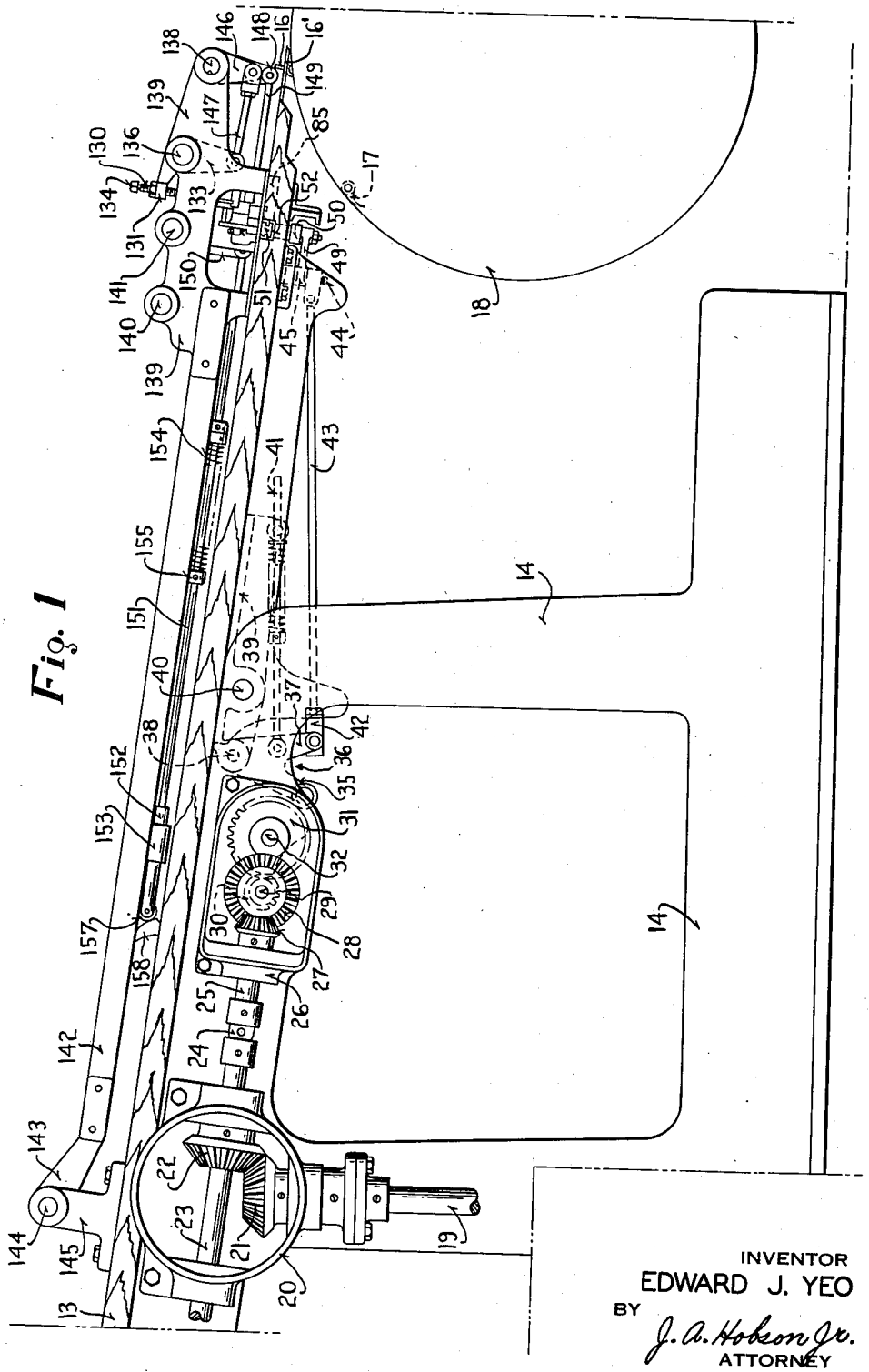
Dec. 31, 1940. E. J. YEO 2,226,957

SHEET FEEDING APPARATUS

Filed Nov. 3, 1939 4 Sheets-Sheet 1

Fig. 1



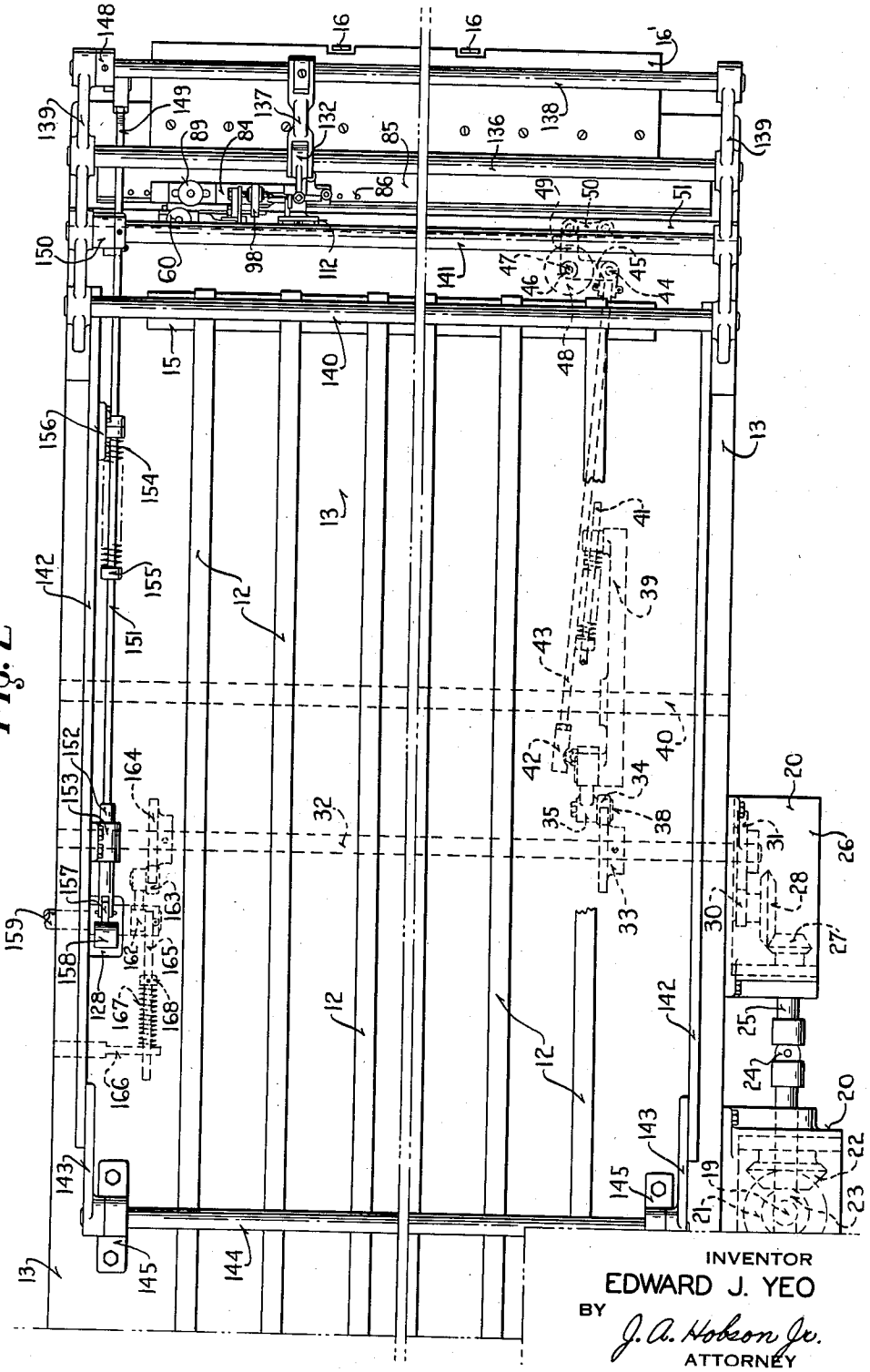
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SHEET FEEDING APPARATUS

Filed Nov. 3, 1939 4 Sheets-Sheet 2

Fig. 2



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SHEET FEEDING APPARATUS

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Fig. 8

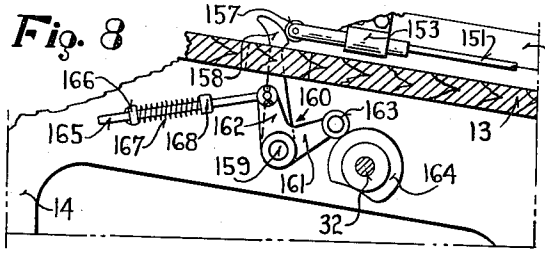
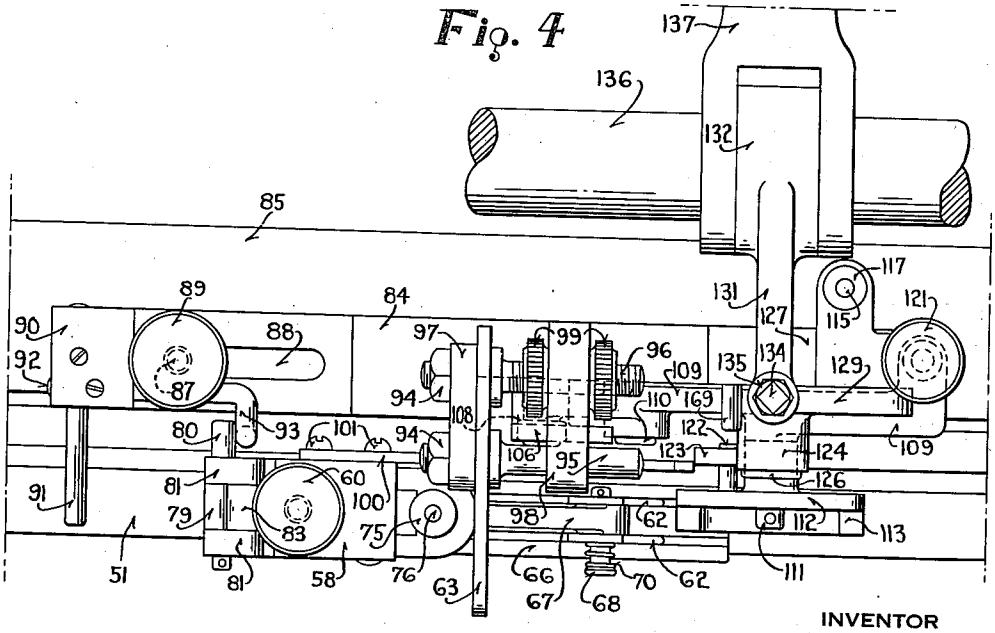


Fig. 3

Fig. 4



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SHEET FEEDING APPARATUS

Filed Nov. 3, 1939 4 Sheets-Sheet 4

Fig. 5

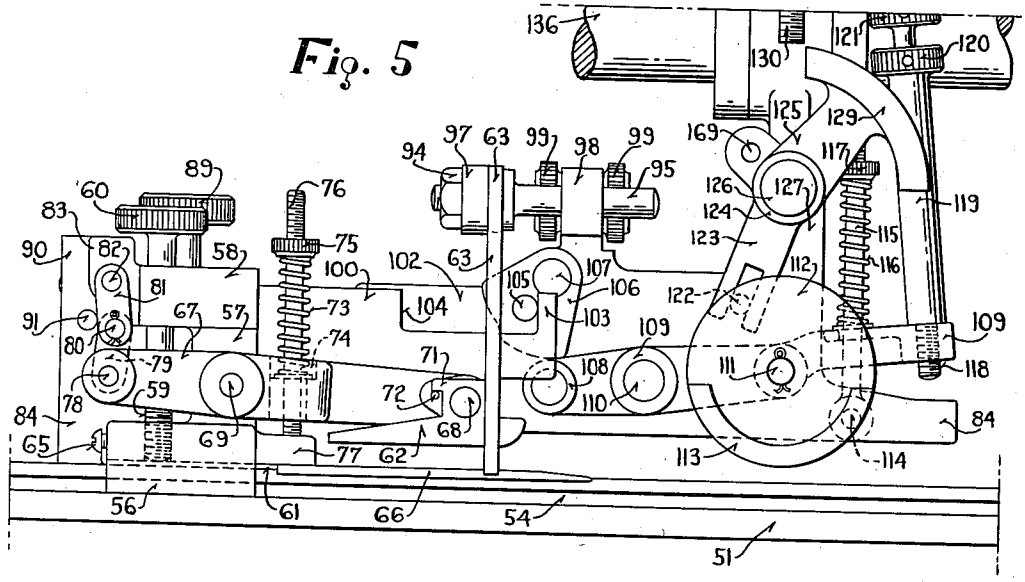


Fig. 7

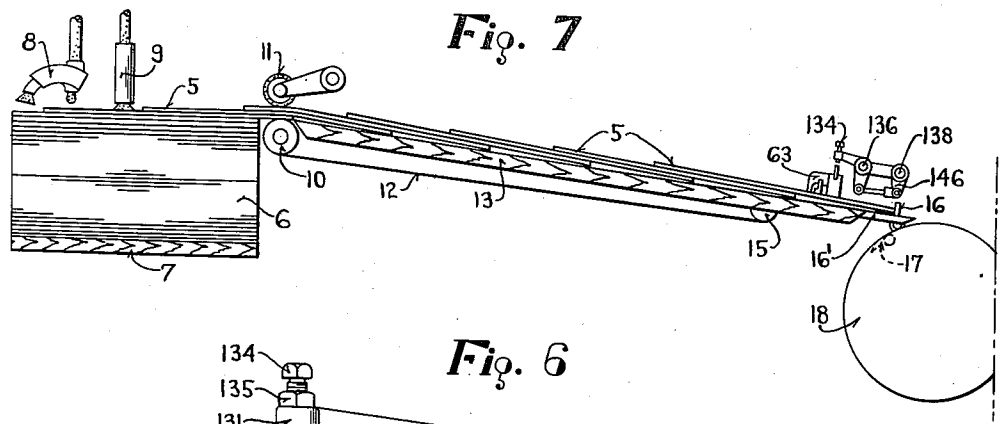
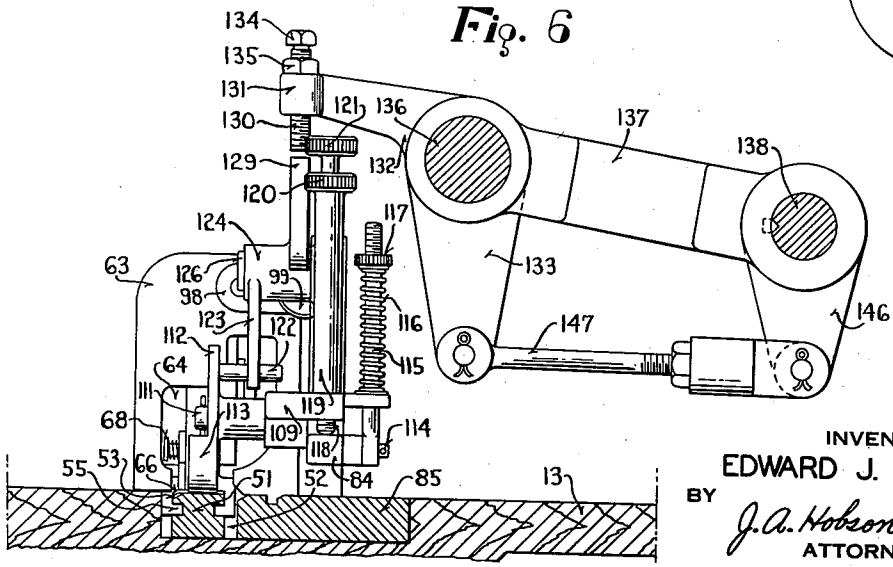


Fig. 6



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UNITED STATES PATENT OFFICE

2,226,957

SHEET FEEDING APPARATUS

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Application November 3, 1939, Serial No. 302,647

20 Claims. (Cl. 271—56)

This invention relates to sheet feeders and more particularly to sheet calipering or excess sheet detecting mechanisms thereof employed to prevent a sheet feeder from feeding more than one sheet at a time to a printing or other sheet fed machine.

The present invention is adapted for embodiment in either sheet by sheet feeders or stream feeders and one object of said invention is to provide an improved sheet calipering or excess sheet detecting mechanism applicable to both of said types of feeders and which, through novel association with and operation by side registering mechanism, is automatically timed thereby.

Another object of the present invention is to provide an improved sheet calipering or excess sheet detecting mechanism for sheet feeders which, through novel association with and operation by side registering mechanism, requires no separate timing and therefore enables the feeder to be more quickly timed with, and set into operation relative to, the printing press or other sheet fed machine with which the feeder is associated.

Another object of the present invention is to provide a method of controlling the results or effects of sheet calipering or detecting operations by and during performance of sheet registering operations.

Another object of the present invention is to provide an improved sheet calipering or excess sheet detecting mechanism for sheet feeders which is so constructed and arranged as to enable previously employed separate timing and operating means to be eliminated with resulting decreased manufacturing and maintenance costs of the feeder.

Another object of the present invention is to provide an improved calipering or excess sheet detecting mechanism associated with side registering mechanism in a manner such that the calipering or detecting operation as well as the side registering operation may be performed on the front or leading sheet of a stream of lapped sheets simultaneously and without the necessity of having to separately time the two operations.

These and other objects of the present invention will appear from the following description and in order to more clearly understand said invention reference may be had to the accompanying drawings in which like reference characters indicate like parts throughout the several views.

In said drawings:

Fig. 1 is an enlarged side elevation of the front portion of a stream feeder illustrated diagrammatically in Fig. 7 and embodying sheet calipering or excess sheet detecting mechanism constructed and arranged in accordance with the present invention;

Fig. 2 is a top plan view of the feeder structure and sheet calipering or excess sheet detecting mechanism shown in Fig. 1;

Fig. 3 is an enlarged rear elevation of the sheet calipering or excess sheet detecting mechanism illustrated in Figs. 1 and 2, showing the parts in their normal positions when calipering a single sheet;

Fig. 4 is a top plan view of the sheet calipering or excess sheet detecting mechanism shown in Fig. 3;

Fig. 5 is a view similar to Fig. 3 but showing the parts of the sheet calipering or excess sheet detecting mechanism in their non-calipering positions;

Fig. 6 is a vertical longitudinal sectional view of the sheet calipering or excess sheet detecting mechanism shown in Figs. 3, 4 and 5;

Fig. 7 is a diagrammatic side elevation of a stream feeder embodying sheet calipering or excess sheet detecting mechanism constructed and arranged in accordance with the present invention; and

Fig. 8 is a side elevation, partly in section, showing parts of sheet caliper or detector controlled feeder stopping and press tripping mechanism.

Referring to the drawings, and more particularly to Fig. 7, sheet calipering or excess sheet detecting mechanism constructed and arranged in accordance with the present invention is therein shown applied to a stream feeder, that is, a feeder in which the sheets are separated and forwarded relative to a supply thereof and conveyed slowly in lapped relation to a printing press or other sheet fed machine which takes the sheets successively from the front of the stream and prints or performs some other operation thereon.

A stream feeder illustrated diagrammatically in Fig. 7 is of well known construction and operation and needs no detail description herein. It may be pointed out, however, that the sheets 5 are arranged in a pile 6 supported on an elevator 7 that acts to raise the pile intermittently and thereby keep the top thereof at a predetermined elevation for the action of rearwardly disposed suction type sheet separating and forwarding means 8 and 9 that separate and forward the sheets relative to the pile.

In the type of stream feeder shown in Fig. 7 the sheet separating means 8 engages the rear

edges of the sheets in succession and lifts or separates them in like manner from the pile, and the sheet forwarding means 9 engages separated sheets in succession and advances them in like manner under and in lapped relation with preceding separated and forwarded sheets into contact with a feed roller 10 having cooperatively related therewith pressure rollers one of which is indicated at 11. The rollers 10 and 11 are mounted in any suitable manner on the feeder framework (not shown).

The feed roller 10 is driven slowly in any suitable manner and, in conjunction with the pressure rollers 11 and tapes 12 which pass over and are driven slowly by the feed roller, advances a stream of the separated and forwarded sheets in lapped relation along a feed board 13. The feed board 13 (Figs. 1, 2, 7 and 8) is supported in any suitable manner on frames 14 disposed rearwardly of the printing press or other sheet fed machine with which the feeder is associated. The tapes 12, which as previously stated, pass over and are driven slowly by the feed roller 10, also pass over the feed board 13 and an idler roller 15 (Fig. 2) located at the front of said board and journalled thereon in any suitable manner.

As will appear from the foregoing, a stream of lapped sheets is advanced along the feed board 13 with the leading sheet uppermost. In this way, the tail of each sheet is disposed or lapped over the head of the next succeeding sheet and each sheet as it arrives at the front of the feed board and in proximity to the printing press or other sheet fed machine may thus be readily front and side registered with respect to the printing or other work performing elements of said machine. Accordingly, if the machine to be fed is a printing press, as shown diagrammatically herein, the front stops 16 thereof (Fig. 7) will be operated in synchronism with the feed of the sheets and the action of the press so as to be engaged with the leading edge of the front sheet upon its arrival at the forward end of the feed board 13. The front stops 16 preferably swing up and down through slots formed on the forward edge of a plate 16' secured in any suitable manner on the front of the feed board 13. After being front registered by the stops 16 and calipered and side registered as hereinafter described, the stops 16 move downwardly and the sheet is seized along its front edge by grippers 17 mounted on a cylinder 18 of the press and acting in conjunction with said cylinder to carry the sheet into the press for performance thereby of the printing operation upon the sheet and delivery thereof from the press in the usual manner.

As will appear from the foregoing, each sheet upon arrival at the front stops is front registered thereby whereupon the sheet is then side registered. These front and side registering operations are well understood in the art and are for the purpose of front and side registering the sheet with respect to the printing or other work performing elements of the press or other machine with which the feeder is associated. In accordance with the present invention sheet calipering or excess sheet detecting means is employed which is in calipering or detecting position during sidewise movement of the sheet incident to performance of the side registering operation. Further, and in accordance with the present invention, calipering or detecting motion of the sheet calipering or excess sheet detecting means is derived from the side registering mechanism. It is therefore preferable to proceed first with description of a side registering mechanism which, as herein shown, is of known construction and operated and arranged as follows.

Motion of the side registering mechanism is derived from a vertical shaft 19 (Figs. 1 and 2) which is driven from any suitable source of power and has its upper end journalled on and projecting in a gear housing 20 that is bolted or otherwise suitably secured to one of the frames 14. The shaft 19 has fixed on its upper end within the housing 20 a bevel gear 21 which meshes with and drives a similar gear 22 also located in said housing and fixed on a shaft 23 extending therethrough and journalled in suitable bearings thereon. This shaft 23 has a universal connection 24 with a short shaft 25 that extends within and is journalled in any suitable manner on a second gear housing 26 bolted or otherwise suitably secured on the adjacent frame 14 forwardly of and in spaced relation with the housing 20. Fixed on the shaft 25 within the housing 26 is a bevel pinion 27 which meshes with and drives a bevel gear 28 which is also located within said housing and journalled on a stud 29 extending in the housing and secured thereto in any suitable manner. The bevel gear 28 has secured thereto or formed integrally therewith a spur pinion 30 located in the housing 26 and meshing with and driving a spur gear 31 also located in said housing. The spur gear 31 is fixed on and drives a cam shaft 32 extending transversely of the feeder into the housing 26 and journalled in any suitable manner on the frames 14.

The shaft 32 has fixed thereon and rotated thereby a cam 33 (Fig. 2) with which is engaged a cam roller 34 journalled on one arm 35 of a lever 36 (Fig. 1) the other arm of which is indicated at 37. This lever 36 is pivoted at 38 on a bracket 39 mounted on a stay shaft 40 and bolted or otherwise suitably secured to the feed board 13 at the underside thereof. The lever 36 has pivotally connected therewith one end of a spring pressed rod 41 the opposite end of which is slidably mounted in a suitable opening formed in the forward end of bracket 39. It will thus appear that arm 36 is cam operated in one direction and spring operated in the opposite direction by the cam 33 and the rod 41, respectively.

The arm 37 of lever 36 has pivotally connected therewith as by a ball and socket connection 42, one end of a rod 43 which is reciprocated by said lever and has its opposite end pivotally connected, as at 44, with one arm 45 of a bell crank lever 46 (Fig. 2). The lever 46 is pivoted at 47 on a circular bracket 48 that is bolted or otherwise suitably secured on the feed board 13 forwardly and at the underside thereof. The other arm 49 of bell crank lever 46 has pivotally connected therewith one end of a link 50 the opposite end of which is pivotally connected with a bar 51 extending transversely of the feed board at the front thereof and slidably mounted in a suitable channel 52 (Figs. 1 and 6) formed or secured in the board and likewise extending transversely thereof.

The top of the bar 51 is flush with the top of the feed board 13 and, as shown in Fig. 6, said bar is bevelled along its rear top edge, as at 53, in order to insure that the sheets will not be obstructed by the bar as they move thereover on the feed board 13. The bar 51, through the described connections therefor with the recipro-

cating rod 43, will be continuously reciprocated transversely of the feed board 13, and the reciprocating bar 51 is connected with and operates the side registering mechanism to be presently described.

For this purpose, the bar 51 is provided along the length thereof at its opposite sides with slots 54 in which are engaged tenons 55 (Fig. 6) that are secured to or formed integrally with a bracket 56 that rests on the top of bar 51. This bracket 56 has a vertical reduced portion 57 and an enlarged top or upper portion 58. The bracket 56 may have sliding movement along the bar 51 to proper operative position where said bracket is then secured to said bar by a clamp screw 59. The clamp screw 59 is journalled in the upper portion 58 of bracket 56 and has threaded engagement in a suitable opening in said bracket so that the latter can be clamped to bar 51 by said screw. The clamp screw 59 is provided at its upper end above bracket portion 58 with a knurled operating head 60 upon turning of which in the proper direction, bracket 56 may be unclamped from or clamped to bar 51 for adjustment and clamping purposes relative thereto.

The side registering mechanism is of the gripper type and includes a lower reciprocating jaw 61 (Figs. 3 and 5), an upper reciprocating jaw 62 movable toward and away from the lower jaw, and a stationary side registering plate 63 having an opening 64 (Fig. 6) therein through which jaws 61 and 62 are reciprocated. Jaws 61 and 62 first grip a sheet fed therebetween to the front stops 16 by tapes 12, then draw the sheet sidewise into engagement with plate 63 to side register the sheet, and thereafter release said sheet for seizing thereof by grippers 17 and carrying of the sheet into the printing press by said grippers and the cylinder 18. The lower gripper jaw 61 comprises a thin elongated steel strip or the like disposed on bar 51 and having an outer end extending between the bar and the bracket 56 and bent upwardly and secured to said bracket by a set screw 65. As shown in Figs. 3, 5 and 6, the rear edge of jaw 61 is bent or turned downwardly as at 66, in general conformity with the rear bevelled edge 53 of bar 51, to prevent obstruction to forword movement of the sheets 5 over said jaw 61 as the sheets are fed forwardly to stops 16 by tapes 12.

The upper gripper jaw 62 comprises thin vertically disposed elongated sheet gripping plates arranged at opposite sides of the inner end of a lever 67 and pivotally connected therewith as by a spring biased pin 68. The lever 67 is also reciprocated through opening 64 of side registering plate 63, and said lever is pivotally mounted at 69 on the reduced vertical portion 57 of the bracket 56 at the rear thereof. The spring 70 of pin 68 yieldably engages the plates of jaw 62 with lever 67 while at the same time providing for relative pivotal movement therebetween. Undue tilting of jaw 62 is prevented by lugs 71 (Fig. 5) formed on the plates of said jaw and engageable with pins 72 on the lever 67.

The gripper jaw 62 normally tends to close relative to jaw 61, such tendency being produced by a spring 73. One end of spring 73 is seated in a recess 74 formed in the upper side of lever 67 inwardly of the pivot 69 thereof. The opposite end of spring 73 bears against an adjusting nut 75 threaded on the upper end of a screw 76 which passes through said spring. The screw 76 also passes through a suitable opening in lever 67 and has threaded engagement with a suitable opening formed in a lug 77 of bracket 56. It will therefore appear that pressure between jaws 61, 62 produced by spring 73 may be varied by the adjusting nut 75.

Raising and lowering movement of jaw 62 relative to jaw 61 during reciprocation of said jaws by bar 51 is obtained in the following manner and by the following described means. Pivotally connected as at 78 with the outer end of lever 67 is a toggle link 79 which, in turn, is pivotally connected by a pin 80 with toggle links 81 (Figs. 3, 4 and 5). The toggle links 81, in turn, are pivotally connected as at 82 with a lug 83 formed on the upper portion 58 of bracket 56. Disposed adjacent the reciprocating bracket 56 is a stationary bracket 84. This bracket 84 is mounted on and adjustable along a plate 85 (Figs. 2, 4 and 6) to proper position relative to the reciprocating bracket 56. The plate 85 extends transversely of the feed board 13 at the front thereof and is secured therein in any suitable manner such that the top of the plate will be in substantially the same plane as that of the top of the feed board. Plate 85 is provided longitudinally thereof with spaced threaded openings 86 (Fig. 2) and when bracket 84 has been properly adjusted relative to reciprocating bracket 56, said bracket 84 is secured in fixed position on said plate by a clamp screw 87. This clamp screw 87 is rotatably mounted in an elongated vertical slot 88 of bracket 84 and is threaded into the proper one of the series of openings 86. The screw 87 is provided with a knurled operating head 89 and through the provision of slot 88 bracket 84 may be adjusted within limits along plate 85 without having to remove screw 87 from bracket 84 and the threaded opening of plate 85 with which said screw is engaged.

Bracket 84 is provided at the outer end thereof with a vertical lug 90 having secured therein and projecting rearwardly therefrom in alinement with toggle pivot pin 80, a toggle straightening pin 91 (Figs. 3, 4 and 5). Lug 90 of bracket 84 also has secured therein and projecting inwardly therefrom a toggle breaking pin 92 the inner end 93 of which is bent rearwardly and downwardly into the path of travel of the toggle pivot pin 80 which, as clearly shown in Fig. 4, projects forwardly from the toggle comprised by links 79 and 81.

The side registering plate 63 is secured, as by nuts 94, on a guide pin 95 and an adjusting screw 96, there being a plate stiffening block 97 interposed between nuts 94 and said plate. The guide pin 95 and the adjusting screw 96 pass through suitable openings in, and are supported by, a lug 98 formed on and extending vertically from the bracket 84. Threaded on adjusting screw 96 at opposite sides of lug 98 are adjusting and locking nuts 99 by means of which the side register plate 63 may be adjusted laterally to, and locked in, proper side registering position.

Assuming now that the reciprocating bracket 56 and jaws 61, 62 are moving inwardly with the latter open, and that a sheet has been fed by tapes 12 between said jaws into engagement with stops 16. The sheet is thus front registered by stops 16 and then, being at rest, is gripped by jaw 61, 62. Gripping of the sheet by the jaws results from toggle pin 80 striking the bent end 93 of toggle breaking pin 92. This occurs as the bracket 56 and jaws 61, 62 move inwardly, and immediately upon breaking of the toggle 79, 81 in this manner, the spring 73 forces jaw 62 down

into engagement with the front registered sheet which is then gripped between said jaw and the jaw 61.

The bracket 56 and jaws 61, 62 then move outwardly drawing the sheet sidewise until its side edge engages plate 63. The sheet is thus side registered, at which time the jaws 61, 62 slide off the sheet through continued outward movement thereof with the bracket 56. The toggle comprised by links 79 and 81 then strikes the toggle straightening pin 91, thereby straightening said toggle and raising jaw 62 relative to jaw 61 against the tension of spring 73. The jaws 61, 62 are thus opened whereupon they move inwardly with the bracket 56 to engage the next front registered sheet and move it sidewise from rest to side register it, as previously described.

In accordance with the present invention sheet calipering or excess sheet detecting means is provided which is in calipering or detecting position with relation to a sheet while it is being moved sidewise to be side registered. Further, and in accordance with the present invention, calipering or detecting motion of parts of the sheet calipering or excess sheet detecting mechanism is derived from moving parts of the side register mechanism. Accordingly, in the embodiment of the invention herein shown, the reciprocating bracket 56 has secured thereto and reciprocating therewith a plate 100 (Figs. 3, 4 and 5). This plate 100 is located forwardly of bracket 56 and secured to the top portion 58 thereof as by set screws 101. The plate 100 extends horizontally and inwardly from bracket 56 and is provided on its inner end and upper edge with a slot 102. An inner shoulder 103 and an outer shoulder 104 define the length of the slot 102 and are formed adjacent thereto on the plate 100. Extending in the slot 102 is a pin 105 that is secured to and projects rearwardly from a cam 106. This cam 106 is pivoted, as at 107, on the bracket 84 adjacent the lug 98 thereof. Cam 106 engages a roller 108 journalled on the inner end of an arm 109 which is pivoted, as at 110, on the bracket 84. The arm 109 is provided thereon with a pin 111 on which is rotatably mounted a sheet calipering or excess sheet detecting element or wheel 112. The axis of rotation of wheel 112 extends in the direction of feed of the sheets along board 13 and the wheel 112 is provided circumferentially and rearwardly thereof with an arcuate shaped weighted portion 113 by which said wheel is normally weight biased against rotation.

The inner end of the bracket 84 has pivotally connected therewith, as at 114, a rod 115 which extends upwardly through a suitable opening in the inner end of the pivoted arm 109. Mounted on the rod 115 above the arm 109 is a spring 116. The lower end of the spring 116 bears against the arm 109 and the upper end of said spring bears against an adjusting nut 117 threaded on the upper end of the rod 115. The spring 116 normally tends to engage the roller 108 with the cam 106, such engagement, however, being regulated by an adjusting screw 118 threaded through a suitable opening in the inner end of arm 109 and engaging the inner end of bracket 94. The adjusting screw 118 extends upwardly through and is threaded in a sleeve 119 supported on the inner end of lever 109 and provided with an operating head 120 for locking the screw 118 in adjusted position. The screw 118 is provided with an operating head 121 for adjusting said screw relative to the sleeve 119, the arm 109 and the inner end of bracket 84. The sheet calipering or excess sheet detecting element 112 is raised and lowered, as presently described, to caliper or detect the sheets. The downward movement of element 112 is so regulated that at the limit thereof a space will be left between said element and the bar 51 equal only to the thickness of a single sheet. This space may be regulated as desired, in accordance with variations in thickness of single sheets handled in the machine, by the adjusting screw 118.

The sheet calipering or excess sheet detecting element 112 has fixed thereon and projecting forwardly therefrom a pin 122 with which is engaged the forked end of one arm 123 of a bell crank 124 the other arm of which is indicated at 125. This bell crank 124 is pivoted, as at 126, on a vertically extending lug 127 of bracket 84 so as to swing transversely of the direction of feed of the sheets about an axis extending in said direction.

The bell crank arm 125 has secured to or formed integrally therewith at its upper end an arcuate shaped weighted abutment 129 which is normally weight biased to the full line position thereof shown in Fig. 3 to enable rocking movement past the same of raising and lowering sheet feeder and printing press control means herein shown as comprises by a detent 130. This detent 130 is operated at right angles to the reciprocating jaws 61, 62 and is preferably in the form of a machine screw threaded through a suitable opening in the rear end of one arm 131 of a bell crank lever 132 the other arm of which is indicated at 133. The upper end of detent 130 is provided with an adjusting head 134 and a lock nut 135 by means of which said detent can be adjusted vertically on arm 131 to various positions and locked in any of the same. The bell crank lever 132 is loosely mounted on a shaft 136 between the forked apertured rear extremity of a tie link 137 through which said shaft extends transversely of the direction of feed of sheets along board 13. A forward forked, apertured extremity of tie link 137 has extending therethrough a rock shaft 138 disposed in spaced parallel relation with the shaft 136. The rock shaft 138 is journalled in any suitable manner in brackets 139 in which the shaft 136 as well as parallel shafts 140 and 141 are mounted. The brackets 139 are bolted or otherwise suitably secured on the forward ends of frame members 142 the rear ends of which are bolted or otherwise suitably secured on arms 143 fixed on opposite ends of a cross shaft 144 journalled in suitable bearings in brackets 145 that are bolted or otherwise suitably secured to the feed board 13 near the rear thereof. It will thus appear that the brackets 139 and parts carried thereby may be swung up with the frame members 142 relative to the feed board 13 about the axis provided by the cross rod 144.

The rock shaft 138 has keyed thereon between the forward forked extremity of tie link 137 an arm 146. This arm 146 has pivotally connected therewith one end of a link 147 the opposite end of which is pivotally connected with the arm 133 of bell crank 132. It will thus appear that the rocking motion of shaft 138, imparted thereto as presently described, results in rocking motion of bell crank 132 and up and down movement of detent 130. It will further appear that through the provision of tie link 137 arm 146 and bell crank lever 132 may be adjusted simultaneously along shafts 136 and 138 to adjust detent 130 laterally in accordance with lateral adjustment of brackets 56, 84 and the parts carried thereby. Such adjustments are made, of course, in accord-

ance with the various widths of sheets handled in the machine.

Shaft 138 is rocked by suitable means for this purpose so that detent 130 is lowered each time a sheet is being moved sidewise to side register the same. As herein shown, said means comprises an arm 148 fixed on the rock shaft 138 at one end thereof as clearly shown in Figs. 1 and 2 of the drawings. The arm 148 has pivotally connected therewith one end of a short link 149 the opposite end of which is pivotally connected with an arm 150 loosely mounted on the shaft 141. Arm 150 has pivotally connected therewith one end of a spring pressed rod 151 the opposite end of which is enlarged at 152 and slidably mounted in a guide 153 that is bolted or otherwise suitably secured on one of the frame members 142 at the inner side thereof. The spring 154 for rod 151 is mounted thereon between a collar 155 and a bracket 156. The collar 155 is secured on rod 151 in any suitable manner and the bracket 156 is bolted or otherwise suitably secured on the frame member 142 which carries the bracket 153.

The enlarged rear end portion 152 of rod 151 has journalled therein rearwardly of bracket 153 a roller 157. Roller 157 is engaged by a cam operated arm 158 which extends upwardly through a suitable opening 128 (Fig. 2) formed in the feed board 13 at one side thereof. Arm 158 is fixed on a shaft 159 (Figs. 2 and 8) which is journalled in a suitable bearing on one of the frames 14. Shaft 159 also has fixed thereon a bell crank 160 the arms of which are indicated at 161 and 162 respectively. Bell crank arm 161 has journalled thereon a roller 163 engaged with a cam 164 that is fixed on cam shaft 32. Arm 162 has pivotally connected therewith one end of a spring pressed rod 165 the opposite end of which is guided in a suitable opening formed in a stud 166 secured to the adjacent frame 14 in any suitable manner. The spring 167 for rod 165 is mounted thereon between the stud 166 and a collar 168 adjustably secured on said rod in any suitable manner.

The operation of the side registering mechanism having been previously described, it is now only necessary to describe the operation of the sheet calipering or excess sheet detecting mechanism. These two operations are performed in a substantially simultaneous manner, that is, when the gripper jaws 61, 62 move inwardly and jaw 62 is lowered toward jaw 61 to grip the front registered sheet in conjunction therewith, the sheet calipering or excess sheet detecting element 112 is also lowered into its sheet calipering or excess sheet detecting position indicated in full lines in Fig. 3 of the drawings. At this time the sheet is at rest against the front stops 16 and extends between element 112 and bar 51 as well as between jaws 61 and 62. Lowering movement of the sheet calipering or excess sheet detecting element 112 is accomplished through inward movement of plate 100 with bracket 56 and gripper jaws 61, 62. Upon such inward movement of plate 100, shoulder 104 thereof strikes pin 105 and swings cam 106 in a counter clockwise direction as viewed in Fig. 3 of the drawings. Such counter clockwise movement of cam 106 enables spring 116 to swing arm 109 clockwise about its pivot 110 and thus lower the sheet calipering or excess sheet detecting element 112 to its calipering or detecting position relative to the sheet. Simultaneously with lowering movement of element 112 to said position jaws 61, 62 are closed and move outwardly to bring the sheet sidewise into engagement with the side registering plate 63.

If, during such sidewise movement of the sheet, there is no additional sheet or sheet thickness present, element 112 will stand stationary in its lower calipering or excess sheet detecting position. In such event, the jaws 61, 62 will thereafter release the sheet through continued outward movement of bracket 56. During such continued outward movement of bracket 56 plate 100 has corresponding movement and shoulder 103 of said plate strikes pin 105 and swings cam 106 clockwise to the full line position thereof indicated in Fig. 5 of the drawings. Such clockwise movement of cam 106 depresses roller 108 and the outer end of arm 109 and thus raises the sheet calipering or excess sheet detecting element 112 so that said element as well as the gripper jaws 61, 62 assume the full line positions thereof shown in Fig. 5 of the drawings. When the sheet has been fed forwardly, front registered, calipered and side registered as described, and no excess sheet or sheets have been detected, said sheet is taken by the grippers 17 of cylinder 18 and carried thereby into the printing press which then prints and delivers the sheet. These operations are performed in the order named on successive sheets as long as no excess sheet or sheets are detected by the sheet calipering or excess sheet detecting element 112, and normal feeding and printing of the sheets in succession thus proceeds without interruption.

When no excess sheet or sheet thickness is present at the time of the side registering and the calipering or excess sheet detecting operations, the arcuate shaped abutment 129 stands in the full line position thereof shown in Figs. 3 and 5 of the drawings and the detent 130 is moved downwardly and upwardly past said abutment by the connections for said detent with rock shaft 138. Rocking of shaft 138, as before described, is accomplished by reciprocation of rod 151 which, in turn, is effected by the cam and spring operated lever 158 which is allowed to rock as long as the detent 130 has no obstruction to its downward movement. Rocking of lever 158 is accompanied by rocking of shaft 159. This shaft 159 is connected with well known mechanism (not shown) which will stop the feeder and trip the printing press in the event rocking movement of shaft 159 is interrupted.

Since in the embodiment of the invention herein shown, the sheets are fed in lapped relation, it will be obvious that at certain times there may be more than a single sheet between the element 112 and the bar 51 as, for example, when a sheet is being carried into the press by grippers 17 and a succeeding sheet is approaching the front stops 16. The timing of the feeder, press, side registering mechanism and sheet calipering or excess sheet detecting mechanism is such, however, that the side registering grippers move inwardly and close and the sheet calipering or excess sheet detecting element is lowered only when one sheet should normally be present for the side registering and the calipering or detecting operations.

Assuming now that two sheets are fed to stops 16 at a time when normally one sheet only should be present for the side registering and the calipering or detecting operations. In this event, and with a double thickness between the lowered element 112 and the jaws 61, 62 said element will, upon sidewise movement of the double sheet thickness imparted thereto by grippers 61, 62, be rotated clockwise about its pivotal axis 111 as

viewed in Fig. 3 of the drawings. Such rotation of element 112 causes the pin 122 thereon to swing bell crank 124 counter clockwise about its pivotal axis 126 and thus swing abutment 129 in the same direction into the path of downward movement of detent 130. The abutment 129 may be swung within limits indicated by the full and dotted line positions thereof shown in Fig. 3 of the drawings, and excess swinging movement of said abutment is prevented by a pin 189 mounted on an extension of lug 127 and adapted to be engaged by the bell crank arm 125.

When the abutment 129 is swung into the path of movement of detent 130 lowering movement of said detent is prevented. Consequently lever 158 cannot actuate rod 151 and fully rock the shaft 138. Under these conditions roller 163 cannot follow the low part of cam 164 to fully rock shaft 159. Failure of shaft 159 to fully rock results in actuation of the above mentioned feeder stopping and press tripping mechanism (not shown) which is connected with said shaft. Actuation of said mechanism stops the feeder and trips the printing press thereby preventing more than one sheet at a time from being fed to and printed by said press.

Upon stopping of the feeder and tripping of the printing press, the leading and excess sheet or sheets of the stream are removed, whereupon the feeder and the printing press are again started by suitable means for this purpose and the forward feeding, front-registering, sheet calipering or excess sheet detecting, side registering and printing operations proceed normally in connection with successive sheets of the stream.

It will appear from the foregoing that in accordance with the present invention the result or effect of the sheet calipering or excess sheet detecting operation is controlled by movement of a sheet sidewise as, for example, to side register it. If no excess sheet is calipered or detected the result or effect of the calipering or detecting operation is to let normal sheet feeding proceed. If an excess sheet or sheets are detected the result or effect of the calipering or detecting operation is to actuate the caliper or detector and thereby stop the feeder and trip or stop the press or other machine fed thereby. In either case, and as above stated, the result or effect of the sheet calipering or detecting operation is, in accordance with the present invention, controlled by sidewise movement of the sheets.

It will further appear from the foregoing that sheet calipering or excess sheet detecting mechanism for a sheet feeder may, in accordance with the present invention, be timed and operated directly from the side registering mechanism instead of by separate cams and elements heretofore employed. This has the advantage of materially decreasing the time required to operatively associate the feeder with a printing press or other machine to be fed thereby and also has the advantage of decreased manufacturing and maintenance costs of the feeder with greater simplicity of operation thereof.

The present invention has been illustrated and described in detail with reference to one embodiment thereof shown in the accompanying drawings but it is to be expressly understood that said invention is not limited to said embodiment or otherwise than by the terms of the appended claims.

What I claim is:

1. In the feeding and calipering of sheets, the method which comprises moving the sheets laterally of the path in which they are fed to thereby produce the results of the calipering operations.

2. In calipering forwardly fed sheets, the method of controlling the effect of the calipering operations which comprises moving the forwardly fed sheets laterally of their normal path of travel while they are calipered.

3. In the calipering and side registering of sheets, the method which comprises producing the results of the calipering operations by performance of the side registering operations.

4. In calipering forwardly fed sheets, stopping and calipering the forwardly fed sheets and controlling the effect of the calipering operations by moving the forwardly fed and stopped sheets laterally of their path of forward movement while they are calipered.

5. In a sheet feeder, the combination of means for moving sheets laterally of their normal path of travel, and sheet calipering or excess sheet detecting means controlled by lateral movement of sheets imparted thereto by said first named means.

6. In a sheet feeder, the combination of means for moving sheets laterally and side registering them, and sheet calipering or excess sheet detecting means controlled by lateral movement of sheets imparted thereto when they are moved laterally by said first named means for side registration of said sheets.

7. In a sheet feeder, the combination of means for moving sheets laterally of their normal path of travel, and movable sheet calipering or excess sheet detecting means arranged for operation by two or more sheets when the same are simultaneously fed to and moved laterally by said first named means.

8. In a sheet feeder, the combination of a side register device and means for moving sheets thereto laterally of their normal path of travel, and movable sheet calipering or excess sheet detecting means arranged for operation by two or more sheets when the same are simultaneously fed to and moved laterally by said sheet moving means toward said side register device.

9. In a sheet feeder, the combination of means for moving sheets laterally of their normal path of movement to side register them with respect to a printing press, movable sheet feeder and printing press control means, and movable sheet calipering or excess sheet detecting means controlling the action of said sheet feeder and printing press control means and arranged for operation by two or more sheets when the same are simultaneously fed to and moved laterally by said first named means.

10. In combination, means for moving sheets laterally to side register them, movable sheet calipering or excess sheet detecting means, and connections between said means for operating one of the same from the other.

11. In combination, means for moving sheets laterally to side register them, movable sheet calipering or excess sheet detecting means, and means operated by said first named means for imparting movement of said sheet calipering or excess sheet detecting means.

12. In combination, reciprocating sheet gripping means, reciprocating sheet calipering or excess sheet detecting means, and connections between said means for operating one of the same from the other.

13. In combination, laterally reciprocating opening and closing sheet gripping means, ver-

tically movable sheet calipering or excess sheet detecting means, and means controlled by the reciprocating sheet gripping means for moving said sheet calipering or excess sheet detecting means upwardly and downwardly in synchronism with the opening and closing actions of said laterally reciprocating sheet gripping means.

14. In combination, laterally reciprocating sheet gripping and releasing means for moving sheets, sheet calipering or excess sheet detecting means adjacent the same and movable at right angles thereto toward and away from the sheets, and means controlled by the reciprocating sheet gripping and releasing means for imparting movement to said sheet calipering or excess sheet detecting means toward and away from the sheets simultaneously with the sheet gripping and releasing actions of said reciprocating sheet gripping and releasing means.

15. In combination, means reciprocating transversely of the direction of feed of sheets for moving the sheets laterally to side register them, a lever pivoted on an axis extending in said direction, a sheet calipering or excess sheet detecting element mounted on said lever, and means controlled by said reciprocating means for rocking said lever and raising and lowering said sheet calipering or excess sheet detecting element.

16. In combination, means reciprocating transversely of the direction of feed of sheets, a cam operated by said means, a lever pivoted on an axis extending in said direction and operated by said cam, and a sheet calipering or excess sheet detecting element mounted on and operated by said lever.

17. In combination, an oscillating lever pivoted on an axis extending in the direction of feed of sheets, a sheet calipering or excess sheet detecting element mounted on said lever for rocking movement thereby and rotation about an axis extending in said direction, reciprocating sheet feeding and printing control means, and pivotally mounted means controlling the action of said sheet feeding and printing control means and controlled by said sheet calipering or excess sheet detecting means through rotation or non-rotation thereof.

18. In combination, raising and lowering sheet calipering or excess sheet detecting means rotatable about an axis extending in the direction of feed of sheets, raising and lowering sheet feeding and printing control means movable about an axis extending transversely of said direction, and means rotatable through rotation of said sheet calipering or excess sheet detecting means for preventing lowering movement of said sheet feeding and printing control means.

19. In combination, raising and lowering sheet calipering or excess sheet detecting means rotatable about an axis extending in the direction of feed of sheets and normally weight biased against rotation, raising and lowering sheet feeding and printing control means, and weight biased normally inoperative rotatable means associated with the sheet calipering or excess sheet detecting means and rendered operative on rotation thereof to prevent lowering movement of said sheet feeding and printing control means.

20. In combination, an oscillating lever, a sheet calipering or excess sheet detecting element rotatably mounted on the lever and normally weight biased against rotation, a pin on the sheet calipering or excess sheet detecting element, a raising and lowering sheet feeding and printing control member, and means controlling the action of said sheet feeding and printing control member comprising a pivoted element having an arm engaged with said pin and an arcuate shaped abutment weight biased to a normally inoperative position removed from the path of movement of the sheet feeding and printing control member, rotation of the sheet calipering or excess sheet detecting element moving said abutment into the path of movement of the sheet feeding and printing control member to thereby stop lowering movement thereof.

EDWARD J. YEO.

CERTIFICATE OF CORRECTION.

Patent No. 2,226,957. December 31, 1940.

EDWARD J. YEO.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 6, second column, line 67, claim 11, for "of" before "said" read --to--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of February, A. D. 1941.

Henry Van Arsdale,

(Seal) Acting Commissioner of Patents.