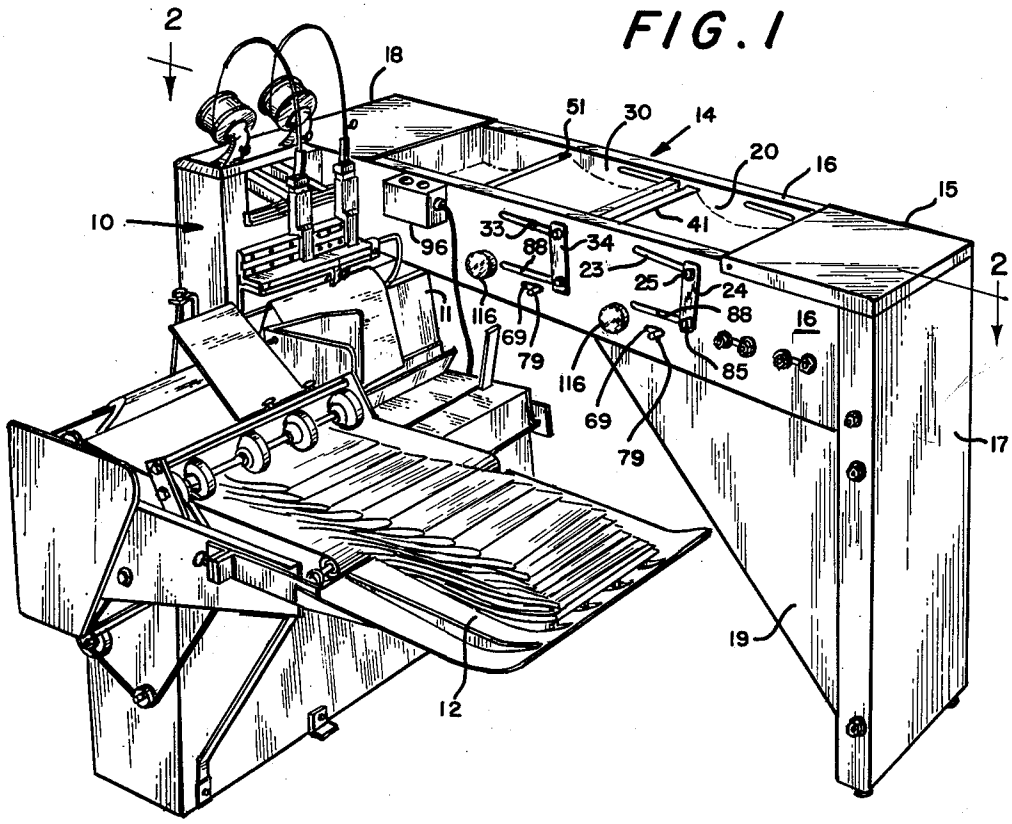
April 7, 1964 M. NELSON 3,128,092

COLLATOR FOR FOLDED SHEETS

Filed May 31, 1962 4 Sheets-Sheet 1

FIG. 1



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April 7, 1964 M. NELSON 3,128,092

COLLATOR FOR FOLDED SHEETS

Filed May 31, 1962 4 Sheets-Sheet 2

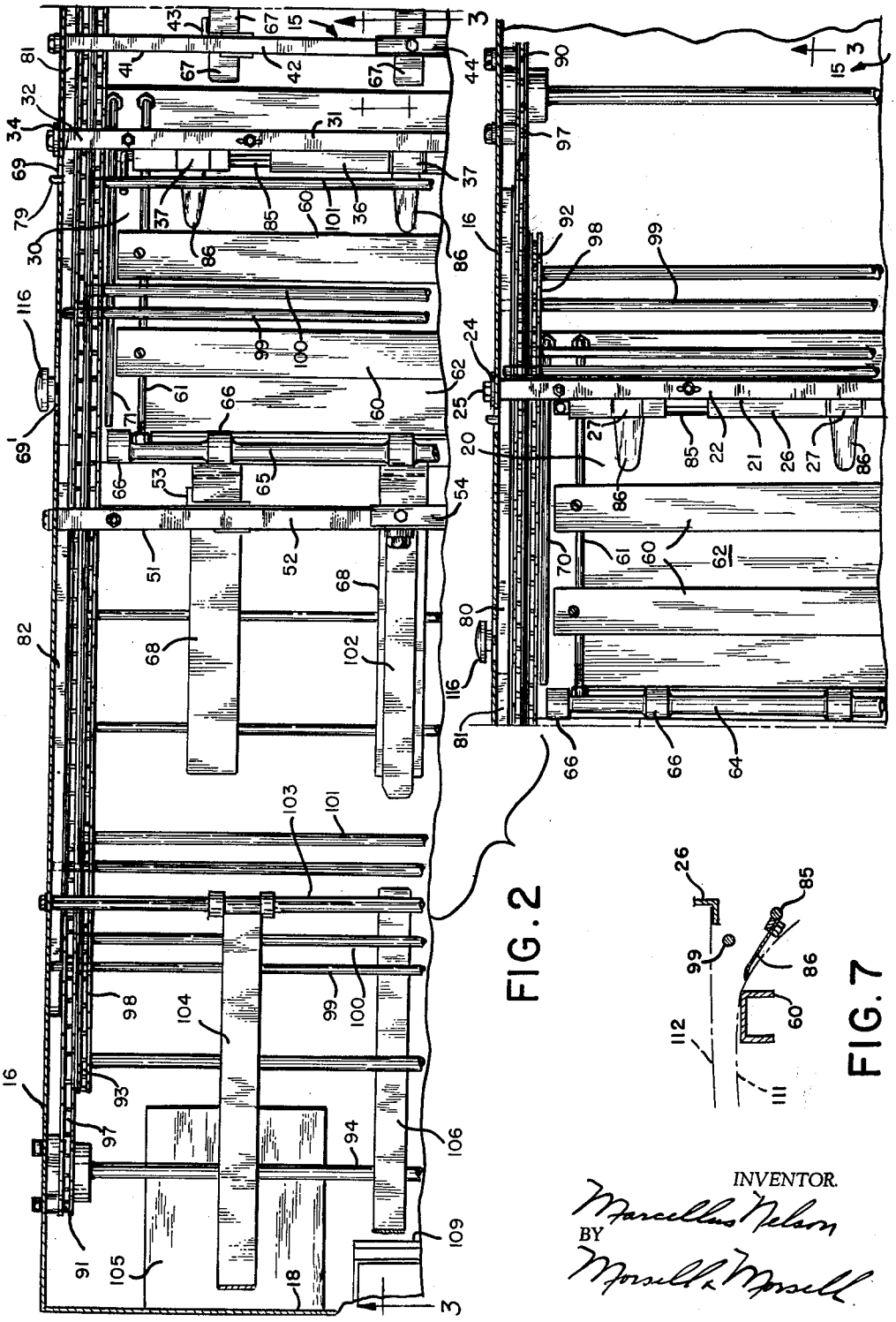

FIG. 2

FIG. 7

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April 7, 1964 M. NELSON 3,128,092

COLLATOR FOR FOLDED SHEETS

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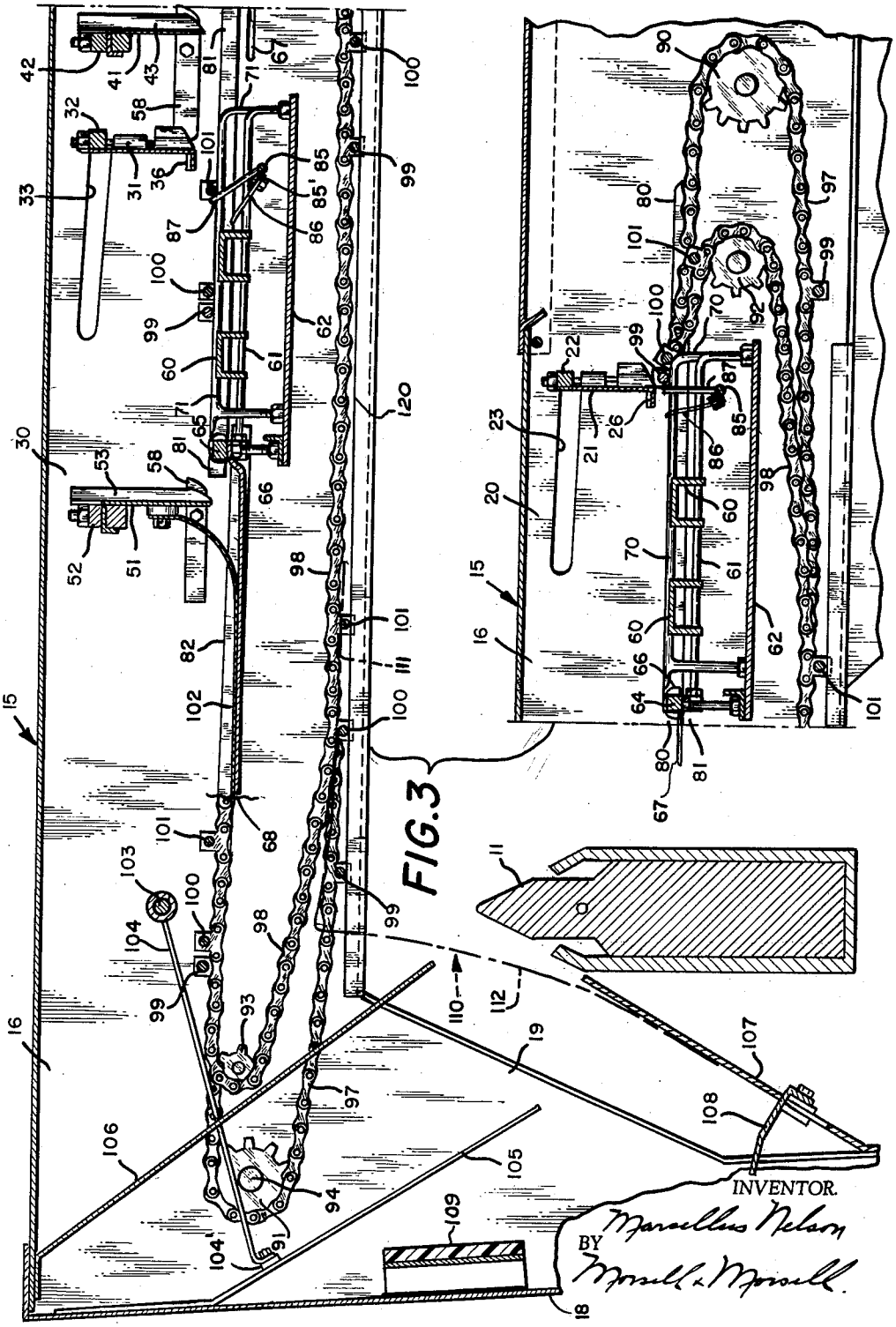

FIG. 3

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COLLATOR FOR FOLDED SHEETS

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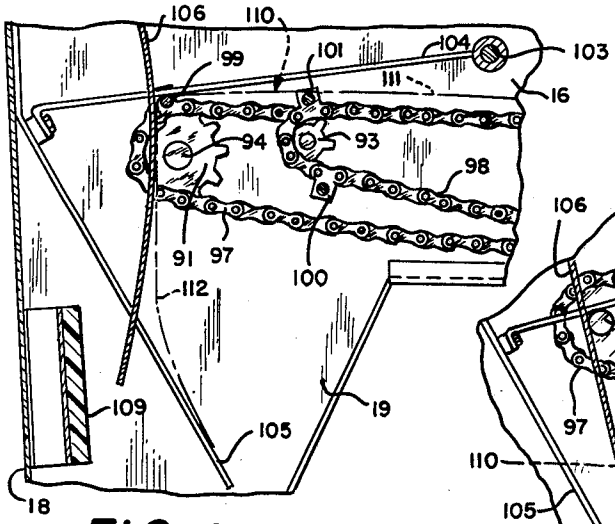

FIG. 4

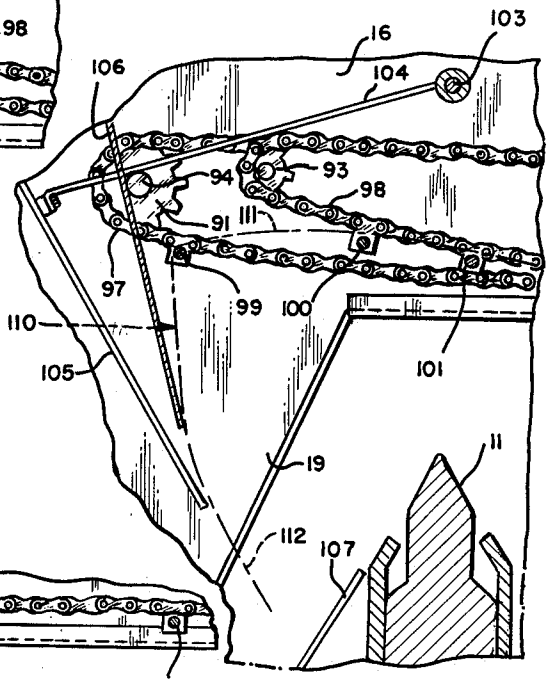

FIG. 5

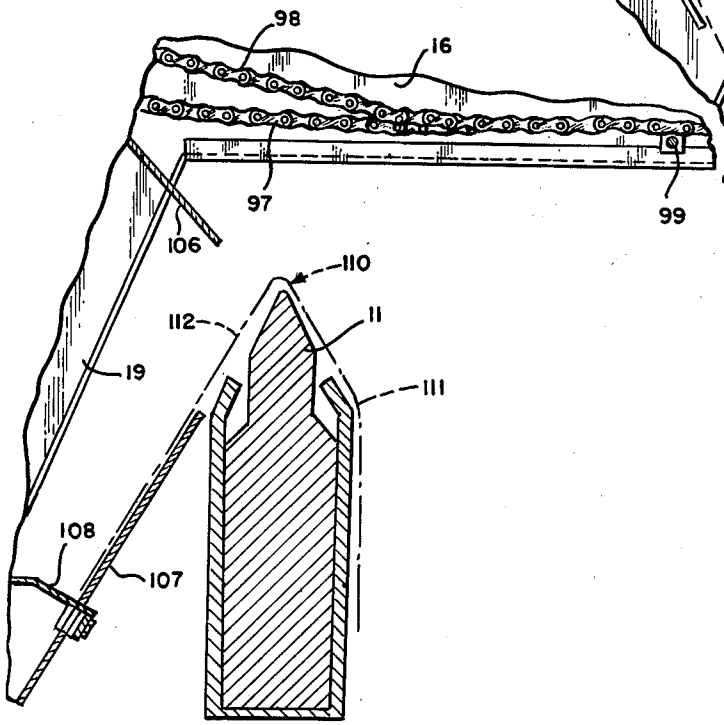

FIG. 6

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3,128,092

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3,128,092

COLLATOR FOR FOLDED SHEETS

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Filed May 31, 1962, Ser. No. 199,185

8 Claims. (Cl. 270—54)

This invention relates to improvements in collators for folded sheets, and more particularly to a novel collator adapted to automatically deliver assembled folded sheets to a stitching machine saddle.

Collators of the general type herein concerned are employed for the purpose of automatically assembling folded printed sheets, or so-called signatures, to form multi-page publications, as is fully described in my issued Patent No. 2,883,185, and the present invention is intended as an improvement on such collators.

A more particular object of the present invention is to provide a novel collator which is especially designed for booklets or pamphlets of the type wherein the assembled folded sheets are stapled or saddle-stitched together along their fold lines to form a finished booklet, the present machine including simple mechanical means for automatically draping said sheets on a stitching machine saddle, and thereby eliminating the necessity for employing separate, expensive pneumatic devices to perform the latter operation, as is presently required.

A further object of the invention is to provide a novel collator for the purpose described which includes improved means for automatically assembling the folded signatures at relatively high speeds, and which improved collator is completely reliable in operation.

Still further objects of the present invention are to provide an improved collator which is relatively simple and inexpensive in design and construction, which requires a minimum of set-up time, and which can be employed with existing automatic stitching machines.

With the above and other objects in view, the invention consists of the improved collator for folded sheets and all of its parts and combinations, as set forth in the claims, and all equivalents thereof.

In the accompanying drawings, illustrating one complete embodiment of the preferred form of the invention, and wherein the same reference numerals designate the same parts in all of the views:

FIG. 1 is a perspective view of the improved collator operatively associated with a stitching machine;

FIG. 2 is a fragmentary, two-part top view looking in the direction indicated by line 2—2 of FIG. 1;

FIG. 3 is a two-part longitudinal sectional view through said machine, taken along line 3—3 of FIG. 2;

FIG. 4 is a fragmentary longitudinal sectional view showing, by dot and dash lines, a signature about to commence its approach to the stitcher saddle;

FIG. 5 is a fragmentary longitudinal sectional view showing the signature during its approach to the stitcher saddle;

FIG. 6 is a fragmentary longitudinal sectional view showing the signature deposited on the stitcher saddle preparatory for stitching; and

FIG. 7 is a fragmentary longitudinal sectional view, partially diagrammatic, showing the action of the picker fingers in spreading the leaves of a signature.

Referring now more particularly to FIG. 1 of the drawings, the improved collator comprising the present invention is designated generally by the numeral 14. In its normal use, said collator 14 is mounted adjacent and is operatively associated with an automatic stitching machine 10 which is designed to receive the booklets or other publications assembled by said collator and to apply so-called saddle stitching thereto, which common form of binding consists of two or more staples or stitches projected through the fold line of the booklet. The design

and operation of said stitching machine 10 is not a part of the present invention, and will not be described herein except insofar as is necessary to permit a clear understanding of the improved collator.

Said collator 14 includes a rectangular, forwardly inclined frame 15 (FIG. 1) having side walls 16, a rear end wall 17, a front end wall 18, and supporting members 19. Formed in the intermediate portion of said frame are a plurality of sheet-holding compartments or hoppers, two being shown at 20 and 30; and in the use of the collator all of the sheets or signatures intended to form one set of pages in the booklet or other publication are stacked in one of said hoppers, while the signatures forming another set of pages are stacked in the other hopper, said stacks being arranged so that the first hopper 20 contains those signatures which are intended to fit within the signatures contained in the second hopper 30. It is to be understood, of course, that it is possible to include any number of such hoppers in a collator incorporating the novel features of the present invention, depending upon the number of pages in the booklet, and the invention is not to be limited to a unit having only two hoppers.

With reference now more particularly to said sheet-holding compartments, or hoppers 20 and 30, it will be seen in FIGS. 2 and 3 that the rearward hopper 20 includes a vertical rear wall assembly 21 which extends transversely between the frame side walls 16, and which depends from a point adjacent the top of the frame 15 to a point intermediate its depth. The lower longitudinal edge of said hopper rear wall is bent at a right angle to form a short, forwardly-projecting horizontal sheet-supporting shelf 26, and spaced along the length of said shelf are a plurality of upwardly-deflected offsets 27 (FIG. 2). The upper portion of said hopper rear wall assembly includes a bar 22 having ends projecting transversely and adjacent the elongated longitudinal slots 23 in the frame side members (FIGS. 1 and 3). Secured on the outer sides of the device are plates 24 (FIG. 1) which are clampingly engaged against the exterior of said frame side members by adjusting bolts 25 which extend through the slots into the ends of the bar 22. When said adjusting bolts are loosened, said bar 22 is slidably adjustable in said longitudinal frame slots 23 to permit the shifting of the hopper rear wall assembly either forwardly or rearwardly, the purpose of which will be hereinafter described.

The front wall 41 of the hopper 20 is permanently secured to and between the frame side elements 16, and includes an upper, bar member 42 which preferably has graduations marked thereon. A depending center stop plate 44 (FIG. 2) is fixed on said bar, and adjustably slidably mounted on the bar on opposite sides of said stop plate are a pair of corner holders 43 which extend downwardly approximately half the depth of the frame. Said corner holders 43 may be adjusted laterally on the graduated bar 42 and set to correspond to the width of the particular signatures being assembled to engage the forward corners thereof.

The forward hopper 30 is identical in design to the above-described hopper 20, having a longitudinally-adjustable rear wall assembly 31 which is spaced a short distance forwardly of the front wall 41 of said first hopper, and which rear wall assembly includes a forwardly-projecting shelf 36 having offsets 37, a top bar 32, frame slots 33, and side clamping plates 34. The front wall 51 of said hopper 30 includes a graduated horizontal top bar 52, a center stop plate 54, and a pair of adjustable corner holders 53.

As best appears in FIGS. 2 and 3, the hopper bottom portions include transverse, signature-supporting slats 60 which are adjustably and removably mounted on and

between longitudinal rods 61 supported by rigid base plates 62 mounted below each of said hoppers. Said base plates have lateral studs 79 projecting through slots 69 in the frame side elements (FIG. 1), and associated with said base plates are hand bolts 116 on the frame exterior which have threaded shafts projecting inwardly therefrom through slots 69' and threadedly engaging said base plates. The hand bolts can be tightened or loosened to permit the longitudinal shifting and locking of the plates within their respective hoppers as allowed by the slots 69 and 69'.

Adjacent the forward end of each of the hoppers 20 and 30 and supported on the hopper bottoms 62 are transverse cam bars 64 and 65, respectively, which are positioned somewhat behind the fronts of the hoppers. Spaced along the lengths of said bars are cams 66. Projecting forwardly from said cam bar 64 in the first hopper and beneath the stop plates at the front are a plurality of short, flat paper-supporting yielding fingers 67 (FIG. 2), and projecting forwardly from the second hopper cam bar 65 are relatively long, flat, paper-supporting arms 68.

Supported on and extending above the base plates 62 on each side of the hoppers 20 and 30 are longitudinally inclined, parallel sets of rods 70 and 71, respectively, which will be hereinafter referred to as the secondary flight rod rails. Said rails are raised slightly above the top surfaces of the paper-supporting slats 60, and are spaced inwardly a short distance from the frame side walls 16. The parallel rails 70 in the first hopper extend forwardly and upwardly at an angle to a point adjacent the cam bar 64, while the rails 71 extend at a similar angle from the rear wall of the second hopper 30 to a point adjacent the cam bar 65.

Affixed to the frame side walls 16, with their upper surfaces extending at the same level and angle as the aforementioned secondary rails are upwardly inclined bars 80 which form what will be hereinafter referred to as the primary flight rails. For the first hopper 20 said primary flight rails 80 terminate adjacent the front wall of said hopper, and underlying the forward ends of said rails 80 and extending forwardly and upwardly substantially the length of the second hopper 30 are similar rails 81. A third set of primary flight rails 82 underlies the forward ends of said rails 81 and extend at an angle forwardly and upwardly beyond said hopper 30.

Spanning the frame side elements 16 beneath the rear walls of both the hoppers 20 and 30 are rock shafts 85 each having a bar 85' rigid therewith (FIG. 3), the latter having spaced picker fingers 86 thereon and normally projecting upwardly therefrom. The tips of said picker fingers are deflected forwardly and are positioned to normally fit within the underside of the aforementioned offsets 27 and 37 formed in the horizontal shelf portions of the hopper back walls. Said rock shafts 85 are provided with torsion springs which are adapted to yieldably maintain said fingers 86 in their upright position, and each of said shafts is provided with an upright leg or trigger 87 which is located between the aforementioned primary and secondary flight rails. The outer ends of said rock shafts 85 project through slots 88 in the frame side walls (FIG. 1) and are journalled in the lower ends of the aforementioned plates 24 and 34 to permit said shafts to be shifted conjointly with the hopper back walls. In the operation of the present invention, said triggers 87 are engaged by forwardly-moving signature-carrying flight bars (to be hereinafter described) to cause the shafts 85 and picker fingers 86 to temporarily rotate forwardly and downwardly against the tension of said torsion springs, to spread the two sides of the signature sheets apart as will be hereinafter described in greater detail (see FIG. 7).

With more particular reference now to FIG. 3, it will be seen that a sprocket wheel 90 is mounted for rotation on and within the frame side wall 16 adjacent the rear end of said frame, there being an identical sprocket (not shown) aligned therewith on the opposite wall. Positioned forwardly of said sprockets 90 are smaller, laterally-inwardly spaced sprockets 92. Mounted adjacent the front end of said frame 15 are a pair of aligned large sprockets 91, and a pair of smaller sprockets 93 are positioned rearwardly thereof. Said forward sprockets 91 are positively connected to a driven shaft 94 driven by means including reduction gears.

In the preferred embodiment of the present invention the machine is electrically driven, there being a control box 96 (FIG. 1) conveniently located thereon.

Trained around the outer, large sprockets 90 and 91 on each side of the machine is an endless chain 97, hereinafter called the primary flight rod chains, and a second endless chain 98, hereinafter called the secondary flight rod chain, is trained about the smaller, inner sprockets 92 and 93 on each side of the frame.

Supported at their ends on and spanning the chains 97 are primary flight rods 99, hereinafter called the pickup rods, and spanning the chains 98 are secondary flight rods 100 and 101. Said rods 99 have end portions which project laterally beyond said chains and which are adapted to ride on the above-mentioned flight rails 80, 81, and 82 during the operation of the machine. Said primary flight rods 99 are spaced apart approximately 18 inches, and said secondary flight rods are so arranged relative to the primary rods that a secondary rod 100 is spaced less than an inch behind each of said primary rods on the upper stretches of said endless chains, with a rod 101 following about three inches behind each of the rods 100. On the lower stretches of said chains the relative positions of said rods are changed, due to the shorter travel cycle of the rods 100 and 101 around their sprocket mountings, which is an important feature in the operation of the present machine, as will be seen. It is to be understood that the above relative distances are merely illustrative, and the exact arrangement and spacing of the pickup rods can be varied and is dependent upon the operational requirements of the particular machine. A novel feature of the present invention is the arrangement of the signature pickup rods 99 in a manner whereby the lead rod on the upper stretch becomes a trailing rod on the return stretch.

With respect now to the forward end portion of the present machine, there are the plurality of flat, paper-supporting arms 68 which project forwardly beyond the front wall of the hopper 30, as mentioned, and mounted thereabove is a flexible arm 102 which pressurably bears on sheets supported on said supporting arms. A fixed transverse rod 103 is mounted forwardly of said paper-supporting members, and a pair of forwardly-projecting arms 104 are rotatably mounted on said bar, said arms having bumpers 104' on their forward free ends. Projecting downwardly and rearwardly at an angle from the front wall of the frame is a guide plate 105, and a flexible pressure arm 106 also projects downwardly and rearwardly from said frame front portion and is positioned to pressurably bear against the fold of a signature sheet on the forwardmost primary pickup rod 99 as the latter travels around the sprockets 91 during operation to maintain the signature in proper position on the rod.

As best appears in FIG. 3, the aforementioned automatic stitching machine 10 includes an upright, laterally-extending saddle 11, which is a conventional component of the stitching machine, and which saddle has an extension portion positioned beneath the collator conveyor chains 97 and 98 at a point intermediate the forward end of the collator frame 15 and the front wall 41 of the hopper 30. Said saddle 11 is designed to support the assembled signatures from the collator as they are draped thereover, the signatures being moved on the saddle to stitching position, by means forming no part of the present invention, where the staples are applied to secure the signatures together in the form of a booklet. Mounted on the forward end of the collator frame and associated with said stitcher saddle are a plurality of yielding arms

107 (FIG. 3) having shelf members 108 vertically adjustably mounted thereon for supporting the lower hanging edges of the sheets, the arms 107 ensuring the proper positioning of the assembled signatures on said saddle. As mentioned, the design and function of the automatic stitching machine, including the saddle 11, is not a part of the present invention, and the details of said machine are not described herein except insofar as is necessary in conjunction with the collator.

Operation

In the operation of the present collator, a stack of signatures which are to form the inner pages of the booklet is placed in the rear hopper 20, as described, and the exterior signatures are placed in the hopper 30. In accordance with the invention of my prior patent, said signatures are folded so that the top leaf of each extends a short distance beyond the corresponding edge of the lower leaf, said overhanging portions or lips being trimmed from the assembled booklet at a later time if desired, and said signatures are positioned in the hopper with the fold lines leading. The length and width of the hoppers are adjusted so that they conform to the size of said signatures by means of the adjustments heretofore described, and when said signatures are positioned in the hoppers the trailing edges of their top leaves rest on the short, forwardly-projecting shelves 26 and 36 on the hopper rear walls. The forward, fold edges of said signatures abut the hopper front walls 41 and 51 with the forward corners in the adjustable corner holders 43 and 53.

When the power drive means is actuated, either by electrical energy as described or by any other suitable prime mover and drive arrangement, the endless chains 97 and 98 are caused to travel on their sprocket mountings, in a counterclockwise direction in the drawings with the chain stretches moving at the same speed. As the upper stretches of said chains move forwardly the spaced, transverse rods carried thereby are continuously advanced, each of the pickup rods 99 being followed by a pair of spaced, secondary rods 100 and 101 as hereinabove described.

As best appears in FIG. 3, when the leading rod 99 of one rod set reaches the rear wall of the first hopper 20 it engages the spring urged, pivotal trigger 87 and pushes the same downwardly and forwardly, thus causing the rock shaft 85 and picker fingers 86 associated therewith to rock forwardly and downwardly also. Said picker fingers are normally positioned so that their tips fit within the offsets 27 in the rear wall shelf 26, as described, and as said fingers swing downwardly they engage the edge of the lower, short leaf 111 of the bottommost signature in the stack and pull the same downwardly therewith (see also FIG. 7). The longer, upper leaf 112 of the same signature is supported by said shelf 26 as mentioned, and through the action of said picker fingers the bottommost signature is held in opened position to receive the rods.

As said pickup rods 99 advance between the leaves of the bottommost signature in the first hopper they also travel up the inclined surfaces provided by the rails 70 and 80, there being a certain amount of play in the chains to permit such upward movement, and when the leading pickup rod 99 reaches and engages within the signature fold its ends then fall from the forward ends of the inclined rails 80 onto the rails 81 therebelow, there being coacting guide cams 58 on the frame side walls to compel said downward movement. This downward movement of the signature-carrying rod 99 is sufficient to permit the same and the signature carried thereby to pass under the bottom of the hopper forward wall 41. The following, secondary rods 100 and 101, which later function to support the upper leaf of the signature in a horizontal position have ends supported on the rails 70 and ride over the cam surfaces 66 on the cam bar 64 as they reach the ends of their inclined rails 70, falling downwardly to a position where they will also pass under the hopper front wall, the signature also being guided over the cams 66. Thus, the bottommost signature in the hopper 20 is withdrawn from said hopper and carried downwardly and then forwardly into the hopper 30.

In the event the space between the bottom surface of the hopper and the lower edge of the front wall of the hopper is insufficient to permit the passage of the particular signatures therethrough, due to the thickness of the paper or the like, the space, or gap, can be readily adjusted merely by shifting the hopper bottom assembly rearwardly. This may be accomplished by loosening the hand bolts 116 and shifting said assembly longitudinally within their slotted frame mountings, as hereinabove described.

The pickup rod 99, together with the signature thereon, then travels under the rear wall 31 of the hopper 30. As the rod 99 passes under said rear wall it engages the spring urged trigger 87 (FIG. 2) and causes the picker fingers 86 in said second hopper to separate the leaves of the bottommost signature therein in the same manner shown in FIG. 7, thus permitting said forwardly-moving rod to insert the signature already being carried thereby between the rearwardly diverging leaves of said bottommost signature in the second hopper. In a machine having two hoppers, the signatures stacked in the first or rear hopper 20 would form pages numbered 3, 4, 5, and 6, of the assembled booklet, while the signatures in hopper 30 form pages 1, 2, 7, and 8 (or the cover leaves) of said booklet. In this respect, however, it is intended that any number of similar hoppers could be incorporated in the present machine, depending upon the number of pages in the booklets or pamphlets to be assembled.

When the forwardly-moving primary pickup rod 99 engages within the fold of the bottommost signature in the second hopper, the signature previously removed from the first hopper 20 is in a fully-inserted condition in said second signature. At the same time, the ends of said moving rod 99 fall downwardly off the ends of the inclined rails 81 and are guided by the cam ends 58 onto the rails 82 therebelow, thus pulling the two interfitting signatures under the hopper front wall 41 and forwardly along the rails 82. The following, secondary rods 100 and 101, which support the upper signature leaves in a horizontal position, fall downwardly over the cams 66 and are also thus permitted to pass under the hopper front wall. After passing beyond said hopper front wall, said moving signatures are yieldingly maintained between the flat supporting members 68 and the flexible arm 102.

With respect now to the operational sequence after the interfitting signatures have been withdrawn from their hoppers, as described, attention is directed to FIGS. 3 through 6 of the drawing, wherein the operational sequence of one set of pickup rods is shown. In said progressive views while the interfitting signatures have been designated by a single dot and dash line 110, it is to be understood that 110 is intended to represent two or more interfitting signatures.

As appears in FIGS. 4 and 5, the signature-supporting rods 100 and 101 on the secondary flight bar chains 98 travel around their aligned sprockets 93 before the pickup rod 99 which is at the fold line reaches its sprockets 91, the length of said secondary chains being substantially shorter. Thus, said rods 100 and 101 which were the trailing rods on the upper stretch become the lead rods on the lower, return stretch. As said primary pickup rod 99 turns about its sprockets 91 (FIG. 4) the aforementioned flexible arm 106 yieldingly bears thereagainst to maintain the folded signatures firmly on said rod, there being a resilient bumper 109 on the frame front wall for said flexed arm. Simultaneously, the arms 104 rest on and bear against the upper surface of said signatures near the rod-carried fold line, thus providing means for maintaining the interfitting signatures on their carrying rods during the movement of said rods about their sprocket

mountings. During said movement of the pickup rods around the sprockets the upper leaves 111 of the signatures are still supported thereby and by the rods 101, and the lower free leaves 112 of said signatures are guided by the angled plates 105 to eliminate the possibility of their becoming fouled in the drive mechanism.

Referring now to FIG. 3, signatures (not shown) which are being moved by the left-hand pickup rod 99 on the upper stretch will move toward the sprocket wheels 93 and 91, the rear edges of both the upper and lower leaves of the signatures being supported on the bars 68. As the pickup rod 99 moves closer to the sprocket 91 the trailing edges of the signature sheets will eventually move past the ends of the supporting bars 68. At this point the lower leaves of the signatures will fall down by gravity to the dot and dash line position 112 shown in FIG. 4. The upper leaves will still be supported in horizontal position by the rods 101 as shown in FIG. 4. As the rod 99 travels down around the sprockets 91 to the position of FIG. 5, the upper leaves will now be supported by both of the bars 100 and 101, which are now ahead of the pickup rod 99. As the rods travel from the position of FIG. 5 to the lower stretch position of FIG. 3, the downwardly hanging leaves 112 will drape against the left-hand side of the saddle 11 as shown by dot and dash lines in FIG. 3. Thereafter the rods 99, 100 and 101 will move past the edges of the supported upper leaves 111, allowing said upper leaves to fall down onto the right-hand side of the saddle as shown in FIG. 6. Suitable means (not shown) will then move the draped signatures to the left along the saddle, referring to FIG. 1, off of the arms 107 into a position on the saddle portion which is in the stitcher 10 for the stitching operation, leaving room on the right-hand end of the saddle 11 for the next signatures to be draped thereon. In the stitcher, the staples are applied and the finished booklet is discharged onto a conveyor 12 or the like, as is shown in FIG. 1.

On the return stretches of the conveyor chains the projecting ends of the rods 99, 100, and 101 are all supported slidably on the side ledges 120.

It is to be understood, of course, that the foregoing operational description is intended to cover the cycle of only one set of pickup rods. There are, however, a plurality of such rod sets mounted in spaced relation along the endless chains and functioning simultaneously to provide a high-speed operation. The number of said pickup rod sets, and the speed thereof, can be varied to suit particular requirements.

A further important feature of the invention, which is an improvement over my prior patent, and which ensures that the rods enter within the sheets in proper position, resides in the picker fingers 86 which are mounted on the rock shafts 85 and which swing downwardly in timed relationship with the movement of the flight rods, as shown in FIG. 7, to hold the bottom leaves of the signatures in such position that the rods may readily enter between leaves during pickup. These fingers are actuated by the rods 99, 100 and 101 which engage the triggers 86 just before each rod enters.

Another improvement resides in the arrangement of the cam ends 58 with respect to the ends of the flight rod rails 80 and 81 which guide the rods to a lower level so that the rods and signatures can pass beneath the front walls of the hoppers. In this connection the cam bars 64 and 65 with the cams 66 thereon serve to smoothly guide the secondary flight rods 100 and 101 and the signatures downwardly to a lower level to pass beneath the hopper walls.

From the foregoing detailed description, it will be seen that the present invention comprises a collator which not only provides improved, efficient means for assembling folded, printed sheets, but which collator includes simple, mechanical means for automatically delivering the assembled signatures to a stitching machine in the proper position for stapling, thus eliminating the necessity for a separate, expensive pneumatic apparatus such as is presently employed for that purpose. In addition, the present machine requires a minimum of set-up time, and it can be readily installed with existing automatic stitching machines.

As hereinabove mentioned, it is to be understood that the improved collator comprising the present invention includes not only the embodiment thereof illustrated in the drawings and hereinabove described, but any and all changes or modifications as may come within the spirit of said invention and within the scope of the following claims.

What I claim is:

1. Sheet handling apparatus comprising a frame, movable sheet moving means for moving collated signatures having leaves on each side of a fold line longitudinally of said frame, said sheet moving means including means for causing the signatures to be opened into inverted V-form at a predetermined point in their movement with the leaves on one side of the fold line hanging free and the opposite leaves supported in a generally horizontal plane, a receiving saddle extending transversely of said frame directly below said moving means and so positioned that one of its sides obstructs movement of said free-hanging signature leaves while said signatures pass thereabove, there being means temporarily supporting the horizontal leaves against downward movement by gravity until said supporting means progresses to a position to permit said leaves to fall by gravity into draped position on the other side of said saddle with the signature fold line on top of the saddle, and means for driving said sheet moving means.

2. Sheet handling apparatus comprising a frame, movable endless sheet moving means for moving collated signatures having leaves on each side of a fold line longitudinally of said frame, said sheet moving means including means for causing the signatures to be opened into V-form at a predetermined point in their movement, a receiving saddle extending transversely of said frame below said endless sheet moving means so positioned that one of its sides obstructs movement of one set of leaves of said signatures after they have been opened up, a second movable endless means having mechanism temporarily supporting the other set of leaves against downward movement by gravity until said mechanism progresses to a position to permit said other set of leaves to fall by gravity into draped position on the other side of said saddle with the signature fold line on top of the saddle, and means for driving said movable endless means.

3. Sheet handling apparatus comprising a frame, movable endless sheet moving means having pickup rods for moving collated signatures having leaves on each side of said rods longitudinally of said frame, said endless sheet moving means including means for causing the signatures to be opened into V-form at a predetermined point in their movement, a receiving saddle extending transversely of said frame below said moving means and so positioned that one of its sides obstructs movement of one set of leaves of said signatures after they have been opened up, second movable endless means having rods temporarily supporting the other set of leaves against downward movement by gravity until said supporting rods progress to a withdrawn position from the signatures to permit said other set of leaves to fall by gravity into draped position on the other side of said saddle with the signature fold line on top of the saddle, and means for driving said movable endless means.

4. Sheet handling apparatus comprising a horizontal frame, movable endless sheet moving means having upper and lower horizontal stretches and having pickup rods for moving collated signatures having upper and lower leaves on opposite sides of said rods longitudinally of said frame, said endless sheet moving means including means for causing lower leaves to fall by gravity to a downhanging position at a predetermined point in their

movement as they approach the lower stretch, a receiving saddle extending transversely of said frame below said endless sheet moving means and so positioned that one of its sides obstructs movement of the downhanging set of leaves of said signatures, a second movable horizontal endless means shorter than said first endless means having upper and lower stretches and having rods temporarily supporting the other set of leaves against downward movement by gravity until said supporting rods progress sufficiently far on the lower stretch to permit said other set of leaves to fall by gravity into draped position on the other side of said saddle with the signature fold line on top of the saddle, and means for driving said movable endless means.

5. Sheet handling apparatus comprising a horizontal frame, movable endless sheet moving means having upper and lower horizontal stretches and having pickup rods for moving collated signatures having upper and lower leaves on opposite sides of said rods longitudinally of said frame, said endless sheet moving means including means for causing lower leaves to fall by gravity to a downhanging position at a predetermined point in their movement as they approach the lower stretch, a receiving saddle extending transversely of said frame below said endless sheet moving means and so positioned that one of its sides obstructs movement of the downhanging set of leaves of said signatures, a second movable horizontal endless means shorter than said first endless means having upper and lower stretches and having a plurality of rods temporarily supporting the other set of leaves against downward movement by gravity until said supporting rods progress sufficiently far on the lower stretch to permit said other set of leaves to fall by gravity into draped position on the other side of said saddle with the signature fold line on top of the saddle, and means for driving said movable endless means.

6. Sheet handling apparatus comprising a horizontal frame, a first set of oppositely disposed generally horizontal, movable conveyor chains having forward and return stretches and having longitudinally spaced transversely extending pickup rods for moving collated signatures having leaves on each side of a fold line in which a pickup rod is engaged, a second set of generally horizontal, movable endless conveyor chains having spaced transversely extending leaf supporting rods thereon, said second set of chains having forward and return stretches with its forward stretch terminating short of said first set whereby when said pickup rods progress with said first set to start the return stretch said leaf supporting rods on said second set of chains arrive at their return stretch earlier to continue supporting the upper leaves of the signature while the lower leaves are allowed to fall by gravity to downhanging position from said pickup rod, a receiving saddle extending transversely of said frame below said sets of endless chains and so positioned that one side obstructs movement of said downhanging leaves while the other leaves are still supported by the support rods on the second set of endless chains, the latter ultimately moving to a release position to permit said upper leaves to fall in draped position on the other side of said saddle with the signature fold line on top of the saddle, and means for driving said movable endless chain sets.

7. Sheet handling apparatus comprising a horizontal frame, a first set of movable oppositely disposed generally horizontal conveyor chains having forward and return stretches and having longitudinally spaced transversely extending pickup rods for moving collated signatures having leaves on each side of a fold line in which a pickup rod is engaged, a second set of movable generally horizontal endless conveyor chains having spaced transversely extending leaf supporting rods thereon, said second set of chains having forward and return stretches with its forward stretch terminating short of said first set whereby when said pickup rods progress with said first set to start the return stretch said leaf supporting rods on said second set of chains arrive at their return stretch earlier to continue supporting the upper leaves of the signature while the lower leaves are allowed to fall by gravity to downhanging position from said pickup rod, a receiving saddle extending transversely of said frame below said sets of endless chains and so positioned that one side obstructs movement of said downhanging leaves while the other leaves are still supported by the support rods on the second set of endless chains, the latter ultimately moving to a release position to permit said upper leaves to fall in draped position on the other side of said saddle with the signature fold line on top of the saddle, and means for driving said movable endless chains.

8. Sheet handling apparatus comprising a horizontal frame, a first set of movable, oppositely disposed generally horizontal conveyor chains having forward and return stretches and having longitudinally spaced transversely extending pickup rods for moving collated signatures having leaves on each side of a fold line in which a pickup rod is engaged, said pickup rods having projecting ends, a second set of movable horizontal endless conveyor chains having spaced transversely extending leaf supporting rods thereon with projecting ends, said second set of chains being within and terminating short of said first set whereby when said pickup rods progress with the first set to start the return stretch said leaf supporting rods on said second set of chains arrive at their return stretch earlier to continue supporting the upper leaves of the signature while the lower leaves are allowed to fall to downhanging position from said pickup rods, slide means on the frame for supporting the projecting ends of said pickup rods, slide means supported within said first slide means for supporting the ends of said leaf supporting rods, a receiving saddle extending transversely of said frame below said sets of endless chains and so positioned that one side obstructs movement of said downhanging leaves while the other leaves are still supported by the support rods on the second set of endless chains, the latter ultimately moving to a release position to permit said upper leaves to fall in draped position on the other side of said saddle with the signature fold line on top of the saddle, and means for driving said movable endless chains.

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