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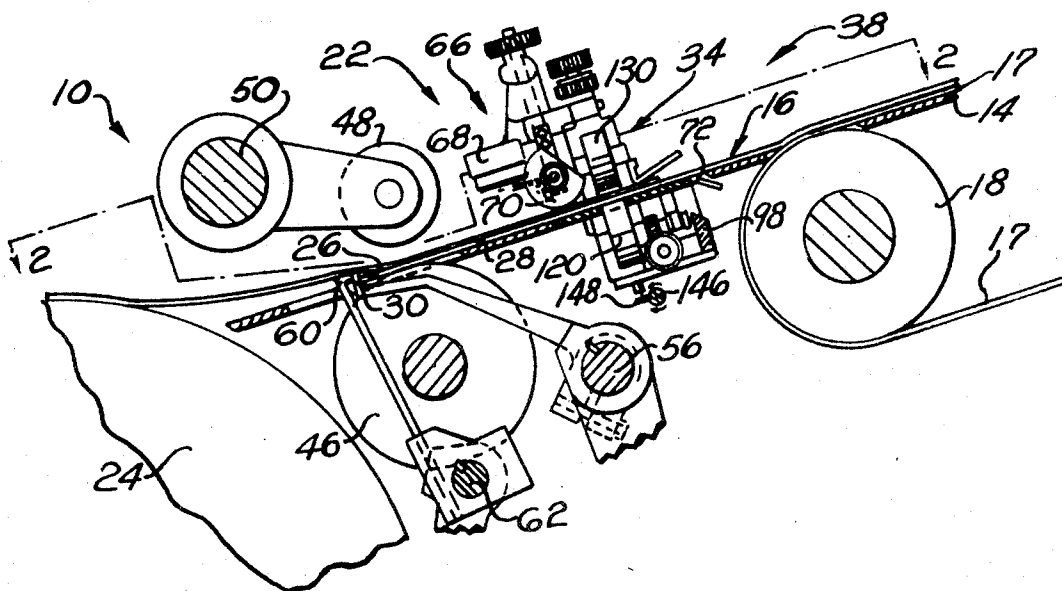
[54] **TURNED CORNER AND MULTIPLE SHEET
DETECTOR**
10 Claims, 8 Drawing Figs.

[52] U.S. Cl. 271/57,
271/47
[51] Int. Cl. B65h 7/06
[50] Field of Search 271/56, 57,
47, 59, 49

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ABSTRACT: An improved apparatus for feeding sheets into an assembly for operating on the sheets, such as a printing press or cutting and creasing machine, includes a side guide assembly and a detector assembly. The side guide assembly positions the sheets transversely to the direction of flow. The detector assembly is mounted on the side guide assembly and detects thicknesses of sheets in excess of a predetermined thickness to thereby detect the presence of a folded corner on a sheet or a number of sheets in excess of a predetermined number. To minimize false or erroneous actuations of the detector assembly due to vibrations and other causes, the detector assembly includes a detector wheel or member which is rotated through a relatively large distance about fixed axis by engagement with a thickness of sheets in excess of the predetermined thickness to effect an actuation of the detector assembly.



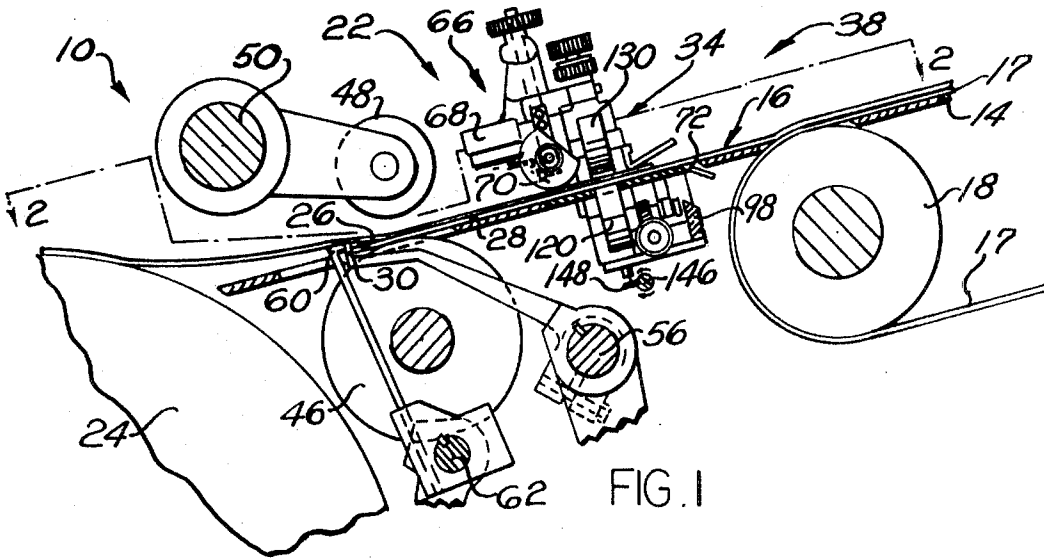


FIG. 1

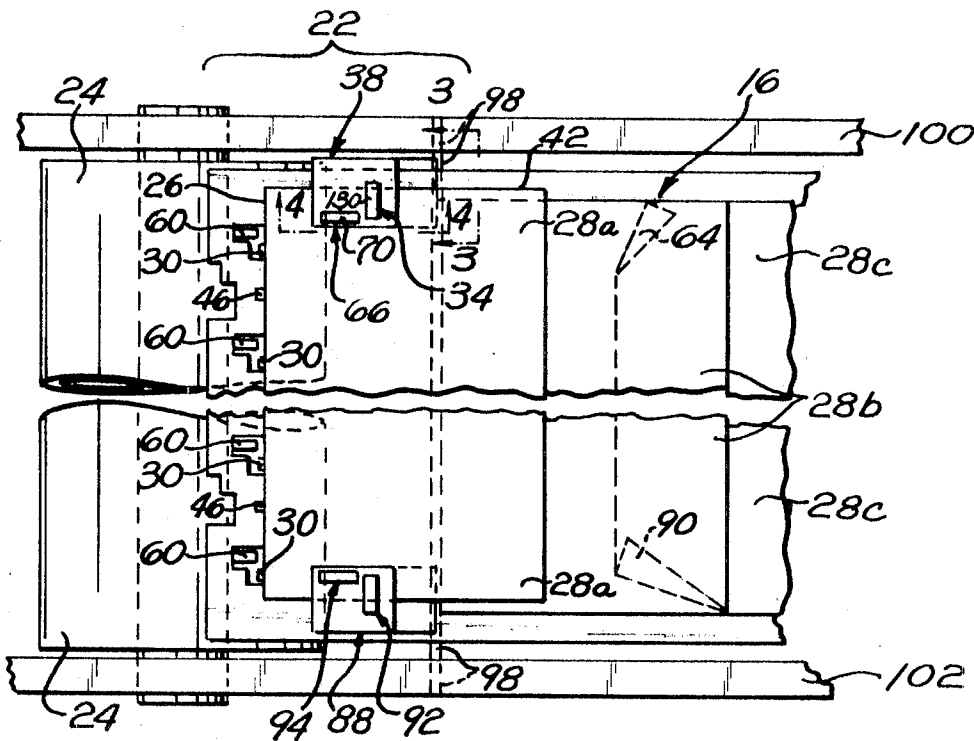
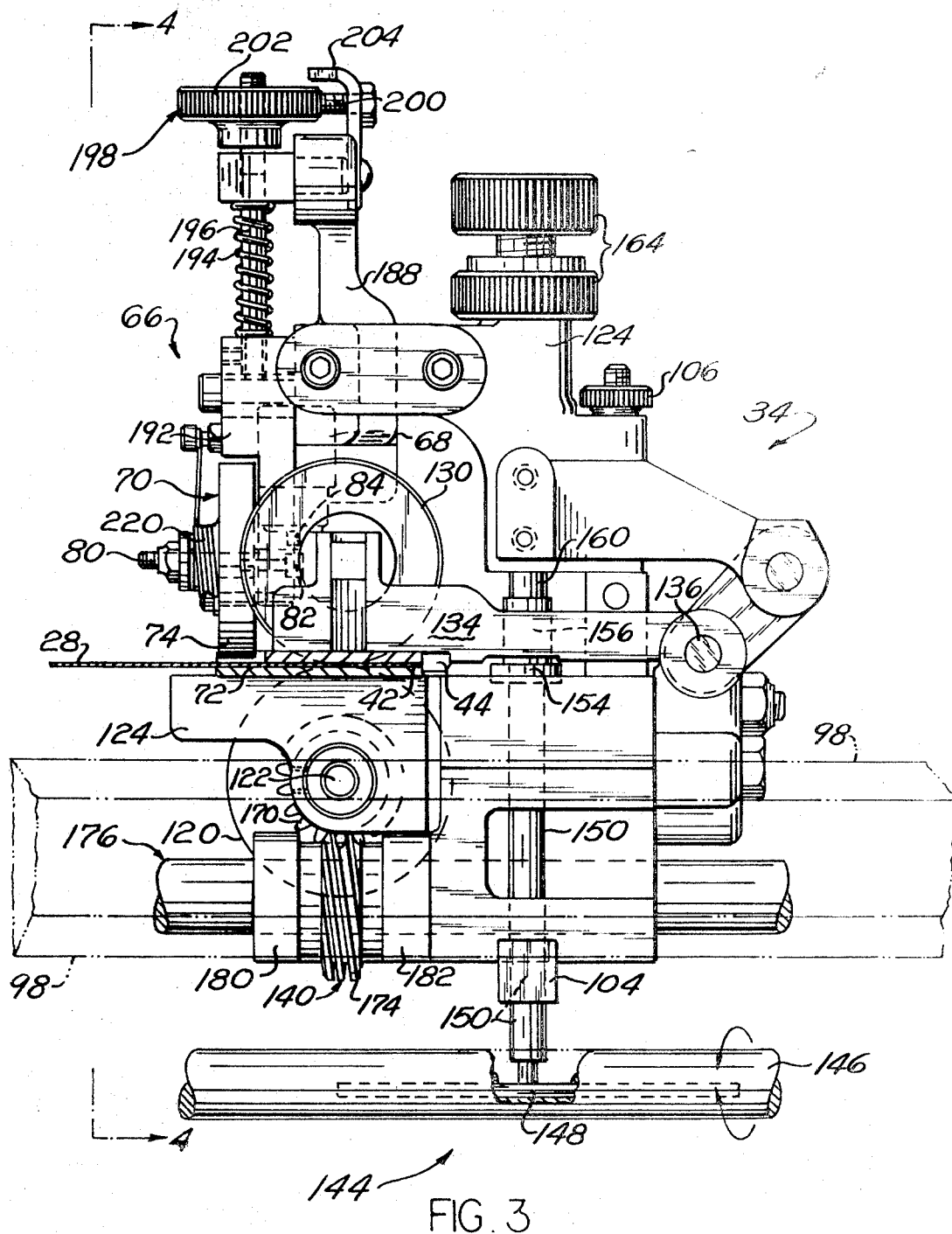
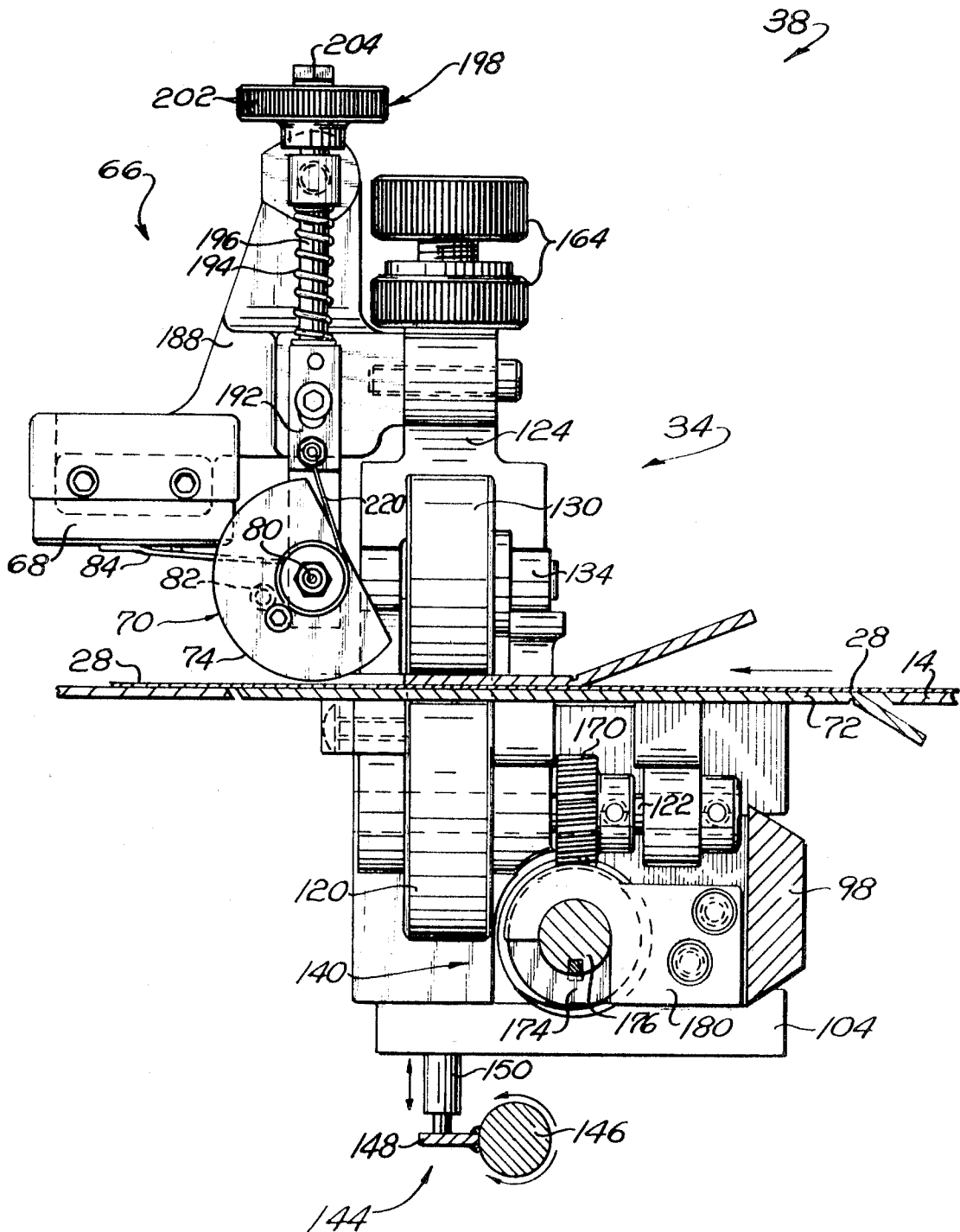


FIG. 2

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TURNED CORNER AND MULTIPLE SHEET DETECTOR

This invention relates generally to a sheet-feeding mechanism and more particularly to a side guide assembly for registering sheets and a detector assembly for detecting either turned corners or multiple sheets.

Sheets of material having folded or turned corners are occasionally fed into sheet-type printing presses. During "backing up" operations wherein the back of a sheet is printed after the face or front of the sheet has been printed, folded corners are particularly likely to occur as a result of the sheet handling required during such an operation. Thus, during a "backing up" operation the corners of sheets printed on their front side may be folded or turned under as the sheets are manually separated into groups at the discharge end of the printing press, or being transported back to a pile elevator, or being turned over and placed on the pile elevator. Once these sheets have been positioned on the pile elevator they are again fed, with any folded or turned corners which may be present, into the printing press to print the back sides of the sheets.

The blankets of a printing press may be crushed or inelastically deformed by thicknesses of sheets in excess of a predetermined thickness. This excessive thickness of sheets can be caused by either turned corners on sheets or a feeding of a plurality of sheets at one time. To prevent damage to the blankets, it is a common practice to use multiple sheet detectors to detect the presence of a plurality of sheets and to thereupon effect a stoppage of the printing press.

These known multiple sheet detectors have been located relatively large distances inwardly of the side edges of the sheets. Therefore, they have been ineffective for detecting turned corners which may occur closely adjacent to the side edges of the sheets. In addition, these known multiple sheet detectors have been somewhat unsatisfactory due to vibration-induced, false or erroneous operations of the multiple sheet detectors. These false or erroneous operations result in unnecessary stoppages of the printing press. In fact, when handling very thin paper stock, operators of printing presses sometimes disconnect known multiple sheet detectors to prevent the detectors from stopping the printing press in response to vibration of the detectors.

Accordingly, it is an object of this invention to provide a new and improved apparatus and method for detecting the presence of turned or folded corners on sheets and for detecting the presence of excess or multiple sheets.

Another object of this invention is to provide a new and improved apparatus and method for detecting the presence of turned corners adjacent to either or both side edges of sheets of material.

Another object of this invention is to provide a new and improved apparatus for detecting the presence of a thickness of sheets in excess of a predetermined thickness wherein the apparatus is mounted in such a manner as to be substantially unaffected by vibrations induced by operation of an associated assembly for working on the sheets.

Another object of this invention is to provide a new and improved apparatus in accordance with any of the preceding objects wherein the apparatus includes a side guide assembly for positioning the sheets and a detector assembly mounted on the side guide assembly for detecting the presence of turned corners and for detecting the presence of a number of sheets in excess of a predetermined number.

Another object of this invention is to provide a new and improved apparatus including a pair of turned corner and multiple sheet detector assemblies each of which is mounted on an associated side guide assembly for transverse movement therewith to enable the positions of the detector assemblies to be adjusted to detect the presence of a turned or folded corner on either or both sides of streams of sheets of different dimensions.

Another object of this invention is to provide a new and improved apparatus in accordance with the next preceding ob-

ject wherein the detector assemblies each include a detector member which must be rotated through a relatively large distance about a fixed axis to effect a stoppage of an associated assembly for working or operating on the sheets to thereby minimize false or erroneous operation of the detector assemblies and unnecessary stoppages of the associated assembly.

Another object of this invention is to provide a new and improved method for detecting the presence of a thickness of sheets in excess of a predetermined thickness in a moving stream of sheets, including the steps of engaging a detector member with an uppermost sheet of the thickness of sheets in excess of the predetermined thickness, moving the detector member through a distance greater than the predetermined distance by frictional engagement between the detector member and the uppermost sheet, and interrupting the movement of the stream of sheets in response to the movement of detector member.

These and other objects and features of the invention will become more apparent upon a consideration of the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a schematic elevational view of a portion of a printing press constructed in accordance with the present invention;

FIG. 2 is a schematic plan view, taken generally along the line 2-2 of FIG. 1, illustrating the relationship of a pair of side guide and detector assemblies of the printing press to a stream of sheets which is moving forward toward a feed cylinder for the printing press;

FIG. 3 is an enlarged elevational view, taken generally along the line 3-3 of FIG. 2, illustrating an embodiment of a side guide and detector assembly constructed in accordance with the present invention;

FIG. 4 is an enlarged sectional view, taken generally along the line 4-4 of FIG. 2, further illustrating the side guide and detector assembly of FIG. 3;

FIG. 5 is a schematic illustration of a detector member of the side guide and detector assembly of FIGS. 3 and 4, the detector member being shown in its normal or unactuated condition;

FIG. 6 is a schematic illustration, similar to FIG. 5, showing the relationship of a turned corner to the detector member immediately before the turned corner is detected;

FIG. 7 is a schematic illustration showing the detector member in an operated condition to which it was actuated in response to the presence of the turned corner of FIG. 6; and

FIG. 8 is a schematic illustration, similar to FIG. 7, showing the detector member in an operated condition indicating the presence of a number of sheets in excess of a predetermined number of sheets.

The present invention provides a method and apparatus for detecting the feeding of either multiple sheets or sheets having turned corners. To enable turned corners adjacent to either side edge of a sheet in a stream of sheets to be detected, a pair of turned corner and multiple sheet detector assemblies are advantageously provided on opposite sides of the stream of sheets. When the presence of either a turned corner or multiple sheets is detected, operation of an associated assembly for working on the sheets is stopped. In accordance with the present invention, each detector assembly is mounted on an associated side guide or register assembly. This enables the positions of the turned corner and multiple sheet detector assemblies to be readily adjusted, by merely making necessary changes in the positions of the associated side guide assemblies, to permit the detector assemblies to be used to detect the presence of a folded corner on either side of streams of sheets of different dimensions. In addition, mounting the turned corner and multiple sheet detector assemblies on the side guide assemblies tends to reduce false, vibration-induced, actuation of the detector assemblies and unnecessary stoppages of the associated assembly for working on the sheets. To further reduce false or erroneous actuations of the turned

corner an multiple sheet detector assemblies, they each include a detector member or wheel which must be rotated through a relatively large distance before the detector assembly is actuated and the associated assembly for working on the sheets is stopped.

Although an apparatus constructed in accordance with the present invention can be used in association with many different types of assemblies for working or operating on sheet material, such as cutting and creasing machines, the apparatus is illustrated herein in association with a printing press 10. The printing press 10 includes a feed table 14 along which a stream 16 of sheets is forwarded or moved in an underlapped relationship away from a suitable pile elevator (not shown) by tapes 17 which extend around tape rolls 18. The tapes 17 transport the sheets to a registering station, indicated generally at 22 in Fig. 2, where they are registered relative to an associated printing apparatus (not shown) before being conducted to the printing apparatus by a feed cylinder 24.

To front register the sheets, the leading or gripper edge 26 of each sheet 28 is in turn engaged by a plurality of front stops 30 at a forward end of the registering station 22. These front stops 30 project upwardly and arrest the forward movement of the sheets 28. In so doing, the front stops 30 align the leading edge 26 of each of the sheets 28 with the axis of rotation of the feed cylinder 24 and the printing cylinders (not shown) of the printing press 10.

After the leading edge of one of the sheets 28 has been front registered by engagement with the stops 30, the sheet is side registered. This is accomplished by operation of a side guide or register assembly 34 of a guide and detector assembly 38 (FIGS. 1, 3 and 4). Operation of the side guide assembly 34 moves the sheet 28 laterally or transversely to the direction flow of the stream 16 (Fig. 2). This lateral movement is arrested by engagement of a side or guide edge 42 of the sheet 28 with a side register block 44 (See Fig. 3) of the side guide assembly 34.

The front- and side-registered sheet 28 is then fed to the cylinder 24 by operation of drive rollers 46 and idler rollers 48 (FIG. 1). To this end, the idler rollers 48 are moved downwardly into engagement with an upper surface on the sheet 28 by pivoting movement of a transversely extending support or rockshaft 50. Once lowered, the idler rollers 48 press a back of bottom surface of the sheet 28 against the cooperating drive rollers 46. Contemporaneously with this downward movement of the idler rollers 48, the front stops 30 are retracted by a pivoting of a support shaft 56. The drive rollers 46 then move the sheet 28 forwardly into engagement with suitable grippers (not shown) on the feed cylinder 24.

Before the next succeeding sheet reaches the forward end of the registering station 22, overguide hooks 60 are swung upwardly (to the position illustrated in Fig. 1) by operation of a support shaft 62 to lift the trailing edge of the preceding sheet away from the leading end portion of the next succeeding sheet. Contemporaneously with this upward movement of the overguide hooks 60, the stops 30 are returned to their operative position illustrated in Fig. 1 to intercept and front register the next succeeding sheet in the manner previously explained in connection with the preceding sheet. A fuller disclosure of the operation of the front stops 30 and overguide hooks 60 is set forth in U.S. Pat. No. 2,984,483 issued on May 16, 1961 to K.E. Kist and entitled Sheet Registering Mechanism and Method.

If any of the sheets 28 has a turned corner or if multiple sheets have been fed by the sheet-feeding mechanism (not shown), the blankets of the printing press 10 could be crushed. This crushing of the blankets of printing press 10 can result from a greater-than-normal sheet thickness in the area of the turned corner or in the areas where the multiple sheets are underlapped by adjacent sheets in the stream 16 of sheets. In the illustrated embodiment of the invention a normal sheet thickness comprises two layers of underlapping sheets 28a and 28b (FIG. 5), a turned corner 64 (FIGS. 2, 6 and 7) on the sheet 28c forms an excessive thickness of three layers in the

area of the turned corner. Similarly, the feeding of excess or multiple sheets forms an excessive thickness of three layers, i.e. sheets 28d, 28e and 28f (see FIG. 8), in the areas where the multiple sheets 28e and 28f underlap the preceding sheet 28d.

To protect the blankets of the printing press 10 against being crushed by an excessive thickness of sheets, the guide and detector assembly 38 (FIG. 4) includes a turned corner and multiple sheet detector assembly 66. The turned corner and multiple sheet detector assembly 66 detects the presence of a thickness of sheets in excess of a predetermined thickness, that is the presence of three or more layers of sheets in the illustrated embodiment of the invention. A suitable control device, such as a switch 68, is actuated in response to the detection of an excessive sheet thickness by the turned corner and multiple sheet detector assembly 66. Actuation of the switch 68 activates a control circuit to trip the printing press 10 and stop the flow of sheets or perform another control function to the end of protecting the blankets against being crushed.

The turned corner and multiple sheet detector assembly 66 is mounted on the side guide assembly 34 and includes a rotatable detector member or wheel 70 (see FIG. 4). The detector member 70 is rotated relative to a fixed reference or base plate 72 in response to movement past the detector assembly 66 of a thickness of sheets in excess of a predetermined thickness. To provide for this rotation of the detector member 70, the detector member has an arcuate peripheral surface 74 which is spaced from an upper surface of the fixed base plate 72 by a distance, indicated at 76 in FIG. 5, which is just slightly greater than the thickness to be detected by the turned corner and multiple sheet detector assembly 66. Therefore, the upper surface of a thickness of sheets which is greater than the predetermined thickness will engage the peripheral surface 74 and rotate the detector member 70 as the excessive sheet thickness is moved past the detector assembly 66.

By making the distance 76 just slightly greater than the predetermined thickness, a thickness of sheets which is equal to or less than the predetermined thickness passes between the detector member 70 and the base plate 72 without engaging the peripheral surface 74 and actuating the turned corner and multiple sheet detector assembly 66. This is illustrated schematically in FIG. 5 wherein the predetermined sheet thickness, in the present instance the two layers formed by the sheets 28a and 28b, is passing freely through the space 76. Since there is a slight clearance space between the sheet 28b and the peripheral surface 74 of the detector member 70, the detector member remains in the normal or unoperated condition of FIG. 5. Of course, the position of the detector member 70 relative to the base plate 72 can be adjusted to allow any desired sheet thickness to pass freely through the space 76.

When a thickness of sheets in excess of the predetermined thickness tries to pass between the fixed base member 72 and the peripheral surface 74 of the detector member 70, the upper surface of the sheets engages the peripheral surface of the detector member. Continued forward or downstream movement causes the detector member 70 to be pivoted about its axis 80, by frictional engagement of the upper surface of the sheets with the peripheral surface 74 of the detector member. As the detector member 70 pivots about its axis 80, an actuator pin 82 is brought into engagement with an arm 84 of the switch 68 (see FIGS. 7 and 8). This operates the switch 68 to activate control circuitry (not shown) to perform a suitable control function which prevents the blankets of the printing press 10 from being damaged by the excessive sheet thickness.

Since the detector member 70 is located closely adjacent to one side edge of the stream 16 of sheets (see FIG. 2), the turned corner and multiple sheet detector assembly 66 is able to detect the presence of the turned corner 64. Accordingly, when the turned corner 64 approaches the detector member 70 (see FIG. 6), the turned corner 64 becomes wedged between the peripheral surface 74 of the detector member 70

and the fixed base plate 72. This wedging action presses the trailing end of the leading sheet 28b into tight frictional engagement with the leading end of the sheet 28c on which the turned corner 64 is formed. By the time the leading end of the sheet 28c reaches the position shown in FIG. 6, the preceding sheet 28b is being positively pulled forward by rotation of the feed cylinder 24 which has gripped the leading end of the sheet 28b. The positive forward movement of the sheet 28b is transmitted to the sheet 28c by the frictional engagement between the sheets 28b and 28c. Therefore, the turned corner 64 is positively pulled forward into the space 76 by the preceding sheet 28b.

As the corner 64 is being positively pulled into the space 76 by the frictional cooperation between the sheets 28b and 28c, the detector member 70 is positively rotated to the actuated condition of FIG. 7. This positive rotational movement of the detector member 70 results from the frictional engagement of the peripheral surface 74 of the detector member with the upper surface of the sheet 28b. Thus, when the upper surface of the sheet 28b is wedged against the peripheral surface 74 of the detector member 70, continued forward movement of the sheet 28b positively rotates the detector member 70 about its axis 80. This positive rotation of the detector member 70 moves the actuator pin 82 through a relatively large arcuate distance, that is from the position shown in Fig. 6, to the position shown in Fig. 7, to operate the control switch 68.

A second guide and detector assembly 88 is mounted adjacent to the opposite side of the stream 16 (see FIG. 2) to detect a turned corner adjacent to the opposite side edge of the sheet 28b, such as the corner 90. The guide and detector assembly 88 is generally similar in structure to the guide and detector assembly 38 and includes a side guide assembly 92 and a turned corner and multiple sheet detector assembly 94 which are of the same structure as the side guide assembly 34 and the turned corner and multiple sheet detector assembly 66. When the sheets are being registered by the side guide assembly 34 for printing on their face sides, the side guide assembly 92 is operated in one direction to move the sheets toward the side guide assembly 34 in a known manner. During a subsequent "backing up" operation wherein the sheets are printed on their back sides, the same side edge of the sheets should be used for registering the sheets to prevent a loss of accuracy due to sheets which are not true rectangles. Therefore, during a "backing up" process the direction operation of the side guide assemblies 34 and 92 are reversed in a known manner and the sheets are moved toward the side guide assembly 92 for side registration.

In addition to detecting the presence of corners adjacent to either side of the stream 16 of sheets, the turned corner and multiple sheet detector assemblies 66 and 94 function to detect the presence of a number of sheets in excess of a predetermined number, such as the three sheets 28d, 28e and 28f of FIG. 8. The relatively large number of sheets, caused by the feeding of a plurality of sheets simultaneously at the pile elevator (not shown), results in a combined sheet thickness which is greater than the space or distance 76 between the peripheral surface 74 of the detector member 70 and the upper surface of the fixed base 72. Therefore, when the excess or multiple sheets 28e and 28f approach the detector member 70, they are wedged between the base 72 and the peripheral surface 74 in much the same manner as previously explained in connection with the turned corner 64.

This wedging action presses the sheets 28d, 28e and 28f into tight frictional engagement with each other. Therefore, the positive pulling action of the feed cylinder 24 on the leading sheet 28d (Fig. 8) is frictionally transmitted to the lower sheets 28e and 28f. This results in the multiple sheets 28e and 28f being positively pulled forwardly by the sheet 28d in much the same manner previously explained in connection with the turned corner 64. This forward movement pivots the detector member 70 to the operated condition illustrated in FIG. 8. The switch 68 is then operated to trip off the printing press 10 and stop the flow of sheets or perform another suitable control

function to protect the blankets against being crushed. Of course, the presence of the excess or multiple sheets 28e and 28f actuates the turned corner and multiple sheet detectors 66 and 94 on both sides of the stream 16 of sheets.

The guide and detector assemblies 38 and 88 are both mounted on a transversely extending support bar or member 98 (FIGS. 2, 3 and 4) which extends between opposite longitudinally extending frame members 100 and 102. The side guide assembly 34 is fixedly secured to the support bar 98 by a clamp member 104 (see FIG. 4). The clamp member 104 can be released by means of a knob 106 (see FIG. 3) to enable the guide and detector assembly 38 to be moved longitudinally along the support bar 98. Of course, the guide and detector assembly 88 is mounted on the support bar 98 in a similar manner. This mounting arrangement enables the position of the guide and detector assemblies 38 and 88 to be adjusted along the support bar 98 when the width of the sheets 28 forming the stream 16 of sheets is varied. It should be noted that when the width of the sheets 28 is varied, the positions of each of the side guide assemblies 34 and 92 and the associated turned corner and multiple sheet detector assemblies 66 and 94 are adjusted at the same time with a minimum of effort. For example, by adjusting the position of the side guide assembly 34, the position of the associated turned corner and multiple sheet detector assembly 66 is automatically adjusted.

The longitudinally extending side frames 100 and 102 are connected with similar side frames for the printing cylinders (not shown) of the press 10. Therefore, during operation of the printing press 10 vibrations are transmitted to the side frames 100 and 102. Economical operation of the printing press 10 requires that the turned corner and multiple sheet detector assemblies 66 and 94 be actuated to the operated condition only when there is an excessive sheet thickness present. The mounting of the turned corner and multiple sheet detector assemblies 66 and 94 on the associated side guide assemblies 34 and 92 provides a solid mounting for the turned corner and multiple sheet detector assemblies. This solid mounting tends to minimize the effect of vibrations on the turned corner and multiple sheet detector assemblies 66 and 94 so that vibration-induced false or erroneous actuations of the detector assemblies are minimized.

The possibility of false or erroneous operation of the turned corner and multiple sheet detector assemblies 66 and 94 due to vibrations, or other causes, is further minimized by the necessity of pivoting the detector members through a relatively large distance to actuate the associated switch and stop the operation of the printing press. Thus, the detector member 70 of the turned corner and multiple sheet detector assembly 66, must be pivoted through a relatively large operating distance from the normal or unoperated condition of FIGS. 3, 5 and 6 to the operated condition of FIGS. 7 and 8. The operating distance through which the detector member 70 is moved to its operated condition is substantially greater than the predetermined distance 76 and, normally, is many times greater than the arcuate distance through which the detector member 70 is pivoted under the influence of vibrations. It should be noted that even when the turned corner and multiple sheet detector assembly 66 is being subjected to relatively severe vibrations, variations in the distance 76 are relatively small. This is because both the base plate 72 and the detector member 70 are mounted on the associated side guide assembly 34 and vibrate in synchronism with each other and the side guide assembly 34.

As was previously explained, the side guide assembly 34 moves each of the sheets 28 laterally into engagement with the side register block 44 (FIG. 3) to align the sheets with the cylinders of the printing press 10. To provide for this lateral movement, the side guide assembly 34 (see FIGS. 3 and 4) includes a lower or base drive roller 120 which is mounted for rotation about an axle 122 (FIG. 3) mounted on a fixedly secured body section 124 of the side guide assembly 34. An idler roller 130 cooperates with the drive roller 120 and is rotatably mounted on a support bracket 134. The bracket 134

is pivotally secured at 136 to the body 124 (see FIG. 3). This pivotal mounting of the bracket 134 enables the idler roller 130 to be moved toward the drive roller 120 to engage a sheet 28 in the nip between the rollers.

When sheets 28 are to be registered against the side register block 44, the drive roller 120 is continuously driven in a clockwise direction (as viewed in FIG. 3) by a drive mechanism 140. Therefore when the idler roller 130 is moved downwardly, that is to the position illustrated in FIGS. 3 and 4, the engaged sheet 28 is pressed against the drive roller 120 and moved laterally or transversely to its direction of flow. This lateral movement brings the side edge 42 of the sheet 28 into abutting engagement with the register block 44 to position the sheet relative to the printing press 10. When the sheets 28 are to be side registered by the side guide assembly 92, the direction of rotation of the drive roller 120 is reversed to move the sheets toward the side guide assembly 92.

After the sheet 28 has been registered by engaging the side edge 42 against the register block 44, the front stops 30 (FIGS. 1 and 2) are retracted. Contemporaneously therewith, the idler roller 130 is moved away from the drive roller 120 by pivoting the support bracket 134 upwardly about its mounting 136 (FIG. 3). The sheet 28 can then be moved forwardly by the previously described cooperation between the drive roller 46 (FIG. 1) and idler roller 48.

The upward movement of the support bracket 134 is accomplished by operation of an actuator assembly 144 (FIGS. 3 and 4). To this end, the actuator assembly 144 includes a rockshaft or actuator shaft 146 which is oscillated about its longitudinal axis to move a longitudinally extending bar 148. Movement of the longitudinally extending bar 148 is transmitted to the bracket 134 by a pushrod 150 having a head portion 154 (FIG. 3) which engages a tappet portion 156 of the support bracket 134. The tappet portion 156 can advantageously take the form of a wear-resistant steel slug fixedly mounted on the bracket 134. An upper surface of tappet portion 156 is in turn engaged by a plunger member 160 which is pressed downwardly by a spring (not shown) located in an upper extension of the fixedly secured body section 124. The pressure exerted by the spring against the plunger member 160 and the bracket 134 can be adjusted by knobs 164 to thereby enable the nip pressure between the idler roller 130 and drive roller 120 to be adjusted.

The continuously operating drive mechanism 140 includes a driven gear 170 which is fixedly secured to the axle 122 of the drive roller 120. A worm gear 174 is slidably keyed to a continuously rotating drive shaft 176 and drivingly engages the gear 170. The worm gear 174 is held against sliding movement relative to the drive shaft 176 by a pair of arms 180 and 182 (see FIG. 3) which trap the worm gear 174 and hold it against axial movement while enabling it to be rotated by rotation of the drive shaft 176. It should be noted that when the position of the guide and detector assembly 38 is adjusted transversely to the stream 16 of sheets, the worm gear 174 is moved axially along the drive shaft 176 by the arms 180 and 182.

In the illustrated embodiment of the invention (FIGS. 3 and 4), a base frame 188 of the turned corner and multiple sheet detector assembly 66 is fixedly mounted on the frame 124 of the side guide assembly 34. To enable excessive sheet thickness to move through the space 76 (FIG. 5) without damaging the turned corner and multiple sheet detector assembly 66, the axle 80 of the detector member 70 is secured to a block 192 (FIG. 4) which is movable vertically relative to the fixed base plate 72 against the influence of a stiff biasing spring 194. A threaded adjustment shaft 196 can be rotated by a knob 198 to adjust the predetermined distance 76 to any desired value. A suitable screw 200 (FIG. 3) cooperates with serrations 202 on the side of the knob 198 to provide an audible click for each increment through which the knob 198 is turned. In addition, a pointer 204 cooperates with a suitable scale (not shown) on the upper face of the knob 198 to provide a further indication of the distance through which the axis 80 or detector member 70 has been moved. Once the distance

76 has been adjusted, the detector member 70 is held against vertical movement by the stiff spring 194 which is located between frame 188 and the block 192.

In view of the foregoing description it can be seen that the guide and detector assemblies 38 and 88 both include turned corner and multiple sheet detector assemblies 66 and 94 for detecting turned corners (similar to the turned corners 64 and 90 of FIG. 2) adjacent to opposite sides of a stream 16 of sheets. In addition to detecting turned corners, the turned corner and multiple sheet detector assemblies 66 and 94 also detect the presence of a number of sheets in excess of a predetermined number, that is the feeding of multiple sheets. Since the turned corner and multiple sheet detector assemblies 66 and 94 are mounted on associated side guide assemblies 34 and 92, the positions of the turned corner and multiple sheet detector assemblies are adjusted when the size of the sheets in the stream 16 of sheets is varied by merely making the necessary adjustments in the positions of the associated side guide assemblies 34 and 92. Therefore, the turned corner and multiple sheet detector assemblies 66 and 94 are easily positioned to detect the presence of turned corners adjacent to opposite sides of streams of sheets of different dimensions.

In addition to enabling the detector assemblies 66 and 94 to detect the presence of turned corners, the mounting of the detector assemblies on the associated side guide assemblies 34 and 92 provides a relatively solid vibration-retarding mounting. This relatively solid mounting minimizes the effect of vibrations on the turned corner and multiple sheet detector assemblies to thereby minimize vibration-induced false or erroneous actuations of the detector assemblies. To further reduce the possibility of false or erroneous operation of the turned corner and multiple sheet detector assemblies 66 and 94, the assemblies have detector members, similar to the detector member 70, which are effective to stop the operation of the printing press only after the detector members have been rotated through a relatively large operating distance. Since the detector members are urged toward their normal or unoperated positions by biasing springs, similar to a biasing spring 220 of FIGS. 3 and 4, normal operating vibrations are unable to pivot the detector members through the relatively large distance to their operated condition.

Having described the invention herein we claim the following:

1. An apparatus for use in association with a conveyor means for transporting a stream of underlapped sheets to a sheet-handling machine, means for temporarily arresting and front registering a sheet at its lead edge while said sheet is partially covered by the trailing edge of a preceding sheet in the stream, said front registering means being cyclically moved into the path of sheets from below the stream, side registering means for frictionally engaging the arrested sheet from above and below to move the arrested sheet against a side-registering block located upstream of the front-registering means, means to operate the conveyor means at a speed whereby the lead edge of the sheet next to be registered arrives at the location of said side-registering means after the side-registering means releases the engagement above and below on the previously registered sheet, means for forwarding each of the registered sheets to the sheet-handling machine, detecting means adjacent the location of said side-registering block, said detecting means having sheet-contacting elements above and below the stream of sheets, which elements are spaced apart a distance adapted to permit free passage of two sheet thicknesses but to frictionally engage the stream from opposite sides in event sheet thicknesses greater than two are presented between said sheet-contacting elements, at least one of said elements being movable about a fixed axis and adapted to pivot with the stream of sheets when engaged thereby, and means actuated by rotation of said movable element to perform a machine-interrupting function, the sheet-contacting elements of said detecting means being spaced in proper detecting position from at least the time the lead edge of a moving sheet next to be registered arrives at said movable

element until the trailing edge of a previously registered sheet in the sheet-handling machine passes said movable element, whereby turned corners on sheets are detected as an excess thickness of sheets.

2. An apparatus as set forth in claim 1, wherein said movable element is mounted above the stream of sheets and said apparatus further includes positive drive means for pulling an upper sheet of the underlapped stream of sheets into said detecting means in such a manner that frictional engagement between the upper sheet and the next adjacent lower sheet pulls either three sheets or a turned corner on a pair of underlapped sheets into the space between the sheet-contacting elements of said detecting means so that the upper sheet engages the peripheral surface of said movable one of said sheet-contacting elements and rotates the movable element about its fixed axis to actuate said detecting means.

3. Apparatus as set forth in claim 1, wherein said detecting means further includes second sheet-contacting elements located on a side of the stream of sheets opposite from said side-registering block to detect the presence of turned corners on the side of the stream of sheets opposite from the side-registering block, said second elements being spaced apart a distance adapted to permit free passage of two sheet thicknesses but frictionally to engage the stream from opposite sides in event sheet thicknesses greater than two are presented between said second sheet-contacting elements whereby turned sheet corners adjacent to the side of the stream of sheets opposite from said side registering block are detected as an excess thickness of sheets.

4. Apparatus as set forth in claim 1, wherein said detecting means is mounted on said side-registering means.

5. An apparatus for use in association with a conveyor means for transporting a stream of underlapped sheets to a means for operating on the sheets, said apparatus comprising a side guide assembly for positioning each of the sheets in turn in a direction transverse to their direction of flow toward the means for operating on the sheets, said side guide assembly including a side register block adapted to be mounted along one side of the conveyor means and means for moving a sheet transverse to the direction of flow and into engagement with said side register block, and turned corner and multiple sheet detector means mounted on said side guide assembly for continuously checking the stream of sheets to detect the presence of three sheets and for continuously checking the stream of sheets to detect the presence of a turned corner on one sheet of a pair of sheets disposed in an underlapped relationship, said detector means including a base member which is adapted to be engaged by lower surfaces of the sheets, a detector member mounted for rotation about an axis which is fixed relative to said base member and extends generally perpendicular to the direction of flow of the sheets, said detector member having a peripheral surface spaced from said base member by a distance which is at least as great as the thickness of two of the sheets to enable two underlapped sheets to pass freely between said peripheral surface of said detector member and said base member, said peripheral surface of said detector member being spaced from said base member by a distance which is no greater than the thickness of three of the sheets to enable an upper surface of one of a plurality of sheets to firmly engage said peripheral surface of said detector member as either three sheets or a turned corner on one of a pair of underlapped sheets passes through the space between the peripheral surface of said detector member and said base, said detector member being rotatable about its fixed axis by engagement of an upper surface of a sheet with said peripheral surface of said detector member as the sheet moves in the direction of sheet flow to indicate the presence of either three sheets or a turned corner on one of a pair of underlapped sheets, and means for mounting said base member and said detector member on said side guide assembly.

6. An apparatus as set forth in claim 5, wherein said apparatus further includes positive drive means for pulling an upper sheet of the underlapped stream of sheets into said de-

tector means in such a manner that frictional engagement between the upper sheet and the next adjacent lower sheet pulls either three sheets or a turned corner on a pair of underlapped sheets into the space between the detector member and the base member so that the upper sheet engages the peripheral surface of said detector member and rotates the detector member about the fixed axis to actuate said detector means.

7. An apparatus for operating on sheet material comprising conveyor means for transporting a stream of underlapped sheets, cylinder means for working on the sheets transported by said conveyor means, frame means for supporting said conveyor means and said cylinder means, first and second side guide means located on opposite sides of the stream of sheets for positioning the sheets relative to said cylinder means in a direction transverse to the direction of flow, said first and second side guide means being independently movable transversely of the direction of flow to thereby enable the locations of said first and second side guide means to be adjusted to position sheets of different dimensions, said first and second side guide means each including a side register block, a pair of cooperating rollers for moving a sheet transversely to the direction of flow and into engagement with said side register block, and mounting means for connecting said side guide means to said frame means, and first detector means mounted on said first side guide means and second detector means mounted on said second side guide means for continuously checking opposite sides of the stream of sheets to detect the presence of a sheet having a turned corner adjacent to either side of the stream of sheets and for continuously checking opposite sides of the stream of sheets to detect the presence of three or more sheets, said first and second detector means each being connected to an associated side guide means for movement therewith transversely to the direction of flow to thereby enable the positions of said first and second detector means to be adjusted to detect the presence of a turned corner on either side of streams of sheets of different dimensions, said first and second detector means each including a base member which is adapted to be engaged by lower surfaces of the sheets, a detector member mounted for pivotal movement about an axis which is fixed relative to said base member and extends generally perpendicular to the direction of flow of the sheets, said detector member having a peripheral surface spaced from said base member by a distance which is at least as great as the thickness of two of the sheets to enable two underlapped sheets to pass freely between said peripheral surface of said detector member and said base member, said peripheral surface of said detector member being spaced from said base member by a distance which is no greater than the thickness of three of the sheets to enable an upper surface of one of a plurality of sheets to firmly engage said peripheral surface of said detector member as either three sheets or a turned corner on one of a pair of underlapped sheets passes through the space between the peripheral surface of said detector member and said base, said detector member being rotatable about its fixed axis by engagement of an upper surface of a sheet with said peripheral surface of said detector member as the sheet moves in the direction of sheet flow to indicate the presence of either three sheets or a turned corner on one of a pair of underlapped sheets, and means for mounting said base member and said detector member on an associated one of said guide means.

8. The method of detecting the presence of folded corners at the leading and trailing edges of rectangular sheets being fed in underlapped stream fashion toward a registering mechanism of a sheet-handling machine comprising the steps of arresting a first sheet in said stream of sheets from below to front register the sheet while said first sheet is partially covered by the trailing end portion of a preceding sheet being processed by a sheet-handling machine, side registering the first sheet by frictionally gripping the first sheet from above and below while urging the first sheet against a side-registering block positioned upstream of the front-registering mechanism,

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said step of side registering the first sheet commencing after the trailing end portion of the preceding sheet in the stream has passed the side-registering block, conveying remaining sheets in said stream at a speed such that leading edge portions of the second and subsequent sheets each arrive at the side registering location after side registering of the first sheet has been completed and the frictional grip on the first sheet has been released, and detecting turned corners on the leading edge portion of a sheet next to be registered and on the trailing edge portion of a previously registered sheet by sensing the stream of sheets at a turned corner detecting station to detect the presence of three or more sheet thicknesses from at least the time the leading edge portion of a sheet next to be registered arrives at the detection station until the trailing edge portion of a previously registered sheet departs from the detection station to enable turned corners to be detected as three or more sheet thicknesses, and interrupting machine

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operation in response to detecting three or more sheet thicknesses at the detection station.

9. A method as set forth in claim 8, further including the steps of pulling an upper sheet of the underlapped stream of sheets into said detection station in such a manner that frictional engagement between the upper sheet and the next adjacent lower sheet pulls either three sheets or a turned corner on a pair of underlapped sheets into the detection station.

10. A method as set forth in claim 8, wherein said step of sensing the sheets at a turned corner detection station includes the steps of simultaneously sensing opposite sides of the stream of sheets to detect the presence of three or more sheet thicknesses at either one of the opposite sides of the stream of sheets to thereby detect turned sheet corners at either one of the opposite sides of the stream of sheets.

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