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C. H. HEIGL ET AL
COLLATOR

3,008,705

Filed May 8, 1957

4 Sheets-Sheet 1

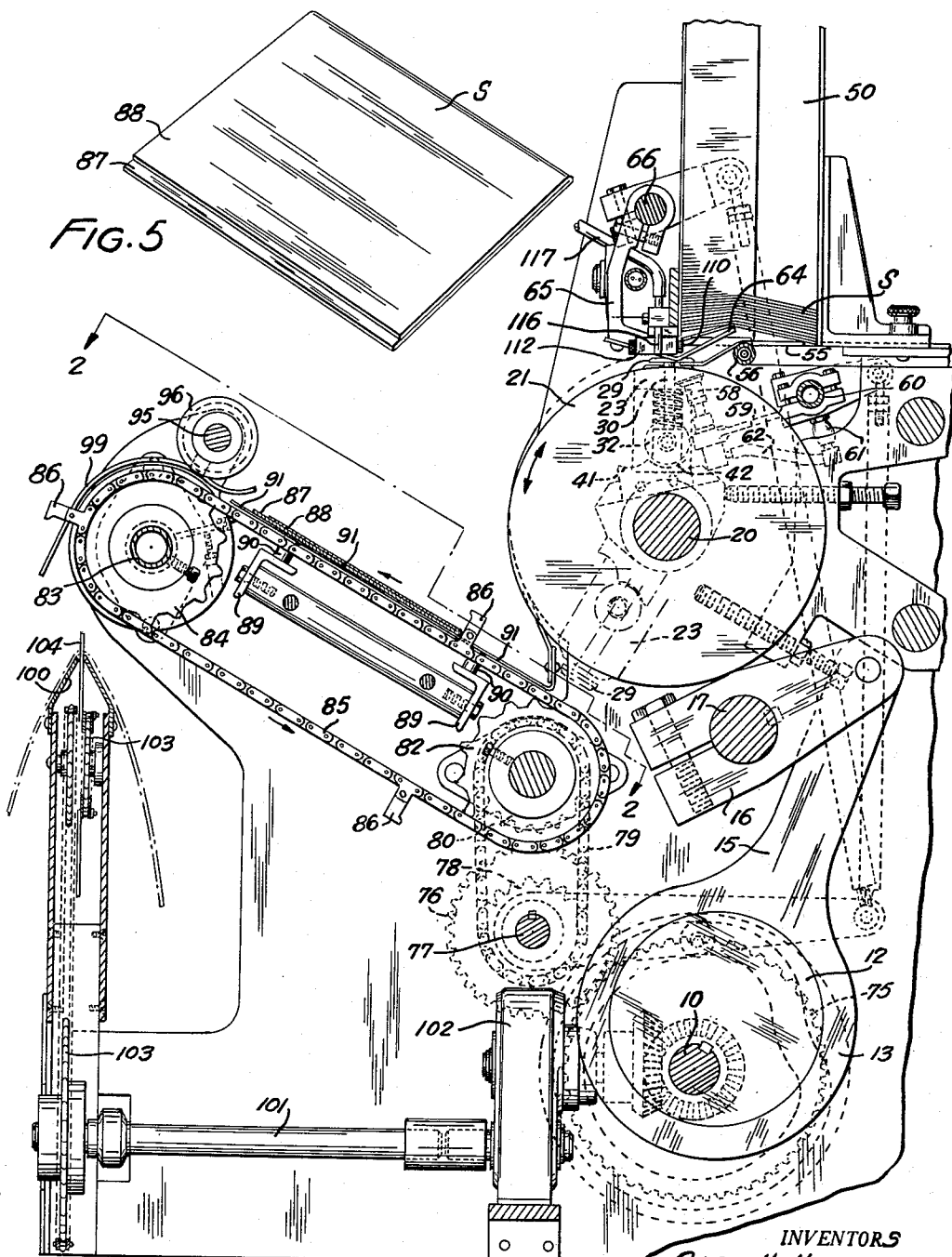


FIG. 1

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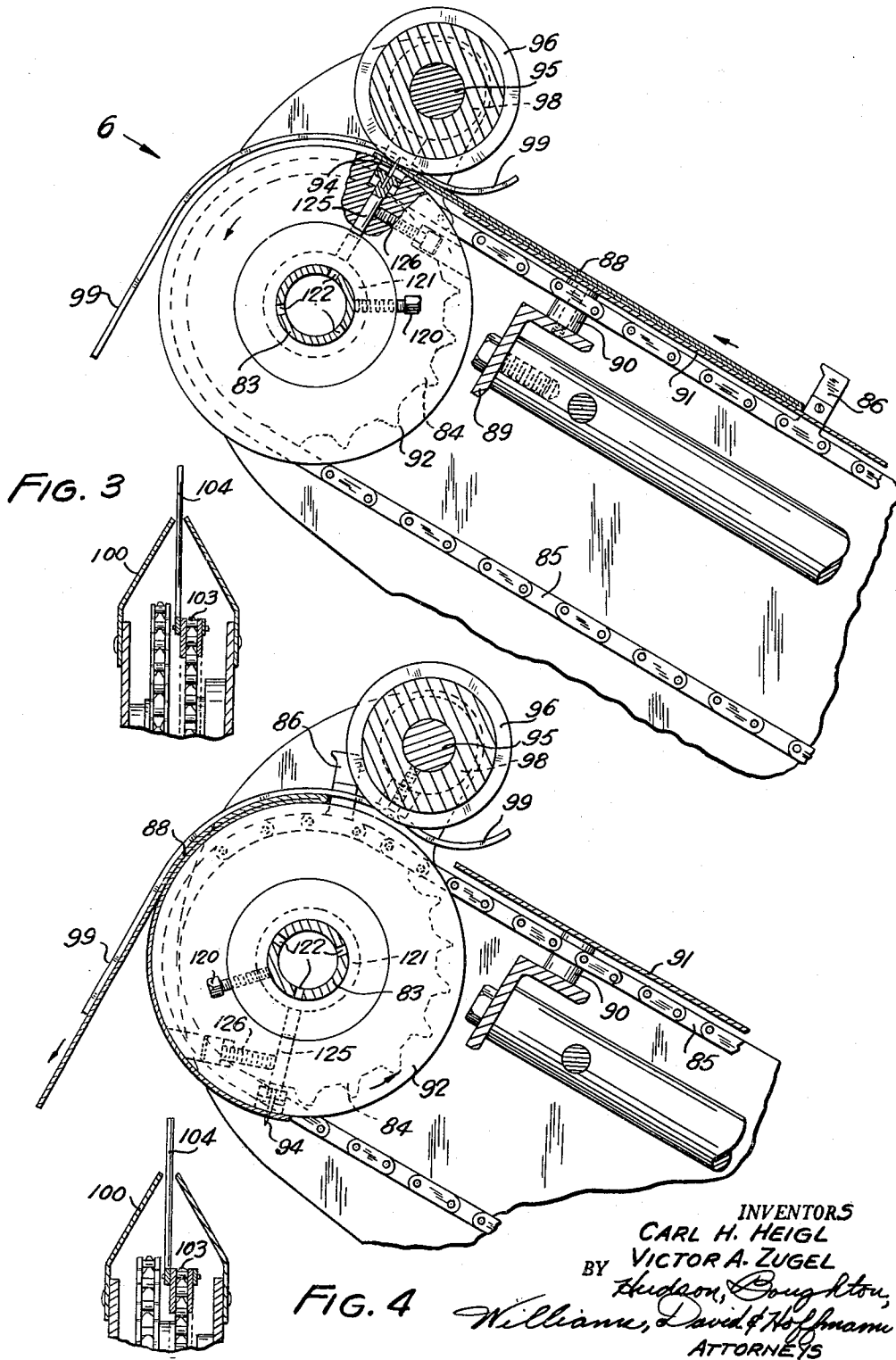
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4 Sheets-Sheet 4

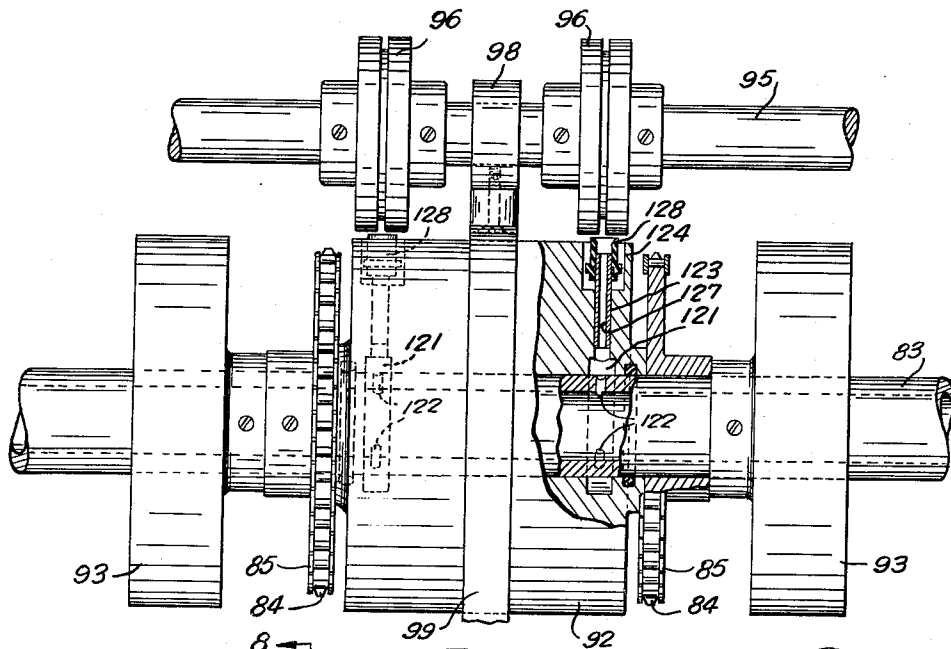


FIG. 6

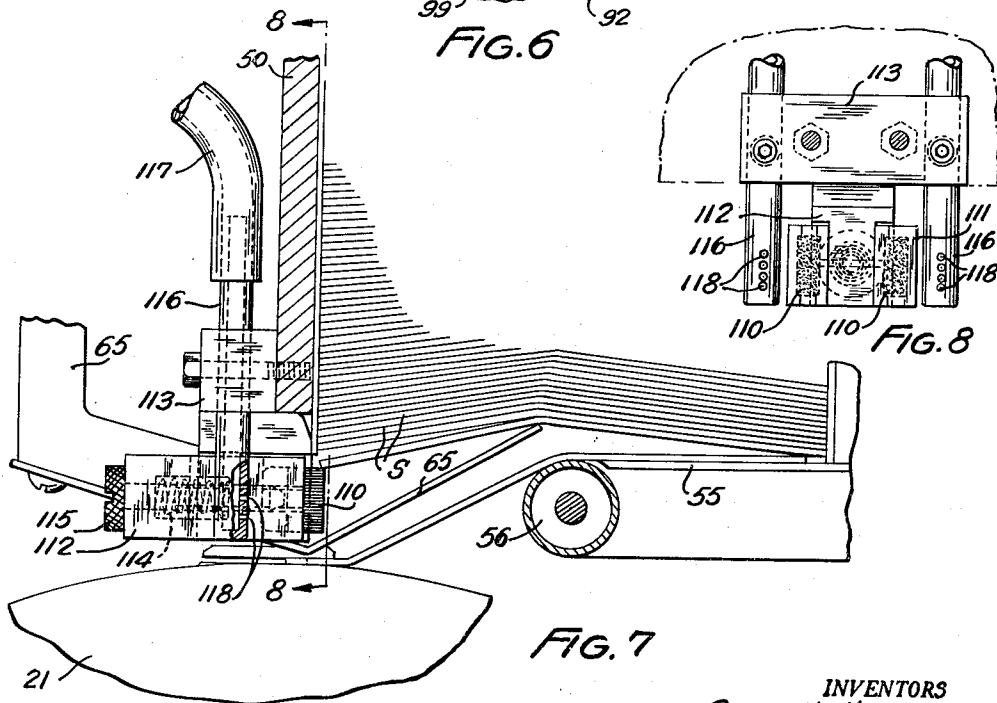


FIG. 8

FIG. 7

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3,008,705
COLLATOR

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This invention relates to improvements in collators, more particularly collators of that type in which folded sheets are opened and placed one inside another so that the pack of collated sheets may then be fastened together at the folds.

The means heretofore employed for opening up folded sheets preparatory to collating them is complicated and expensive, and the number of such machines in use is considerably limited on that account. The present invention is intended to materially reduce the cost while performing the purpose with equal, if not improved, effectiveness.

One of the objects of the invention is the provision of a novel method of collating such sheets, including a new method of opening the folded sheets before they are collated.

Another object of the invention is the provision of a collator of the type indicated which will be capable of rapid operation with such accuracy and certainty as to require substantially no attention except for maintaining the hoppers at the individual stations properly filled and making certain that the collated bundles or packs are properly fed into such additional apparatus as is provided for stapling or otherwise fastening together the opened sheets of each pack.

Another object of the invention is the provision of novel means for opening the folded sheets preparatory to dropping them onto a saddle of conventional form.

Still another object is the provision of prongs rotating about a horizontal axis which are caused to enter a forward extension of the lower leaf of the folded sheet and to release the sheet only after the prongs begin their rearward travel, the upper leaf then moving clear of the pierced leaf, thereby opening the folded sheet so that it may be permitted to drop onto the saddle, properly placed for the purpose, along which the packs are slid intermittently for collating purposes. The forward extension is provided by making the fold line of each sheet slightly off center, and when the packs of collated sheets are fastened together they are so trimmed as to remove the pierced extensions.

Another object is to mount the prongs in roller means and to press the sheet extension against the roller means by wheels bearing against the roller means on either side of each prong, this pressing means consisting preferably of two wheels grooved on their peripheries to receive the prongs in the grooves.

A further object is the provision of means for substituting rotating suckers for the rotating prongs by the simple expedient of mounting suckers or prongs interchangeably in holes in the said roller means, the roller means being hollow and suitably connected with a vacuum pump or other suction means.

Still another object of the invention is the provision of vertically disposed brush means at the base of each hopper over which the bottom folded sheet must be drawn and by means of which the separation of such lowermost sheet from the sheet next above is effectually accomplished.

Other objects and features of novelty will appear as we proceed with the description of that embodiment of the invention which, for the purposes of the present applica-

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tion, we have illustrated in the accompanying drawings, in which:

FIG. 1 is a transverse sectional view taken substantially along the line 1—1 of FIG. 2 showing one of the hoppers with means for extracting folded sheets one at a time from the hopper and depositing them upon transverse inclined endless conveyors, at the remote ends of which the rotating prongs above referred to are positioned.

FIG. 2 is a view looking down upon a portion of the machine which has to do with the opening of the folded sheets at two of the stations, of which there are usually a plurality in the machine, the view being taken substantially along the line 2—2 of FIG. 1.

FIG. 3 is a detail sectional view on a larger scale, the view being taken substantially along the line 3—3 of FIG. 2 and showing the prongs just after they have entered the extension on the lower leaf of a folded sheet.

FIG. 4 is a detail sectional view taken on a plane substantially like that of FIG. 3, but showing the folded sheet advanced to the point where the extension is about to leave the prongs and the opened sheet is about to leave the conveyor preparatory to being dropped onto the saddle.

FIG. 5 is a detail perspective view of a folded sheet.

FIG. 6 is a detail view looking substantially in the direction of arrow 6 in FIG. 3, but showing a modified construction in which suckers are employed instead of prongs for engaging the lowermost leaf of a folded sheet to open it as it travels over the said roller means, the roller means being partially broken away to more clearly illustrate the suckers and associated parts.

FIG. 7 is an enlarged view of a portion of the construction shown in FIG. 1, illustrating the brush means disposed at the base of the hopper.

FIG. 8 is a detail view taken substantially along the plane of the line 8—8 of FIG. 7.

In FIG. 1 there is shown a hopper 50 in which folded sheets S are stacked at each station of the machine.

One or more vertically disposed brushes 110 are disposed at the bottom of the hopper and extend rearwardly into the hopper a short distance. These brushes are mounted in a brush holder 111 of U-shape which straddles a bracket 112 that is secured by suitable means to a block 113 attached to the hopper. The brush holder is urged backwardly toward the hopper by a coil spring 114 and may be adjusted forwardly by a screw 115 working against the action of the spring. In the block 113 there are carried also a pair of metal tubes 116 which are connected by flexible hoses 117 to an air blast. The tubes 116 in their rear sides have a series of ports 118 through which air may be discharged to assist brushes 110 in separating the folded sheets at the bottom of the hopper. A hopper base 55 extends forward from the rear of the hopper and at its forward extremity about midway between the front and back walls of the hopper there is a roller 56. The base 55 and the roller 56 tend to support the folded sheets.

The shaft 10 rotates continuously. Upon it there is mounted eccentrically a circular disc 12 upon which a ring 13 bears. Integrated with the ring there is a connecting rod 15 which is pivoted at its upper end to a crank 16 that is keyed to an oscillating shaft 17 which, by means of suitable gearing not herein shown, oscillates shaft 20 through an angle of about 160°. At each station of the machine there are two spaced discs 21 which are clamped to shaft 20. Between these discs and attached thereto there is mounted a block 23 which contains guides for radially movable spaced rods 30 on the outer ends of which there are mechanical grippers 29.

By suitable mechanism disclosed in detail in our co-pending application Serial No. 601,256, filed July 31,

1956, the discs 21 with the block 23 are caused to oscillate from the upper position of the block shown in FIG. 1 to the lower position thereof illustrated in the same figure. When the block is in its upper position the mechanical grippers 29 open to receive a folded sheet and then close to grip it after which the block 23 swings down through the aforesaid angle of 160° to the lower position where the grippers 29 open to release and deposit the folded sheet.

A sucker 58 mounted on an arm 59 is clamped to a hollow shaft 60 running the length of the machine in which suction is induced to be effective for a portion of each cycle. The sucker 58 is a telescoping sucker disposed in a transverse plane midway between the grippers 29. At each station a connection 61, which may include a valve, is joined with the lower end of the sucker by a flexible conductor 62. The sucker comprises a cylinder and a piston which is normally extended by a spring, not shown. As soon as the sucker rises bodily far enough to contact the bottom folded sheet, it is sealed by the sheet, whereupon the sucker quickly draws the piston downwardly against the action of the spring, telescoping the sucker and lowering the forward edge of the sheet into engagement with the block 23 in position to enable the mechanical grippers to press the sheet against the block. Thereafter the suction is relieved. As soon as the sucker 58 descends far enough to be out of the way, a finger 64 that is normally in withdrawn position swings backward to the illustrated position to support the next higher folded sheet. The finger 64 is mounted on arm 65 that is fastened to a rock shaft 66. The oscillations of shafts 60 and 66 are effected by means of cams on the constantly rotating shaft 10.

As each folded sheet comes down over a pair of discs 21 it is released by the grippers 29 at the end of that oscillation and drops onto an upwardly inclined endless chain conveyor now to be described.

A gear 75 on constantly rotating shaft 10 meshes with the gear 76 on a shaft 77 which carries a sprocket wheel 78 that drives a chain 79 running over a sprocket wheel 80 on a shaft 81 that extends throughout the length of the machine. Shaft 81 drives identical endless chain conveyors in all of the stations. At each station shaft 81 carries a pair of spaced sprocket wheels 82. On a somewhat elevated shaft 83 to the left there are mounted two similarly spaced sprocket wheels 84. Over each pair of sprockets 82 and 84 there run endless chains 85. There is thus provided an endless conveyor for each station. Each chain is provided with a plurality of projections 86 which constitute pushers. The folded sheets are dropped onto the conveyors of the different stations simultaneously, with the folded edges rearmost and the longer leaf underneath. The folded sheets are carried forward and upward by the projections 86, the lower leaf being marked 87 and the upper one 88.

Between the upper and lower runs of the chains there are mounted angle irons 89 which support small spool shaped blocks 90 to which are secured metal plates 91, three at each station, which together constitute an inclined conveyor base or support over which the folded sheets are pushed. The intermediate plate 91 of each sheet is spaced from the outer plates far enough to clear the chains 85.

On the shaft 83 at each station there is what we term "roller means." Preferably each such means comprises a central relatively wide portion 92 disposed between the chains and narrower lateral portions 93. These three elements of the roller means are all fastened to the shaft 83, and they are dimensioned to have the same surface speed as the chains.

The central element 92 of the roller means carries a pair of outwardly extending prongs 94, these prongs being in alignment in the various stations. They have sharp points for readily entering and piercing the paper. To insure their penetrating the paper fully there is mounted

on a fixed shaft 95 wheels 96 that press the paper against the roller means 92. Preferably these wheels 96 are grooved peripherally in line with the prongs. They are free to turn upon the shaft, being held against movement axially by collars 97 pinned to the shaft, and being turned by friction from the roller means 92 acting through the folded sheet.

Supported on the fixed shaft 95 between each pair of wheels 96 there is mounted a bracket 98 which carries a narrow metal guard 99 that confines the folded sheet as it travels over the roller means and prevents the unpierced upper leaf from moving too far outward.

When the pierced portion at the forward end of the lower leaf of the folded sheet reaches the position illustrated in FIG. 4, it leaves the roller means 92. If it does not drop off the prongs it will be pulled off by the chains as the lower runs of the latter move rearwardly. The projection 86 continues then to push the folded edge of the sheet forward and down until it drops off the roller means onto a saddle 100 properly positioned to receive it. The sheet is thus opened and caused to straddle a saddle 100.

The chains are all adjustable on their sprockets so that the projections 86 may be caused to become effective at the same instant. An opened sheet is deposited on the saddle at each station simultaneously. During the interim between the successive depositing of sheets on the saddle the pack at each station is advanced to the next station so that the sheets are collated, one from each station. In order to accomplish this result a shaft 101 may be driven from shaft 10 through an intermittently acting clutch mechanism 102, the shaft 101 driving an endless chain 103 upon which are mounted pins 104 projecting through the saddle 100 for advancing the different packs in a manner well known in the art.

The central part 92 of each roller means is fixed in a selected angular position by a set screw 120. Such an adjustment is necessary whenever the length of the folded sheets is changed in order that the projections 86 may feed the sheets onto the prongs 94 at the proper instant.

Each central part 92 of the roller means is provided with two annular grooves 121 that are connected with the bore of hollow shaft 83 by means of one or more ports 122. A single radial hole 123 extends from each groove 121 to a small pocket 124 at the periphery of the roller part 92. In this hole we may mount a rod 125 secured in place by a set screw 126, which rod carries the prong 94 previously referred to.

In some cases, for example when the fold of each sheet is in the middle so that the lower leaf does not project forward beyond the upper one, and hence can not be separated by the prongs, we eliminate the prongs and use suckers that act upon the lower leaf only. This may be readily accomplished in our machine by removing the rods 125 with their prongs and inserting in their place tubular elements 127 which fits the holes 123 snugly and carry on their outer ends flexible suckers 128 of rubber or the like. When these suckers are used the bore of hollow shaft 83 is connected with a suitable source of suction. When a pair of aligned suckers 128 are covered by the forward end of a bottom leaf of a folded sheet, being held against the roller 92 by the wheels 96, the mouths of the suckers are closed by the lower leaf of the sheet and that leaf is firmly held against the roller 92 by the suction. It therefore follows the periphery of the roller 92 down to the point of tangency between the roller and the chains 85, at which point the chains strip the leaf from the roller, causing it to drop over the right side of the saddle 100, while the other leaf is guided under the metal guard 99 and falls over the left side of the saddle. The effect is therefore the same as with the embodiment in which prongs 94 are used, except that no trimming to remove the punctured extension of the lower leaf is necessary. The ready interchangeability of the prongs and

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suckers is a great convenience in the machine of the invention, as will be readily appreciated.

The present invention has been described with respect to a folded sheet having two leaves and it will be appreciated by those skilled in the art that such a folded sheet is commonly termed a signature.

Having thus described our invention, we claim:

1. In a sheet-handling machine for handling a sheet folded along a fold line to provide two leaves with one leaf extending beyond the other leaf and providing a leading edge for the folded sheet, conveyor means comprising an endless flexible member movable through an elongated path disposed to provide upper and lower generally straight runs for the flexible member with the flexible member moving along a circular arc at the exit end of said upper run which connects the upper and lower runs, a pin carrier member disposed coaxially with the axis of said circular arc and rotatable about the axis of said arc, said conveyor means being adapted to advance a sheet through a sheet path along the upper run thereof and over said carrier member with the said leading edge of the sheet leading the sheet and said one leaf being disposed adjacent said endless member, and said carrier member having a pin fixed in the periphery thereof and extending radially outwardly therefrom across the path of a sheet advanced by said conveyor means when said carrier member is in a predetermined angular position where said pin lies along a radius of said member perpendicular to the sheet path whereby said pin is adapted to pierce a sheet disposed over said carrier member upon rotation of said carrier member in the direction of movement of said conveyor means to said predetermined angular position, means at the exit end of said conveyor means and above said carrier member for backing a sheet positioned over said carrier member to restrain movement of the sheet away from the carrier member as the sheet is engaged by said pin as the pin approaches said predetermined angular position so the sheet can be pierced by said pin, the circular path of said pin upon rotation of said carrier member from said predetermined angular position in the direction of movement of said conveyor means crossing the path of the lower run of said flexible member to move said pin inwardly of the lower run and to cause a sheet pierced by said pin to strip against the lower run of said endless member to thereby move a pierced sheet from the pin as the carrier member is rotated, and means for timing the rotation of said carrier member and the sheets being advanced by said conveyor means to time the arrival of said carrier member at said predetermined position with the arrival of the leading edge of a sheet being advanced over said carrier member by said conveyor means to cause said pin to pierce the sheet adjacent its said leading edge and forwardly of its said other leaf.

2. In a sheet-handling machine for handling a sheet folded along a fold line to provide two leaves with one leaf extending beyond the other leaf to provide a leading edge for the folded sheet, conveyor means comprising an endless flexible member movable through an elongated path disposed to provide upper and lower generally straight runs for the flexible member with the flexible member moving along a circuit arc at the exit end of said upper run which connects the upper and lower runs, a pin carrier member disposed coaxially with the axis of said circular arc and rotatable about the axis of said arc, a sheet-supporting table disposed immediately above the upper run of said conveyor means and terminating adjacent said carrier member, said endless flexible member having projections extending outwardly therefrom and through said table when moving through the upper run to engage and advance a sheet on said table over said carrier member with the said leading edge of the sheet leading the

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sheet and said one leaf being disposed adjacent said table and said carrier member having a pin fixed in the periphery thereof against movement relative thereto and extending radially outwardly therefrom across the path of a sheet advanced by said conveyor means when said carrier member is in a predetermined angular position where said pin lies along a radius of said carrier member perpendicular to the sheet path whereby said pin is adapted to pierce a sheet disposed over said carrier member upon rotation of said carrier member in the direction of movement of said conveyor means to said predetermined angular position, means at the exit end of said conveyor means above said carrier member for backing a sheet positioned over said carrier member to restrain movement of the sheet away from the carrier member when it is engaged by the pin as it approaches said predetermined angular position so the sheet can be pierced by said pin, the path of said pin upon rotation of said carrier member from said predetermined angular position in the direction of movement of said conveyor means crossing the path of the lower run of said flexible member to move said pin inwardly of the lower run and to cause a sheet pierced by said pin to strip against the lower run of said endless member to move a pierced sheet from the pin as the carrier member is rotated, the rotation of said carrier member being timed with the arrival of the leading edge of a sheet being advanced over said carrier member to cause said pin to pierce the sheet adjacent its said leading edge and forwardly of its said other leaf.

3. In a sheet-handling machine for opening a signature having one leaf extending beyond the other leaf, endless flexible conveyor means having upper and lower reaches, drive means for driving said conveyor means, a rotatable member at one end of said reaches and around which said conveyor means extends and with which said conveyor means is interconnected to effect movement of said conveyor means and rotatable member in unison, said conveyor means being adapted to advance a signature along the upper reach thereof toward said one end, a pin fixedly carried by said rotatable member and projecting radially outwardly thereof, backing means overlying said rotatable member at said one end of said upper reach to resist movement, away from the rotatable member, of a signature disposed between the backing means and rotatable member when the signature is first engaged by said pin as the latter rotates with said rotatable member, said drive means driving said conveyor means to advance a signature along the upper reach to said one end to have the said one leaf of the signature pierced by said pin as the signature moves between the backing means and said member, wherefore said one leaf thereafter moves arcuately with said pin during the rotation of the rotatable member until said pin moves with said member arcuately transversely of said lower reach of the conveyor means and said one leaf contacts said lower reach and is constrained thereby to move divergently relative to said arcuately moving pin wherefore said pin is withdrawn from said one leaf.

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