March 5, 1963 B. B. PASQUINELLI 3,080,163

SHEET REGISTERING MECHANISM

Filed Sept. 2, 1960 4 Sheets-Sheet 1

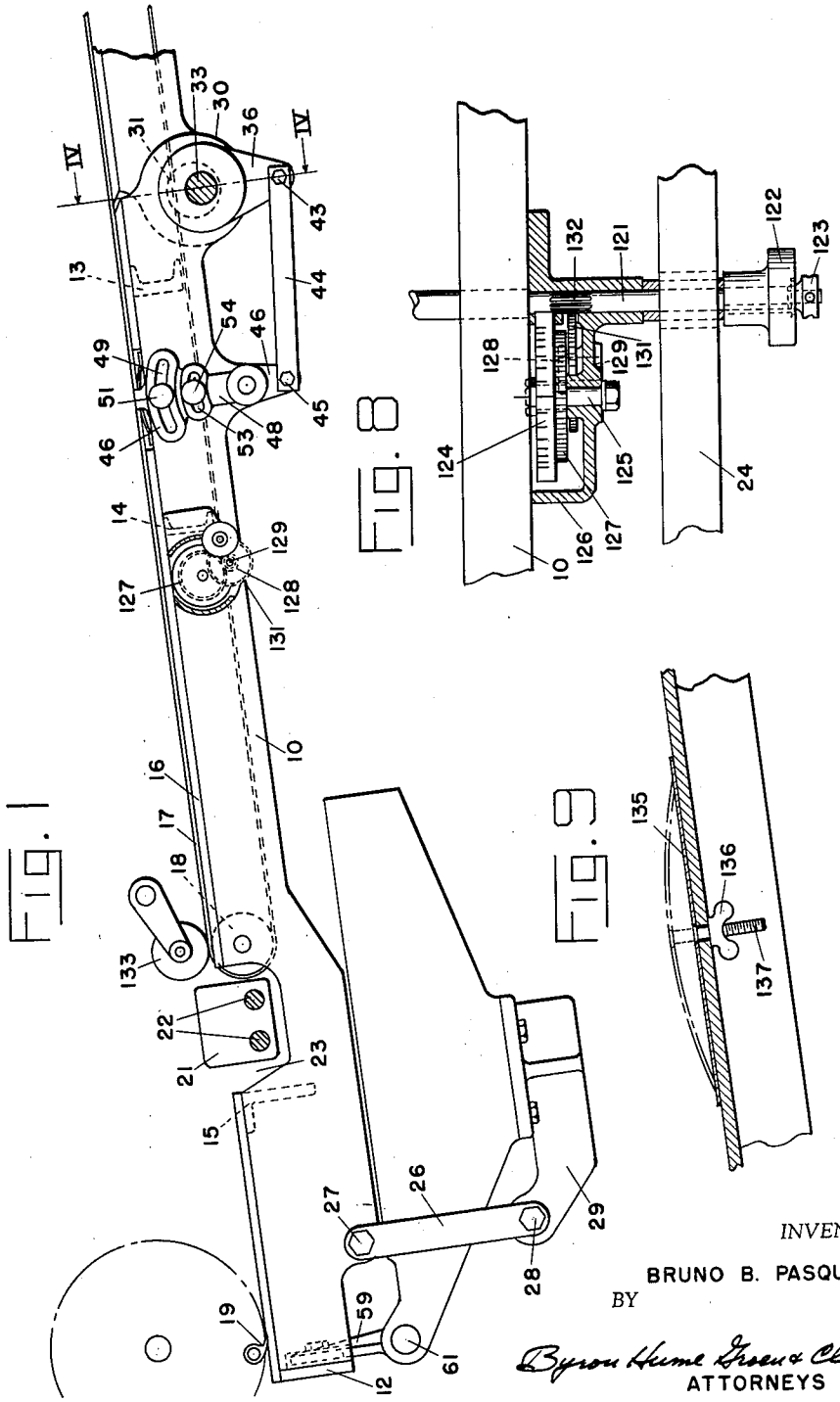


FIG. 1

FIG. 8

FIG. 9

INVENTOR.

BRUNO B. PASQUINELLI

BY

Byron Hume Green & Clement

ATTORNEYS

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SHEET REGISTERING MECHANISM

Filed Sept. 2, 1960 4 Sheets-Sheet 2

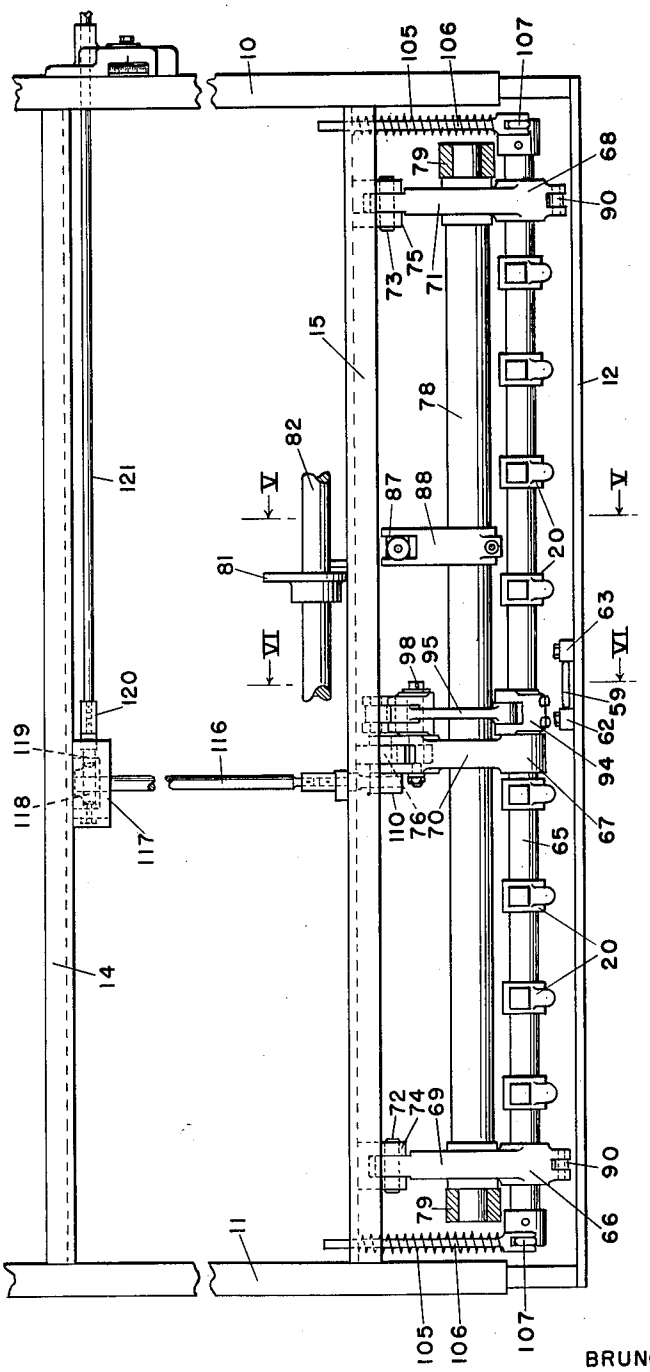


FIG. 2

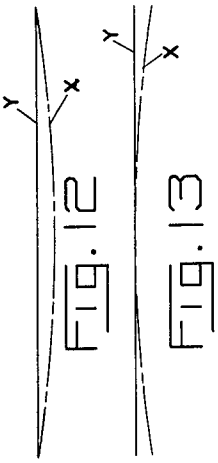


FIG. 12

FIG. 13

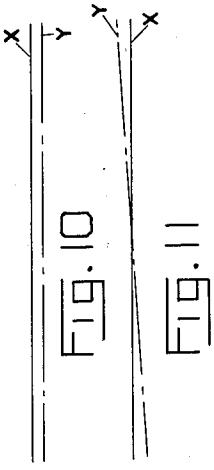


FIG. 10

FIG. 11

INVENTOR.
BRUNO B. PASQUINELLI

BY

Byron Hume Brown & Clement
ATTORNEYS

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SHEET REGISTERING MECHANISM

Filed Sept. 2, 1960 4 Sheets-Sheet 3

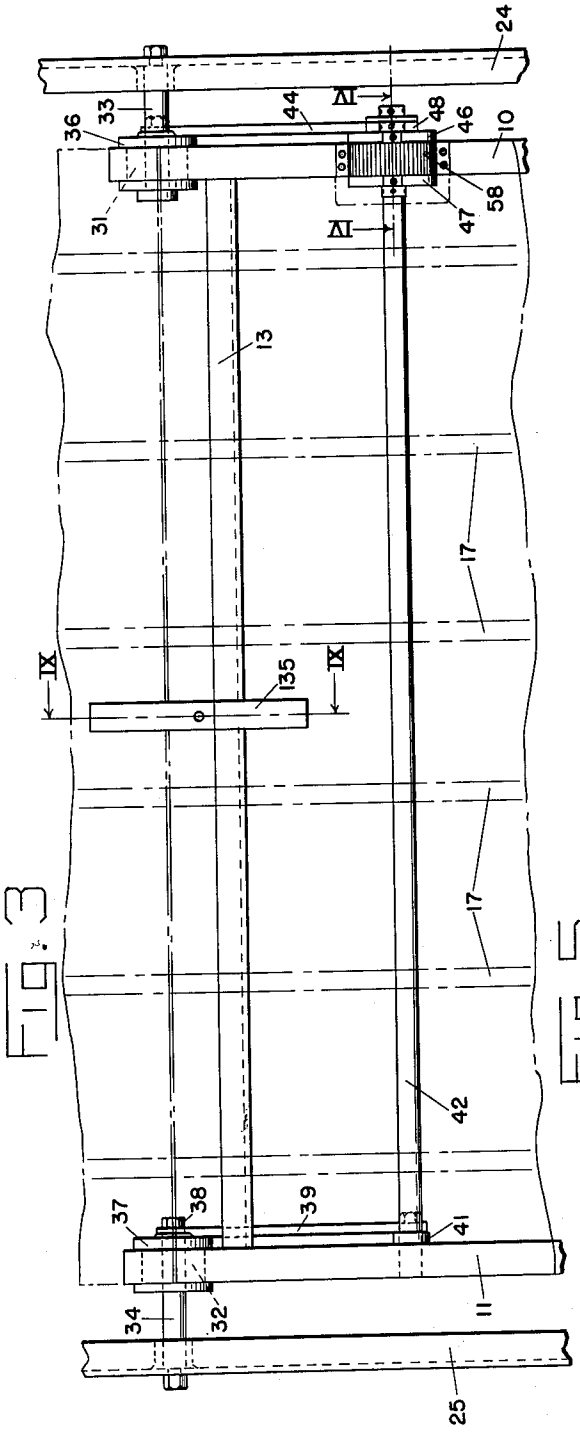


FIG. 3

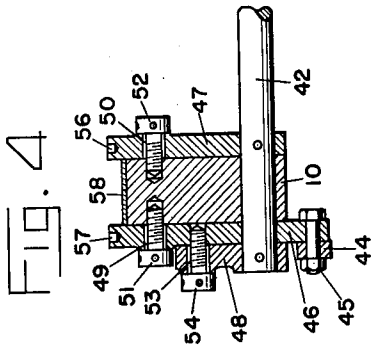


FIG. 4

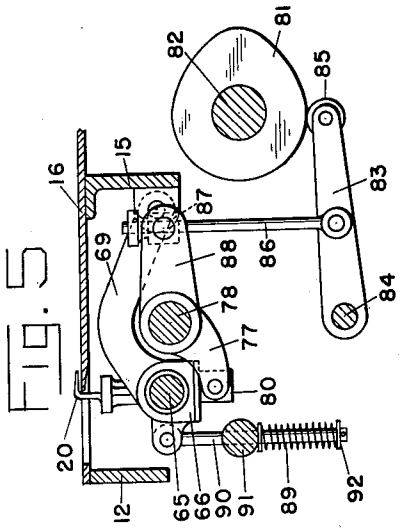


FIG. 5

INVENTOR.
BRUNO B. PASQUINELLI

BY

Byron Hume Green & Clement
ATTORNEYS

March 5, 1963 B. B. PASQUINELLI 3,080,163

SHEET REGISTERING MECHANISM

Filed Sept. 2, 1960 4 Sheets-Sheet 4

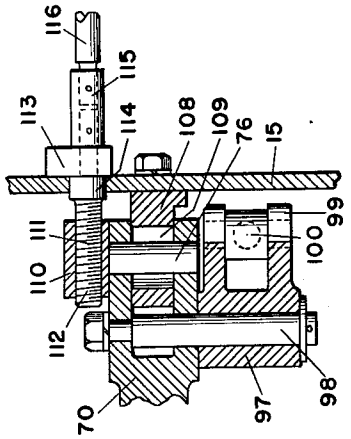


FIG. 7

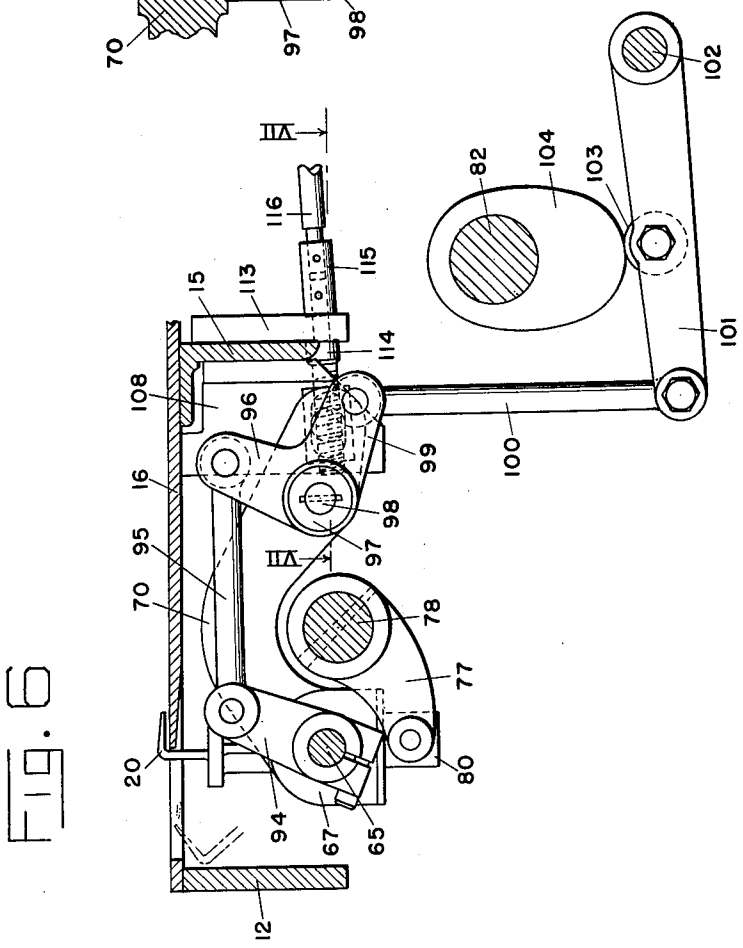


FIG. 6

INVENTOR.

BRUNO B. PASQUINELLI

BY

Byron Hume Groen & Clement

ATTORNEYS

United States Patent Office 3,080,163 Patented Mar. 5, 1963

3,080,163

SHEET REGISTERING MECHANISM

Bruno B. Pasquinelli, Evergreen Park, Ill., assignor to Miehle-Goss-Dexter, Incorporated, Chicago, Ill., a corporation of Delaware

Filed Sept. 2, 1960, Ser. No. 53,833
12 Claims. (Cl. 271—60)

This invention pertains to mechanisms for accurately positioning sheet material before it is fed into a sheet processing machine. More specifically, the invention relates to an improved sheet registering device for printing presses or the like machines which is completely adjustable while the press is in operation to compensate for inaccurately cut, distorted or otherwise defective sheets so that such sheets may be registered with the same precise accuracy as perfect sheets.

To produce high quality, multi-color reproductions on sheet fed printing presses, the sheets to be printed must be accurately registered immediately before they are fed into the press. Such registration is usually effected by front and side guide mechanisms located on the register table which function to position the sheet in register with relation to the form on the plate cylinder. The front guide mechanism usually consists of a series of guides which are aligned transversely across the path of the sheets and which serve to correct the lay of each sheet and to time the leading edge thereof with respect to the impression or feed in cylinder. The side guide mechanisms function to correct the lateral position of each sheet and consist of means which are adapted to move the sheet laterally to a predetermined side register position while the sheet is at rest against the front guides and before it is fed to the impression cylinder.

Under ideal conditions the conventional front and side registering devices operate effectively and excellent results are obtained. Quite frequently, however, irregularities are encountered which cannot be conveniently compensated for by the standard guide mechanisms and thus time consuming manual adjustments are required before consistent, accurate registration of the sheets is possible. These irregularities may be caused by any one of various factors.

For example, when the sheets are cut from a continuous web at the mill, the shear blade may be sprung or distorted in such manner that the front edges of the sheets are cut at a slight angle and thus are not normal to the side edges. Or if the blade is slightly bowed, the edges of the sheets may be concave or convex. If such defective sheets are fed into a press without compensating for the abnormal condition of the leading edge, they obviously will not contact all of the register guides properly and thus will not be presented to the impression cylinder in precise register.

It also happens that the printing plate or form may not be locked up in precise register on the plate cylinder. In other words the leading edge of the plate may be advanced or retarded with respect to the proper register position, or the plate may be slightly skewed, so that its leading edge is not precisely parallel to the line of register. This is a condition which can occur very readily on the big offset presses which use relatively large, unwieldy plates and it is very difficult and inconvenient to readjust the plates after they have been clamped in position. Nevertheless, readjustment of the plate is essential if the impressions are to be printed in register unless the guide mechanisms can be quickly and conveniently adjusted to compensate for the error in the positioning of the printing plate.

Lateral stretch or "fan out" of the sheets is another condition which is frequently encountered, particularly on offset presses, when sheets are fed through a press two or more times to receive subsequent color impressions. This condition apparently is due to the effect of the moisture and ink which the sheet absorbs during the first impression, together with the pressing action of the printing cylinders which causes the sheet to expand in width or "fan out" progressively from front to back. If the guide mechanisms can not be adjusted to correct for such distortion of the sheet, the subsequent impressions printed thereon will not be in precise register throughout the entire area of the sheet.

In order to compensate for these various irregularities of the sheets or in the placement of the form, it is necessary with the known front guide mechanisms to adjust the setting of each individual front guide. Since a multiplicity of such guides are involved, each one of which requires a slightly different setting it will be appreciated that such adjustments are tedious and time consuming and can only be accomplished while the press is shut down. Furthermore, it is obviously a trial and error method usually requiring a number of readjustments before the precise settings are attained and this in turn results in the printing of numerous waste sheets of paper as well as a substantial loss of production time.

One of the primary objects of this invention, therefore, is to provide an improved sheet registering device which is conveniently adjustable while the press is in operation to compensate for irregularities in the sheet material to be printed so that defective sheets can be registered with the same precise accuracy as perfect sheets.

Another object of the invention is to provide a register mechanism which is adjustable longitudinally as well as angularly in the plane of the sheets whereby the register position of the sheets can be modified with relation to the form on the plate cylinder.

A still further object resides in the provision of means for cocking or bowing the front guides in order to warp the body of a sheet in such manner that the trailing portion thereof will be brought into register without affecting the register of impressions on the leading edge.

A further object is to provide means having operation in conjunction with the front guides for introducing a longitudinal wave in the trailing portion of a sheet whereby the leading edge can be more readily made to conform with the front guides when the latter are adjusted to a bowed position.

Another object is to provide adjustable registering means wherein the manual controls for effecting adjustments are conveniently located at the operators station at one side of the machine so that adjustments can be made while the machine is in operation and which also includes suitable indicia for indicating the extent and direction of such adjustments.

Other objects and advantages of the invention will become apparent from the following description and accompanying drawings wherein;

FIGURE 1, is a side elevational view of a sheet registering mechanism incorporating the improvements of the present invention;

FIGURE 2, is a partial plan view, with the sheet supporting surface omitted, and illustrating the front guide assembly at the front end of the register table;

FIGURE 3, is a plan view of the rear portion of the register table illustrating the mechanism whereby it is adjustably supported in the side frame members;

FIGURE 4, is a sectional view taken along the line IV–IV of FIGURE 1 and illustrating the control mechanism for imparting longitudinal and angular adjustments to the register table in the plane of the sheets;

FIGURE 5, is a sectional view taken substantially along the line V—V of FIGURE 2;

FIGURE 6, is a sectional view taken along the line VI—VI of FIGURE 2 and illustrating the mechanism

for oscillating the front guides into and out of the path of the sheets;

FIGURE 7, is a sectional view along the line VII—VII of FIGURE 6;

FIGURE 8, is an enlarged plan view, partly in section, illustrating the manual control means for adjusting the front guides;

FIGURE 9, is an enlarged sectional view along the line IX—IX of FIGURE 3, and illustrating the means for introducing a wave in the trailing portion of the sheets; and

FIGURES 10, 11, 12, and 13, are views illustrating conditions which can readily be compensated for with the present apparatus to effect accurate register of the sheets.

With reference to the drawings and particularly FIGURES 1, 2, and 3, the sheet registering table of the present invention is composed of a base frame which consists of a pair of side members 10 and 11, a front transverse member 12, a rear channel member 13 and two intermediate cross members 14 and 15 all of which are secured together in any suitable manner to provide a rigid frame for the top board 16. In its operative position, the register table is located between a feeding device and the machine to which the sheets are to be fed and a series of endless tapes 17 which are tracked about a roller 18 journalled in the side members 10 and 11 serve to advance the sheets from the feeding device to the front end of the table where they are front and side registered before they are engaged by means such as the grippers 19 of a sheet transfer device and conveyed to an impression cylinder or the like sheet carrying member.

The mechanism for effecting side register of the sheets while they are at rest against the front register guides 20, FIGURE 2, does not form any pertinent part of the present invention. However, it is located adjacent the front end of the register table and it has been illustrated schematically in FIGURE 1 as consisting of side guide elements 21 which are mounted on cross bars 22. The cross bars are arranged transversely of the register table in the recess 23 provided therefor in the side members 10 and 11 and they are arranged to be supported independently of the table in the stationary frame members 24 and 25, FIGURE 3, so that the side registering mechanism does not move with the register table when the latter is adjusted.

To permit of adjustment relative to its normal sheet registering position whereby to modify the lay of the sheets with respect to the transfer grippers 19, the register table is pivotally supported at the front end by means of links 26. One such link is pivotally connected as at 27 to the side members 10 and 11 at each side of the table and the depending ends thereof are also pivotally connected as at 28 to a stationary member 29 of the feeder frame. Thus the table is relatively free to move forward and back as well as angularly with respect to the transfer grippers 19 as it pivots on the links 26 and it will be noted that these links are arranged substantially perpendicular to the plane of the register table so that such movements of the table will not materially affect its vertical position relative to the grippers 19.

At the rear of the register table, each side frame member 10 and 11 is formed with an enlarged journaling portion 30 which is bored to receive the eccentrics 31 and 32 respectively. These eccentrics in turn are rotatably mounted on stub shafts 33 and 34 which project inwardly from the respective stationary frame members 24 and 25 and each eccentric is formed with a depending arm 36, 37 by means of which it can be rotated about the axis of its respective stub shaft whereby to adjust the position of the register table. It will be noted that when the register table is in its normal register position as illustrated in FIGURE 1, the axes of the eccentrics 31 and 32 and their supporting shafts 33 and 34 are aligned in a plane which is substantially perpendicular to the

surface of the top board 16. Accordingly, when the eccentrics are rotated, movement of the table will be substantially in the plane of the top board 16.

As shown best in FIGURE 3, the arm 37 of eccentric 32 is pivotally connected at 38 to a link 39 which extends forwardly and is in turn pivotally connected to the arm 41 fixed to the cross shaft 42. This shaft extends transversely across the full width of the register table and is journalled for rotation in the side frame members 10 and 11. In a similar manner the arm 36 of eccentric 31 is pivotally connected as at 43 to a link 44 which in turn is pivotally connected at 45 to a lever 46 which constitutes one element of a control mechanism for effecting selective adjustments of the respective eccentrics whereby to vary the register position of the table.

The manual control means for adjusting the angular position of the eccentrics 31 and 32 is located at the operator's station on the feed side of the register table and is comprised of the lever 46 and associated levers 47 and 48, see FIGURE 4. The lever 46 is rotatably mounted on the cross shaft 42 outside the frame member 10, whereas the lever 47 is mounted inside the frame member and is pinned to the shaft 42 so that movement of said lever will impart corresponding rotary movement to said shaft. The levers 46 and 47 are provided with arcuate slots 49 and 50 respectively, and they are arranged to be secured in their respective adjusted positions by means of locking screws 51 and 52 which are inserted through the respective slots and are threaded into the frame member 10. The third lever 48 is somewhat smaller than the levers 46 and 47 and is pinned to the end of shaft 42 adjacent the lever 46. It is also provided with an arcuate slot 53 through which is inserted a locking screw 54. This latter screw is threaded into the lever 46 so that when the screw is tightened the two levers 46 and 48 will be locked together for purposes of adjustment as will be more fully described.

From the description thus far it will be understood that when the respective levers 46 and 47 are actuated corresponding motion will be imparted through the respective links 44 and 39 to the eccentrics 31 and 32 to thereby adjust the register position of the table. These adjustments may be made by rotating both eccentrics in unison which will have the effect of advancing or retracting the register table relative to the grippers 19 while maintaining its leading edge parallel to the axis of the transfer gripper shaft, or the respective eccentrics may be actuated independently or in opposite directions whereby to adjust the table angularly with respect to the transfer gripper shaft and in the plane of the sheets. For example, to effect adjustment of the eccentric 32 on the drive side of the register table the locking screws 52 and 54 are released so that the shaft 42 can be rotated independently of the lever 46. By inserting a pin wrench or similar tool in the recess 56 of lever 47 said lever can be rocked about the axis of shaft 42 to the required extent. Since this lever is pinned to the shaft 42, corresponding rotary motion will be imparted thereto and this in turn will be transmitted through the lever 41 and link 39 to the eccentric 32. When this adjustment is made, the lever 48 will move in unison with lever 47 because it too is pinned to the shaft 42, but because the locking screw 54 is released, the lever 46 and its associated eccentric 31 will remain motionless. After the adjustment is completed the levers are then locked by tightening the screws 52 and 54.

For adjusting the eccentric 31 on the feed side of the table it is necessary to release screws 51 and 54 whereupon the lever 46 can be moved by means of a pin wrench inserted in the opening 57 to transmit rotary motion to said eccentric through the link 44. Such motion will be restricted to the eccentric 31 because the shaft 42 will be locked against movement with the lever 46 by the screw 52.

which conditions are illustrated in FIGURES 10 and 11.

In other words, if the form is clamped in correct alignment on the plate cylinder, but in a position which is advanced or retarded with respect to the proper register position, as indicated by the broken line Y in FIGURE 10, the register table and therewith the guides 20 can be advanced or retarded by appropriate adjustment of both of the eccentrics 31 and 32 so that the register position of the leading edge of the sheet, indicated by the solid line X in FIGURE 10, can be made to coincide with the leading edge of the form.

Moreover, if the leading edge of the sheet is not normal to the side edges or if the position of the plate is slightly skewed on the plate cylinder in a manner indicated by the broken line Y in FIGURE 11, the guides can be shifted angularly by appropriate adjustment of either one or both of the eccentrics 31 or 32 so that the angle of the leading edge of the sheets, in the register position, will be made to coincide with the position of the form.

In addition to the foregoing adjustments the guide assembly is also adapted to be adjusted whereby to compensate for sheets having concave or convex leading edges as well as for the purpose of distorting a normally straight leading edge of a fanned out sheet in order to bring the tail edge thereof into register.

The mechanism whereby such further adjustments of the front guide assembly is accomplished, notwithstanding the bodily motion and other adjustments imparted thereto, is associated with the center supporting arm 70. As shown in FIGURE 7, the pivot pin 76 for the center supporting arm 70 is mounted in a bracket 108 which is fixed to the cross member 15 intermediate the supporting brackets 74 and 75 for the other arms 69 and 71. This bracket, however, is provided with an elongated slot 109 which is adapted to maintain the pin 76 against vertical motion but which provides clearance whereby the pin may be adjusted longitudinally of the register table whereby to advance or retard the center portion of the shaft 65 with respect to its terminal ends.

The pin 76 has a rectangular block 110 formed integral therewith at one end and this block is provided with a tapped hole to receive the threaded end 111 of an adjusting screw 112 which is rotatably mounted in a bracket 113 secured to the rear face of the cross member 15. The screw is secured against axial movement in the bracket 113 by means of the collar 114 formed thereon and by means of the coupling 115 which connects the screw to the end of a shaft 116. The shaft 116 extends rearwardly, substantially parallel to the plane of the register table and its opposite end is rotatably mounted in a housing 117 mounted on the cross member 14. At its terminal end and within the housing 117 the shaft 116 is provided with a worm gear 118 which is adapted to mesh with a worm 119, the latter being rotatably mounted in the housing 117 with its axis transverse to the axis of the worm gear 118. One end of the worm is connected by a coupling 120 to a shaft 121 and this shaft extends laterally through the side frame member 10 of the register table and beyond the stationary frame member 24, see FIGURE 8. At its free end the shaft 121 is provided with a control knob 122 by means of which the shaft can be rotated and a nut 123 is threaded onto the end of said shaft for locking the control knob 122 and therewith the shaft 121 in any selected position.

With the arrangement as described it will be seen that when the locking nut 123 is released the control knob 122 can be turned in either direction to impart corresponding motion to the screw member 112. Accordingly, when the knob is turned clockwise as viewed in FIGURE 8 for example, it will have the effect of threading the screw 112 into the block 110 in an axial direction to the left as viewed in FIGURE 7. Since the screw member 112 is locked against axial movement by the collar 114 and coupling 115, however, rotation thereof will cause the block 110 and therewith the pin 76 to slide rearwardly in the slot 109 of the bracket 108 toward the cross member 15. The supporting arm 70 will also be retracted with the pin 76 and thus the center portion of the guide shaft 65 will be bowed rearwardly with respect to its terminal ends. Counterclockwise rotation of the knob 122 obviously will reverse this motion and the arm 70 will be advanced to thereby bow the shaft 65 forwardly with respect to its terminal ends.

It will be noted that in order not to affect the timing of the front guides as regards their oscillation into and out of the path of the sheets, the pivot pin 98 for the bell crank 97 is mounted in the center supporting arm 70 so as to move therewith when the latter is adjusted. Thus the angular relation between the arm 96 of the bell crank and the lever 94 and the shaft 65 is maintained constant through all positions of the supporting arm 70. Moreover, the connecting link 100 between the arm 99 of the bell crank and the actuating lever 101 is disposed perpendicular to the plane of the register table so that movement of the bell crank and/or the register table will have substantially no effect on the associated linkage.

The direction and extent of adjustment imparted to the shaft 65 can readily be determined by means of a calibrated scale formed on the periphery of the wheel 124, see FIGURE 8. This wheel is rotatable on a shaft 125 in the housing 126 and is adapted to be actuated when the control knob 122 is adjusted by means of a gear 127 which is formed integral with the wheel 124 and meshes with a pinion gear 128 mounted on the shaft 129. A second pinion gear 131, formed integral with the hub of gear 128 is adapted to mesh with gear teeth 132 formed on the actuating shaft 121. Thus it will be apparent that when the control knob 122 is actuated corresponding rotary motion will be transmitted to the calibrated wheel 124 to thereby indicate the direction and extent of adjustment imparted to the shaft 65. This makes it possible to preadjust the guides to the approximate setting required to compensate for any concave or convex condition of the sheets and final adjustments which may be necessary to bring the sheets into precise register can be made conveniently and quickly by appropriate adjustments of the control knob 122 while the press is in operation.

It will be evident from the mechanism just described that the guide assembly can be adjusted to compensate for conditions as illustrated in FIGURES 12 and 13 wherein the broken lines X indicate the curved condition of the leading edge of a sheet with respect to the normal setting of the front guides indicated by the solid lines Y. By appropriate adjustment of the guide shaft 65 the guides can be cocked or bowed so as to conform with the leading edge of the sheet regardless of whether it is curved convex or concave and thus such sheets can be accurately registered and fed through the press in the same manner as perfect sheets.

This adjustment is also used as stated hereinbefore in order to distort otherwise perfect sheets for the purpose of compensating for a fanned out condition of their trailing edges. When a fanned out condition is encountered, it is necessary to bow the front guides in a forward direction as indicated by the broken line X in FIGURE 12 so as to distort the leading edge of the sheet and thus, in effect, pull in the lateral edges along the trailing portion of the sheet by an amount equivalent to the extent that the trailing portion of the sheet has been expanded beyond its normal width. Under such circumstances it is usually necessary to increase the coefficient of friction between the sheet advancing tapes 17 and the sheets on the register table so that the leading edges of the sheets will be crowded against the guides and caused to conform to the bowed position of the guides. This can be accomplished by providing conventional drop rollers such as are indicated at 133 in FIGURE 1 and which are adapted to press the sheets

When it is desired to adjust both eccentrics in unison and to the same extent, the locking screw 54 is tightened whereby to lock the lever 46 to the shaft 42 through the lever 48 and the locking screws 51 and 52 are released so that the arms 46 and 47 are free to move. Accordingly when a pin wrench is inserted in either one of the recesses 56 or 57 the respective levers can be actuated in unison and corresponding motion will be imparted through the shaft 42 and the respective linkages to the eccentrics 31 and 32. It will be apparent that this motion will be uniform for both eccentrics since the lever 46 is locked to the shaft 42 through the lever 48.

A calibrated scale 58 mounted on the frame member 10 between the levers 46 and 47 clearly indicates the direction and extent of adjustment imparted to the table.

When only one eccentric, 32 for example, is actuated to effect an angular adjustment of the table as explained above, it will be evident that the table would have a normal tendency to pivot about the opposite eccentric and that the front end of the table would thus have a tendency to shift laterally to the right as viewed in FIGURE 2. It is important, however, that any such lateral movement be restricted to the rear portion of the table so that the register relation between the sheets and the relatively fixed side guides will not be disturbed. This is accomplished by means of a pivot member 59 which is located adjacent the middle of the front cross member 12 and which serves to prevent any lateral movement of the front edge of the table. The pivot member 59 is mounted on a stationary cross shaft 61 located below the register table and it is adapted to project upwardly between guide blocks 62 and 63 secured to the inner face of the front cross member 12. The side edges of the pivot member are adapted to have a close sliding fit with the guide blocks so that lateral movement of the table is eliminated but which will permit the blocks to move relative to the pivot member when the registed table is advanced or retarded longitudinally in the path of the sheets.

Accordingly, when angular adjustments are imparted to the register table by actuation of either one of the eccentrics individually, the front end of the table will be prevented from shifting laterally. Instead, the entire table will pivot about the pivot member 59 and the force will be transmitted to the rear portion of the table causing it and therewith the eccentrics 31 and 32 to shift laterally on the respective supporting shafts 33 and 34. It will be appreciated that the extent of adjustment imparted to the table is relatively small and, therefore, the normal tolerances provided in the actuating members is sufficient to permit such angular adjustments without interference between the coacting members.

The front guides 20 which determine the front lay of the sheets are carried by the register table and are adapted to move therewith when the table is adjusted. As shown in FIGURE 2, a series of these guides are arranged in spaced relation transversely across the path of the sheets and they are mounted on a supporting shaft 65 which is arranged to have bodily as well as rotary motion whereby to impart to the guides the compound motion necessary for performing their function. The shaft 65 is disposed adjacent to and parallel with the front cross member 12 and it is rotatably mounted in the bearing brackets 66, 67, and 68, formed at the ends of the respective arcuate supporting arms 69, 70, and 71. As illustrated in FIGURE 2, the arms 69 and 71 which journal the terminal ends of the shaft 65 are pivotally mounted on pins 72 and 73 inserted in the brackets 74 and 75 on the cross member 15. The center arm 70, however, is pivoted on a pin 76 which is arranged to be adjustable longitudinally in its supporting bracket for a purpose to be explained hereinafter.

The bearing brackets 66, 67, and 68, and therewith the front guide shaft 65 are arranged to be oscillated in a path substantially normal to the plane of the register table by means of a series of actuating arms 77 which are suitably fixed to an operating shaft 78 journalled for rotation in bearings 79 on the feeder frame. As shown in FIGURE 5, each one of the arms 77 is provided with a block 80 which engages the bottom surface of its respective bearing bracket 66, 67, 68, so that when the shaft 78 is oscillated, corresponding motion will be imparted to the shaft 65. This motion is intended to raise the guides above the plane of the register table to insure their engagement with the leading edge of each succeeding sheet whereupon they are lowered to their sheet registering position as illustrated in FIGURE 5 to effect final register of the sheet before it is taken by the grippers 19.

The shaft 78 is arranged to be oscillated whereby to raise the front guides in timed relation to the movement of the sheets by means of a cam 81 which is mounted on the cam shaft 82. The cam shaft is suitably journalled for rotation in the feeder frame and is arranged to be driven through one complete revolution for each cycle of operation and as the cam 81 rotates therewith it imparts intermittent oscillating motion to a lever 83 which is pivotally mounted on a shaft 84 and carries at its free end a cam roller 85. The lever 83 is connected by the rod 86 to a pivot block 87 at the end of the arm 88 and this arm in turn is secured to the shaft 78. Consequently, as the cam 81 rotates, the shaft 78 will be oscillated and this motion will in turn raise the front guide shaft 65 once for each cycle of operation.

During this operation the cam follower 85 is maintained in constant contact with the cam 81 by means of compression springs 89 which are mounted on rods 90 pivotally connected to the ends of the respective supporting arms 69 and 71. The depending end of each rod 90 projects through an opening in a stationary cross shaft 91 to receive the spring 89 which is confined between said shaft and a washer 92 on the end of the rod. Thus the spring exerts a constant pressure between the shaft 91 and the end of the rod 90 to urge the arms 69 and 71 in a downward direction which in turn forces the cam roller 85 against the cam 81.

In addition to the bodily movement as previously described, the front guides 20 are also adapted to be oscillated about the axis of the shaft 65 between a register position as shown in full lines in FIGURE 6 and a retracted position which is illustrated by broken lines in the same figure so that a registered sheet can be transferred by the grippers 19 to an impression cylinder or the like sheet handling member. The mechanism for oscillating the guides is illustrated in FIGURE 6 and comprises a lever 94 which is connected by a link 95 to the arm 96 of a bell crank 97. The bell crank is pivoted on a pin 98 secured to the center supporting arm 70, see FIGURE 7, and the other arm 99 thereof is connected by a link 100 to the end of an actuating lever 101 mounted on the shaft 102. The lever 101 carries a cam roller 103 which is adapted to be actuated by a control cam 104 and this cam is also mounted for rotation with the cam shaft 82. Thus as the cam 104 rotates the shaft 65 and therewith the guides 20 will be oscillated in timed relation with the movement of the sheets. Compression springs 105, see FIGURE 2, mounted on the rods 106 are adapted to exert a constant pressure between the frame member 15 and the levers 107 on the ends of the shaft 65 whereby to move the guides 20 to their retracted position and to maintain the roller 103 in contact with the cam 104.

From the description thus far it will be evident that the guides 20 and the respective actuating mechanisms associated therewith are constructed and arranged so that when the mechanism is in operation the complete register table assembly can readily be adjusted whereby to compensate for any discrepancy in the placement of the form on the plate cylinder or for sheets having leading edges which are not normal to the side edges and

against the tapes **17**. The pressure of the drop rollers increases the friction between the sheets and the tapes and the sheets will thus be urged against the guides **20** with sufficient force to cause their leading edges to engage all of the respective guides. The drop rollers will, of course, be timed so as to maintain the sheet in this registered position against the guides until the leading edge is gripped by the grippers **19** of the sheet transfer mechanism. As soon as the grippers have closed on the edge of the sheet, however, the rollers **133** will be raised in the usual manner so that the sheet will be free to move with the grippers **19** as they accelerate it from its register position and transfer it to the sheet carrying cylinder.

As an alternative for the ordinary friction driven drop rollers **133**, independent drive means may be provided for these rollers whereby the sheets will be urged more positively against the front guides. Such drive-up rollers would preferably be driven by a sensitive slip clutch mechanism such as a magnetic particle or fluid clutch which could be adjusted to exert a force on the sheets sufficient to bow their leading edges against the front guides but which would slip when this force is exceeded so as to avoid crumpling the sheets against the guides. Such drive-up rollers would also preferably be mounted so that they would be raised off the sheet as soon as its leading edge is engaged by the transfer grippers **19**.

The vast majority of sheet material can be properly registered by the mechanisms thus far described, particularly with regard to the crowding of the sheets against the bowed guides to correct for fan out. However, this operation can be greatly facilitated particularly when relatively stiff sheet material is being handled if a wave is created in the trailing portion of the sheet at the center thereof. This may be accomplished by the mechanism illustrated in FIGURES 3 and 9 which comprises a flat band **135** of spring material which is mounted at the rear of the register table so as to extend in a longitudinal direction under the trailing portion of a sheet when its leading edge is at the front guides. The band **135** is arranged to be adjustable vertically by means of a wing nut **136** which is threaded onto the screw **137** connected at the middle of the band **135** and which is inserted through an opening in the register table. When the wing nut is pulled up tight against the panel **16** of the table the band **135** will assume a flat position as indicated in section in FIGURE 9. When the wing nut is backed off, however, the resilient spring pressure of the band will cause it to expand or raise to an elevated position as indicated by the broken lines in this figure to thereby introduce a wave in the rear portion of the sheet.

Accordingly, when relatively stiff sheet material must be corrected for fan-out, the band **135** is adjusted to an appropriate elevated position to thereby introduce a longitudinal wave in the trailing portion of the sheets. This will cause the sheet to be more flexible and thus the leading edge will more readily assume the bowed condition of the guides under the influence of the tapes **17** in combination with the drop or drive up rollers **133** as hereinbefore mentioned.

It will be obvious that since the wing nut **137** is accessible from beneath the feed table, adjustments can be made to the band **135** while the press is in operation. However, it also will be apparent that remote control means similar to those provided for the other mechanisms can be provided for adjusting the band **135** should such controls be required or deemed necessary.

Having thus described a preferred embodiment of the invention it is to be understood that the scope of protection is not to be limited by details of construction as various other forms of the device will be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. In a sheet registering device the combination comprising an adjustable support for the sheets to be registered, sheet forwarding means for advancing the sheets over said support, a series of aligned sheet controlling elements mounted on said support, said elements being adapted to intercept each advancing sheet at spaced intervals across its leading edge to register it, adjustable control means for displacing said elements at the middle of the leading edge of a sheet relative to those at the sides thereof, and means for introducing a wave in the trailing portion of the sheet to thereby facilitate bowing of its leading edge to conform to the displaced controlling elements.

2. In a sheet registering device the combination comprising, a support for the sheets to be registered, sheet forwarding means for advancing the sheets over said support, a series of aligned sheet controlling elements mounted on said support, said elements being adapted to intercept each advancing sheet at spaced intervals across its leading edge to register it, adjustable control means for displacing said elements at the middle of the leading edge of a sheet relative to those at the sides thereof, means operatively associated with said control means for indicating the direction and extent of adjustment imparted to said elements, and means for introducing a wave in the trailing portion of the sheet to thereby facilitate the bowing of its leading edge to conform to the displaced controlling elements.

3. In a sheet registering device the combination comprising, a support for the sheets to be registered, sheet forwarding means for advancing the sheets over said support, a series of aligned sheet controlling elements mounted on said support, said elements being adapted to intercept each advancing sheet at spaced intervals across its leading edge to register it, mechanism including adjustable means for displacing said elements at the middle of the leading edge of a sheet relative to those at the sides thereof, manual control means located at one side of said support for adjusting said mechanism while the device is in operation, means operatively associated with said control means for indicating the direction and extent of adjustment imparted to said elements, and vertically adjustable means for introducing a wave in the trailing portion of the sheet to thereby facilitate the bowing of its leading edge to conform to the displaced controlling elements.

4. In a sheet registering device the combination comprising, a support for the sheets to be registered, sheet forwarding means for advancing the sheets over said support, a flexible shaft arranged transverse to the path of the sheets and journaled for rotation on said support, a series of front guides on said shaft, said guides being adapted to intercept each advancing sheet at spaced intervals across its leading edge to register it, means for oscillating said shaft whereby to move said guides into and out of the path of the sheets at predetermined intervals, and adjustable mechanism for bowing said shaft in a plane parallel to the path of the sheets whereby to advance or retract the guides at the center portion of said shaft relative to those at the ends thereof.

5. In a sheet registering device the combination comprising, a support for the sheets to be registered, a flexible shaft, means mounting said shaft on said support including an arm at each end and substantially at the center of said shaft, a series of front guides on said shaft, said guides being adapted to intercept each advancing sheet at spaced intervals across its leading edge to register it, mechanism for adjusting said center arm whereby to bow said shaft and thereby advance or retract the guides at the center of said shaft relative to those at the ends thereof, and manual control means located at one side of said support for adjusting said mechanism while the device is in operation.

6. In a sheet registering device the combination comprising, an adjustable support for the sheets to be registered, a flexible shaft mounted on said support, a series

of front guides on said shaft, said guides being adapted to intercept each advancing sheet at spaced intervals across its leading edge to register it, eccentric means for bodily moving said support and therewith said guides longitudinally as well as angularly in the plane of said sheets, adjustable means for displacing the center portion of said shaft independently of said support in a plane parallel to the path of the sheets whereby to advance or retract the guides at the center of said shaft relative to those at the ends thereof, manual control means for actuating said eccentric means and said adjustable means respectively from a remote location at one side of said support, and means operatively associated with the respective control means for indicating the adjusted position of said support and said guides.

7. In a sheet registering device comprising a support for the sheets to be registered and a series of front guides aligned transversely across the front end of said support for intercepting the leading edge of each sheet to register it, the combination comprising, adjustable mechanism for displacing said guides at the middle of said support relative to those adjacent the sides thereof for the purpose of bowing the leading edge of the sheet, sheet advancing means for urging the sheet against said guides and in a manner that the leading edge thereof will be bowed into contact with each one of said guides, and means at the rear of said support and adjustable vertically relative thereto for introducing a longitudinal wave in the trailing portion of the sheet to thereby facilitate the bowing of its leading edge.

8. In a sheet registering device the combination comprising, a support for the sheets to be registered, sheet forwarding means for advancing the sheets over said support, a flexible shaft arranged transverse to the path of the sheets and journaled for rotation on said support, a series of front guides on said shaft, said guides being adapted to intercept each advancing sheet at spaced intervals across its leading edge to register it, means for oscillating said shaft whereby to move said guides into and out of the path of the sheets at predetermined intervals, additional mechanism for imparting bodily movement to said shaft in a direction substantially normal to the plane of said support to insure engagement of the leading edge of each succeeding sheet by said guides, and adjustable mechanism for bowing said shaft in a plane parallel to the path of the sheets whereby to advance or retract the guides at the center portion of said shaft relative to those at the ends thereof.

9. In a sheet registering device the combination comprising, a support for the sheets to be registered, sheet forwarding means for advancing the sheets over said support, a member mounted transversely on said support, a series of aligned sheet controlling elements mounted on said member, said elements being adapted to intercept each advancing sheet at spaced intervals across its leading edge to register it, and adjustable control means for bowing said member to thereby displace the sheet controlling elements at the middle of the leading edge of a sheet relative to those at the sides thereof.

10. In a sheet registering device the combination comprising, a support for the sheets to be registered, sheet forwarding means for advancing the sheets over said support, a member mounted transversely on said support, a series of aligned sheet controlling elements mounted on said member, said elements being adapted to intercept each advancing sheet at spaced intervals across its leading edge to register it, adjustable control mechanism for bowing said member to thereby displace the sheet controlling elements at the middle of the leading edge of a sheet relative to those at the sides thereof, and manual control means located at one side of said support for adjusting said mechanism while the device is in operation.

11. In a sheet registering device the combination comprising, a support for the sheets to be registered, sheet forwarding means for advancing the sheets over said support, a member mounted transversely on said support, a series of aligned sheet controlling elements mounted on said member, said elements being adapted to intercept each advancing sheet at spaced intervals across its leading edge to register it, mechanism including adjustable means for bowing said member to thereby displace the sheet controlling elements at the middle of the leading edge of a sheet relative to those at the sides thereof, manual control means located at one side of said support for adjusting said mechanism while the device is in operation, and means operatively associated with said control means for indicating the direction and extent of adjustment imparted to said elements.

12. In a sheet registering device the combination comprising, a support for the sheets to be registered, sheet forwarding means for advancing the sheets over said support, a member mounted transversely on said support, a series of aligned sheet controlling elements mounted on said member, said elements being adapted to intercept each advancing sheet at spaced intervals across its leading edge to register it, first manual control means for adjusting said support and therewith said elements longitudinally as well as angularly in a plane parallel to said sheets to thereby modify the register position of said sheets, and second manual control means for bowing said member to thereby displace the sheet controlling elements at the middle of the leading edge of a sheet relative to those at the sides thereof.

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