

July 29, 1958

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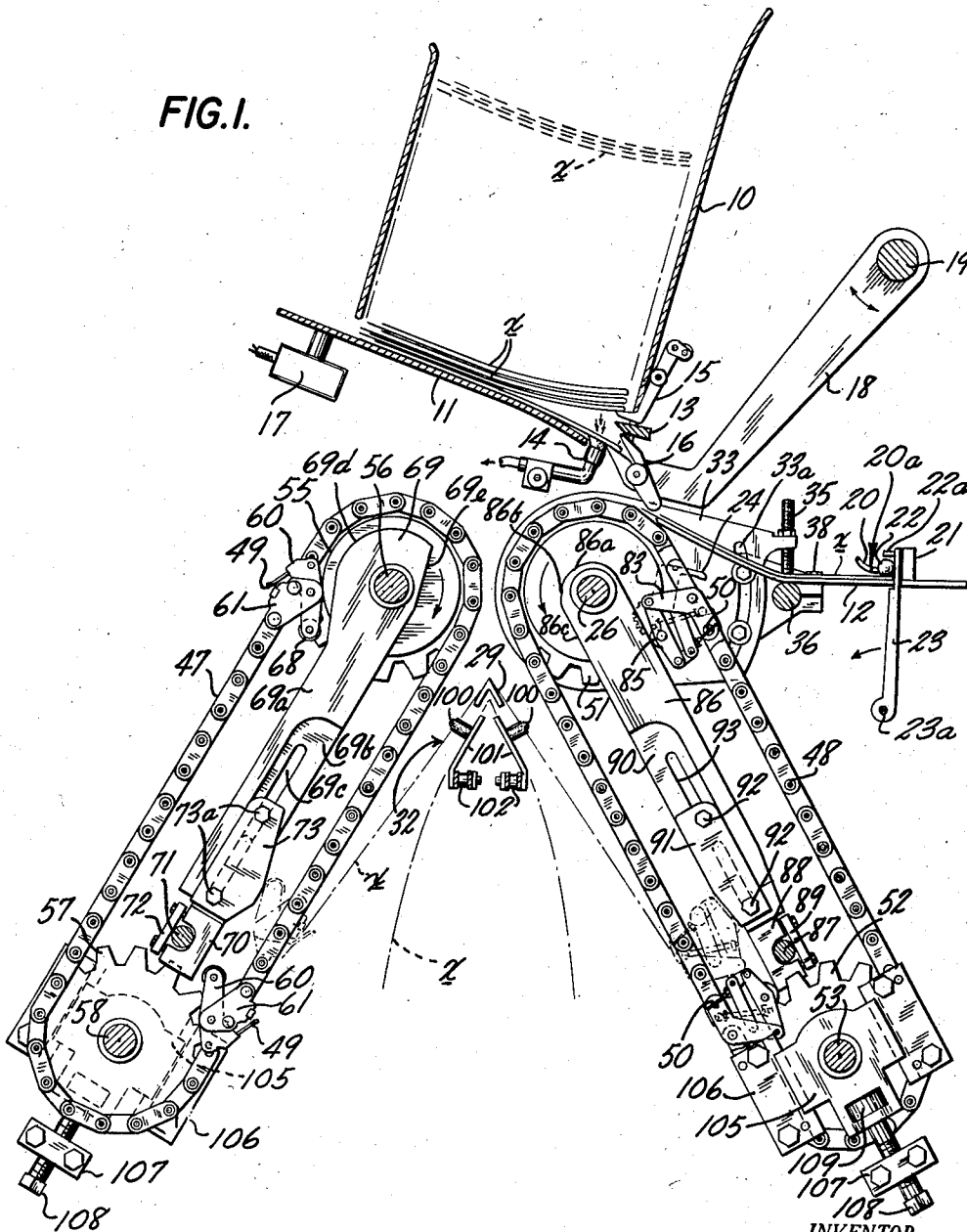
2,845,264

SIGNATURE FEEDING AND OPENING MECHANISM

Filed July 8, 1954

5 Sheets-Sheet 1

FIG. 1.



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5 Sheets-Sheet 2

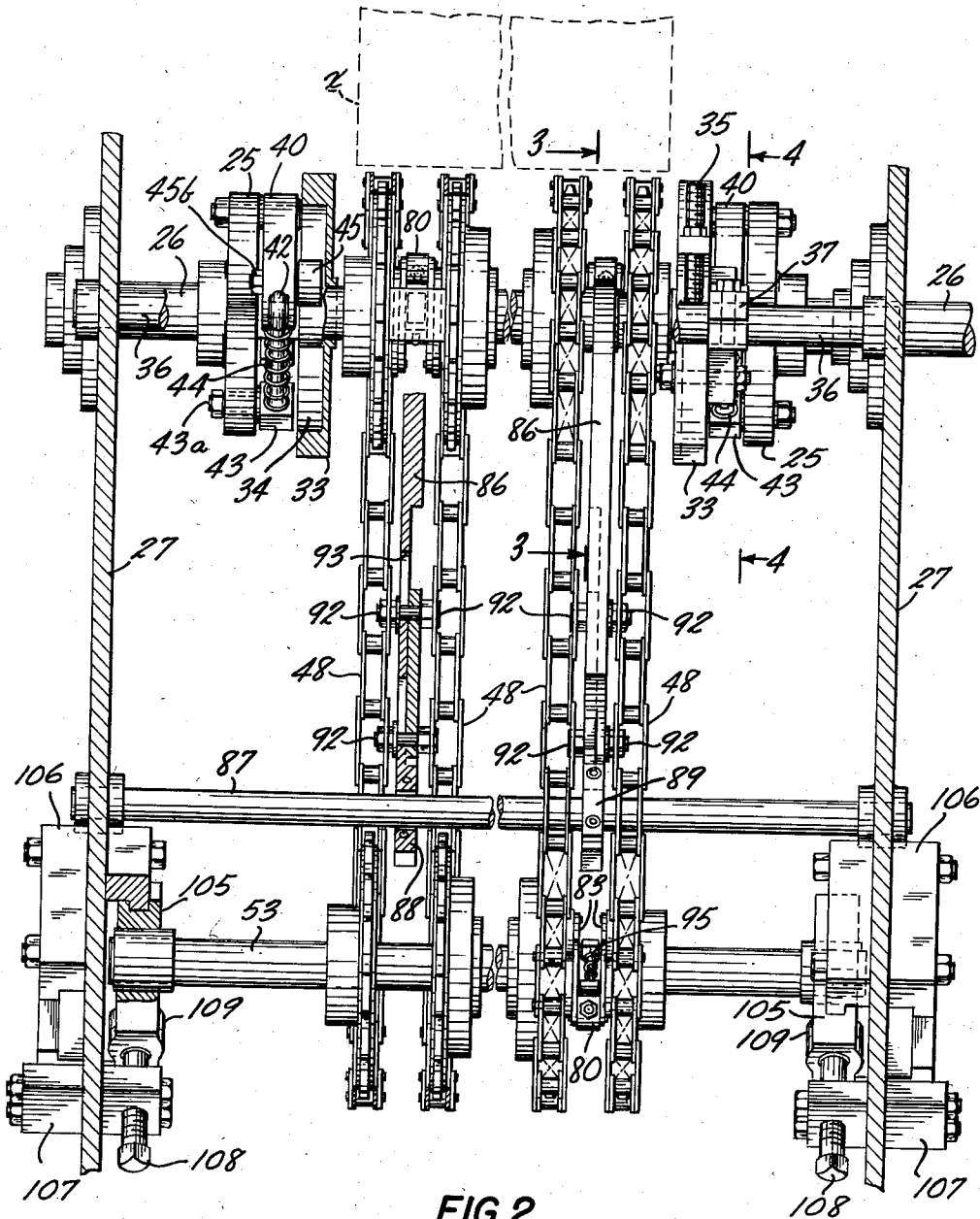


FIG. 2.

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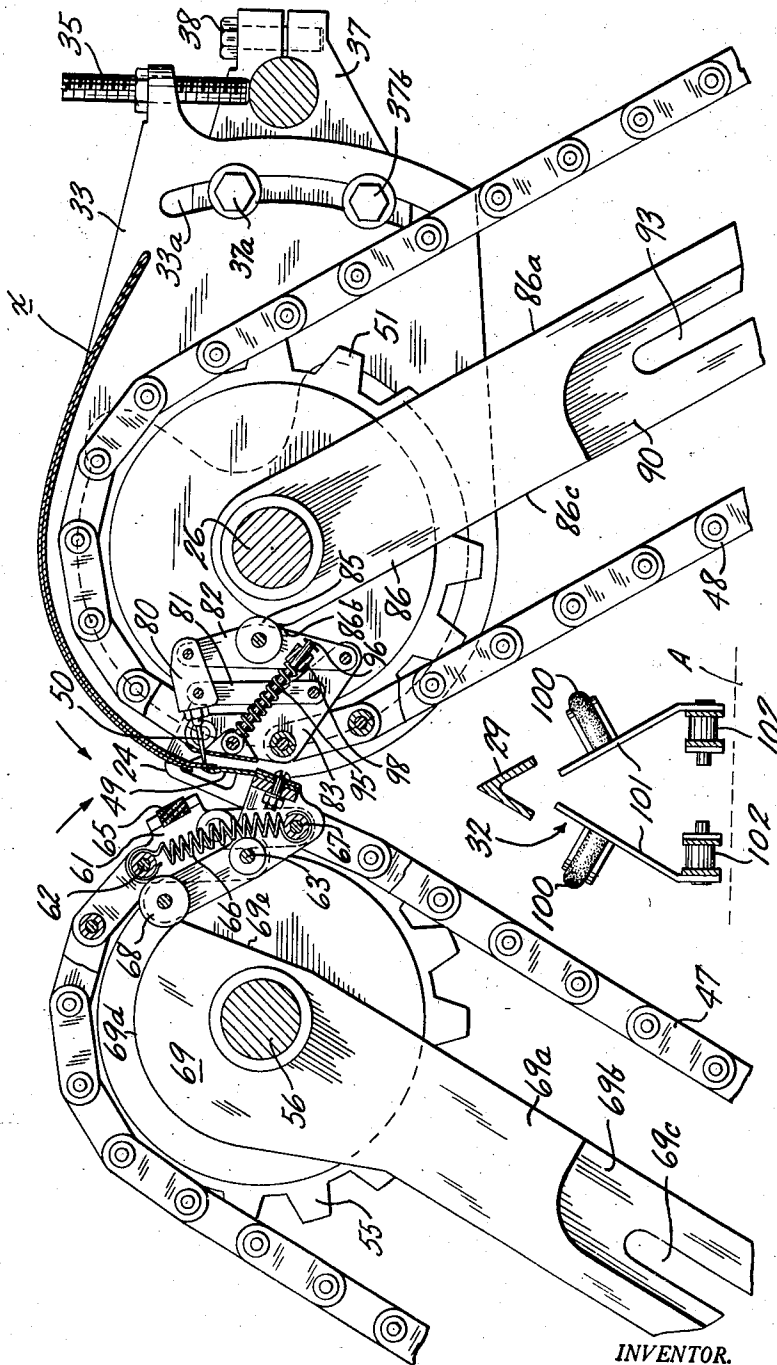
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SIGNATURE FEEDING AND OPENING MECHANISM

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5 Sheets-Sheet 3

FIG. 3.



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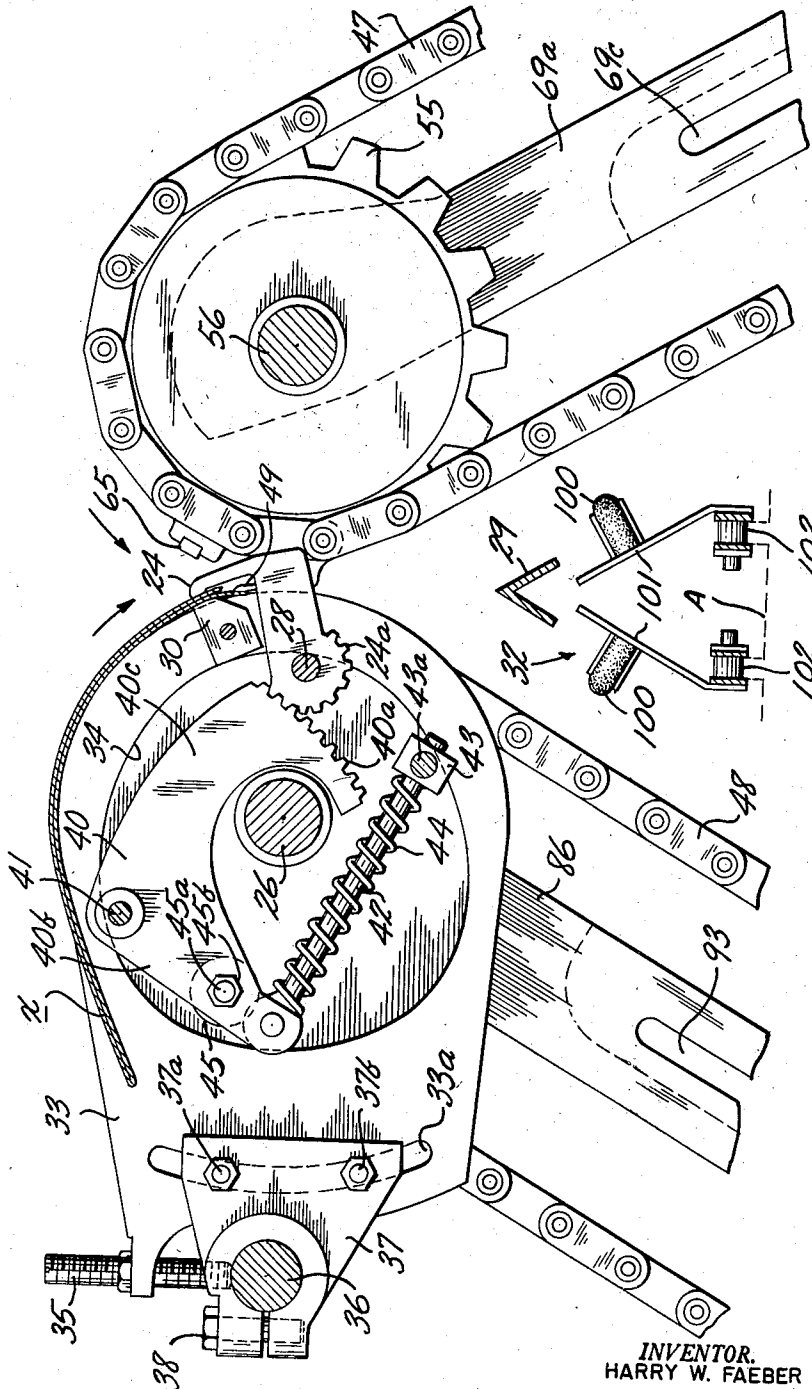
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SIGNATURE FEEDING AND OPENING MECHANISM

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5 Sheets-Sheet 4

FIG. 4.



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SIGNATURE FEEDING AND OPENING MECHANISM

Filed July 8, 1954

5 Sheets-Sheet 5

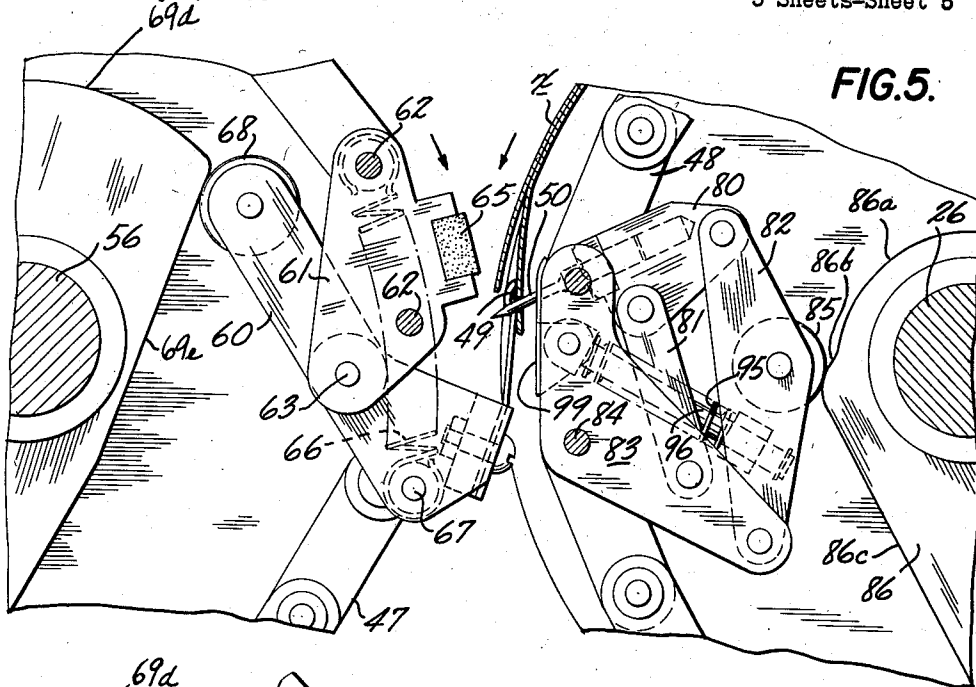


FIG. 5.

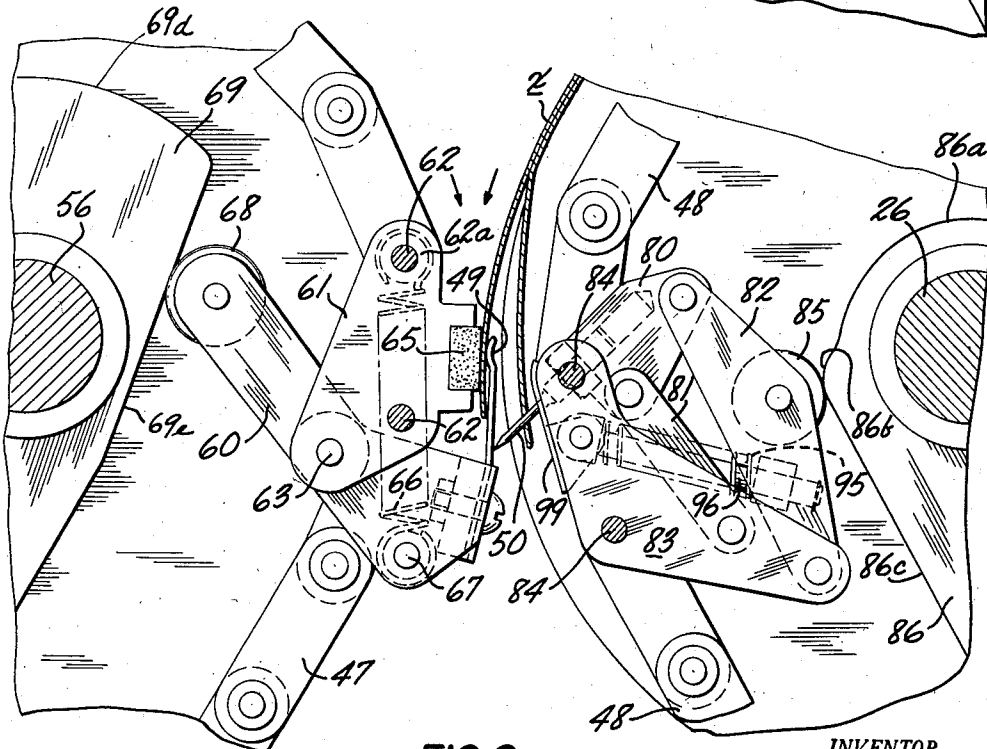


FIG. 6.

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2,845,264

SIGNATURE FEEDING AND OPENING MECHANISM

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Application July 8, 1954, Serial No. 442,149

15 Claims. (Cl. 270—54)

This invention relates to collators wherein a plurality of different folded sheets or "signatures," each containing a number of different pages, are inserted in their proper places to form a book or booklet, and more especially to a collator and to a system of collating wherein different folded signatures which are to comprise the book or booklet are stored in separate feeding bins, removed from the bins one at a time, opened and transferred onto a continuous conveyor, the signatures from successive bins being deposited on the conveyor one on top of another in proper sequence to make up the book or booklet ready for binding.

The present invention is part of an over-all system for producing bound books or booklets in a continuous operation. In this system, paper stock is fed from one or more rolls to one or more printing machines for the printing of a plurality of pages, the printed web slit into continuous strips which are introduced into a folding machine attached to each press, where the strips are cut and folded into signatures, the folded sheets or "signatures" from each printing machine delivered to and stored in one of a number of individual bins, the signatures in the various bins collated in proper sequence on a conveyor in book or booklet form and transported to a binding or stapling station, then to a trimmer, and finally the bound and trimmed books or booklets collected at a delivery terminal for addressing and mailing or bundling and shipping.

In the present invention the folded signatures in each bin are released one at a time and the leaves comprising the signature separated and deposited upon the continuously moving conveyor in such a way that the leaves straddle the conveyor, that is to say, they are supported on the conveyor with their leaves suspended from opposite sides of the conveyor and the folded edges at the top. As the conveyor advances from one bin to the next, the signatures from succeeding bins are similarly delivered at the proper time and in the proper sequence to the conveyor, one on top of the other. With the leaves thus spread apart and the signatures assembled one on top of another with the folded edges aligned at the top, the collated pages are ideally arranged and disposed for binding or stapling.

The details and features of the present invention are more fully set forth and explained in the description of the invention which follows and in the accompanying drawings in which:

Fig. 1 is an illustrative side elevation, partly in cross-section, of the present invention;

Fig. 2 is a front elevation of part of the mechanism for separating the open end of the folded sheet and depositing it on the conveyor;

Fig. 3 is a view taken on the line 3—3 of Fig. 2, looking in the direction of the arrows;

Fig. 4 is a view taken on the line 4—4 of Fig. 2, looking in the direction of the arrows; and

Figs. 5 and 6 are enlarged views of the mechanism

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shown in Fig. 3 with the parts represented at different stages of operation.

Referring to the drawings, and especially to Fig. 1, folded sheets or signatures *x*, each preferably comprising four or a multiple of four printed pages of a book or booklet, are fed one on top of another into separate bins or hoppers 10 commonly known in the trade as "pockets." The signatures may also include a so-called "gate fold," which is an extra wide page folded back into the book upon itself along a line inside the trim size. The signatures may be loaded into the pocket in piles (so-called "brick piles") containing a sufficient number of signatures to form approximately a 6" high stack. Only one of the bins is shown in the drawings, but it should be understood that a plurality of such bins, as many as there are signatures to be inserted, are arranged in line. The signatures are fed one at a time from each of the bins, and they are collected by a constantly moving conveyor, generally designated by the reference number 32, which travels from bin to bin receiving a signature from each, one on top of another, in proper sequence to form a book. The signatures are opened before they are delivered to the conveyor, and the signatures are deposited on the conveyor with the folded edges at the top. In the normal course, the center signature containing the center pages would be the first received by the conveyor, with the others received on top thereof in proper order. Thus, when the conveyor has received a signature from each bin, one on top of another in the proper sequence, the signatures will be arranged on the conveyor in book form ready for binding. It is to be noted that the last pocket may deposit a 4-page signature (single fold), which might be of relatively heavier paper to form the cover of the book.

The folded sheets or signatures *x* are fed into the bins 10 from the top and fall by gravity to the bottom with the open end of the signature toward the rear and the folded edge at the front. The signatures in the bin are supported from the bottom upon a thin angularly inclined sheet metal base 11, and a gap between the lower end of the front of the bin 10 and the front edge of the base 11 forms a discharge opening through which the signatures may be released one at a time onto a platform or tray 12.

The signatures *x* are folded in such a way that one leaf thereof is slightly longer than the other, and the signatures are deposited in the bin in such a way that the longer leaf is at the bottom. The reason for this will be apparent. The base 11 is inclined downwardly toward the discharge opening of the bin, and the walls of the bin are substantially perpendicular to the base 11. Prior to release, the rear portion of the bottom signature rests upon and is supported by the base 11, and the front or folded edge of the signature is supported above the discharge opening by a projecting pin or lip 13 and the lower hook end of a pivotal finger 15.

The pin or lip 13 projects into the bin or hopper 10 sufficiently to prevent the folded signatures from falling down by their own weight. At regular timed intervals a reciprocating arm 14, located below the signature bin or hopper at the discharge opening and carrying a suction or vacuum cup, pulls the bottom signature down past the projecting pin or lip 13. Although the pin projects into the hopper sufficiently to prevent the signatures from falling down by their own weight, it does not prevent the bottom signature from being pulled down by the suction arm; in other words, the backbone of the signature actually brushes by this retaining pin as it is pulled downwardly.

When a signature is to be withdrawn from the bin 10, the finger 15 is pivoted to inoperative position and

the suction arm 14 comes into contact with the lower front surface of the sheet, pulling it past the pin or lip 13 and delivering it to the jaws 16 of a reciprocating feeder arm 18. An electrical vibrating device 17 attached to the underside of the base 11 vibrates or jogs the sheets *x* in the bin so that they will be easily separated and delivered to the gripping jaws 16 one at a time. While the bottom signature is being pulled down, the finger 15 pivots inwardly, thus entering into the gap between the bottom signature and the one just above it and lifting the pile into the position shown in Fig. 1. This will relieve some of the weight of the pile and reduce the friction resisting the removal of the bottom signature.

The bottom sheet may be withdrawn by a single gripping jaw 16, or preferably by a pair of gripping jaws acting in unison and adapted to grip the sheet at two points symmetrically spaced with respect to the center of the signature. The gripping jaw 16 is supported at the end of the downwardly disposed oscillating feeder arm 18 pivotally mounted on the shaft 19. The arm 18 is first pivoted in a clockwise direction, as viewed in Fig. 1, so that the gripping jaw may grasp the folded edge of the sheet, and then the arm 18 is swung in the opposite direction so that the sheet will be completely withdrawn from the bin 10 and deposited on top of the platform 12.

The opening of the gripping jaws 16 is so timed that they release the signatures at the moment the jaws pass back stop 21. The folded end of the signature is thus introduced between platform 12 and guide 20 and brought up against stop 21. Spherical weight 22 is free to move up and down slightly in opening 20a of guide 20 and is prevented from jumping out upward by top retainer 22a. These weights are provided for the purpose of engaging the leading folded edge or backbone of the signature and to prevent the signature from bouncing away from the back stop 21. The spherical weight may be a loose steel ball which exerts just enough pressure by its own weight to prevent back bounce.

As explained above, in the folding operation, the signatures are folded so that one leaf projects slightly beyond the other. The sheets are delivered to the bins 10 in such a way that this longer leaf is always at the bottom, and hence, it is at the bottom while the signature is in the waiting position on the table 12. At the proper time, both registering arms 23, which are clamped or set screwed on one shaft 23a in exact alignment with one another, are pivoted in the direction of the arrow in Fig. 1, so that the open end of the signature is delivered to a pair of grippers 24 (only one of which is shown in the drawings), in proper alignment. The grippers 24 are each pivotally mounted to the side faces of separate rotatable discs 25 (see Fig. 2), and both of the discs 25 are mounted at opposite ends of a common rotatable drive shaft 26 supported at both ends between side frames 27. As best shown in Fig. 4, the grippers 24 are pivoted on shafts 28, and the shafts 28 are mounted eccentrically to the discs 25. The side faces of each of the discs 25 also carries an anvil 30 in fixed relation to the gripper and against which the gripper 24 banks to grip the edge of a signature therebetween.

As viewed in Fig. 1, the grippers 24 travel in a counter-clockwise direction, passing the rear edge of the platform 12 during their upward movement, and it is at this point that the registering arms 23, moving in unison, advance the folded signature to the open grippers. The grippers close on the leading edge of the signature, grasping it tightly against the anvil 30, and as shown in Fig. 4, the signature is transported toward the conveyor 32.

Turning now to a more detailed description of the grippers 24 and the manner in which they are opened and closed, a pair of fixed plate members 33 (see Figs.

2 and 4) having internal cam surfaces 34 are adjustably supported on the shaft 26, each member 33 being spatially separated from, but in close proximity to, one of the discs 25. The front ends of the plate members 33 each carry an adjustable set screw 35, the lower end of which is adapted to bank against a transverse shaft 36. The transverse shaft 36 is also supported at both ends in the side frames 27 of the machine. The shaft 36 carries thereon two brackets 37, one adjacent to each of the plate members 33. Each bracket 37 is tightly and fixedly attached to the shaft 36 by a screw 38 which brings together flexible portions of a split end of the member 37. The side face of each of the brackets 37 is provided with transverse locking screws 37a, 37b, which screws are adapted to be accommodated in a long, vertically disposed curved slot 33a formed in the plate member 33. It is evident that the plate member 33 may be pivotally adjusted on the shaft 26 by turning the set screw 35, and that by so pivotally adjusting the plate member 33, the position of the cam 34 relative to the shaft 26 may be accurately fixed. It is also evident that the member 33 may be locked in its adjusted position by tightening the nuts of the screws 37a, 37b.

The opening and closing action of each of the grippers 24 is controlled by the cam surface 34 and the cam controlled pivotal lever 40 pivotally connected to the side face of the disc 25 by a shaft 41 (see Fig. 4). The lever has arms 40b and 40c. The end of the arm 40c is provided with a gear segment 40a which engages with the companion gear segment 24a of the grippers, and the end of the arm 40b is pivotally connected to a rod 42 which slidably engages a hole formed in a block 43. The block 43 also is pivotally mounted to the side face of the disc 25 by a stub shaft 43a. The rod 42 accommodates a compression spring 44 thereon which acts between the block 43 and the arm 40b, the expansive action of the spring normally urging the pivotal lever 40 to the position illustrated in Fig. 4 to maintain the gripper 24 closed, that is to say, to maintain the gripper in banking contact with the anvil 30. The arm 40b of the lever 40, however, carries a roller 45 which is adapted to be controlled by the cam 34. The roller 45 is rotatably mounted on a small shaft 45a threadably attached to the arm 40b and held in place by a nut 45b. As the lever 40 and the gripper 24 are translated in a circular path on the side face of the rotating disc 25, the roller 45 of the lever is moved relative to the surface of the stationary cam 34.

During that portion of the cycle in which the grippers 24 are adapted to be closed, the arm 40 is urged by the spring 44 to its extreme clockwise position, as viewed in Fig. 4, the roller 45 being out of contact with the high portion of the cam surface 34. As the disc 25 continues to rotate, the roller 45 comes into contact with the low portion of the cam 34, thereby pivoting the lever 40 in a counter-clockwise direction, as viewed in Fig. 4, against the pressure exerted by the spring 44, and the lever 40 is pivoted sufficiently to cause the gripper 24 to be moved to open position.

The operation of the grippers 24 is such that they are open as they approach the end of the table 12 upon which the signature is waiting, and as anvil 30 passes under the edge of the signature, close on the leading edge of the signature. The grippers carry the signature toward a narrow gap between the upper end of two oppositely inclined groups of closed chains 47, 48 the trailing edge of the signature either being suitably supported and guided or following freely.

The chains 47, 48 are the carriers for sheet engaging members which separate the leaves of the signature and deliver them to a stationary delivery bar 29 from which they are picked up by the conveyor 32. The chains 47, 48 all travel continuously at the same speed, however, the chains 47 travel in opposite directions in respect

to the chains 48. The chains 47, 48 are arranged in pairs, and there are two pairs of the chains 47 and two pairs of the chains 48. The chains of each pair are spaced apart, side by side, and carry the sheet retaining members between them; moreover, the two pairs of chains are spaced apart from each other, and the sheet retaining members carried between each pair of the chains of each of the groups 47, 48 simultaneously engage the same edge of a sheet. In the present embodiment illustrated in the drawings, each pair of the chains 47 carries two gripper devices 49, and each pair of the chains 48 carries two sheet-piercing pins 50, the grippers 49 and sheet-piercing pins 50 being the sheet engaging members and cooperating with each other in a manner which will be described to separate the leading open end of the signature, and to guide each leaf of the signature on opposite sides of the delivery bar 29. Each pair of chains may be replaced by a single chain in which case the sheet retaining member would be mounted on the side of a single chain instead of being arranged between the two members of a pair of chains as shown in the drawings.

In the embodiment shown in the drawings, the four chains 48 each engage companion sprocket wheels 51 mounted on the upper rotatable shaft 26 and sprocket wheels 52 mounted on a lower rotatable shaft 53, the lower shaft 53 being parallel to the upper shaft 26. Likewise, the four chains 47 pass around four sprocket wheels 55 mounted on a rotatable shaft 56 and four sprocket wheels 57 mounted on a rotatable shaft 58. The disposition of the shafts 56, 58, the sprocket wheels 55, 57, and the chains 47, is similar and symmetrical to the disposition of the shafts 26, 53, the sprocket wheels 51, 52, and the chains 48; except that they are located on opposite sides in relation to the signature receiving bar 29 and the conveyor 32, and the chains 47, 48 are arranged in oppositely inclined fashion. More specifically, the chains 47, 48 are continuously driven in opposite directions to carry the grippers 49 and the sheet-piercing pins 50 toward each other in converging directions at the top, and then away from each other in diverging directions as they travel downwardly along their lower spans between the sprocket wheels.

The grippers 49 and the signature-piercing pins 50 are mounted in similar fashion, the former between the pairs of chains 47 and the latter between the pairs of chains 48. Any number of grippers 49 may be carried at spaced intervals between each pair of chains 47, and any number of sheet-piercing pins 50 may be carried at similarly spaced intervals between each pair of chains 48. The arrangement of the grippers 49 carried by the chains 47 is such that a pair of the grippers, one from each pair of the chains 47, said grippers traveling side by side in unison with one another, simultaneously engages opposite ends of the leading edge of the shorter leaf of the signature, and the arrangement of the pins 50 is such that a pair, one associated with each of the pairs of chains 48, said pins also traveling side by side in unison, simultaneously engages opposite ends of the leading edge of the longer leaf of the signature. As the grippers 49 and pins 50, moving in closed paths in opposite directions and in synchronism, come together at the narrow gap between the chains 47 and 48, they cooperate with each other to separate the leaves of the signature and to deposit the signature, folded edge at the top, upon the transverse delivery bar 29 from which the signature is removed by the conveyor 32. The spacing between successive pairs of grippers 49, on the one hand, and between successive pairs of sheet-piercing pins 50, on the other hand, is such that a pair of each comes together in synchronism to properly deliver a signature to the delivery bar 29 during each signature feeding cycle of the grippers 24 and in proper time relation to the grippers 24.

The action of the grippers 49 and the pins 50 is best described with reference to Figs. 3, 5 and 6. Turning first to a description of the structure and operation of the grippers 49, the grippers are mounted to a pivotal arm 60, which arm 60 is pivotally mounted between a pair of spatially separated members 61 by a connecting pin 63. Each member 61 is rigidly affixed to a link of one of the chains 47 by means of the rivets 62 which connect the said link in the chain; the members 61 which support the same gripper are attached to corresponding links of the paired chains. A gripper pad 65 is supported between the members 61, and the gripper 49 is normally urged in banking contact with the pad 65 by means of a tension spring 66 stretching between a rung 62a extending between the paired chains 47 and a pin 67 carried by the arm 60.

The end of the arm 60 opposite the gripper 49 carries a roller 68 which roller is adapted to engage the contour of a cam 69. The cam 69 is formed along the edge of a long, angularly disposed member 69a, which member is supported between the inclined spans of the chain 47 by the shaft 56 at its upper end and by the transverse shaft 71 at its lower end. More specifically, as best shown in Fig. 1, the member 69a is connected at its lower end to a block 70, and the block 70 is provided with a semi-cylindrical groove to accommodate the shaft 71. The block 70 is attached to the shaft 71 by means of an upper bar or clamp 72 which is connected to the block by means of screws.

A cam 73 is adjustably attached to the member 69a. The cam 73 is accommodated within a groove 69b of the member 69a, which groove contains a long slot 69c through which bolts 73a of the cam 73 pass. The cam 73 may be locked in set position along the length of the member 69b by tightening the bolts 73a.

The contour of the cam 69 comprises a raised surface 69d and a drop-off surface 69e. When the roller 68 engages the raised surface 69d, the gripper 49 is pivoted against the action of the spring 66 to open position, and remains open until the roller passes the raised surface 69d and follows the drop-off surface 69e, (see Fig. 6), at which point the spring 66 is permitted to close the gripper. The gripper remains closed while it is being transported downwardly along the lower stretch or span of the path of the chains 47, until the roller 68 engages the raised surface of the cam 73, at which point the gripper is opened to release the sheet. It is evident that by adjusting the position of the cam 73 with respect to the member 69a, the point at which the gripper releases the sheet can be accurately controlled.

The signature-piercing pins 50 are mounted in similar fashion to the grippers 49 between each pair of chains 48. The pins 50 are anchored in a holder 80 (see Figs. 3, 5 and 6), and the holder 80 is connected on each side by two substantially parallel links 81 and 82 to and between a pair of arms 83 each rigidly connected to one of the paired chains 48 by the rivets 84 which connect successive links of the chains 48. The links 81, 82 are all pivotally connected at one end to the holder 80 and at the other end to the arm 83, and the links 82 carry a roller 85 between them. The roller 85 engages a cam surface of a long member 86, which member 86 is similar to the above-described member 69a. The member 86 is supported at its upper end on a shaft 26 and at its lower end from a shaft 87. More specifically, the lower end of the member 86 is connected to a block 88, and the block 88 is attached to the shaft 87 by means of a cross bar or clamp 89 held to the block by screws or bolts.

The member 86 also contains a groove 90 which accommodates a cam 91, the screws 92 of the cam passing through an elongated slot 93 formed in the member 86. The cam 92 may be adjusted along the length of the member 86 in the same way that the cam 73 may be adjusted with respect to the member 69a,

The roller 85 is maintained in contact with the cam surface of the member 86 by a compression spring 95. The compression spring 95 is supported on a rod 96 which is pivotally connected at one end between the arms 83 and slidably mounted at the other end in a pivotal block 98. The block 98 is pivotally supported between the links 82. The extreme end of the rod 96 contains a cotter pin to prevent the rod from being accidentally removed from the block 98.

The pin 50 is adapted to be thrust forwardly and retracted through a hole or slot in a plate or shield 99, which shield 99 is mounted between the rigid arms 83. When the roller 85 is in contact with the surface 86a along the upper edge of the member 86, the pin 50 will be in its retracted inoperative position. However, when the roller reaches the raised portion 86b of the cam 86 (see Fig. 3), the roller is lifted and the pin 50 is thrust forwardly through the shield 99. The pin 50 remains in its forward operative position while the roller follows the surface 86c of the member 86 and remains in this forward operative position until the roller reaches the low portion of the cam 91, at which point the pin is again retracted through the shield 99 to inoperative position. The adjustment of the positions of the cams 73 and 91 bear a definite relation to one another because the retraction of the pin should occur at substantially the same time as the opening of the grippers 49.

The delivery of the signature from the tray or platform 12 onto the continuous conveyor may now be described. As explained above, the open end of the signature x is delivered to the grippers 24 which carry the signature over the top of the chains 48 and the sprocket wheels 51. As best shown in Fig. 3, each end of the longer leaf of the signature is pierced by a pin 50 as the signature enters the narrow gap between the sprocket wheels 51, 55, this piercing action of the signature occurring at both ends of the signature x by pins operating in unison. The grippers 49 act as backings for the signature while it is being pierced by the pins, and accordingly each gripper 49 is provided with a slot (not shown) to accommodate the thrust of the pin through the signature. The continued movement of the chains 47, 48 causes the signature x to be advanced to the position illustrated in Fig. 5 with the upper ends of the open grippers 49 being inserted between the leaves of the signature. The insertion of grippers 49 between the leaves of the signatures is accomplished in the following manner: gripper arm 60 pivots around pin 63 as cam follower 68 descends along cam race 69e. It is obvious from the geometry of the arrangement that, as the gripper 49 closes upon pad 65, it also moves upward, so that the upper end of the gripper 49 is inserted between the leaves of the signature in order to have a separating effect thereon. As the chains continue their movement, the gripper 49 closes upon the shorter leaf of the signature, firmly locking the shorter leaf against the pad 65. As soon as the signature x is delivered to and within the control of the pin 50, the grippers 24 are opened and have no further effect on the signature x.

The further downward movement of the pin 50 carries with it the longer leaf of the signature and the further downward movement of the gripper 49 brings with it the shorter leaf of the signature, so that as the pin and gripper start down along their lower spans or stretches, in diverging directions, the leaves of the signature are further separated, and the upper folded edge of the signature is pulled down upon the signature receiving bar 29, preparatory to being picked up by the conveyor 32. When the signature has been properly delivered to the bar 29, each leaf being suspended from an opposite side thereof, the ends of the leaves of the signature are released by the grippers 49 and the pins 50. The gripper 49 is opened to release the shorter leaf of the signature upon engagement of the roller 68 with the inclined

surface of the cam 73, as described above, and the longer leaf of the signature is released by the retraction of the pin 50 behind the shield 99 caused by the roller 85 reaching the downwardly inclined surface of the cam 91.

The construction and operation of the conveyor 32 is more fully shown and described in my Patent No. 2,810,468, granted October 22, 1957, however, and it suffices to say for present purposes that the conveyor comprises a pair of front and rear plates 101 having rollers 102 which travel on tracks of a supporting structure A, shown in phantom lines in Fig. 4. The conveyor is divided along its length into a plurality of compartments or signature carrying pockets separated by successive pairs of forwardly and rearwardly projecting partitions 100. As explained above, the delivery bar 29 is located transversely below and between the narrow gap of the chains 47, 48, and the conveyor, which is preferably continuously moving, travels directly below the delivery bar 29 and in a parallel direction thereto. If a signature has been delivered to the bar 29, the outwardly projecting partitions 100 will engage the edges of the hanging leaves of the signature, the continued movement of the conveyor translating the signature along the bar to the discharge end thereof. Since the plates 101 are disposed between the hanging leaves of the signature, the signature drops by gravity onto the conveyor in the same manner that it was supported on the bar 29, namely, with the folded edge at the top and the leaves straddling the plates 101. The conveyor travels from one bin to the next receiving a signature, one on top of another, in each successive pocket of the conveyor. As explained above, the signatures are so printed initially and delivered to appropriate bins that the signatures are collected from the bins, one at a time and in proper sequence, to compile an entire book or booklet in each pocket of the conveyor. The book or booklet will be assembled in its final form and with the pages in proper order, so that the conveyor may transport the books to the binding station.

In order to maintain the chains 47, 48 taut in traveling over their respective sprockets, the shafts 58, 53, instead of being mounted directly to the side frames 27, are mounted to slidable plates 105 mounted in runways or guideways of blocks 106. The blocks 106 are bolted directly to the side frames 27, as are smaller individual blocks 107 which accommodate adjusting screws 108. The screws 108 are threaded through holes in the blocks 107, and the upper ends of the screws are provided with collars 109 which fit into slots formed in the slidable plates 105. It is seen that by rotating the screws 108, the slides 105 will be moved in their respective guideways in the blocks 106 to translate the shafts 58, 53 toward or further away from the shafts 56, 26, respectively.

It is, of course, understood that the term "signature" as used herein is not limited to a single folded sheet, but may include a plurality of folded sheets. Also, it is evident that a plurality of inserted folded sheets may be handled by the present invention in the same manner as a single folded sheet.

The invention has been shown and described in but a single and preferred form and by way of example, and obviously many modifications may be made therein without departing from the spirit of the invention. For example, it is obvious that the signatures, instead of being first delivered to the transverse bars 29, may be delivered directly to the conveyor 32. It is to be understood, therefore, that the invention is not to be limited to any specified form or embodiment, except insofar as such limitations are set forth in the appended claims.

I claim:

1. In a collating system wherein a plurality of different folded signatures stored in separate bins are assembled in book form on a continuous conveyor which moves from bin to bin in proper sequence, the combination of signature releasing means associated with each

bin, a pair of sheet retaining members, said sheet retaining members traveling in synchronism in separate closed paths, the paths converging and then diverging, grippers traveling in a closed orbital path for feeding the open end of the released signature to the point at which the paths of the sheet retaining members converge, means for closing the grippers on the leading edge of the signature, means for actuating the sheet retaining members whereby they first cooperate to cause one of the sheet retaining members to engage one leaf of the signature before the other sheet retaining member engages the other leaf of the signature, means for opening the grippers, the leaves of the signature being separated as the sheet retaining members diverge, and means for releasing the sheet retaining members at the appropriate time to permit the signatures to be delivered to the conveyor.

2. A combination as set forth in claim 1 wherein one leaf of the folded signature is longer than the other and wherein one of the sheet retaining members comprises a sheet piercing pin adapted to pierce the longer leaf of the signature and thereby retain said leaf.

3. In a collating system wherein a plurality of different folded signatures stored in separate bins are assembled in book form on a continuous conveyor which moves from bin to bin in proper sequence, the combination of signature releasing means associated with each bin, a platform means to deliver the signature to the platform, a stop for the registration of the leading edge of the signature, means adjacent the stop for frictionally engaging the leading edge of the signature, a pair of sheet retaining members, said sheet retaining members traveling in synchronism in separate closed paths, the paths converging and then diverging to opposite sides of the conveyor, a movable gripper, pivotal means to advance the signature from the waiting position to the movable gripper, said gripper delivering the open end of the signature to the sheet retaining members, the sheet retaining members each engaging one of the leaves of the signature, the leaves of the signature being separated as the sheet retaining members diverge, and the leaves being released by the sheet retaining members at the appropriate time to permit the signature to be delivered to the conveyor.

4. In a collating system the combination of a plurality of bins for accommodating folded signatures, the signatures being folded with one leaf longer than the other, a conveyor movable from one bin to the next, receiving a signature from each to make up a book, and means for delivering a folded signature to the conveyor, which means comprises a platform, means for delivering a signature from a bin to a platform, a movable sheet gripper, means for translating said sheet gripper past said platform, said gripper being open to receive the signature as it travels past said platform, means for advancing the signature to the open gripper, means for closing said gripper on the signature, a second gripper movable in a closed path, a sheet-piercing pin movable in a separate closed path, said second gripper and said pin movable in synchronism, means for urging said pin toward the leaf of the signature and the second gripper to pierce the end of the longer leaf of said signature and thereby retain said leaf, said second gripper being open to receive the shorter leaf of the signature and serving as a backing for the signature while the pin pierces the leaf, means for closing the second gripper to retain said shorter leaf, the second gripper and the pin moving in diverging directions to opposite sides of the conveyor, and means for opening said second gripper and for retracting said pin at the proper point to release the leaves of the signature, the arrangement being such that the signature is delivered to the conveyor with its folded edge at the top and its leaves straddling the conveyor.

5. A combination as set forth in claim 4 including a pick-up bar located directly above the conveyor, the

signature being delivered to the pick-up bar by the release of the leaves of the signature by the second-mentioned gripper and the retracting pin.

6. A combination as set forth in claim 4 wherein the first-mentioned gripper is pivotally mounted and translated in a circular path, and characterized further in that the gripper is provided with a gear segment, the means for opening and closing the said gripper comprising a pivotal cam controlled gear segment engaging the gear segment of the gripper, said pivotal gear segment also being translated in a circular path.

7. A combination as set forth in claim 4 characterized in the fact that the open second-mentioned gripper serves as a backing for the longer leaf of the signature and contains a slot to permit the leaf to be pierced by the pin.

8. A combination as set forth in claim 4 wherein the relative movement between the open second-mentioned gripper and the signature being transported by the first-mentioned gripper is such that the second-mentioned gripper is inserted between the leaves of the signature to permit the second-mentioned gripper to close on one of the leaves.

9. A combination as set forth in claim 4 including two link chains, each passing around a pair of separated sprocket wheels, the two chains being in close proximity at the top and then traveling in diverging paths, the second-mentioned gripper being mounted to one of said chains and carried thereby, and the sheet-piercing pin being mounted to the other of said chains and being carried thereby.

10. A combination as set forth in claim 4 wherein the second-mentioned gripper is pivotally mounted, and including cam surfaces to open and close the said gripper.

11. A combination as set forth in claim 4 including cam surfaces for controlling the piercing and retracting operations of the piercing pin.

12. A combination as set forth in claim 4 including adjustable cams for controlling the point at which the signature is released, by the second-mentioned gripper and the sheet-piercing pin.

13. In a machine for handling signatures, a gripper traveling in a closed path, a sheet piercing pin traveling in a different closed path, signature receiving means, said paths converging above the signature receiving means, means for delivering an edge of the signature to the point at which the paths converge, means for opening the gripper, means for actuating the pin to pierce a leaf of the signature, the open gripper serving as a backing for the signature while the pin pierces said leaf of the signature, means formed in the gripper for accommodating the pin, and means for closing the gripper on the other leaf of the signature.

14. A combination as set forth in claim 13 wherein the gripper is slotted to accommodate the pin, and including a companion surface against which the gripper closes to engage a leaf of the signature.

15. In a machine for handling signatures having one leaf longer than another, a slotted gripper traveling in a closed path, a sheet piercing pin traveling in a different closed path, a slotted shield for the sheet piercing pin, signature receiving means, said paths converging above the signature receiving means, a transfer gripper traveling in a closed orbital path for feeding an edge of the signature to the point at which the paths converge, means for opening the slotted gripper, the slotted gripper acting as a backing for the pin while the pin pierces the longer leaf, the pin engaging the slot in the gripper, the transfer gripper moving relatively to the slotted gripper, permitting the slotted gripper to enter between the leaves of the signature, means for closing the slotted gripper, means for opening the gripper and means for retracting the pin through the slotted shield to release the signature when the signature is delivered to the signature receiving means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,845,264

July 29, 1958

Harry W. Faeber

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 12, line 4, list of references cited, for "2,508,604" read
--2,568,604--.

Signed and sealed this 14th day of October 1958.

(SEAL)

Attest:

KARL H. AXLINE

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Commissioner of Patents