registered laterally of the process direction. Another device which re-registers copy sheets in these same circumstances is described in our EP-A-0 378 005, in which sheets passing through a sheet arrangement in a first, process, direction are not shifted laterally, but when stopped and reversed are shifted laterally so that they are driven towards an edge registration wall.

There is still a need for an inexpensive, accurate and reliable device for laterally registering sheets, especially in the situation described above where the sheet is stopped and reversed in a duplex copying or printing machine.

The present invention is intended to meet this need, and accordingly provides a sheet feeding apparatus including feeding means for feeding sheets in a process direction and registration means for registering each sheet in a direction laterally of the process direction, the registration means comprising shifting means for laterally shifting the feeding means, a sensor arranged to provide a signal on detecting the presence of a sheet, and control means to control the lateral shifting means in response to said signal, characterised in that the control means is arranged such that if the sheet is not detected by the sensor on initial entry of the sheet into the feeding means the shifting means is activated to move the feeding means laterally towards the sensor until the sheet is detected by the sensor whereupon said lateral movement is stopped, or if the sheet is detected on initial entry of the sheet into the feeding means the shifting means is first activated to move the feeding means laterally away from the sensor until the sensor no longer detects the sheet and is then activated to move the feeding means towards the sensor as aforesaid.

The apparatus of the invention has the advantage that it can accommodate wide range of sheet positions as the sheet enters the device, on either side of a desired registration position. Whatever the initial sheet position, the device will always register the sheet in the same direction, thereby eliminating any inconsistencies due to backlash or hysteresis in the system.

An apparatus in accordance with the invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is schematic diagram showing the paper paths in a printer capable of making duplex copies and incorporating the sheet feeding apparatus of the invention; and

Figure 2 is a diagrammatic plan view of a sheet feeding apparatus according to the invention.

Referring to figure 1, the main elements of a xerographic laser printer 10 are shown in diagrammatic form. The printer produces prints, or copies, of input information in electronic form, typically derived from documents. The electronic input information, in digital form, is processed by an electronic sub-system (ESS) 11, and is used to modulate a scanning light beam 12, produced by a laser, in a raster output scanner (ROS) 13. The light beam 12, typically a laser beam, is directed onto a photoreceptor contained within a xerographic cassette 14. The photoreceptor is uniformly electrostatically charged and moved past a slit in the underside of the cassette 14. The beam 12 is scanned across the slit to form an electrostatic latent image on

the photoreceptor by selectively discharging the uniform charge where light falls on it. The electrostatic latent image is developed with toner particles which adhere selectively to the latent image in the same configuration as the image, and the developed image is transferred, at transfer station 15, to a sheet of paper. The paper sheet, carrying the developed image, then passes through a fuser 16, consisting of a heated roller and a co-operating back-up roller, to fuse the image to the paper sheet, forming a permanent print or copy. The copy may then be transported into one of two output trays, as will be described in more detail below, or be returned, in a duplex imaging mode, to the xerographic cassette to receive a further developed image on its second side.

Paper sheets to receive the developed images are fed out of any one of four trays 21, 22, 23 and 24, with the different trays being capable of containing different sizes and different numbers of sheets. For example, tray 21 is a high capacity tray for containing the size of sheet most often used in the printer, for example A4 sheets. Trays 22 and 23 will accommodate larger sizes, and tray 24 may be used, for example, to contain special sheets such as coloured sheets or transparencies. Sheets are fed out of the trays 21, 22, 23 and 24 by respective sheet feeders 31, 32, 33 and 34, then by transport rollers through converging sheet paths until the sheet fed from any one of the four trays is fed by common fed roller pair 25 into the xerographic cassette 14 at transfer station 15. The sheet carrying the developed image then passes through fuser 16.

The further progress of a copy sheet through the machine depends on whether a simplex (one-sided) or duplex (two-sided) copy is being made. If a simplex copy is being made, the sheet follows upper paper path 26 after passing through transport rollers 27, 28. The sheet may then travel upwardly around sheet path 30, to be deposited in the top output tray 35, or it may proceed substantially horizontally along a path 36 to an inverter drum 37 before being deposited on the receiving tray of a high capacity stacker 38. A suitable sheet deflector is provided at point 29 so that the sheet passes along the chosen one of sheet paths 30 and 36.

In the case where a duplex copy is to be made, the sheet carrying its first-side image passes through transport rollers 27, 28 as before, but is deflected at point 39 along a lower sheet path 40 towards a pair of reversing rollers 41, 42. After a major portion of the sheet has been fed through reversing rollers 41, 42, along sheet path 43, and if necessary into vertical storage bin 44, the reversing rollers 41, 42 are stopped, and rotated in the opposite sense so as to refeed the sheet along a return paper path 45 from which it passes between transport rollers 28 and 46 to join the paper path normally followed by sheets initially fed from uppermost tray 24. The sheet then passes

through common feed rollers 25 to receive a developed image on its other side at transfer station 15 of xerographic cassette 14. Thereafter, the duplex copy follows the upper paper path 26 as already described, with the option of feeding the sheet out into the top output tray 35, or the high capacity stacker 38.

Referring now to figure 2, there is shown a plan view of the reversing rollers 41 (with the co-operating rollers 42 beneath them, not visible in the figure). Rollers 41 or 42 are driven so that, in co-operating with each other, they drive a sheet 50 in the direction of arrow 51 until a major portion of the sheet has passed between the rollers. The rollers are then stopped, and the sheet registered laterally as will be described below. The rollers are then reversed to drive the sheet back towards the xerographic cassette as described above.

Lateral registration of the sheet is achieved by movement of a carriage 52 which carries the rollers 41 and 42, the carriage being driven laterally of the process direction by a motor 53. Before each sheet of the paper is fed into the rollers 41, 42, the carriage is moved to a "home" position by motor 53, the home position being detected by a home position sensor 54. Thus, between the feeding of successive sheets, the carriage 52 is moved to the right if the home sensor 54 can see the carriage, or to the left if the sensor is clear. At the point that the sensor changes state, the motor 53 is stopped, and the carriage is in its home position.

A sheet of paper then enters the rollers 41, 42, and can be in any of a wide range of lateral position, as indicated by the extreme positions indicated in broken outline at 55 and 56. Once the sheet has been fed through the reversing rollers 41, 42 to the correct extent, the rollers stop. If, at this point, a sheet edge sensor 57 cannot see the sheet, then the motor 53 is energised to move the carriage, and hence the rollers carrying the sheet, to the left. When the sensor 57 changes state, the motor is stopped, and the sheet is registered. If, however, the edge sensor 57 can see the paper, then the motor 53 is energised to move the carriage to the right until the sensor no longer sees the paper sheet, at which point the motor 53 is reversed and the carriage is moved to the left. When the edge sensor 57 changes state, the motor is stopped, and the sheet is registered.

In this way, any backlash in the system or hysteresis in the edge sensor 57 is accounted for. Once the sheet is registered, it is ready to be fed back to the transfer station.

The registration system of the invention provides an accurate, reliable, and inexpensive way of registering sheets, whether in a reversing roller arrangement, as described, or in any other situation where a sheet needs to be registered laterally of its process direction. The approaching sheet can be positioned over a wide range of lateral positions, such that the edge

of the sheet may or may not be sensed initially by the edge sensor 57. This arrangement is very economical on space within the machine.

Claims

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1. Sheet feeding apparatus including feeding means for feeding sheets in a process direction and registration means for registering each sheet in a direction laterally of the process direction, the registration means comprising shifting means for laterally shifting the feeding means, a sensor arranged to provide a signal on detecting the presence of a sheet, and control means to control the lateral shifting means in response to said signal, characterised in that the control means is arranged such that if the sheet is not detected by the sensor on initial entry of the sheet into the feeding means the shifting means is activated to move the feeding means laterally towards the sensor until the sheet is detected by the sensor whereupon said lateral movement is stopped, or if the sheet is detected on initial entry of the sheet into the feeding means the shifting means is first activated to move the feeding means laterally away from the sensor until the sensor no longer detects the sheet and is then activated to move the feeding means towards the sensor as aforesaid.

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 2. The apparatus of claim 1 including means for driving the sheet feeding means to drive a sheet in a first direction, stopping the sheet in the sheet feeding means to enable the registration means to register the sheet, and reversing the feeding means to drive the sheet in a direction opposite the first direction.

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 3. The apparatus of claim 1 or claim 2 wherein the sheet feeding means comprises at least one pair of rollers mounted on a carriage, the lateral shifting means being connected to the carriage.

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Fig. 1.

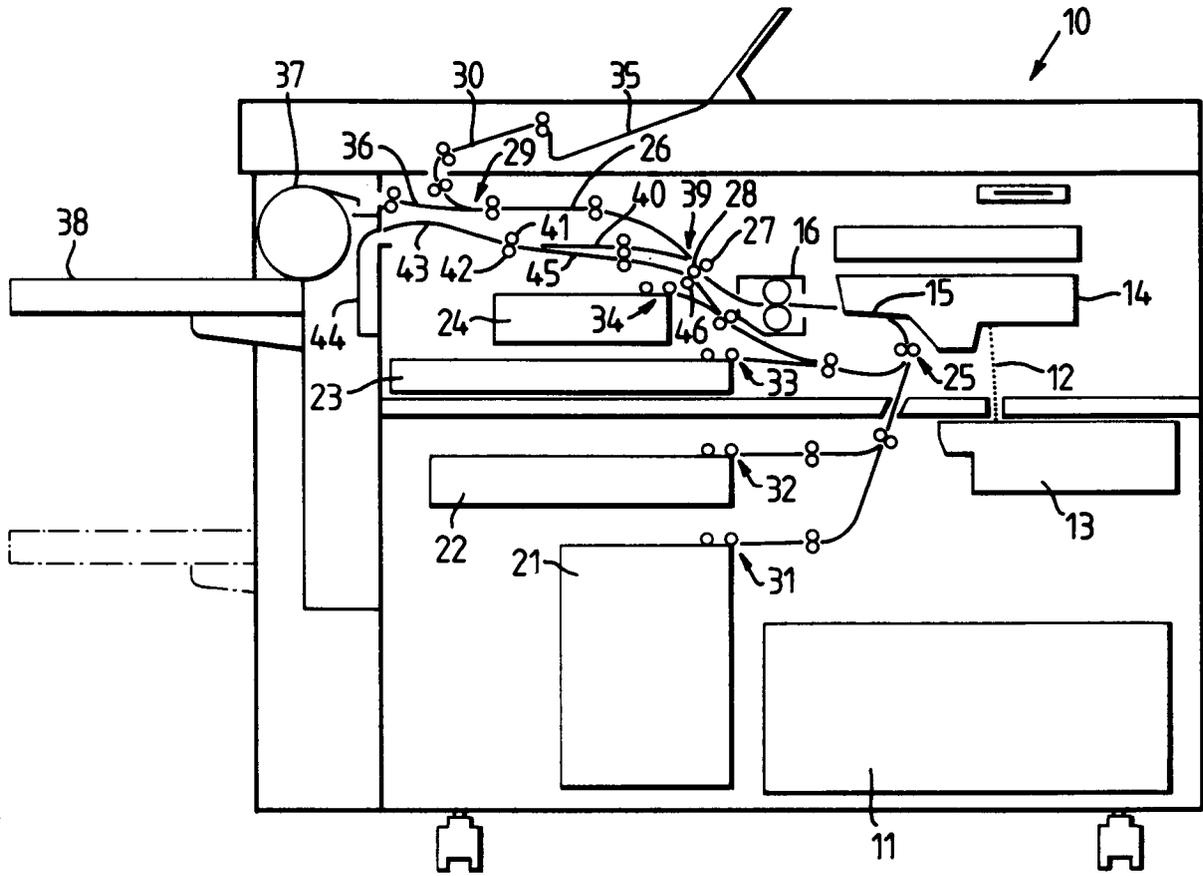
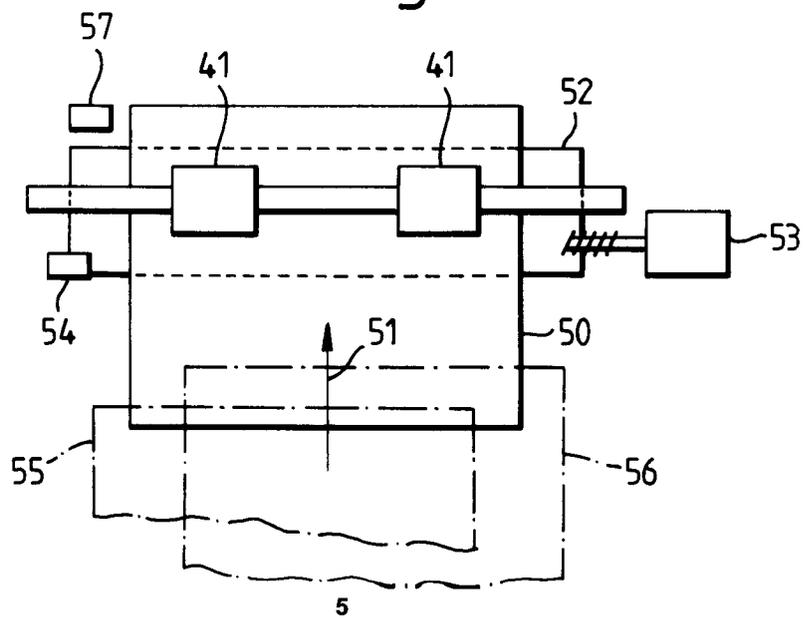


Fig. 2.





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 92308288.7
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	<p><u>US - A - 4 805 892</u> (CALHOUN) * Fig., column 3, lines 38-56 * --</p>	1-3	<p>B 41 J 13/30 B 65 H 9/10</p>
Y	<p><u>EP - A - 0 114 393</u> (HEIDELBERGER DRUCKMASCHINEN) * Fig. 4; page 6, lines 15-26 * -----</p>	1-3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			<p>B 41 J B 65 H</p>
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
VIENNA		27-10-1992	MEISTERLE
CATEGORY OF CITED DOCUMENTS			
<p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p>		<p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>	

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